

PERFORMANCE MANAGEMENT

STUDY TEXT

B5

Intermediate level



THE NATIONAL BOARD OF
ACCOUNTANTS AND AUDITORS
TANZANIA (NBAA)

B5 PERFORMANCE MANAGEMENT



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MANAGEMENT**
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FOREWORD.

The National Board of Accountants and Auditors is a professional body in Tanzania, established under the Auditors and Accountancy Registration Act No 33 of 1972 (CAP 286 R.E.2002). The Board has been charged with among other things, the responsibility to promote, develop and regulate the accountancy profession in the country.

In fulfilling its statutory obligations, NBAA prepares National Accountancy Examination Scheme for students aspiring to sit for Accounting Technician and Professional Examinations. Further, for effective implementation of the examination scheme and improve examination results, the Board provides Study Guides for all subjects to assist both examination candidates and trainers in the course of learning and teaching.

The Study Guides have been prepared in the form of text books with examples and questions to enable the user to have comprehensive understanding of the topics. The Study Guides cover a wide range of topics in the NBAA syllabi and adequately cover the most comprehensive and complete knowledge base that is required by a learner to pass the respective examination levels.

Furthermore, the Study Guides have been prepared to match with the Competency Based Syllabi to enable the learners to be exposed to practical understanding of issues rather than memorisation of concepts. In this case, the Study Guides are characterized by the following features:-

1. Focus on outcomes – The outcomes shown in every topic provides clear understanding on what to be learnt.
2. Greater workplace relevance – the guides emphasize on the importance of applying knowledge and skills necessary for effectively performance in a work place. This is different from the traditional training where much concern has been expressed in theoretical perspectives.
3. Assessments as judgments of competence – The assessment questions embedded in the Study Guides are adequate measures of understanding of the subject matter.

Study Guides are also useful to trainers specifically those who are teaching in the review classes preparing learners to sit for the professional examinations. They will make use of these Study Guides together with their additional learning materials from other sources in ensuring that the learners are getting sufficient knowledge and skills not only to enable them pass examinations but also make them competent enough to perform effectively in their respectively workplace.

NBAA believes that these standard Study Guides are about assisting candidates to acquire necessary skills and knowledge that will enable them to perform as professionals. The outcomes to be achieved are clearly stated so that learners may know exactly the skills and knowledge they are supposed to acquire in a particular topic.

NBAA wishes all the best to NBAA Examination candidates, trainers in their review classes, lecturers in the higher learning institutions and all other beneficiaries of these learning materials in making good use of the Study Guides towards promoting the accountancy profession in Tanzania.

CPA. Pius A. Maneno
EXECUTIVE DIRECTOR

JUNE, 2019

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584

Features of the book

The book covers the entire syllabus split into various chapters (referred to as sections in the book). Each chapter discusses the various Learning Outcomes as mentioned in the syllabus.

Contents of each section

- **'Get Through Intro'**: explains **why** the particular section is important through real life examples.
- **'Learning Outcomes'**: on completion of a section, students will be able to understand all the learning outcomes which are listed under this icon in the section.

The Learning Outcomes include:

- ✓ **'Definition'**: explains the meaning of important terminologies discussed in the learning Outcome.
 - ✓ **'Example'**: makes easy complex concepts.
 - ✓ **'Tip'**: helps to understand how to deal with complicated portions.
 - ✓ **'Important'**: highlights important concepts, formats, Acts, sections, standards, etc.
 - ✓ **'Summary'**: highlights the key points of the Learning Outcomes.
 - ✓ **'Diagram'**: facilitates memory retention.
 - ✓ **'Test Yourself'**: contains questions on the Learning Outcome. It enables students to check whether they have assimilated a particular Learning Outcome.
- **Self-Examination Questions'**: exam standard questions relating to the learning outcomes given at the end of each section.

EXAMINATION STRUCTURE

The syllabus is assessed by a three hour paper based examination. 5 conventional questions of 20 marks each need to be solved.

The examination will consist of two sections.

Section A	One compulsory question
Section B	Four questions out of Six

SECTION A1: COST CLASSIFICATION

Learning Outcomes

- a) Classification of costs, including classification by nature, functions, traceability to products, relevance to decision making, cost behaviour, and accounting treatment
- b) Estimate costs by using both linear and non-linear methods, including: High-low method, Regression analysis, Accounting analysis, and Learning Curve

1. Classification of costs, including classification by nature, functions, traceability to products, relevance to decision making, cost behaviour, and accounting treatment

COST CLASSIFICATION

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

Costing is the process of determining the cost of doing something, e.g. the cost of manufacturing an article, rendering a service or performing a function.

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

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

To simplify things here, cost objectives are divided into three broad categories: costs for **stock valuation**, costs for **decision making** and costs for control.

Cost objectives

1. Costs for stock valuation
2. Costs for decision-making
3. Costs for control

Possible methods of cost classifications

Period and product costs
Elements of manufacturing costs
Job and process costs

Cost behaviour
Relevant and irrelevant costs
Avoidable and unavoidable costs
Sunk costs
Opportunity costs
Marginal and incremental costs

Controllable and uncontrollable costs
Cost behaviour

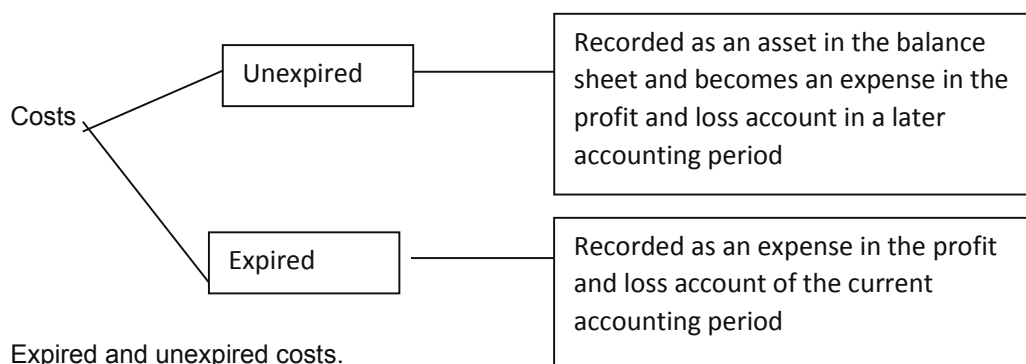
For stock valuation and profit measurement we must distinguish between unexpired costs (assets) and expired costs (expenses). **Unexpired costs** are the resources that have been acquired and that are expected to contribute to future revenue; they are recorded as assets in the balance sheet. When they have been consumed in the

2: Cost Accounting Techniques

generation of revenue and have no future revenue-producing potential, they are considered to be expired costs (expenses) in the profit and loss account. For example, the costs incurred in producing goods for resale where such goods remain unsold and held in stocks are recorded as unexpired costs in the balance sheet. When the goods are sold, these unexpired costs become expired costs (expenses) as represented in the cost of goods sold calculation, and they are matched against sales revenue to calculate profit. Hence an expense is a cost which has been consumed in earning revenue.

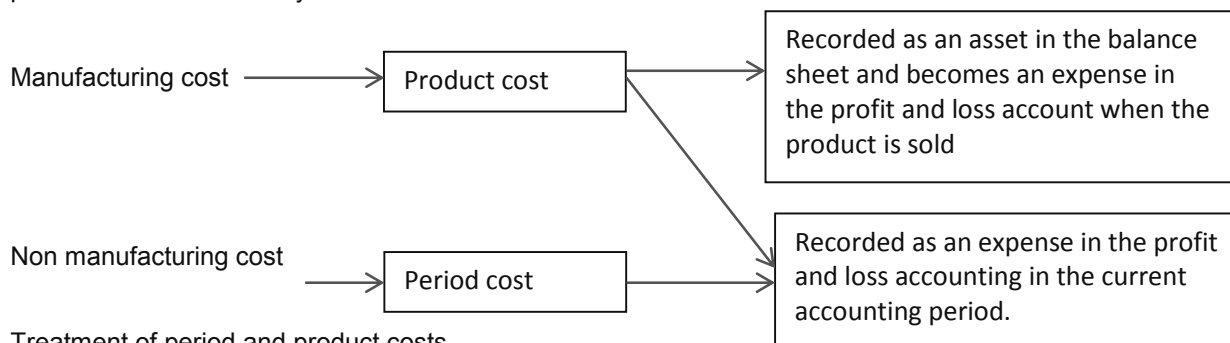
Period and product costs

Product costs are those costs that are identified with goods purchased or produced for resale. In a manufacturing organisation they are costs that the accountant attaches to the product and that are included against sales for calculating profit. Period costs are those costs that are not included in the stock valuation and as results are treated as expenses in the period in which they are incurred. Hence no attempt is made to attach period costs to products for stock valuation purposes.



In a manufacturing organisation all manufacturing costs are regarded as product costs and non-manufacturing costs are regarded as period costs.¹ In retailing or wholesaling organisations goods are purchased for resale without changing their basic form. The cost of the goods purchased is regarded as a product cost and all other costs such as administration and selling and distribution expenses are considered to be period costs.

You will see that both product and period costs are eventually classified as expenses. The major difference is the point in time at which they are so classified.



Elements of manufacturing costs

In manufacturing organisations the calculation of product costs consists of three elements: direct materials, direct labour and manufacturing overhead. For stock valuation the costs of a product are collected as follows:

	(TZS)
Direct materials	xxx
Direct labour	xxx
Prime cost	xxx
Manufacturing overhead	xxx
Total manufacturing cost	xxx

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

direct materials. For example, the nails used in the manufacture of a particular desk can be identified specifically with the desk, but, because the cost is likely to be insignificant, the expenses of tracing such items do not justify the possible benefits from calculating more accurate product costs. Note that indirect materials form part of the manufacturing overhead cost.

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

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

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

It is not possible to attach overhead costs accurately to products, since overhead costs are incurred for the benefit of all products, and the amount of the accountant resolves this problem by ascertaining the total overheads for a period and then sharing these costs among the products that have been manufactured during the period, on some sensible basis.

The distinction between direct and indirect costs depends on the cost objective. Costs are classified as direct or indirect, depending on their traceability to the cost objective. If the cost objective is establish the cost of using various distribution channels for **decision-making** then the rental of warehouses and the salaries of storekeepers will be regarded as direct costs for each distribution channel. These costs, however, cannot be regarded as direct costs for each distribution channel. These costs, however, cannot be directly traced to products, and are therefore indirect for **stock valuation** purposes.

Job and process costs

For stock valuation we have noted that the manufacturing cost must be calculated for each unit of output. In an organisation that produces a wide range of products or jobs, and where each order is unique and requires different amounts of labour, material and overhead, the cost of each order must be calculated separately. Such a cost accumulation system is known as a **job costing system**. An alternative cost accumulation system known as **process costing** can be applied to an organisation that produces many units of the same product during a period. With a system of process costing, the allocation of manufacturing cost to a specific order is unnecessary. Instead, the cost of a single unit can be obtained by merely dividing the costs of production for a period by the number of units produced in that period. In other words, the cost of an order is assumed to be the average cost per unit of all the units that have been produced during the period multiplied by the number of units ordered.

Job costing classification is suited to industries that produce specialized or made-or-order outputs. Examples of such industries include construction, printing machinery and shipbuilding. Because each customer's order is normally unique, average costs per unit of output are not suitable.

Additional costs and revenue classifications can be developed to facilitate an evaluation of various alternative actions for decision-making and planning and we shall now discuss the following classifications:

1. Costs and revenue behaviour in relation to volume of activity;
2. Relevant and irrelevant costs;
3. Sunk costs;
4. Avoidable and unavoidable costs;
5. Opportunity costs;
6. Incremental and marginal costs/revenue

Cost and revenue behaviour

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

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

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

The terms 'variable', 'fixed', 'semi-variable' have been traditionally used in the management accounting literature to describe how a cost react to changes in activity. **Short term** variable cost vary in direct proportion to the volume of activity; that is, doubling the level of activity will double the total variable cost. Consequently, total variable costs are linear and unit variable cost is constant.

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

You will see that the total fixed costs are constant for all levels of activity whereas unit fixed costs decreases proportionally with the level of activity.

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

Within shorter time periods, costs will be fixed or variable in relation to changes in activity. **The shorter the time period, the greater the probability that a particular cost will be fixed.**

Relevant and irrelevant costs and revenues

For decision-making costs and revenues can be classified according to whether they are relevant to a particular decision. **Relevant costs and revenues** are those **future** costs and revenues that will be changed by a decision, whereas irrelevant costs and revenues are those that will not be changed by a decision, whereas **irrelevant cost and revenues** are those that will not be affected by the decision.

Avoidable and unavoidable costs

Sometimes the terms **avoidable and unavoidable costs** are used instead of relevant and irrelevant costs. Avoidable costs are those costs that may be saved by not adopting a given alternative, whereas unavoidable costs cannot be saved. Therefore only avoidable costs are relevant for decision-making purposes. Consider the example that we used to illustrate relevant and irrelevant costs. The material costs of TZS100 are unavoidable and irrelevant, but the conversion costs of TZS200 are avoidable and hence relevant. The decision rule is to accept those alternatives that generate revenues in excess of the avoidable costs.

Sunk costs

These costs are the cost of resources already acquired where the total will be unaffected by the choice between various alternatives. They are cost that have been created by a decision made in the past and that cannot be changed by any decision that will be made in the future. The expenditure of TZS100 on materials that were no longer required, referred to in the preceding section, is an example of a sunk cost. Similarly, the written down values of assets previously purchased are sunk costs.

This cost cannot be changed by any future decision and is therefore classified as a sunk cost. **Sunk costs are irrelevant for decision-making**, but they are distinguished from irrelevant costs because not all irrelevant costs are sunk costs.

Opportunity costs

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

Engineering methods

Engineering methods of analyzing cost behaviour are based on the use of engineering analyses of technological relationships between inputs and outputs – for example methods study, work sampling and time and motion studies. The procedure in such a study is to make an analysis based on direct observations of the underlying physical quantities required for an activity and then to convert the final results into cost estimates. Engineers, who are familiar with the labour and machine hours required for various operations; prices and rates are then applied to the physical measures to obtain the cost estimates. The engineering method is useful for estimating costs of repetitive processes where input-output relationships are clearly defined. For example, this method is usually satisfactory for estimating costs that are usually associated with direct materials, labour and machine time, because these items can be directly observed and measured.

The engineering method is not restricted to manufacturing activities – time and motion studies can also be applied to well-structured administrative and selling activities such as typing, invoicing and purchasing. It is not generally appropriate, however, for estimating costs that are difficult to associate directly with individual units of output, such as many types of overhead costs, since these items cannot easily be directly observed and measured.

The use of these is most appropriate when direct costs form a large part of the total costs and when input-output relationships are fairly stable over time. Engineering methods may also be applied in situations where there are no historical data to analyse past cost relationships.

Inspection of the accounts/Accountant analysis

The inspection of accounts method requires that the departmental manager and the accountant inspect each item of expenditure within the accounts for some output level, and then classify each item of expense as a wholly fixed, wholly variable or semi-variable cost. A single average unit cost figure is selected for the items that are categorized as variable, whereas a single total cost for the period is used for the items that are categorized as fixed. For semi-variable items the departmental manager and the accountant agree on a cost formula that appears to best describe the cost behaviour.

Cost estimates based on this method involve individual and often arbitrary judgments, and they may therefore lack the precision necessary when they are to be used in making decisions that involve large sums of money and that are sensitive to measurement errors. This method is also inappropriate for calculating flexible budget allowances to be included in performance reports.

High-low method

The high-low method consists of selecting the periods of highest and lowest activity levels and comparing the changes in costs that results from the two levels.

	Volume of production (units)	Indirect costs (TZS)
Lowest activity	5000	22000
Highest activity	10000	32000

The variable cost per unit is calculated as follows:

$$\frac{\text{Difference in cost}}{\text{Difference in activity}} = \frac{\text{TZS } 10,000}{5,000} = \text{TZS } 2 \text{ variable cost per unit of output}$$

The non-variable cost can be estimated at any level of activity (Assuming a constant unit variable cost) by subtracting the variable cost portion from the total cost. At an activity level of 5000 units the total cost is TZS22000 and the total variable cost is TZS10000 (5000 units at TZS2 per unit). The balance of TZS12000 is therefore assumed to present the non-variable cost.

Regression Analysis

A regression equation identifies an estimated relationship between a dependent variable (cost) and one or more independent variables (i.e. an activity measure or cost driver) based on past observations. When the equation includes only one independent variable, it is referred to as simple regression, and it is possible in this situation to plot the regression equation on a graph as regression line. If there is only one independent variable and the relationship is linear, the regression line can be described by the equation for a straight line:

$$y=a+bx$$

Assuming that we wish to express the relationship between the dependent variable (cost) and the independent variable (Activity), then

y = total cost for the period at an activity level of x

a = total non-variable cost for the period

b = average variable cost per unit of activity

x = activity level for the period

If non-variable costs for a particular period are TZS5000, the average unit variable cost is TZS1, and direct labour hours represent the cost driver, then

$$\text{total cost} = \text{TZS}5000 + [\text{TZS}1 \times \text{direct labour hours}(x)]$$

$$y=a+bx$$

or

The term cost function is often used to refer to an equation that describes the relationship between a dependent variable and one or more independent variables.

Graphical or scatter graph method

You will recall that when we considered the high-low method, we concluded that there was a need to consider all of the available observations when drawing a line to establish a cost estimate. The graphical method recognizes this and uses all the available observations in arriving at the cost estimate; the total costs are plotted on a graph for each activity level. The total cost is represented on the vertical axis and the activity levels are recorded on the horizontal axis. A straight line is fitted to this scatter of points by visual approximation.

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Example

The total maintenance costs and the direct labour hours for the past ten 4 weekly accounting periods were as follows:

Period	Hours	Maintenance cost y
1	400	960
2	240	880
3	80	480
4	400	1200
5	320	800
6	240	640
7	160	560
8	480	1200
9	320	880
10	160	440

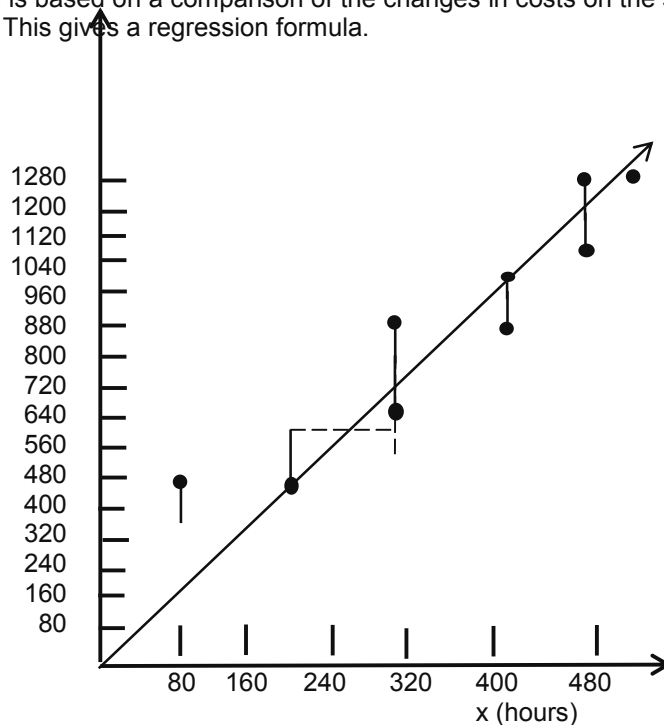
You are required to estimate the regression equation using the graphical method.

The maintenance costs are plotted on a graph and straight line is drawn through the middle of the data points as closely as possible so that the distances of observations above the line are equal to the distances of observations below the line.

The point where the straight line in figure below cuts the vertical axis (i.e. TZS240) represents the non-variable costs, item a in the regression formula $y = a + bx$. The unit variable cost b in the regression formula is found by observing the differences between two points on the line and completing the following calculations:

$$\begin{aligned} \text{Difference in cost} &= \frac{\text{TZS720} - \text{TZS560}}{\text{240 hours} - \text{160 hours}} = \text{TZS2 per hour} \\ \text{Difference in activity} & \end{aligned}$$

This calculation is based on a comparison of the changes in costs on the straight line between activity levels of 160 and 240 hours. This gives a regression formula.



graph of maintenance at different activity levels.

$$Y = 240 + 2x$$

If x is assigned a value of 100 hours then

$$Y = 240 + 2 \times 100 = \text{TZS440}$$

The least-squares method

This method determines mathematically the regression line of best fit. It is based on the principle that the sum of the squares of the vertical deviation from the line that is established using the method is less than the sum of squares of the vertical deviations from any other line that might be drawn. The regression equation for a straight line that meets this requirement can be found from the following two equations by solving for a and b:

$$\sum y = Na + b \sum x \quad (1)$$

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

Where N is the number of observations.

To illustrate the least-squares method, let us assume that past observations of maintenance costs and hours of activity have been recorded and computations have been made. We can now insert the computations into the formulae as follows:

$$19\ 800 = 12a + 1260b \quad (1)$$

$$2\ 394\ 000 = 126a + 163\ 800b \quad (2)$$

To solve for b multiply equation by 105 (1260/12), to give

$$2\ 079\ 000 = 1260a + 132\ 300b \quad (3)$$

Subtracting equation (3) from equation (2) the a terms will cancel out to yield $315\ 000 = 31\ 500b$, so that
 $b = \text{TZS}10$

Substituting this value of b into equation (1) and solving for a, we have

$$19\ 800 = 12a + 1260 \times 10$$

And so $a = 600$

Substituting these values of a and b into the regression equation $y = a + bx$, we find that the regression line can be described by

$$Y = 600 + 10x$$

We can now use this formula to predict the cost incurred a different activity levels, including those for which we have no past observations.

Hours X	Maintenance cost y (TZS)	X ²	Xy
90	1500	8100	135 000
150	1950	22 500	292 500
60	900	3 600	54 000
30	900	900	27 000
180	2 700	32 400	486 000
150	2 250	22 500	337 500
120	1 950	14 400	234 000
180	2 100	32 400	378 000
90	1 350	8 100	121 500
30	1 050	900	31 500
120	1 800	14 400	216 000
60	1 350	3 600	81 000
<u>Σx= 1260</u>	<u>Σy = 19 800</u>	<u>Σx² 163 800</u>	<u>Σxy = 2 394 000</u>

The Learning curve Theory

The predominant assumption so far has been that total costs can be estimated using a straight line formula $y = a + bx$. This might not always be the case and sometimes total costs might be non-linear, one cause of non-linear costs is the learning curve phenomenon.

The speeding up of a job with repeated performance is known as the learning effect or learning curve effect and the reduction in the required direct labour time for a job may be quantified. As the operation is repeated, the workers become familiar with the work, labour efficiency increases and the labour cost per unit declines.

This process continues for some time and a regular rate of decline in cost per unit can be established at the outset. This rate of decline can then be used in predicting future labour costs.

The learning process starts from the point when the first unit comes off the production line, from then on, each time cumulative production is doubled, and the average time taken to produce each unit of cumulative production will be a certain percentage of the average time per unit of the previous cumulative production.

Learning curve is the mathematical expression of the phenomenon that, when complex and labour-intensive procedures are repeated, unit labour times tend to decrease at a constant rate. The learning curve models mathematically this reduction in unit production time.

The learning curve effect applies to a group of workers doing the same job repetitively with the same equipment and machinery. Improvement in efficiency from better machinery or better materials would not be the result of the learning effect.

The learning rate

The cumulative average time per unit produced is assumed to fall by a constant percentage every time total output of

For example, the first unit of output requires 100 hours and 80% learning curve applied, the production time would be as follows

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Number of Unit produced	Cumulative average time required Per unit hours	Total time required hrs	Incremental time for additional unit hours
1	100	(100 x 1) = 100	-
2*	(80% x 100) = 80	80hrs x 2 = 160	60 (for 1 extra)
4*	(80% x 80) = 64	64hrs x 4 = 256	96 (for 2 extra)
8*	(80% x 64) = 51.2	51.2hrs x 8 = 409.6	153.6 (for 4 extra)

The product doubles, this constant percentage is known as the learning rate

An 80% learning curve will be used for illustration since appears to be a learning factor which commonly applies.

Note * output is being doubled each time

Learning curve formula

The learning curve can be expressed in equation form as

$$\text{Hence } Y = ax^b$$

Where

Y is the cumulative average time taken per unit

x = total number of units

a = time taken for the first unit

b = index of learning

Where $b = \frac{\text{the log of learning}}{\text{Log of 2}}$

Reasons for the effect of learning curve

The primary reasons for why learning curve effects apply, of course, is the complex processes of learning involved. Learning generally begins with making successively larger finds and then successively smaller ones. The equations for these effects come from the usefulness of mathematical models for certain somewhat predictable aspects of those generally non-deterministic processes, which include:

- **Labour efficiency** - Workers become physically more dexterous. They become mentally more confident and spend less time hesitating, learning, experimenting, or making mistakes. Over time they learn short-cuts and improvements. This applies to all employees and managers, not just those directly involved in production.
- **Standardization, specialization, and methods improvements** - As processes, parts, and products become more standardized, efficiency tends to increase. When employees specialize in a limited set of tasks, they gain more experience with these tasks and operate at a faster rate.
- **Technology-Driven Learning** - Automated production technology and information technology can introduce efficiencies as they are implemented and people learn how to use them efficiently and effectively.
- **Better use of equipment** - as total production has increased; manufacturing equipment will have been more fully exploited, lowering fully accounted unit costs. In addition, purchase of more productive equipment can be justifiable.
- **Changes in the resource mix** - As a company acquires experience, it can alter its mix of inputs and thereby become more efficient.
- **Product redesign** - As the manufacturers and consumers have more experience with the product, they can usually find improvements. This filters through to the manufacturing process.
- **Value chain effects** - Experience curve effects are not limited to the company. Suppliers and distributors will also ride down the learning curve, making the whole value chain more efficient.
- **Network-building and use-cost reductions** - As a product enters more widespread use, the consumer uses it more efficiently because they're familiar with it. One fax machine in the world can do nothing, but if everyone has one, they build an increasingly efficient network of communications. Another example is email accounts; the more there are, the more efficient the network is, the lower everyone's cost per utility of using it.
- **Shared experience effects** - Experience curve effects are reinforced when two or more products share a common activity or resource. Any efficiency learned from one product can be applied to the other products

Example: Assume that the learning rate for a certain operation is 75% and it took 90 hours to produce the first unit. Calculate the hours required to produce the fifth unit.

By substituting the given data value into C equation, we get

- $b = \log 0.75 / \log 2 = -0.4150$
- Using the above value and the specified data in $Y = ax^b$ yields
- $Y_5 = 90(5)^{-0.4150}$
- $= 46.15$ hours

It will take 46.15 hours to produce the fifth unit

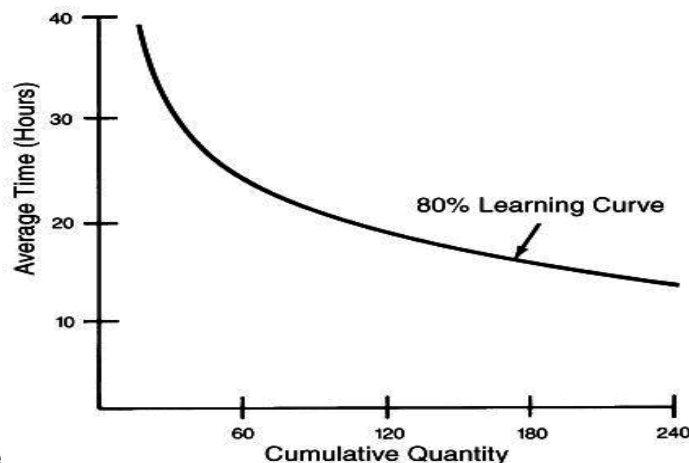
Learning Curve

Chart line representing the efficiencies gained from experience. Basically, it is a curve describing the relationship between the consecutive numbers of units produced (x-axis) and the time per unit produced (y-axis). More specifically, it is based on the statistical findings that as the cumulative output doubles, the cumulative average labour input time required per unit will be reduced by some constant percentage, ranging between 10% and 40%. The curve is usually designated by its complement. For example, if the rate of reduction is 20%, the curve is referred to as an 80% learning curve.

The following data illustrate the 80% learning curve relationship:

Quantity (in Units)		Time (in Hours)	
Per Lot	Cumulative	Total (Cumulative)	Average Time per Unit
15	15	600	40.0
15	30	960	32.0 (40.0 · 0.8)
30	60	1536	25.6 (32.0 · 0.8)
60	120	2460	20.5 (25.6 · 0.8)
120	240	3936	16.4 (20.5 · 0.8)

As can be seen, as production quantities double, the average time per unit decreases by 20% of its immediate previous time, it can be graphed as follows;



Learning curve

Application of learning curve theory

Applications of the learning curve theory include the following;

- pricing decisions, based on the estimates of expected costs;
- requirements for scheduling labour;
- capital budgeting decisions;
- Setting incentive wage rates.
- To calculate the marginal (incremental) cost of making extra unit of a product
- To quote selling prices for a contract, where prices are calculated at cost plus a percentage mark up for period
- To prepare realistic production budgets
- To compare budgeted and actual costs and report cost variances

Limitations of learning curve theory

- It assumes stable conditions at work, which will enable learning curve to take place. This is not always practicable (eg because of labour turnover)
- It must also assume a certain degree of motivation amongst employees
- It might be difficult to obtain enough accurate data to decide what the learning curve is
- There will be a cessation to learning curve eventually, once the job has been repeated often enough

10: Cost Accounting Techniques

Self Examination Questions

*Question 1

The administrator of Azalea hospital would like cost formula linking the costs involved in admitting patients to the number of patients admitted during a month. The admitting department's costs and the number of patients admitted during the immediately preceding eight months are given in the table below

Months	Number of Patients Admitted	Admitting Department Costs (TZS)
May	1,800	14,000,000
June	1,900	15,200,000
July	1,700	13,700,000
August	1,600	14,000,000
September	1,500	14,300,000
October	1,300	13,100,000
November	1,100	12,800,000
December	1,500	14,600,000

Required

1. Use high-low method to establish the fixed and variable components of admitting costs
2. Express the fixed and variable components of admitting costs as a cost formula in the linear equation form $Y = a + bX$

*Question 2

One of Varic Company's products goes through a glazing process. The company has observed glazing costs as follows over the last six weeks

Week	Units Produced	Total Cost (TZS)
1	8	270,000
2	5	200,000
3	10	310,000
4	4	190,000
5	6	240,000
6	9	290,000

For planning purposes the company's management must know the amount of variable cost per unit and the total fixed cost per week

Required

1. Using the least-squares regression method, estimate the variable and fixed elements of the cost
2. Express the cost data in (1) above in the form of $Y = a + bX$
3. If the company processes seven units next week, what would be the expected total cost?

*Question 3

- (a) Explain the theory of the Learning curves
- (b) Indicate the areas where learning curves may assist in management accounting
- (c) Illustrate the use of learning curves for calculating the expected average unit cost of making:
 - (i) 4 machines
 - (ii) 8 machines

Using the data given below

Data

Direct labour needed to make the first machine 1,000 hours

Learning curve 80%

Direct labour Cost TZS 3.00 per hours

Direct Materials Costs TZS 1,800 per machine

Fixed cost for either size order TZS 8,000

***Question 4**

Captain Gift Ltd has designed a new type of sailing boat, for which the cost and sales price of the first boat to be produced has been estimated as follows

	TZS
Materials	5,000
Labour (800 hrs @ TZS 5 per hr)	4,000
Overhead (150% of labour cost)	6,000
Profit mark-up (20%)	3,000
Sales price	18,000

It is planned to sell all the yachts at full cost plus 20%. An 80% learning curve is expected to apply to the production work. A customer has expressed interest in buying the yacht, but thinks TZS18,000 is too high a price to pay. He might want to buy 2, or even 4 of the yachts during the next six months.

He has asked the following questions

- (a) If he paid TZS 18,000 for the first yacht, what price would he have to pay later for a second yacht
- (b) Could Captain Gift Ltd quote the same unit price for two yachts if the customers ordered two at the same time?
- (c) If the customer bought two yachts now at one price, what would be the price per unit for a third and a fourth yacht, if he ordered them separately later on?
- (d) Could Captain Gift Ltd quote a single unit price for
 - (i) Four yachts
 - (ii) Eight yachts
 If they were all ordered now

Assuming that there are no other prospective customers for the yacht, how would these questions be answered?

***Question 5**

A company has developed a new product. Details are as follows:

Selling price and product life cycle

The product will have a life cycle of 10,000 units. It is estimated that the first 9,000 units will be sold for TZS124 each and then the product will enter the "decline" stage of its life cycle. It is difficult to forecast the selling price for the 1,000 units that will be sold during this stage.

Costs

Labour will be paid at TZS12 per hour. Other variable costs will be TZS38 per unit. Fixed costs will total TZS80,000 over the life cycle of the product. The labour rate and both of these costs will not change throughout the product's life cycle.

Learning curve

The first batch of 100 units will take 1,500 labour hours to produce. There will be an 85% learning curve that will continue until 6,400 units have been produced. Batches after this level will each take the same amount of time as the 64th batch. The batch size will always be 100 units.

Required:

Calculate

- (a) the cumulative average time per batch for the first 64 batches
- (b) the time taken for the 64th batch
- (c) the average selling price of the final 1,000 units that will allow the company to earn a total profit of TZS100,000 from the product

Note: The learning index for an 85% learning curve is -0.2345

Ignore the time value of money.

Question 6

Henry Company (HC) provides skilled labour to the building trade. They have recently been asked by a builder to bid for a kitchen fitting contract for a new development of 600 identical apartments. HC has not worked for this builder before. Cost information for the new contract is as follows:

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Labour for the contract is available. HC expects that the first kitchen will take 24 man-hours to fit but thereafter the time taken will be subject to a 95% learning rate. After 200 kitchens are fitted the learning rate will stop and the time taken for the 200th kitchen will be the time taken for all the remaining kitchens. Labour costs TZS15 per hour.

Overheads are absorbed on a labour hour basis. HC has collected overhead information for the last four months and this is shown below:

Hours worked Overhead cost TZS

Month 1	9,300	115,000
Month 2	9,200	113,600
Month 3	9,400	116,000
Month 4	9,600	116,800

HC normally works around 120,000 labour hours in a year.

HC uses the high low method to analyse overheads.

The learning curve equation is $y = axb$, where $b = \log LR / \log 2 = -0.074$

Required:

(a) Describe FIVE factors, other than the cost of labour and overheads mentioned above, that HC should take into consideration in calculating its bid.

(b) Calculate the total cost including all overheads for HC that it can use as a basis of the bid for the new apartment contract.

(a) If the second kitchen alone is expected to take 21.6 man-hours to fit demonstrate how the learning rate of 95% has been calculated.

Questions 7

BFG Limited is investigating the financial viability of a new product the S-pro. The S-pro is a short-life product for which a market has been identified at an agreed design specification. The product will only have a life of 12 months.

The following estimated information is available in respect of S-pro:

1. Sales should be 120,000 in the year in batches of 100 units. An average selling price of TZS1,050 per batch of 100 units is expected. All sales are for cash.
2. An 80% learning curve will apply for the first 700 batches after which a steady state production time will apply, with the labour time per batch after the first 700 batches being equal to the time for the 700th batch. The cost of the first batch was measured at TZS2,500. This was for 500 hours at TZS5 per hour.
3. Variable overhead is estimated at TZS2 per labour hour.
4. Direct material will be TZS500 per batch of S-pro for the first 200 batches produced. The second 200 batches will cost 90% of the cost per batch of the first 200 batches. All batches from then on will cost 90% of the batch cost for each of the second 200 batches. All purchases are made for cash
5. S-pro will require additional space to be rented. These directly attributable fixed costs will be TZS15,000 per month.

A target net cash flow of TZS130,000 is required in order for this project to be acceptable.

Note: The learning curve formula is given on the formulae sheet. At the learning rate of 0.8 (80%), the learning factor (b) is equal to -0.3219.

Required:

(a) Prepare detailed calculations to show whether product S-pro will provide the target net cash flow.

(b) Calculate what length of time then second batch will take if the actual rate of learning is:
(i) 80%;
(ii) 90%.

Explain which rate shows the faster learning.

c) Suggest specific actions that BFG could take to improve the net cash flow calculated above.

Question 8

A company is developing a new product. During its expected life it is forecast that 6,400 units of the product will be sold for TZS70 per unit.

The direct material and other non-labour related costs are expected to be TZS45 per unit throughout the life of the product.

Production is expected to be in batches of 100 units throughout the life of the product. The direct labour cost is expected to reduce due to the effects of learning throughout the life of the product. The total direct labour cost of the first batch of 100 units is expected to be TZS6,000 and an 80% learning effect is expected to occur.

Fixed costs specific to this product are expected to be TZS60,000 in total for the life of the product.

Note: The value of the learning index for an 80% learning curve is -0.3219

Required:

(a) **Calculate** the total direct labour cost of the first:

- (i) 800 units
- (ii) 1,600 units
- (iii) 3,200 units
- (iv) 6,400 units

(4 marks)

(b) **Apply** the results from part (a) to **advise** the company management of the approximate break-even level of sales of the product. (3 marks)

(c) **Explain** the effect on the break-even level of sales if the rate of learning was 90%. (No calculations are required.)

Answer to Self Examination Questions

Answer to SEQ 6

(a) There are various issues that HC should consider in making the bid. (Only five are required for two marks each.)

Contingency allowance. HC should consider the extent to which its estimates are accurate and hence the degree of uncertainty it is subjected to. It may be sensible to allow for these uncertainties by adding a contingency to the bid.

Competition. HC must consider which other businesses are likely to bid and recognise that the builder may be able to choose between suppliers. Moreover, HC has not worked for this builder before, and so they will probably find the competition stiff and the lack of reputation a problem.

Inclusion of fixed overhead. In the long run fixed overhead must be covered by sales revenue in order to make a profit. In the short run it is often correctly argued that the level of fixed cost in a business may not be affected by a new contract and therefore could be ignored in bid calculation. HC needs to consider to what extent the fixed costs of its business will change if it wins this new contract. It is these incremental fixed costs that are relevant to a bid calculation.

Materials and loose tools. No allowance has been made for the use of tools and the various fixings (screws etc) that will be needed to assemble and fit the kitchens. It is possible that most fixings would be provided with the kitchen units, but HC should at least consider this.

Supervision of labour. The time given in the question is 24 hours to 'fit' the first kitchen. There seems no allowance for supervision of the labour force. It could, of course, be included within the overhead figures but no detail is shown.

Idle time. It is common for building works to be delayed by lack of materials for example. The labour time figure needs to reflect this.

Likelihood of repeat business. Some businesses consider it worthwhile to accept a low price for a new contract if it establishes a reputation with a new buyer. HC could offer to do this work cheaper in the hope of more profitable work later on.

The risk of non-payment. HC may decide not to bid at all if it feels that the builder may struggle to pay.

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Opportunity costs of alternate work. Possibility of working in overtime.

(b) Bid calculations for HC to use as a basis for the apartment contract.

Cost	Hours	Rate per hour	Total TZS
Labour	9,247 (W1)	TZS15	138,705
Variable Overhead	9,247	TZS 8 (W2)	73,976
Fixed Overhead	9,247	TZS 4 (W2)	<u>36,988</u>
Total Cost			<u>249,669</u>

(W1)

Need to calculate the time for the 200th kitchen by taking the total time for the 199 kitchens from the total time for 200 kitchens.

For the 199 Kitchens

Using

$$y = ax^b$$

$$y = 24 \times 199^{-0.074}$$

$$y = 16.22169061 \text{ hours}$$

$$\text{Total time} = 16.22169061 \times 199$$

$$\text{Total time} = 3,228.12 \text{ hours}$$

For the 200 Kitchens

$$y = ax^b$$

$$y = 24 \times 200^{-0.074}$$

$$y = 16.21567465 \text{ hours}$$

$$\text{Total time} = 16.21567465 \times 200$$

$$\text{Total time} = 3,243.13 \text{ hours}$$

OR

$$y = ax^b$$

$$y = (24 \times 15) \times 199^{-0.074}$$

$$y = 243.32536$$

$$\text{Total cost} = \text{TZS}48,421.75$$

OR

$$y = ax^b$$

$$y = (24 \times 15) \times 200^{-0.074}$$

$$y = 243.2351198$$

$$\text{Total cost} = \text{TZS}48,647.02$$

$$200\text{th cost} = \text{TZS}225.27$$

The 200th Kitchen took $3,243.13 - 3,228.12 = 15.01$ hours

Total time is therefore:

For first 200 3,243.13 hours

For next 400 ($15.01 \text{ hours} \times 400$) 6,004.00 hours

Total 9,247.13 hours (9,247 hours)

(W2)

The overheads need to be analysed between variable and fixed cost elements.

Taking the highest and lowest figures from the information given:

	Hours	Cost (TZS)
Highest	9,600	116,800
Lowest	9,200	113,600
Difference	400	3,200

Variable cost per hours is $\text{TZS}3,200/400 \text{ hours} = \text{TZS}8$ per hour

Total cost = variable cost + fixed cost

$$116,800 = 9,600 \times 8 + \text{fixed cost}$$

Fixed cost = $\text{TZS}40,000$ per month

Annual fixed cost = $\text{TZS}40,000 \times 12 = \text{TZS}480,000$

Fixed absorption rate is $\text{TZS}480,000/120,000 \text{ hours} = \text{TZS}4$ per hour

(c) A table is useful to show how the learning rate has been calculated.

Number of Kitchens	Time for Kitchen (hours)	Cumulative time (hours)	Average time (hours)
1	24.00	24.00	24.00
2	21.60	45.60	22.80

The learning rate is calculated by measuring the reduction in the average time per kitchen as cumulative production doubles (in this case from 1 to 2).

The learning rate is therefore $22.80/24.00$ or 95%

Answer to SEQ 7

BFG Limited

(a) Sales 120,000 units

Sales Revenue TZS1,260,000

Costs:

Direct materials (W1) TZS514,000

Direct Labour (W2) TZS315,423

Variable overhead TZS126,169

Rent TZS180,000

Net cash flow **TZS124,408**

Target cash flow TZS130,000

The target cash flow will not be achieved

Workings:

(1) Direct material: Batches TZS

First 200 @ TZS500 100,000

Second 200 @ TZS450 90,000

Remaining 800 @ TZS405 324,000

Total **514,000**

(2) Direct labour

For first seven hundred batches $y = axb$

$$y = 2,500 \times 700^{-0.3219}$$

$$y = \text{TZS}303.461045$$

$$\text{Total cost for first 700 batches} = \text{TZS}303.461045 \times 700 = \text{TZS}212,423$$

All batches after the first 700 will have the same cost as the 700th batch. To calculate the cost of the 700th batch we need to take the cost of 699 batches from the cost of 700 batches.

For 699 batches

$$y = a \times b$$

$$y = 2,500 \times 699^{-0.3219}$$

$$y = \text{TZS}303.600726$$

$$\text{Total cost for first 699 batches} = \text{TZS}303.600726 \times 699 = \text{TZS}212,217$$

$$\text{Cost of 700th batch} = \text{TZS}212,423 - \text{TZS}212,217 = \text{TZS}206$$

Total cost for the 12 months of production

$$\text{TZS}212,423 + (\text{TZS}206 \times 500) = \text{TZS}315,423$$

(3) Variable overhead is TZS2 per hour or 40% of direct labour

(b) To calculate the learning factor BFG will have had to measure the time taken to make the first batch (500 hours) and then the time taken to make the second batch. The learning rate measures the relationship between the average time taken between two points as production doubles. The easiest way to measure the learning rate is when the production doubles between the first and second batches.

At 80%

Time for first batch 500

$$\text{Average time for two batches @80\% } 500 \times 0.8 = 400$$

$$\text{Total time for two batches } 2 \times 400 = 800$$

$$\text{Time for second batch } 800 - 500 = 300$$

At 90%

Time for first batch 500

$$\text{Average time for two batches @90\% } 500 \times 0.9 = 450$$

$$\text{Total time for two batches } 2 \times 450 = 900$$

$$\text{Time for second batch } 900 - 500 = 400$$

The 80% learning rate reduces the time taken for the two successive batches above by a greater amount (or faster). Hence the 80% learning rate is the faster learning.

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(c) Possible actions to improve the net cash flows are:

- **Increase the price charged.** The question states that an agreed specification has been reached, however further research may reveal that a higher price could be tolerated by the market. Equally a form of price skimming may be possible to improve short term net cash flow.
- **Reduce the labour cost per batch** by removing unnecessary operations or processes. It may be possible to simplify the design without damaging the ability to achieve the price stated.
- **Improve the learning rate.** This may involve improving the training or the quality of people involved in the production process. This does takes time and costs money in the short run.
- **Consider substitute materials** (without damaging the product specification). Also look for new suppliers to reduce the input cost.
- **Consider ways to reduce the level of variable overhead** incurred by the product.
- **Investigate** whether the production of product X could take place in existing space and hence avoid the extra rent charge. Re-negotiate the rent charge with the landlord.

Answer to SEQ 8

(a)

	No of units	No of batches	Average direct labour cost	Total direct labour cost
	100	1	TZS6,000	TZS 6,000
	200	2	TZS4,800	TZS 9,600
	400	4	TZS3,840	TZS 15,360
Ans (i)	800	8	TZS3,072	TZS 24,576
Ans (ii)	1,600	16	TZS2,457.60	TZS 39,321.60
Ans (iii)	3,200	32	TZS1,966.08	TZS 62,914.56
Ans (iv)	6,400	64	TZS1,572.86	TZS100,663.30

(b)

No of units	3,200	6,400
	TZS	TZS
Sales	224,000	448,000
Direct material and other		
Non-labour related costs	144,000	288,000
Direct labour cost	62,914.56	100,663.30
Fixed cost	60,000	60,000
Total costs	266,914.56	448,663.30
(Loss)	(42,914.56)	(663.30)

As can be seen from the table above the breakeven point seems to be slightly above 6,400 units.

(c) If the rate of learning were to be 90% instead of 80% this means that the labour time (and hence labour cost) per unit would reduce more slowly. Assuming that all other data remained unchanged then costs would be higher and hence the break-even level of sales would also be higher.

SECTION A2: INCOME EFFECTS OF ALTERNATIVE COST ACCUMULATION SYSTEMS

Get Through Intro

The marginal costing method recognises cost behaviour and divides costs into those which vary with production (e.g. raw materials) and those which are fixed for a period (e.g. rent). According to this method, only variable production costs are included in inventory valuation.

In contrast, the absorption costing method suggests computing unit product costs by adding up all the manufacturing costs – fixed as well as variable.

This section deals with the computation of the value of inventory, explaining the situations where profit derived under the two methods may differ and the reasons behind these differences.

Knowledge of marginal costing is essential in understanding how the profit of an organisation may vary under the two methods of costing. It is also important to know that while marginal costing is useful for decision-making, absorption costing is useful for external reporting.

Learning Outcomes

- a) Illustrate overhead allocation and apportionment.
- b) Describe the nature of marginal costing and absorption costing.
- c) Distinguish between marginal costing and absorption costing.
- d) Prepare profits statements based on marginal (variable) costing and absorption costing system.
- e) Explain the difference and reconcile the profits between marginal and absorption costing.
- f) Explain the arguments for and against marginal and absorption costing.

1. Illustrate overhead allocation and apportionment.**[Learning Outcome a]**

There are two types of cost centres where overheads are incurred: the **production cost centre** and the **service cost centre**. The actual processing and manufacture of the product takes place in the production cost centre whereas service cost centres provide services to the production cost centres.

The **first stage** is where the accumulation of overheads occurs, according to the department. The total overheads are allocated and apportioned to the production and service cost centres. Thereafter, in the **second stage**, these costs are applied to the products that are processed in these cost centres.

1.1 Allocation and apportionment of overheads

1. The first step is to **classify the overheads**. Overheads can be classified according to their function. Another classification can be made on the basis of variability i.e. fixed and variable overhead costs.

**Example**

Administrative overheads	cost of book-keeping
Fixed overheads	factory rent, staff salaries
Variable overheads	cost of lubricating oil for machines
Production overheads	salary of the factory supervisor, foremen and tools cost

2. Once the overheads are classified, they need to be **codified** (i.e. coded into categories). Codification is done as it helps in recording the costs. Once the overheads are classified, they are given 'standing order numbers' that are listed in a schedule. All of these are now recorded in computer files in pre-designed packages that assist in the accounting function.
3. Once the classification and codification of the overheads is complete, the **accumulation of overheads** is the next step. This is the first stage in the two stage process of calculation of the absorption rates. The overhead costs are collected from various records such as financial accounts, cost records and so on.

Costs are accumulated for each cost centre. The costs are either allocated or apportioned to the cost centres. Whenever the overhead costs can be **assigned** to the cost centres **on an accurate basis**, the costs are **allocated** to the cost centres. Allocation is performed only when we can precisely assign the costs to a cost centre.

**Example**

Large organisations provide canteen facilities for their employees. If the organisation has a system of coupons against which food is served, then the costs of the canteen can be allocated to the various departments / cost centres on the basis of the coupons submitted by the workers in each department. This is a case of allocation of canteen costs as we have an accurate basis on which to allocate the costs. Coupons are an accurate basis as each coupon has a value that can give us a clear idea of the cost of food consumed by each department.

4. **Apportionment** of costs to the cost centres is performed when we do not have a precise basis to assign the overheads to the cost centres. In this case we generally apportion the costs using the most suitable basis available.

**Example**

Consider the canteen example above. If the organisation does not have a coupon system, then it will not be in a position to accurately calculate the cost of food consumed by each department. In this case, we will take the most suitable basis for assigning the canteen costs to various departments. We will take the number of people in each department as the basis to assign the canteen costs to each department. The method of apportionment of costs is used when the basis is not accurate.

This is the most suitable method available that can give us reasonable assurance that the costs are not apportioned wrongly.

Allocation and apportionment of overheads assigns the entire overheads to production and service cost centres.

We still need to re-distribute the service cost centre overheads to the production cost centres. This is because service centres provide services to the production cost centres. Hence the production cost centres have to bear the cost of these services. This is called **re-apportionment of overheads**, since the overheads once apportioned to the service cost centres are again re-apportioned to the production cost centres in this stage.



Example

In a factory which makes plastic goods, the production department is involved in the actual moulding and finishing of the plastic goods. The stores department does the work of receiving material requisitions and satisfying them. This is a service provided by the stores department to the production department.

If, in the first stage of apportionment, the stores department is apportioned a TZS6.6 million electricity cost then this cost will be again re-apportioned on a suitable basis to the production department. One may take as a basis the number of requisitions received from the production department.

Calculation of overhead absorption rates

Once the apportionment and the re-apportionment of the overheads are complete in the first stage, all the overheads are allocated and apportioned to the production departments. These are now to be assigned to the products. This is the stage where **the overhead absorption rates are calculated**. Once we have the pool of overheads allocated and apportioned to the production departments, we need to divide these by the total number of a suitable unit. The most commonly used unit is a machine hour or a labour hour.

The above procedure provides us with the rate per machine hour / labour hour (or any other unit used). When this rate is multiplied by the number of machine hours or labour hours consumed by each product, the amount of overheads to be assigned to each product is obtained.



Example

Suppose the total machine maintenance cost allocated to a production department is Tsh120,000 and the machine hours recorded in the department are 6,000. The machine maintenance will be assigned to the products on the basis of machine hours required per product as this is the most suitable basis.

The overhead absorption rate will be calculated as = $\text{TZS}120,000 / 6,000 \text{ machine hours}$
 = TZS20 per machine hour.

If one unit of a product processed requires 5 machine hours then the overheads to be assigned to the product will be calculated as:

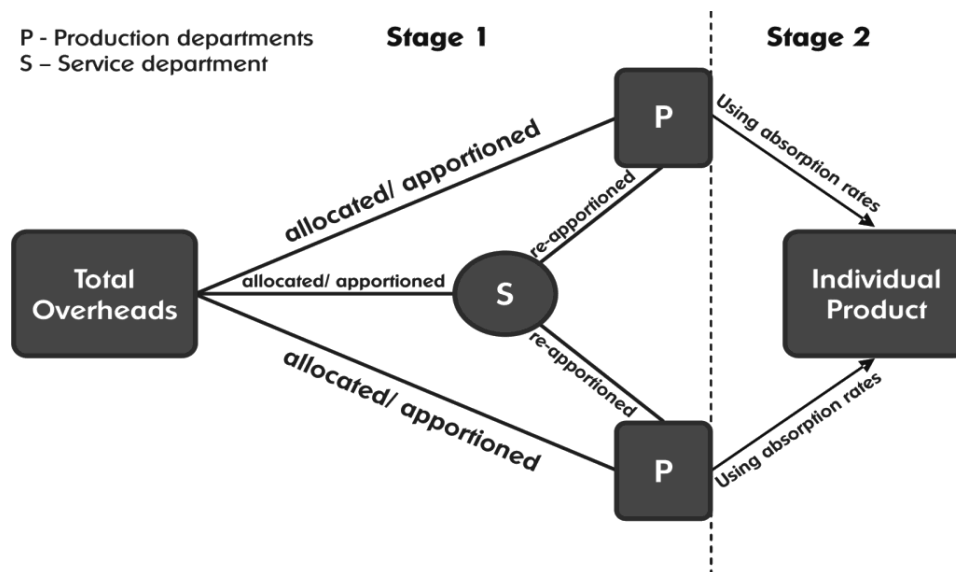
Overhead absorption rate x number of machine hours consumed by the product
 = $\text{TZS}20 \times 5 \text{ hours}$
 = TZS100

In conclusion, the amount of overheads assigned to the product will be Tsh100. This represents all the indirect costs which have gone into making that product.

The detailed procedure for determining the **individual rates of absorption of overheads** for each department can be summarised as follows:

- Allocate and apportion the total amount of overhead expenses incurred to the production and service cost centres.
- Reapportion the service cost centre overheads to the production cost centres.
- Calculate separate overhead rates for each production cost centre.
- Assign cost-centre overheads to products.

Diagram 1: Allocation, apportionment and absorption of overheads



The allocation and apportionment of overheads depends on whether there is an accurate basis available for assigning the overheads.

1.2 Allocation of overheads

Assigning specific overheads to a production/service cost centre or cost unit **on an appropriate basis** is known as the **allocation** of overheads. When costs can be easily identified with a particular cost centre they are allocated to the cost centre.



Example

The cost of tools issued to the maintenance department will be an overhead cost as these are not direct material items but items of indirect material. This is a specific cost that can be identified only with the maintenance department and hence this cost will be allocated to the maintenance department.

When **specific overheads** are incurred for a particular cost centre, those overheads are allocated to it.



Example

A special repair cost is incurred in the machine shop (a cost centre where part processing of the product takes place) due to break down of a machine in the shop. This cost is incurred only in the machine shop and hence this overhead will be allocated only to the machine shop.

Allocation of **common costs** or **general overheads** becomes difficult at times as the basis for allocation is imprecise or arbitrary. In such cases, computation of the exact amount of overheads to be allocated to a cost centre becomes difficult. These can only be allocated to cost centres using an appropriate basis.



Example

In a big manufacturing unit that requires a continuous supply of electricity, the electricity is normally generated in-house. This ensures an uninterrupted supply of electricity. In this case, electricity generation is a secondary activity to the main production activity and hence the cost incurred on this activity will be an overhead cost.

To keep track of the electricity consumption by each department, sub-meters are fitted in each of the departments. The electricity cost, in this case, will be assigned to each department on the basis of the sub-meter readings. Here the allocation of electricity cost is done as the basis of assigning this cost is accurate.

Overheads are always allocated to cost centres. When an organisation is divided into various departments according to their function, it may happen that such division is not suitable for cost allocation. Typically, cost centres are departments, but in some instances a department may contain several cost centres. This helps in the assignment of costs.



Example

An organisation is divided into various departments, one of which is the production department. This department consists of three machines; the melting machine, the moulding machine and the finishing machine. The overheads incurred on each machine can be separately identified.

For costing purposes, instead of considering the entire production department as one single cost centre, we will consider each of the three machines installed as individual cost centres.

1.3 Apportionment of overheads

Certain costs cannot be traced to a particular cost unit or cost centre. Apportionment refers to the proportionate allotment of such overheads to two or more departments or cost centres on an equitable (most suitable) basis. This is done in the case of those overheads which cannot be wholly allocated to a particular department or cost centre.



Example

Consider the above example of the 'in-house electricity generation unit'. If the sub-meters are not fitted in each department then it can pose a problem for the allocation of the electricity costs to the departments.

In this case we will use the most appropriate basis, such as the light points in each department. This will give us a fair amount of accuracy. As the capacity of each light point or power point is given in kilowatts this gives us a nearly accurate estimation of the power consumption in each department. This will now be a case of apportionment of overheads and not allocation.

Although the basis used in the above example does not seem to be accurate we still use it as it gives a greater accuracy than any other basis. It can be argued that all the light points are not in use at all times. However, this is what apportionment means, to assign overheads to the departments using a somewhat arbitrary basis since no accurate basis is available.



Example

The salary of a cleaner (for all departments) is a common cost incurred by all departments. In this case, we do not have any precise basis on which we can assign this cost accurately to the various cost centres. We will therefore take the most suitable basis such as the floor area of each department / cost centre.

This will give a fairly accurate cost apportionment. The larger the area of the department, the greater is the amount of cost apportioned. This is because the cleaner will need more time and effort to clean the department.

The main difference between cost allocation and cost apportionment is that allocation is the tracing of the whole of a cost to a cost centre while apportionment is the distribution of common costs over the cost centres on some suitable basis. In other words, cost allocation is direct, but apportionment needs a suitable basis.

Selection of an appropriate basis

The selection of an appropriate basis for the apportionment of overheads to cost centres is a critical decision. If the basis is not reasonable, it might lead to over- or under-assignment of overheads to the products. One of the criteria is to apportion the overheads on the basis of the benefit received by the department.



Example

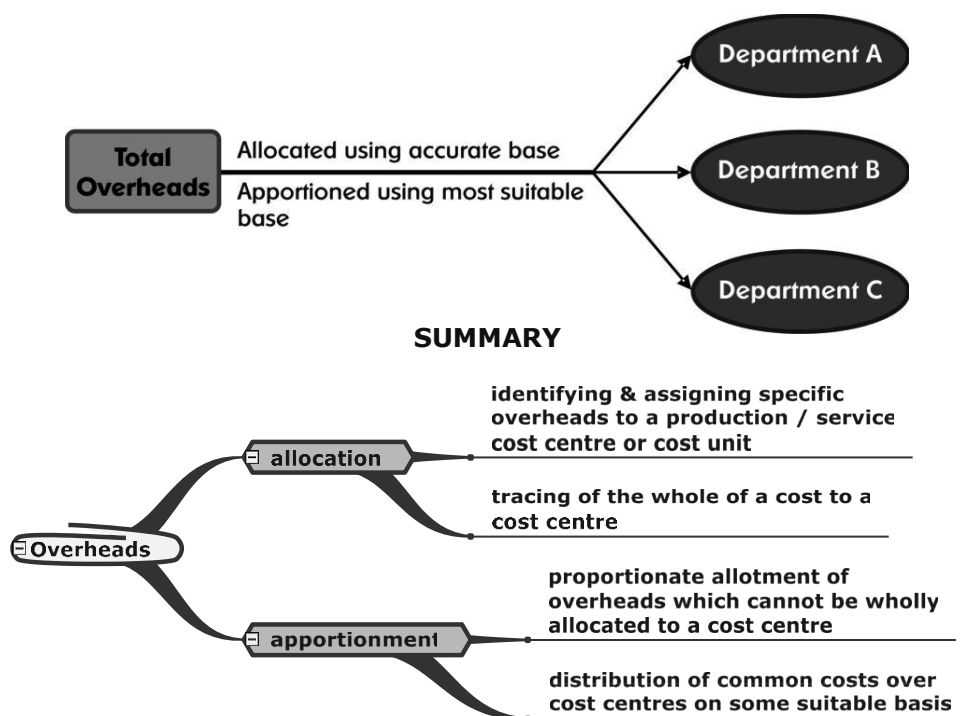
The salary of the supervisor supervising more than one department / cost centre will be apportioned on the basis of the time spent by him in each department. This is a fair basis as he gets paid on the basis of the hours of work completed by him. In this case, each department should bear the supervision costs in the ratio of the time spent by the supervisor in each department.

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One may also apportion the overheads on the basis of the factor that is the most responsible for the costs incurred. The commonly used bases for the apportionment of overhead costs to the cost centres are:

	Overhead cost	Basis of distribution
1	All labour related expenses e.g. time keeping, expenses, staff welfare expenses, canteen expenses and indirect labour	Number of employees or wages paid for each department. Direct labour hours are used as a basis for indirect labour
2	Lighting costs	Number of light points, floor space area occupied
3	Supervising costs	Time spent in each department or number of employees in the department
4	Rent, rates and property taxes, heat, light, air conditioning	Area occupied
5	Depreciation of plant and machinery	Capital value / book value of the machinery or plant will form the basis to apportion depreciation to the machine
7	Advertisement	Advertisement is apportioned to products as a percentage of sales value because advertisement expenses are incurred for the purpose of sale of the products

Diagram 2: Apportionment of overheads



After the allocation and apportionment of the overheads to the cost centres / departments these have to be **charged to the units of production** that are produced in these departments in a specific period. The process of charging the overheads to the units of output is called **absorption of overheads**.



Test Yourself 1

Show the apportionment of the following costs: Costs at the end of the year are as follows:

	TZS'000
Fixed costs	
Rent and rates	4,000
Insurance	20,000
Depreciation on plant and machinery	25,000
General department expenses	37,500
Variable costs	
Indirect wages	15,000
Fuel and power	20,000
Maintenance expenses	10,000

Continued on the next page

Additional cost related data (amounts in TZS'000)

	Department A	Department B	Department C	Department D	Total expenses
Floor area (sq.ft.)	2,000	2,000	4,000	2,000	10,000
Cost of plant and machinery	100,000	250,000	50,000	100,000	500,000
Horsepower (units)	16	24	20	20	80
Labour hours	5,000	10,000	15,000	20,000	50,000
Machine hours	12,000	9,000	6,000	3,000	30,000
Direct expenses	25,000	25,000	20,000	5,000	75,000

Department D is a service department and all other departments are production departments

2. Describe the nature of marginal costing and absorption costing.

3. Distinguish between marginal costing and absorption costing.

[Learning Outcomes b and c]

2.1 The basic concept of absorption costing



Definition

Absorption costing, also known as full absorption costing is a method of costing a product in which all fixed and variable costs are apportioned to cost centres where they are accounted for using absorption rates.

This method ensures that all incurred costs are recovered from the selling price of a good or service. Generally accepted accounting principles (GAAP) require absorption costing for external reporting purpose.

2.2 The basic concept of marginal costing

We have already learnt that fixed and variable costs behave differently with changes in the volume of production. Variable costs (also known as marginal costs) change with an increase or decrease in volume of production (accordingly, the variable costs per unit remain fixed) whereas fixed costs normally remain unaltered with a change in the volume of production. Fixed costs however, will change over time.

When fixed costs are included in total costs, the cost per unit of a product or a service varies from one accounting period to another in accordance with the volume of production / service in each period.

Consequently, one school of thought has said that fixed costs should be **taken out** of total costs, to avoid the variation. This is termed marginal costing.



Definition

'**Marginal costing**' is the accounting system in which variable costs are charged to cost units and fixed costs of the period are written-off in full against the aggregate contribution. Its special value is in recognising cost behaviour, and hence assisting in decision-making.

CIMA Official Terminology, 2005

The **product costs** under marginal costing only include direct materials, direct labour, direct expenses and variable overheads. It recognises cost behaviour and hence is useful in decision-making. Knowledge of marginal cost is fundamental to understanding the concept of marginal costing. Marginal cost is defined as:



Definition

Marginal cost is the cost of one unit of product or service which would be avoided if that unit were not produced or provided.

CIMA Official Terminology, 2005

In other words, it is the amount at any volume of production by which aggregate costs are changed if the volume of production is increased or decreased by one unit. The terms marginal cost and variable cost tend to be used interchangeably.

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Example

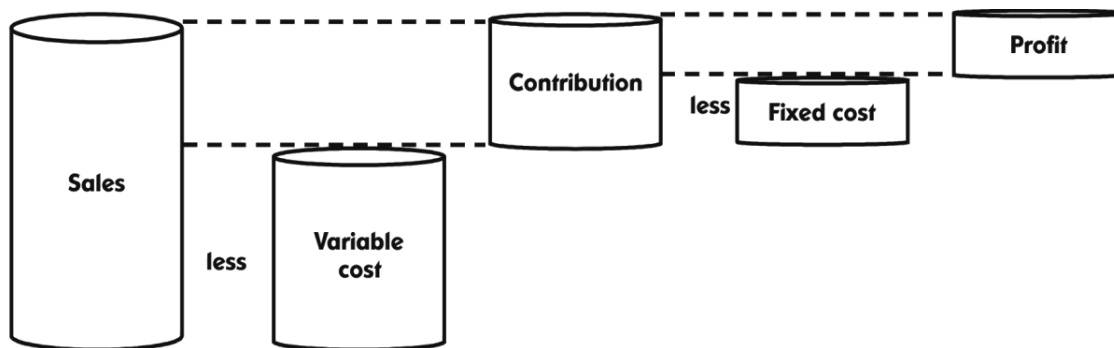
Roberto Plc is in the business of producing toiletries. The variable cost of producing a unit of bathing soap is TZS1,500. The company is currently producing 1,000 units of soap a week. Its fixed costs for the week are TZS500,000. Therefore, the cost of producing the weekly lot of soaps is TZS2,000,000 (TZS1,500 x 1,000 + TZS500,000).

If the company decides to increase the production of the soaps by one unit (i.e. if 1,001 units are produced) its total costs will be TZS2,001,500 (TZS1,500 x 1,001 + TZS500,000). This signifies that the differential cost for producing one extra unit is TZS1,500. By its definition, therefore, TZS1,500 is the marginal cost (which is the variable cost per unit) of the product.

Contribution

In marginal costing, the term contribution signifies an alternative measure of profit, which is computed as sales less the total variable costs of sales. Accordingly, **Contribution = Sales – Variable costs**

Diagram 3: Contribution



Contribution for the period provides a pool (since it recognises a surplus generated by sales revenue over variable costs) out of which the fixed costs for the period are met and any surplus constitutes the profit. It is called contribution because it literally contributes towards fixed costs and profit.

As a result, **Contribution = Fixed costs + Profit**

The sales price as well as the variable cost per unit is fixed for each unit produced and sold. Accordingly, contribution is also fixed per unit. Therefore, like the sales price and the variable costs per unit, the contribution per unit also remains unaltered (unlike profit per unit) over the accounting periods. Accordingly, profit planning for the future becomes easier if the contribution of a product is known rather than its profit.

Profit is calculated as sales less cost of sales (including fixed costs) and so, with an increased volume of sales, a higher profit per unit is generated (as fixed cost is generally constant within a range). On the other hand, contribution changes with a change in the number of units sold. However, it remains constant per unit. Since contribution is controllable and easier to predict than profit, it is used extensively in managerial decision-making such as identifying the most profitable product mix, deciding on whether to make a component or to buy it for use in manufacturing a product (or to sell it outright) and so on.

Also, the concept of contribution is useful for identifying the break-even point, the margin of safety, and for other sorts of cost-volume-profit analysis.



Definition

Cost-volume-profit (CVP) analysis is the study of the effects on future profit of changes in fixed cost, variable cost, sales price, quantity and mix.

The following example presents how contribution and profit are computed and also the effects of change in activity level on contribution per unit and profit per unit.



Example

An excerpt from the financial projections of Ricky Ltd for the month of January, 20X8 is presented as follows:

	TZS'000
Direct material (per unit)	8
Direct labour (per unit)	4
Variable production overhead (per unit)	1
Variable sales overheads (per unit)	2
Selling price	20
Total fixed cost (per month)	3,000
Budgeted production	1,500 units
Potential demand for the product	500 or 600 or 1,200 units

Calculating the contribution at the budgeted activity levels of 500, 600 and 1,200 units requires the following steps:

- Deduct the variable costs of sales from the sales revenue to calculate contribution
- Value the closing inventory at variable cost of production
- Deduct the total fixed costs from the total contribution to get the total profit of the business.

	Situation-1	Situation-2	Situation-3
	500 units (TZS'000)	600 units (TZS'000)	1,200 units (TZS'000)
Sales (a)	10,000	12,000	24,000
Less: Variable cost			
Production cost	6,500	7,800	15,600
	((TZS8+TZS4+Tsh1) x 500)	((TZS8+TZS4+Tsh1) x 600)	((TZS8+TZS4+Tsh1) x 1,200)
Selling expenses	1,000	1,200	2,400
	(TZS2 x 500)	(TZS2 x 600)	(TZS2 x 1,200)
Total Variable cost of sales (b)	7,500	9,000	18,000
Contribution (a – b)	2,500	3,000	6,000
Less:			
Fixed cost Profit / (loss)	3,000	3,000	3,000
Contribution per unit	(500)	0	3,000
	TZS5	TZS5	TZS5
	(TZS2,500/500 units)	(TZS3,000/600 units)	(TZS6,000/1,200 units)

The conclusions from the above example are given below:

Contribution per unit remains the same irrespective of the level of activity. Therefore, the total contribution at any level of activity is the contribution per unit multiplied by the sales volume. Contribution increases in direct proportion to sales volume.

When **contribution exceeds fixed costs, the business starts making a profit** (see situation 3).

When **contribution equals fixed cost there is a situation of no profit no loss** (see situation 2)

When **the contribution is less than fixed costs, the business incurs losses** (see situation 1).

Unlike contribution, profit per unit does not remain constant. It changes along with a change in the level of activity.

Based on the above, the principles justifying **marginal costing as a better tool for profit ascertainment** are as follows:

Fixed costs never undergo any change (within the given range) as long as the activity levels do not change and sales volumes never affect the amount of fixed costs incurred. Hence fixed costs should not be deducted from sales to calculate profit. Profit calculations should be based more on an analysis of contribution. Final profit may be arrived at by deducting the total fixed costs from the total contribution.

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Fixed costs always relate to an **activity period**. These costs do not change with any change in the sales volume. Marginal costing hence operates on the basis of the following assumptions:

Variable costs increase when any additional unit is produced.

Fixed costs remain constant.

Hence profit earned should be calculated as the difference between the sales price and the variable additional costs incurred. This is called contribution.

If sales reduce, only the variable cost of manufacture reduces and hence profit is again equal to the contribution earned on lost sales.

Similarly the valuation of **closing inventories** should also be based on the variable costs incurred on these ignoring the fixed cost component. This is because fixed costs remain the same whether the units are sold or they remain in inventory. Attributing only variable costs to inventory will provide a more realistic picture.

2.3 Distinction between the absorption and marginal costing methods

Absorption costing is the basis of preparing all financial accounting statements. Using absorption costing, all costs are absorbed into production and therefore operating statements do not distinguish between fixed and variable costs.

Under **absorption costing**, the entire costs of production, whether variable or fixed, are considered to be the product costs and only the non-manufacturing costs (both variable and fixed) are considered to be period costs.

Non-manufacturing costs (i.e. administration costs, research and development costs and selling and distribution costs) are not allocated to the products; instead, they are charged as an expense to the period in which they are incurred.

This means, under absorption costing, for product costing and valuation of inventory all the costs that are **incurred in order to produce an item** are considered.

On the other hand, under **marginal costing**, fixed costs are not absorbed into the cost of production.

Only the **variable costs of production** are considered to be **product costs** and the inventory is valued accordingly. **Fixed production costs** as well as all **non-manufacturing costs** (both variable and fixed) are considered to be **period costs** and accordingly they are not considered in determining the product costs or for valuation of inventories.

The following illustration highlights how determination of the cost of production (the cost at which inventories are valued) differs under the two methods:



Example

	Under absorption costing (Cost per unit) TZS'000	Under marginal costing (Cost per unit) TZS'000
Direct material	27.50	27.50
Direct labour	7.50	7.50
Direct expenses	2.50	2.50
	37.50	37.50
- Fixed overhead	2.00	-
- Variable overhead	6.00	6.00
Cost of production	45.50	43.50

A comparison of the absorption costing and the marginal costing method underpins the major differences:

Absorption costing	Marginal costing
For valuation of inventory, both variable and fixed manufacturing costs are considered.	For valuation of inventory, only variable manufacturing costs are considered. Fixed manufacturing costs are considered to be period costs.
Non-manufacturing costs (both variable and fixed) are considered to be period costs and written off (in the costing profit and loss account) in the period in which they are incurred.	Fixed manufacturing costs and non-manufacturing costs (both variable and fixed) are written off in the period in which they are incurred.
Emphasis on profit	Emphasis on contribution
Suitable for external reporting purpose	Suitable for decision making purposes

2.4 The effect of absorption and marginal costing on inventory valuation

Under marginal costing, no fixed manufacturing cost is charged to the product. Only variable manufacturing costs are charged to the product and therefore considered for inventory valuation. Consequently, the cost per unit remains constant irrespective of a change in the activity level. In contrast, under absorption costing, fixed manufacturing costs are assigned to the product. Therefore, the **cost per unit changes along with a change in the activity level**.



Example

Metal Plc follows the absorption costing system. Metal Plc's fixed production cost is TZS100 million. The variable cost (inclusive of direct and indirect costs) per unit is TZS10,000. In the month of April 20X8, the company's production was 10,000 units. Therefore, each product absorbs a fixed cost of TZS10,000 (TZS100m/10,000) making the per unit total cost of production TZS20,000 (variable costs TZS10,000 + fixed costs TZS10,000).

However, in the month of May 20X8, the production volume rose to 12,500 units. Accordingly, the fixed production cost was assigned to each product as TZS8,000 (TZS100m /12,500). Therefore, per unit production cost was TZS18,000 (variable costs TZS10,000 + fixed costs TZS8,000).

This shows that with a change in the activity level (i.e. from 10,000 units to 12,500 units), the cost per unit of the product also changes (from TZS20,000 to TZS18,000) under absorption costing.

Consider the example below to understand how the valuation of inventory differs under marginal costing and absorption costing.



Example

During the month of May, 20X8, Sunshine Ltd produced 1,500 units, and sold 1,200 units. Cost information of Sunshine Ltd:

	Cost per unit of production (TZS'000)
Direct material	10
Direct labour	8
Variable overheads	3
Fixed overheads absorption rate per unit	2

In this case, closing inventory is valued under marginal costing and absorption costing as follows:

Closing Inventory	Marginal costing 300 units (TZS'000)	Absorption costing 300 units (TZS'000)
Direct material	10	10
Direct labour	8	8
Variable overheads	3	3
Fixed overheads	-	2
Per unit cost	21	23
Total inventory value (TZS'000)	6,300	6,900

The example above reveals that the value of closing inventory under absorption costing is higher than the value of closing inventory under marginal costing.

The difference in inventory valuation between the two methods is attributable to the fixed costs that are considered in inventory valuation under the absorption costing method whereas they are not considered under the marginal costing method.

4. Prepare profits statements based on marginal (variable) costing and absorption costing system.

[Learning Outcome d]

The general formats for each of these methods are presented below. These should be committed to memory as they will help you in the exam:

1. General format under absorption costing

	TZS	TZS	TZS
Sales			X
Less: Production costs			
Direct material	X		
Direct Labour	X		
Direct expenses	X		
Prime cost	X		
Variable production overheads	X		
Fixed production overheads (Budgeted fixed cost per unit x No of units produced)	X		
Factory costs or production cost		X	
Difference in opening and closing inventory		X	
Cost of goods sold			X
Gross margin			X
Under / Over absorption of fixed overheads			X / (X)
Less: Non-manufacturing costs			
Administration overheads		X	
Selling and distribution overheads		X	X
Net profit			X

2. General format under marginal costing

	TZS	TZS
Sales		X
Less: Variable costs		
Direct material	X	
Direct labour	X	
Variable overhead	X	
Difference in opening and closing inventory	(X)	
Total adjusted variable cost		X
Contribution margin		X
Less: Fixed overheads		
Production	X	
Administration	X	
Selling expenses	X	X
Net profit		X

The easiest way to understand how to calculate profit or loss under both the methods is by means of an example.



Example

Balloon Ltd produces and markets hot air balloons. It follows a standard costing system and its standard cost card is as follows:

Standard cost card

	TZS'000
Sales price Direct	80
material Direct	11
labour Variable	19
overheads	8

Continued on the next page

Budgeted data for January and February 20X9

Production	20,000 units
Fixed production overhead	TZS100 million
Fixed administration expenses	TZS 36 million
Fixed selling expenses	TZS 22 million
Variable selling expenses	5% of sales

The actual data for December 20X8, January and February 20X9:

The opening inventory for the month of December is 1,000 units.

Production	Production Units	Sales Units	Closing Inventory Units
December 20X8	10,000	10,000	1,000
January 20X9	20,000	15,000	6,000
February 20X9	11,000	14,000	3,000

With the help of the information available, calculate how the profit differs under marginal costing and absorption costing.

Situation -1 production is equal to sales (i.e. opening and closing inventories are the same)

Profit statement under marginal costing system

	December 20X8	
	TZS (million)	TZS (million)
Sales 10,000 units x TZS80,000		800
Less: Variable costs		
Production costs		
Direct material (10,000 x TZS11,000)	110	
Direct labour (10,000 x TZS19,000)	190	
Variable overhead (10,000 x TZS8,000)	80	
Difference in opening and closing inventory W1	0	
	380	
Selling expenses (TZS800 million x 5%)	40	(420)
Contribution		380
Less: Fixed overheads		
Production	100	
Administration	36	
Selling	22	(158)
Net profit		222

Profit statement under absorption costing system

	December 20X8	
	TZS (million)	TZS (million)
Sales 10,000 units x TZS80,000		800
Less: Full production cost		
(W2) 10,000 x TZS43,000	430	
Difference in opening and closing inventory (W4)	0	
Adjusted full production cost		(430)
		370
Less: Non-manufacturing costs		
Administration costs	36	
Selling costs {22 + (800 x 5%)}	62	(98)
Under-absorption fixed production overhead (W3)		(50)
Net profit		222

Continued on the next page

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Workings

W1 Difference in opening and closing inventory (under marginal costing)

	TZS (million)
Opening inventory {1,000 x (TZS11,000+ TZS19,000 + TZS8,000)}	38
Closing inventory {1,000 x (TZS11,000 + TZS19,000 + TZS8,000)}	(38)
Net effect	0

Conclusion: when the opening and closing inventories are the same there is no difference between the profits calculated under marginal costing and absorption costing.

W2 Calculation of full production cost

Fixed production overhead absorption rate = TZS100 million/20,000 units
= TZS5,000 per unit

Full absorption cost per unit = Variable cost per unit + Fixed cost per unit
= (TZS11,000 + TZS19,000 + TZS8,000) + TZS5,000
= TZS43,000

Under absorption costing, the full production cost will be used to value inventory.

W3 Under-absorption of overheads

	December 20X8 TZS (million)
Fixed production overheads absorbed 10,000 units x TZS5,000	50
Less: Fixed production overheads incurred	(100)
Under-absorption of fixed overheads	(50)

As the fixed overheads absorbed are less than the actual overheads incurred, there is under-absorption of overheads. Due to this under-absorption of overheads, the profit shown is more than it actually is. Under-absorbed overheads need to be deducted in order to obtain the correct profit.

W4 Difference in opening and closing inventory (under absorption costing)

	TZS (million)
Opening inventory {1,000 x (TZS11,000+ TZS19,000 + TZS8,000 + TZS5,000) }	43
Closing inventory{1,000 x (TZS11,000+ TZS19,000 + TZS8,000 + TZS5,000) }	(43)
Net effect	0

Conclusion: when the opening and closing inventories are the same there is no difference in the profits calculated under marginal and absorption costing.

Situation - 2 productions exceeds sales (i.e. closing inventory is more than the opening inventory)

Profit statement under marginal costing system

	January 20X9	
	TZS (million)	TZS (million)
Sales 15,000 x TZS80,000		1,200
Less: Variable costs		
Production cost		
Direct material (20,000 x TZS11,000)	220	
Direct labour (20,000 x TZS19,000)	380	
Variable overhead (20,000 x TZS8,000)	160	
Difference in opening and closing inventory (W1)	(190)	

Continued on the next page

Adjusted production cost	570	
Selling expenses (TZS1,200 million x 5%)	60	(630)
Contribution margin		570
Less: Fixed overheads		
Production	100	
Administration	36	
Sales	22	(158)
Net profit/(loss)		412

Profit statement under absorption costing system

	January 20X9	
	TZS (million)	TZS (million)
Sales 15,000 x TZS80,000		1,200
Less: Full production cost		
Cost of production (W2) 20,000 x TZS43,000	860	
Difference in opening inventory and closing inventory (W3)	(215)	(645)
		555
Less: Non-manufacturing costs		
Administration costs	36	
Selling costs {22 + (1,200 x 5%)}	82	(118)
Over- / (under-) absorption fixed production overhead (W4)		0
Net profit		437

Workings**W1 Difference in opening and closing inventory (under marginal costing)**

	TZS (million)
Opening inventory {1,000 x (TZS11,000 + TZS19,000 + TZS8,000)}	38
Less: Closing inventory {6,000 x (TZS11,000 + TZS19,000 + TZS8,000)}	(228)
Net effect	(190)

Note: In financial accounting we have seen that opening inventory is added to the cost of sales and closing inventory is deducted from the cost of sales. The same principle applies here.

W2 Calculation of full production cost

Fixed production overhead absorption rate = TZS100 million/20,000 units
= TZS5,000 per unit

Full absorption cost per unit = Variable cost per unit + Fixed cost per unit
= (TZS11,000 + TZS19,000 + TZS8,000) + TZS5,000
= TZS43,000

Under absorption costing, the full production cost will be used to value inventory.

W3 Difference in opening and closing inventory (under absorption costing)

	TZS (million)
Opening inventory {1,000 x (TZS11,000 + TZS19,000 + TZS8,000 + TZS5,000)}	43
Closing inventory {6,000 x (TZS11,000 + TZS19,000 + TZS8,000 + TZS5,000)}	(258)
Net effect	(215)

W4 Over / under-absorption of overheads

Fixed overheads are absorbed on the basis of budgeted capacity. If the actual capacity is more than the budgeted capacity, this results in over-absorption of overheads and vice-versa

Continued on the next page

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	TZS (million)
Fixed production overheads absorbed 20,000 units x TZS5,000	100
Less: Fixed production overheads incurred	(100)
Over / under-absorption	Nil

Conclusion: the closing inventory is more than the opening inventory i.e. production exceeds sales. In this situation, the profits under absorption costing are more than the profits under marginal costing.

This is because under absorption costing we consider fixed production costs as product costs. Hence, with the increase in the volume of closing inventory, a greater amount of fixed production overheads is included in the closing inventory.

Fixed production costs are therefore deferred as a part of inventory cost on the balance sheet, whereas the whole amount of the fixed production cost is treated as a period cost under marginal costing.

As a general rule, we can say that when **closing inventory exceeds opening inventory, absorption costing will show higher profits** in comparison with marginal costing.

Situation – 3 sales exceed production i.e. closing inventory is less than the opening inventory

Profit statement under marginal costing

	February 20X9	
	TZS (million)	TZS (million)
Sales (14,000 x TZS80,000)		1,120
Less: Variable costs		
Production cost		
Direct material (11,000 x TZS11,000)	121	
Direct labour (11,000 x TZS19,000) Variable	209	
overhead (11,000 x TZS8,000) Difference in	88	
opening and closing inventory (W1) Adjusted	114	
production cost	532	
Selling expenses (TZS1,120 million x 5%)	56	(588)
Contribution margin		532
Less: Fixed overheads		
Production	100	
Administration	36	
Sales	22	(158)
Net profit / loss		374

Profit statement under absorption costing system

	February 20X9	
	TZS (million)	TZS (million)
Sales 14,000 x TZS80,000		1,120
Less: Full production cost		
Cost of production (W2) 11,000 x TZS43,000	473	
Difference in opening inventory and closing inventory (W3)	129	(602)
		518
Less: Non-manufacturing costs		
Administration costs	36	
Selling costs {22 + (TZS 1,120 million x 5%)}	78	(114)
Over / under-absorption fixed production overhead (W4)		(45)
Net profit		359

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Workings**W1 Difference in opening and closing inventory (under marginal costing)**

	TZS (million)
Opening inventory {6,000 x (TZS11,000+ TZS19,000 + TZS8,000)}	228
Less: Closing inventory {3,000 x (TZS11,000+ TZS19,000 + TZS8,000)}	(114)
Net effect	114

W2 Calculation of full production cost

Fixed production overhead absorption rate = TZS100 million/20,000 units
= TZS5,000 per unit

Full absorption cost per unit = Variable cost per unit + Fixed cost per unit
= (TZS11,000+ TZS19,000 + TZS8,000) + TZS5,000
= TZS43,000

Under absorption costing, the full production cost will be used to value inventory.

W3 Difference in opening and closing inventory (under absorption costing)

	TZS (million)
Opening inventory {6,000 x (TZS11,000+ TZS19,000 + TZS8,000 + TZS5,000)}	258
Closing inventory {3,000 x (TZS11,000+ TZS19,000 + TZS8,000 + TZS5,000)}	(129)
Net effect	129

W4 Over/under absorption of overheads

Fixed overheads are absorbed on the basis of budgeted capacity. If the actual capacity is more than the budgeted capacity, it results in over absorption of overheads and vice-versa.

	TZS (million)
Fixed production overheads absorbed 11,000 units x TZS5,000	55
Less; Fixed production overheads incurred	(100)
Over / Under-absorption	(45)

This situation is exactly the opposite of situation 2. Here, the profit under marginal costing is more than the profit under absorption costing.

Under absorption costing, when the closing inventory is less than the opening inventory the profit of the current period is less than that calculated under marginal costing for the following reasons:

Less fixed costs of the current period are transferred to the next period (since fixed costs are in inventory)
A greater share of the fixed costs of the previous period gets transferred to the current period.

**Tip**

When the **opening inventory exceeds** the **closing inventory**, **absorption costing** will **show less profit** in comparison with marginal costing.

As discussed above, we can conclude that when the production exceeds sales the profit under absorption costing will always be more than the profit under marginal costing. This is true because absorption costing rewards production. The reverse is true when the sales exceed the production. Profit under marginal costing exceeds profit under absorption costing since the marginal costing approach rewards sales rather than production.

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Example

The production and sales in units for two consecutive months are given below:

	Month 1	Month 2
Sales (units)	1,900	2,200
Production (units)	1,950	2,100

The opening inventory for month 1 was 200 units. Profits or losses have been calculated for each month using both absorption and marginal costing principles. The sales price per unit was TZS50,000 and the variable production costs were TZS35,000 whereas the total fixed production costs were TZS11,700,000 for month 1 and TZS12,600,000 for month 2.

Calculation of closing inventory

	Month 1	Month 2
Opening inventory	200	250
Production Less:	1,950	2,100
Sales Closing inventory	(1,900)	(2,200)
	250	150

Statement calculating profits under absorption costing

		Month 1 (TZS'000)		Month 2 (TZS'000)
Sales (a)		95,000		110,000
Less: Variable cost of production @ TZS35,000		68,250		73,500
Fixed cost of production		11,700		12,600
Less: Difference in inventory				
Add: Opening inventory	8,200 (200 x TZS[35,000+6,000])		10,250 (250 x TZS[35,000 + 6,000])	
Less: Closing inventory	10,250 (250 x TZS[35,000+6,000])	(2,050)	6,150 (150 x TZS[35,000+6,000])	4,100
Total production costs (b)		77,900		90,200
Profit (a – b)		17,100		19,800

Statement calculating profits under marginal costing

		Month 1		Month 2
Sales		95,000		110,000
Less: Variable cost of production @ TZS5,000		68,250		73,500
Less: Difference in inventory				
Add: Opening inventory	7,000 (200 x TZS35,000)		8,750 (250 x TZS35,000)	
Less: Closing inventory	8,750 (250 x TZS35,000)	(1,750)	5,250 (150 x TZS35,000)	3,500
Total variable costs		66,500		77,000
Contribution		28,500		33,000
Less: Fixed costs		11,700		12,600
Profit		16,800		20,400

Continued on the next page

The above statements make it clear that in month 1, when sales < production, the profit according to marginal costing was less than the profit according to absorption costing since marginal costing rewards sales. Absorption costing profit is greater indicating that it rewards production and not sales.

In month 2 the situation is exactly the opposite i.e. sales > production. Therefore the profit according to marginal costing is more than that of absorption costing.



Test Yourself 2

Sage Ltd has provided the following information:

Standard cost card

	TZS'000
Sales price Direct	1,000
material Direct	120
labour Variable	270
overheads	20

Budget for the month of April and May 20X8

Production	1,000 units
Fixed production overhead	TZS200,000,000
Fixed administration expenses	TZS44,000,000
Fixed selling expenses	TZS70,000,000
Variable selling expenses	7% of sales

Actual data is as follows

Production	Production Units	Sales Units	Inventory Units
March 20X8	1,000	900	100
April 20X8	1,000	900	200
May 20X8	1,200	1,250	150

With the help of this information calculate the profit under marginal costing and absorption costing for April and May 20X8.

5. Explain the difference and reconcile the profits between marginal and absorption costing. [Learning Outcome e]

4.1 Difference of the profits between marginal and absorption costing

By now we have learnt that under absorption costing, inventory is valued at full production cost. This includes fixed production overheads. In contrast, under marginal costing, inventory is valued at variable costs only.

The costs included in the inventory are carried forward to subsequent periods of operation and are charged to the statement of comprehensive income as expenditure in the year in which the inventories are sold.

Ultimately the difference in the profits derived under the two methods is because of the difference in the valuation of the closing inventory. In other words, the difference is attributable to the amount of fixed production overheads included in inventory valuation under absorption costing and not included under marginal costing.

If inventory levels increase then absorption costing profits will be higher than marginal costing profits. On the contrary, if inventory levels reduce, then marginal costing profits will be higher than absorption costing profits.

4.2 Reconciling the profits under absorption and marginal costing

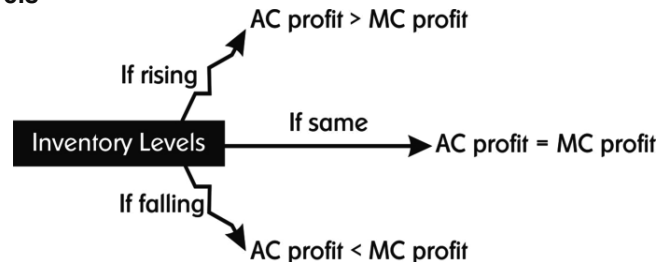
The profits reported under the two costing methods will differ if there is any change in the inventory levels between the beginning and the end of a period. Depending upon whether inventory levels are increasing or decreasing, the profit figure of absorption costing will be different from marginal costing. If the inventory levels remain constant, then there will be no differences in the profit according to the two methods.

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Situation 1: Increase in inventory levels: Absorption costing will report higher profits than marginal costing. This is because some of the fixed costs of production incurred during the period are carried forward to the inventory account and used against sales in the following period.

Situation 2: Decrease in inventory levels: Marginal costing will report higher profits than absorption costing. This is because some of the fixed costs of production incurred during the period which had been carried forward in opening inventory is released and also incorporated in cost of sales.

Diagram 4: Inventory Levels



Statement of reconciliation

From MC to AC profits	From AC to MC profits
Profits under marginal costing	Profits under absorption costing
Add: Difference in valuation of inventory when opening inventory is less than closing inventory	Deduct: Difference in valuation of inventory when opening inventory is less than closing inventory
Or	Or
Deduct: Difference in valuation of inventory when opening inventory is more than closing inventory	Add: Difference in valuation of inventory when opening inventory is more than closing inventory
Profits under absorption costing	Profits under marginal costing



Example

Refer to the example of Balloon Ltd

Reconcile the profits under both the methods for situation 2 and situation 3.

The difference in the profits under marginal and absorption costing is the result of different methods of valuation of inventories under the two methods. We will first calculate the difference in the units of the opening and closing inventories.

Working

W1 Calculation of difference in opening and closing inventories

	January 20X9 units	February 20X9 units
Opening inventory	1,000	6,000
Less: Closing inventory	6,000	3,000
Difference in inventory	5,000	3,000

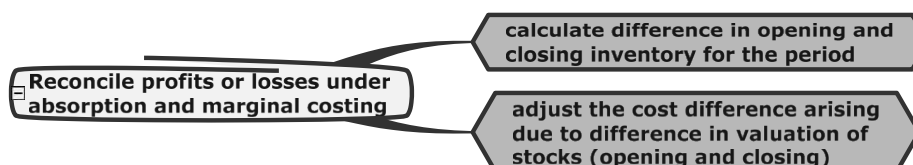
The major difference in the valuation of inventories is due to the fact that marginal costing does not consider the **fixed production costs of TZS5,000** (as computed in the example of Balloon) to be included in inventory. Therefore the inventories under marginal costing are valued at a price of TZS5,000 less than under absorption costing.

Continued on the next page

	January 20X9 TZS million	February 20X9 TZS million
Profit under marginal costing	412	374
Adjust for fixed overheads in inventory		
Add: the difference in valuation when the opening inventory is less than the closing inventory 5,000 units (W1) x TZS5,000 (increase)	25	
Less: the difference in valuation when the opening inventory is greater than the closing inventory 3,000 units (W1) x TZS5,000 (decrease)		(15)
Profits under absorption costing	437	359

However, the differences in profit caused by adoption of the two different methods of costing can only occur in the short term when inventory levels fluctuate. If the inventory level remains constant, then there will be no differences in profit between the two methods. In the long run, the total profit under both the methods will be the same. This is because all the costs included in the inventory (and as a result unable to be charged to the statement of comprehensive income) will eventually be charged to the statement of comprehensive income. It is simply the timing of the sales that causes the differences in profit from period to period.

SUMMARY



Test Yourself 3

Reconcile the profits under marginal and absorption costing methods in Test Yourself 2.

6. Explain the arguments for and against marginal and absorption costing.

[Learning Outcome f]

5.1 Marginal costing

1. Advantages of marginal costing

- (a) In the short term, the marginal cost per unit remains constant. This feature of marginal costing is useful in product pricing.



Example

Red Rose Ltd has a production capacity of 10,000 units. The company operates at 80% of its capacity. The company's cost structure is as follows-

	TZS'000
Direct material (per unit)	6
Direct labour (per unit)	4
Variable overheads (per unit)	2
Monthly fixed overheads	10,000
Actual production level	8,000 units
Selling price	15

The company earns a profit of $(8,000 \times \text{TZS}15,000) - \{(8,000 \times \text{TZS}12,000) + \text{TZS}10,000,000\} = \text{TZS}14,000,000$.

The marketing team of the company received an enquiry from a U.S. based company to supply 1,000 units at a special price of TZS13,000 (i.e. below the normal selling price) but above the variable cost.

Since Red Rose Ltd has to incur fixed expenses irrespective of level of activity, even if the company supplies goods below the normal selling price it will add to the total contribution. Effectively the profit will increase. The increase in profit will be equal to the contribution from the special offer i.e.

Special selling price – Variable cost = Contribution

$\text{TZS}13,000 - \text{TZS}12,000 = \text{TZS}1,000$ per unit.

Total increase in profit will be $\text{TZS}1,000 \times 1000 \text{ units} = \text{TZS}1,000,000$

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- (b) Under marginal costing fixed overheads are considered to be period costs and are deducted from contribution in order to obtain profit. Hence, unlike absorption costing there is no question of under- or over-absorption of overheads.
- (c) Under marginal costing, fixed costs are treated as period costs and are charged to the statement of comprehensive income in the year in which they are incurred. As fixed expenses are not deferred to a later accounting period, marginal costing shows the true profit for the period.
- (d) Marginal costing helps management to take various managerial decisions such as whether to make or buy; whether to shut down a plant or continue production and so on.
- (e) Under marginal costing, it is essential to classify total costs into variable and fixed cost categories. This classification of the costs according to their behaviour helps management to exercise control over the costs.

2. Disadvantages of marginal costing

- (a) Sometimes it is very difficult to classify costs into the fixed or variable categories. Most of the costs are neither purely fixed nor purely variable in nature, e.g. in a telephone bill, the bill amount consists of a fixed element of cost towards rent and some portion towards usage which is variable in nature.
- (b) Under marginal costing one of the basic assumptions is that the fixed costs will remain constant throughout the period under consideration. This may not always be true. The fixed costs may either change within the period under consideration or from one period to the other.



Example

During a period, fixed costs may tend to move upward because of a rise in rental charges or due to salary increases etc.

- (c) Under marginal costing, fixed costs are not included in the value of inventory of finished goods and work-in-progress. Due to this elimination of fixed costs, the inventories are understated.
- (d) The profitability assessment under marginal costing may be useful in the short term, but long-term profit should be determined based on full costs (variable and fixed costs) only.

5.2 Absorption costing

1. Advantages of absorption costing

Under the marginal costing system, fixed costs are ignored for the purpose of decision-making. However, in the long run, the fixed costs must be recovered. Under marginal costing, when a decision is taken on the basis of variable costs only, there may be a situation where the sales revenue is insufficient to recover the fixed costs. However, under absorption costing, a fixed cost is considered to be a product cost (i.e. charged to the product). So, care is taken to ensure that all fixed costs are recovered within the period itself.

- (a) Under absorption costing, the fixed production overheads included in closing inventory are shifted to the next period. These overheads are not charged against revenue until the related goods are sold. As a result, absorption costing gives a more logical profit calculation as the matching principle is followed.
- (b) According to IAS 2 accounting for inventories, it is mandatory to use absorption costing for inventory valuation for the purposes of external reporting.

2. Disadvantages of absorption costing

- (a) Under absorption costing, the per unit cost changes from period to period depending upon the number of units produced during the period. The critics of the method indicate that apportionment of fixed production cost to individual units is carried out on a purely arbitrary basis. Therefore absorption costing is not suitable for decision-making.
- (b) Under absorption costing, costs are classified based on their origin (e.g. direct material, manufacturing overheads, selling and distribution overheads and so on) and not on the basis of their behaviour (i.e. into fixed and variable categories). Hence, for control purposes, absorption costing is not useful.
- (c) The absorption costing method induces a manager to increase the production for a period, even if there is insufficient demand for the product, and ultimately to report higher operating profits.

Answers to Test Yourself

Answer to TY 1

Analysis of distribution of actual overhead costs

Expenses	Basis of apportionment	Dept. A	Dept. B	Dept. C	Dept. D	Total expenses TZS'000
Fixed costs						
Rent and rates	Floor area	800	800	1,600	800	4,000
Insurance	Cost of plant and machinery	4,000	10,000	2,000	4,000	20,000
Depreciation on plant and machinery	Cost of plant and machinery	5,000	12,500	2,500	5,000	25,000
General department expenses	Direct expenses	12,500	12,500	10,000	2,500	37,500
Variable costs						
Indirect wages	Labour hours	1,500	3,000	4,500	6,000	15,000
Fuel and power	Horsepower	4,000	6,000	5,000	5,000	20,000
Maintenance expenses	Machine hours	4,000	3,000	2,000	1,000	10,000
Total expenses		31,800	47,800	27,600	24,300	131,500

Answer to TY 2

Profit statement under marginal costing system

	April 20X8	May 20X8
	TZS million	TZS million
Sales (a)	900 (900 x TZS1,000,000)	1,250 (1,250 x TZS1,000,000)
Less: Variable costs		
Direct material	120 (1,000 x TZS120,000)	144 (1,200 x TZS120,000)
Direct labour	270 (1,000 x TZS270,000)	324 (1,200 x TZS270,000)
Variable overhead	20 (1,000 x TZS20,000)	24 (1,200 x TZS20,000)
Difference in opening and closing inventory (W1)	(41)	20.5
Variable cost of production	369	512.5
Variable Selling expenses	63 (TZS900,000 x 7%)	87.5 (TZS1250,000 x 7%)
Variable cost of sales (b)	432	600
Contribution (a - b) = (c)	468	650
Less: Fixed overheads		
Production	200	200
Administration	44	44
Sales	70	70
Total fixed cost (d)	314	314
Net profit/(loss) (c - d)	154	336

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Profit statement under absorption costing method

	April 20X8		May 20X8	
Production units	1,000		1,200	
	TZS million	TZS million	TZS million	TZS million
Sales @ TZS1,000,000		900		1,250.00
Less: Full production cost				
Cost of production 1,000 / 1,200 x TZS610,000 (W2)	610		732.00	
Difference between opening and closing inventory (W3)	(61)	(549)	30.50	(762.50)
		351		487.50
Less : Non-manufacturing costs				
Administration costs	44		44.0	
Selling costs {TZS70,000,000 + (900 / 1,250 x 7%)}	133	(177)	157.50	(201.50)
Over absorption of fixed production overhead (W4)		0		40
Net profit		174		326

Workings

W1 Difference in opening and closing inventory (under marginal costing)

	April 20X8	May 20X8
	TZS million	TZS million
Opening inventory {100 / 200 x (TZS120,000 + TZS270,000 + TZS20,000) }	41	82.00
Closing inventory {200 / 150 x (TZS120,000 + TZS270,000 + TZS20,000) }	(82)	(61.50)
Net effect	(41)	20.50

W2 Calculation of full production cost

Fixed production overhead per unit = TZS200,000,000/1,000 units = TZS200,000

Full absorption cost per unit = Variable cost per unit + Fixed cost per unit
= (TZS120,000 + TZS270,000 + TZS20,000) + TZS200,000
= TZS610,000

W3 Difference in opening and closing inventory (under absorption costing)

	April 20X8	May 20X8
	TZS million	TZS million
Opening inventory 100 / 200 x 610,000	61	122.00
Closing 200 / 150 x 610,000	(122)	(91.50)
Net effect	(61)	30.50

W4 Calculation of over / (under) absorption of fixed overheads

	April 20X8	May 20X8
	TZS million	TZS million
Fixed production overheads absorbed 1,000 units / 1,200 units x TZS200,000	200	240
Less: Fixed production overheads incurred	(200)	(200)
Over-absorption	0	40

Answer to TY 3

Statement of reconciliation (of profits calculated in the above question)

	April 20X8	May 20X8
	TZS million	TZS million
Marginal costing profit	154	336
Adjust for fixed overheads in closing inventory		
100 units x TZS200,000 (increase)	20	
50 units x TZS200,000 (decrease)		(10)
Absorption costing profit	174	326

Quick Quiz

1. In the two stage procedure of calculation of the overhead absorption rates the overheads are first:
 - A** Apportioned to the service centres.
 - B** Allocated to the departments or cost centres.
 - C** Re-apportioned to the production centres.
 - D** Assigned directly to the products.
2. The overhead expenses which are incurred only in a specific department are:
 - A** Allocated first to the product and then to the department in which the product is processed.
 - B** Allocated directly to that department.
 - C** Allocated to the service cost centres which offer the service.
 - D** Allocated to all the departments equally.
3. Which of the following statements is /are correct with reference to marginal costing?
 - (i) Only variable costs are taken into account for computing the value of inventory
 - (ii) Profitability is determined in terms of marginal contribution
 - (iii) Variable costs are charged to cost units and fixed costs are written-off
 - A** (i) and (ii)
 - B** (ii) and (iii)
 - C** (i) and (iii)
 - D** All of the above
4. Under marginal costing closing inventories are valued at:
 - A** Full cost
 - B** Total production cost
 - C** Variable production cost
 - D** Total variable cost
5. Which of the following statements is incorrect?
 - A** Under absorption costing inventory is valued at variable cost of production
 - B** Absorption costing is also known as full costing
 - C** In the short term, marginal cost remains constant
 - D** Marginal cost is the cost of one product which can be avoided if that unit is not produced
6. Which of these statements is/are incorrect?
 - (i) If there are more sale units than production units, then the marginal costing profit will be more than the absorption costing profit.
 - (ii) If there are fewer sale units than production units, then the marginal costing profit will be less than the absorption costing profit.
 - (iii) Selling units and production units do not make any difference to costing profit.
 - (iv) The difference between marginal costing profit and absorption costing profit is a result of inventory valuation.
 - A** Statements (i), (ii) and (iii)
 - B** Statements (i)
 - C** Statements (iii)
 - D** All of the above
7. Rose Ltd produces 20,000 units by the end of the year. The following statistics are available:

Closing inventory 2,000 units
Total fixed production costs TZS100 million
Marginal costing profit TZS50 million

The amount of absorption costing profit will be:

 - A** TZS50 million
 - B** TZS70 million
 - C** TZS40 million
 - D** TZS60 million

Answers to Quick Quiz

1. The correct option is **B**.

In the two stage procedure, overheads are first allocated to the departments or cost centres. Apportionment of costs to the service cost centres will be the next step after the overheads have been allocated to the various cost centres. Thereafter the overheads which cannot be directly identified with the departments or cost centres are apportioned to service as well as other departments on a suitable basis. Re-apportionment can happen only after basic apportionment is complete. Assignment of overheads to the products is the last stage in the procedure of calculating overhead absorption rates.

2. The correct option is **B**.

When the expenses are incurred only for a specific department, these can be easily identified with that department and hence can be allocated directly to that department. Overheads cannot be identified with a specific unit of product and hence cannot be allocated directly to products. Overheads are never allocated to the service cost centres which offer the service but are allocated to the cost centres that use the service. Overheads incurred only in a specific department cannot be allocated to any other department.

3. The correct option is **D**.

Under marginal costing, only variable costs are accumulated and charged to cost units. Fixed costs of the period are fully written-off. Hence, profitability is determined in terms of marginal contribution that is sales less variable costs. Under this method, only variable manufacturing costs are considered for valuation of inventory.

4. The correct option is **C**.

Marginal costing is a costing method in which prime costs and variable factory overheads are used to value inventories.

5. The correct option is **A**.

Under marginal costing, inventory is valued at the variable production cost. This does not happen under absorption costing. Under absorption costing, inventory is valued at total production cost.

6. The correct option is **C**.

Selling and production units make a difference to costing profit as follows: If production exceeds sales, AC profit is greater than MC profit. On the other hand if sales exceed production, MC profit is greater than AC profit.

7. The correct option is **D**.

Marginal costing profit	=	Absorption costing profit	–	[(Closing inventory) x (Fixed production costs/Production units)]
TZS50 million	=	Absorption costing profit	–	[(2,000 units) x (TZS100 million/20,000 units)]
Absorption costing profit	=	TZS50 million	+	(2 000 units x TZS5)
	=	TZS60 million		

Self-Examination Questions

Question 1

Strickland Company manufactures office furniture. The company provides the following information pertaining to its first year of operation:

Sales	10,000 units
Production	12,000 units
	TZS'000
Sales price (per unit)	18
Direct material (per unit)	3
Direct labour (per unit)	5
Variable overheads	2
Selling and distribution overheads	
Fixed	10,000
Variable	1
Fixed production overheads	24,000

Required:

If the company uses absorption costing, what would be the cost of production and gross margin of the company?

Question 2

Roberto Ltd provides the following information:

Opening inventory for June 20X9	1,000 units
Closing inventory for June 20X9	8,00 units
Profit for June 20X9 (calculated using marginal costing system)	TZS10.1 million
Fixed overhead absorption rate	TZS10,000

Required:

Determine Roberto Ltd's profit if the company uses absorption costing.

Question 3

Following is the budgeted data provided by Marine Ltd, a boat manufacturing company.

Budgeted production quantity (for July 20X9)	20,000 units
Actual production quantity	18,000
Actual sales (for July 20X9)	15,000
	TZS'000
Sales price (per unit)	50
Direct material (per unit)	10
Direct labour (per unit)	10
Variable production overheads	5
Fixed production costs	72,000
Fixed selling expenses	30,000

Required:

Assuming that there is no closing inventory in the month of June 20X9, what should be the value of closing inventory for July 20X9 under the marginal costing system as well as the absorption costing system?

Question 4

The following data has been extracted from the budgets and the standard costing profit statement of Abacus Ltd, a company which manufacturing and sells a single product.

TZS. Per unit	
Selling price	45,000
Direct material cost	10,000
Direct wages cost	4,000
Variable overhead cost	2,500

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Fixed production overhead costs are budgeted at TZS 400,000,000 p.a. Normal production levels are thought to be 320,000 units p.a.

Budget selling and distribution costs are as follows:

	TZS.
Variable	1,500
Fixed	80,000,000 p.a

Budgeted administration costs are TZS120,000,000

The following pattern of sales and production is expected during the first six months of year 2018:

	1 st Quarter January-March	2 nd Quarter April-June
Sales (units)	60,000	90,000
Production (Units)	70,000	100,000

There is no stock on 1st January 2018.

Required:

- (a) Prepare profit statements for each of the two quarters using:
 - (i) Marginal costing
 - (ii) Absorption costing
- (b) Reconcile the profits reported for the quarter January-March 2018 in the answer to (a) above.

Question 5

A company sells a single product at a price of TZS 14 per unit. Variable manufacturing costs per unit of the product are TZS 6.40. Fixed manufacturing overheads per period are TZS 92,000. Fixed manufacturing overheads are absorbed into the cost of production at a unit rate based on normal activity of 20,000 units per period. Any over-or under – absorbed fixed manufacturing overhead balances are transferred to the profit and loss account at the end of each period, in order to establish the manufacturing profit.

Sales and production (in units) for the months of March and April, 20X8 were as follows:

	March	April
Sales	15,000	22,000
Production	18,000	21,000

The manufacturing profit in March 20X8 was reported as TZS 35,800

Required:

- (a) Prepare absorption costing profit statement for April 20X8
 - (b) Prepare marginal costing profit statement for April 20X8.
 - (c) Explain, with supporting calculations:
 - (i) The reasons for the change in profits between March and April where absorption costing is used in each period.
- Why the profits in (a) and (b) above differs.

Question 6

Comparative income statements under absorption costing and marginal costing including reconciliation. The following information relates to the first two years of operation for a newly created division of a manufacturing company.

Standard Manufacturing costs

	Units costs
	TZS
Direct material	400
Direct labour	400
Variable manufacturing Overhead	<u>200</u>

Income Effects of Alternative Cost Accumulation Systems: 45

Total Variable manufacturing cost	1000
Fixed manufacturing cost	<u>400</u>
Total manufacturing cost	<u>1400</u>
Standard Capacity – 200,000 units	
Selling price – TZS 25 per unit	
Selling and Administration Expenses:	
- Variable TZS 200 per unit of output	
- Fixed TZS 300,000	

Production and Sales Statistics

	Year 1	Year 2
Units produced	220,000	170,000
Units sold	<u>180,000</u>	<u>200,000</u>
Inventory change	<u>(+)40,000</u>	<u>(-) 30,000</u>

Required

Prepare Comparative Income Statement, for the first two years of operations, using both Absorption costing and marginal costing. Also prepare a statement reconciling the difference in profit, if any, between the two methods.

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Answer to Self Examination Questions

Answer to SEQ 1

Under absorption costing, cost of goods is calculated as follows:

	TZS'000	TZS'000
Sales (10,000 x TZS18,000)		180,000
Direct material (12,000 x TZS3,000)	36,000	
Direct labour (12,000 x TZS5,000)	60,000	
Variable overheads (12,000 x TZS2,000)	24,000	
Fixed production overheads	24,000	
Cost of production	144,000	
Difference in opening and closing inventory (W1)	(24,000)	120,000
Gross Margin		60,000

Workings

W1 Difference in opening and closing inventory

	TZS'000
Opening inventory	0
Closing inventory (12,000 - 10,000) x TZS144,000,000 /12,000)	(24,000)
	(24,000)

Answer to SEQ 2

	June 20X9 TZS million
Marginal costing profit	10.10
Adjust for fixed overheads in inventory 200 units x TZS10,000 (decrease)	(2.00)
Absorption costing profit	8.10

Answer to SEQ 3

	Marginal costing	Absorption costing
Closing Inventory (18,000 -15,000)	3,000 units	3,000units
	TZS'000	TZS'000
Inventory value includes:		
Direct material	10	10
Direct labour	10	10
Variable overheads	5	5
Fixed overheads	0	4
TZS72,000,000/18,000 units		
Per unit cost	25	29
Total inventory value	75,000	87,000

Answer to SEQ 4

ABACUS LTD Profit Statement

(i) Marginal costing

	January 2018 TZS million	March – April 2018 TZS million
Sales revenue	2,700	4,050
Less: Variable cost of sales:		
Opening stock	Nil	165
Add:		

Variable production costs	<u>1,555</u>		<u>1,650</u>	
	1,555		1,815	
Less: Closing stock	<u>165</u>	<u>990</u>	<u>330</u>	<u>1,485</u>
Gross contribution		1,710		2,565
Less: Variable selling & distribution		<u>90</u>		135
Net contribution		1,620		2,430
Production	100		100	
Selling and distribution	20		20	
Administration costs	30	150	30	150
Budgeted profit		1,470		2,280

(ii) **Absorption Costing**

	January- March 2018 million		April – June 2018 million	
Sales revenue		2,700		4,050
Cost of goods sold:				
Opening stock	Nil		177.5	
Add: Total Production costs	1,242.5		1,775.0	
	<u>177.5</u>	<u>1,065</u>	<u>355.0</u>	1,597.5
Add:/Less:				
Over/under absorbed				
Overheads		12.5		(25)
Gross profit		1,622.5		<u>2,477.5</u>
Less: Total selling & distribution costs		<u>140</u>		<u>185</u>
Fixed selling distribution	20		20	
Administration	30		30	
Variable selling & distribution	<u>90</u>		<u>135</u>	
	<u>140</u>		<u>185</u>	
Net profit	30	1,482.5		2,292.5

b) The difference in profit of TZS 12,500,000 (1,482,500,000- 1,470,000,000) is due to the fact that the part of the fixed production overheads on 10,000 units at TZS 1,250 per unit which are included in the closing stock not recorded as an expense during the current period. With the marginal costing system all of the fixed manufacturing overheads incurred during the period are recorded as expense of the current period.

Answer to SEQ 5(a) **Absorption costing profit for April 20X8**

	TZS	TZS
Sales	(22,000 x 14)	308,000
Less: Cost of sales	(22,000 x 11)	242,000
Manufacturing profit before adjustment		66,000
Overhead over-absorbed	(21,000 – 20,000) x 4.6	<u>4,600</u>
Manufacturing profit		70,600

(b) **Marginal costing profit for April 2009**

	TZS	TZS
Sales	(22,000 x 14)	308,000
Less: Cost of sales	(22,000 x 40)	140,800
Contribution to fixed cost		167,200
Less: Fixed cost		<u>92,000</u>
Manufacturing profit		75,200

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(c) Explanation

(i)	Why profits in March and April differ	
	Profit in April	70,600
	Profit in March	<u>35,800</u>
	Difference	<u>34,800</u>

Explained as:

Additional sales	
(7,000 unit at a profit of 3 per unit)	21,000
Different in fixed overhead	<u>13,800*</u>
Additional profit	<u>34,800</u>
*(3,000 extra units at 4.60)	

- (ii) Why profits in (a) and (b) above differs
 Absorption costing profit – marginal costing profit = change in stock x fixed overhead rate per unit. $70,600 - 75,200 = (4,600) = (1,000) \times 4.60 = (4,600)$
- Sales exceeds production by 1,000 units and hence reduction in stock by 1,000 units. With absorption costing. TZS 4,600 (From previous period) will be released as cost for the current period.

Answer to SEQ 6

Under Absorption Costing Method

	Year 1	Year 2
Production (units)	220,000	170,000
Units sold	180,000	200,000
Sales @ TZS 25 per unit	TZS <u>4,500,000</u>	TZS <u>5,000,000</u>
Opening Stock	-	560,000
Cost of Production		
Direct Material @ TZS 4	TZS 880,000	680,000
Direct labour @ TZS 5	<u>880,000</u>	<u>680,000</u>
Direct variable Mfg Overhead @ TZS 2	440,000	340,000
Fixed Overhead @ TZS 4	880,000	680,000
Total	3,080,000	2,940,000
Less: closing stock 40,000 x TZS 14; 10,000 x TZS 4	560,000	140,000
Cost of Sales (actual)	2,520,000	2,800,000
Less: Over – absorbed fixed cost : 20,000* x TZS 4	(80,000)	
Add: Under –absorbed fixed cost: 30,000 x TZS 4		120,000
Adjusted cost of goods sold	<u>2,440,000</u>	<u>2,920,000</u>
Profit	<u>2,060,000</u>	<u>2,080,000</u>

*Actual production (220,000 units) less standard capacity (200,000 units) = 20,000 units

Under Marginal costing Method

	Year 1	Year 2
Sales	TZS 4,500,000	TZS 5,000,000
Marginal Cost:	180,000	200,000
Opening stock	-	400,000
Direct Material @ TZS 4	880,000	680,000
Direct Labour @ TZS 4	880,000	680,000
Variable Mfg. Overhead @ TZS 20	<u>440,000</u>	<u>340,000</u>
Total Production Variable Cost	2,200,000	2,100,000
Less: Closing Stock	<u>400,000</u>	<u>100,000</u>
Variable cost of Goods Sold	<u>1,800,000</u>	<u>2,000,000</u>
Contribution Margin	2,700,000	3,000,000
Less: Fixed Cost	<u>800,000</u>	<u>800,000</u>
Profit	1,900,000	2,200,000

1. Year 1 Absorption costing shows a profit of TZS 2,060,000 while marginal costing shows a profit of TZS 1,900,000 i.e. difference of TZS 160,000. The reason for this is that fixed cost relating to units presenting closing stock i.e. 40,000 units x TZS 4 or TZS 160,000 has not been charged under absorption costing. For this reason, the profit under absorption costing is more than the profit shown by marginal costing by TZS 160,000/=
2. Year 2 – Marginal costing shows more profit than absorption costing. Profit figure as per marginal costing is TZS 2,200,000 while profit figure as per absorption costing is TZS 2,080,000. Closing stock is less than opening stock. For this reason, the fixed cost relating to units produced in year 1 has been charged in Year 2 under absorption costing. The amount of difference can be explained as follows:

(Opening stock – closing stock) x fixed cost per unit or (40,000 units – 10,000 units) x TZS 4 = TZS 120,000. The difference between profits under two methods in year 2 is also TZS 120,000 i.e. TZS 2,200,000 TZS 2,080,000. A profit under absorption costing in year 2 is less than the profit under marginal costing by this amount.

SECTION A3: ACTIVITY BASED COSTING

■ Get Through Intro

Direct costs (material and labour) are easily traceable to a product or service. In contrast, indirect costs (factory rent, insurance, maintenance etc.) are not easily traceable to a particular product or service.

In the early 1900's, manufacturing costs were predominantly direct; the allocation of indirect costs (i.e. overheads) was not a key issue. In the 21st century, however, most manufacturing and service industries have very few direct costs and most costs are indirect. This change was brought about by changes in technology and increased levels of automation. The allocation of indirect costs is now a key issue for understanding product costs and making pricing decisions.

Traditionally, indirect costs were allocated to the products or services using certain commonly-used allocation bases, namely machine hour and direct labour hour. In the modern environment, using labour or machine hour as a basis of allocation is over-simplistic. Many indirect costs do not change (or change insignificantly) with a change in the number or volume of these commonly-used allocation bases.

More advanced costing techniques such as ABC (activity-based costing) were introduced as refinements of the traditional system. Under the ABC system, it was proposed that the occurrence of indirect costs can be better linked to certain events, tasks or units of work (known as 'activities'). Accordingly, the activity responsible for the occurrence of an indirect cost is first identified. The indirect costs are then allocated to the appropriate activities. Finally, the activity costs are assigned to each product or service, based on the quantum of activity required to produce that product or service.

Students should study this section carefully since, in the present era of 'advanced manufacturing technology', ABC has gained widespread acceptance by organisations in which they may work as future management accountants'. Moreover, activity-based costing is a very important topic from an examination point of view.

■ Learning Outcomes

- a) Identify appropriate cost drivers under ABC.
- b) Calculate costs per driver and per ABC.
- c) Compare ABC and traditional methods of overhead absorption based on production units, labour hours or machine hours.

1. Identify appropriate cost drivers under ABC.

[Learning Outcome a]

1.1 Conceptualising the ABC method and Cost Drivers

Activity-based costing may be described in simple terms as a method of assigning overhead costs to products or services on a more realistic basis than simply production volume (or machine hour / labour hour). The ABC method also attempts to show the relationship between overhead costs and the activities that cause them.

There are considerable similarities between the traditional absorption costing system and the ABC system. Under both methods, indirect costs are allocated using a suitable basis. Under ABC system, each component of indirect cost is allocated using a different basis which actually has a bearing on the quantum of the costs.

In a traditional system, overhead costs are allocated to products using very few allocation bases (e.g. labour hours, machine hours). On the other hand, the ABC system uses many drivers as absorption bases (e.g. number of machine set-ups, number of purchase orders, number of dispatches etc.). As a result, the ABC system normally comes up with more realistic product costs.

In brief, it can be said that **activity-based costing refines the traditional absorption costing system by focussing on the individual activities that have a cause and effect relationship with the overhead costs.** The ABC system calculates the costs of individual activities and assigns the activity costs to products or services (i.e. the cost objects) on the basis of the activities needed to produce each product or service.



Definition

Activity-based costing is an approach to costing that identifies individual activities as fundamental cost objects. It uses the costs of these activities as the basis for assigning costs to ultimate cost objects such as products or services.

Let us explain the terminologies used in the section.

Allocation base: a factor, based on which, overhead costs are allocated to products or services in a systematic way, for e.g. machine hours, direct labour hours, etc.

Activity: an event, task, or unit of work with a specified purpose, for e.g. designing products, setting up machines, operating machines, procuring materials etc. are some of the activities in a manufacturing organisation.

Cost driver: a factor which determines the costs of an activity. It is a variable, such as level of activity, or volume which has a 'cause and effect' relationship with costs in a given time span, for e.g. machine hours, direct labour hours, number of machine set-ups, number of purchase orders, number of inspections, number of product designs and so on.



Definition

A **cost driver** is any factor which causes a change in the cost of an activity, e.g. the quality of parts received by an activity is a determining factor in the work required by that activity and therefore affects the resources required. An activity may have multiple cost drivers associated with it.

There are two kinds of cost drivers:

1. resource cost drivers
2. activity cost drivers.

A **resource cost driver** is used as an allocation base in order to assign the cost of a resource (e.g., staff salary, electricity, advertising, etc.) to an activity. In ABC, activities are treated as a cost pool.

In contrast, **activity cost drivers** are used as allocation bases in order to assign the activity costs to the cost objects (i.e. products or services) based on the usage of an activity by the product or service.

Cost object: Anything (e.g., a product, a service, a department or an activity) for which a measurement of cost is necessary. This is equivalent to "cost centre" in traditional costing.

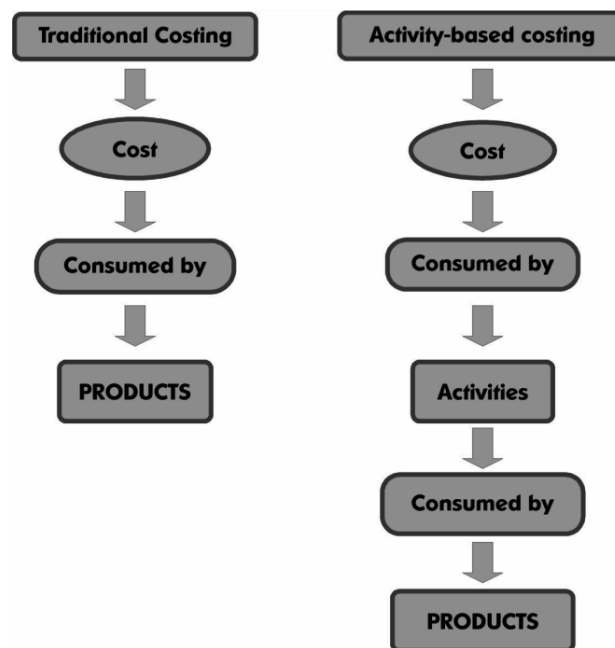
Cost pool: A collection or grouping of individual cost items. It may be the collective costs of the manufacturing department or of the service department or of both the departments. E.g. machine set-up cost, depreciation, supervisor's salary may be pooled or collected in the machine shop.

1.2 The Cost drivers: Contrast with traditional 'Allocation Bases'

Traditional costing systems allocate overheads to products using a small number of **allocation bases** (known as **overhead allocation rates** e.g. machine hour rate, labour hour rate, no. of units produced, etc.) which vary directly with the volume produced (i.e. the number of machine hours / direct labour hour, etc.). Instead of using the terms 'allocation bases' or 'overhead allocation rates' the term '**cost driver**' is used in the ABC system.

In contrast to the traditional system, which uses only volume-based cost drivers (such as machine hour, direct labour hour, units of output), the ABC system uses a wide variety of non-volume-based cost drivers.

Diagram 1: Differences between ABC and Traditional system of costing



1.3 The Cost drivers: Classification

The cost drivers may be classified into:

1. Volume-based cost drivers

Volume-based cost drivers address those activities which have a high correlation with the number of units produced or quantum of services rendered. Examples of volume-based cost drivers are number of machine hours, number of direct labour hours, number of units of output, etc. Using the volume-based cost drivers, depreciation is allocated based on machine hours, supervision cost is allocated based on direct labour hours etc.



Example

If one unit of production requires two hours of machine time, then if production volume increases from 1,000 units to 2,000 units, the machine time required will also increase from 2,000 hours to 4,000 hours. Accordingly, depreciation per machine hour will vary as it is allocated based on machine hours.

2. Non volume-based cost drivers

Non volume-based activities do not take place each time a unit of the product or service is produced. Instead, these activities are correlated with the number of batches of production, number of purchases, etc. that take place over a period of time, within an organisation. Non volume-based cost drivers are basically used to assign support overheads (i.e. the indirect costs that incur for the support activities for production) to products. The term '**support activity**' is discussed in Learning Outcome 3.



Example

Machine set-up normally takes place once before each batch of production commences. The number of machine set-ups required will vary with the number of batches of production. However, they will not vary with the batch size.

Let us consider that in a production centre, production currently takes place in batch sizes of 1,000. Management now decides to double the production by increasing the batch size to 2,000. The machine set-up activity will not increase because it takes place only once before the commencement of each batch of production.

1.4 Identify appropriate volume-based cost drivers

Volume-based drivers are appropriate when activities are performed each time a unit of the product or service is produced.

These cost drivers are appropriate for allocating costs such as energy costs for the machines, depreciation related to machine usage, indirect labour employed in production centres and inspection costs where each item produced is subject to final inspection.



Example

Let us consider that the production volume will increase by 20% causing machine time and direct labour time to increase in the same proportion. Consequently, 20% more energy will be consumed. Therefore, in order to absorb machine energy costs, **machine hours** will be the most appropriate cost driver. If indirect labour cost is incurred at the production centre, it will be highly correlated with direct labour time. Therefore, in order to consume such costs, **direct labour hours** will be the most appropriate cost driver.

1.5 Identify appropriate non volume-based cost drivers

Non volume-based activities are identified by carrying out a detailed analysis of the activities carried out in an organisation. The appropriate activities are chosen keeping in mind factors such as the total costs of the activity (it should be significant enough so as to justify separate treatment) and reasonable correlation of the chosen driver with the costs concerned.

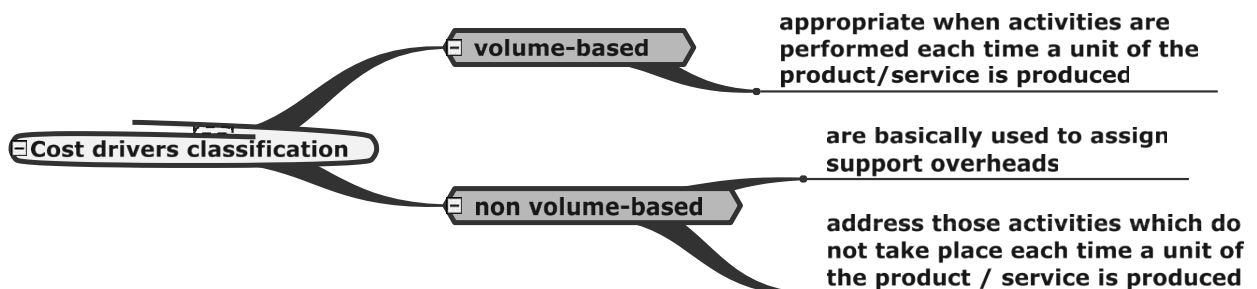


Example

Rather than classifying 'procurement and handling of material' as an activity, each of its constituent tasks e.g. placing orders, receiving and issuing materials, etc. can be classified as separate activities. This helps to allocate the activity costs based on the appropriate cost driver.

Activities	Cost driver
Placing order / ordering materials	No. of material orders
Material handling	No. of movements of material

SUMMARY





Test Yourself 1

Match the following costs with their appropriate cost drivers and also identify volume based and non-volume based cost drivers:

COSTS	COST DRIVERS
1. Depreciation	A. No. of set ups
2. Indirect labour cost	B. No. of purchases
3. Machine set up cost	C. No. of product design
4. Order placing cost	D. No. of inspections
5. Inspection cost	E. Machine hours
6. Design cost	F. Direct labour hours

2. Calculate costs per driver and per ABC.

[Learning Outcome b]

2.1 Calculation of costs per driver using ABC

The following steps are used to calculate the cost per driver:

Step 1

Identify the components of the total overhead costs which have a 'cause and effect relationship' with one or more of the activities required for manufacturing a product. The costs are then accumulated for each activity. These accumulated activities are known as a 'cost pool' and are equivalent to conventional cost centres.

Step 2

Identify the appropriate cost drivers for each component of cost. This step has already been discussed in Learning Outcome 1. It should be reiterated that cost drivers are nothing but allocation bases and are signified by the factors which determine the costs of an activity.

Step 3

Cost per driver for each item of overhead cost is calculated by dividing the cost item as identified in step 1 above, by the appropriate cost driver as identified in step 2.

Diagram 2: Steps for the calculation of cost per driver using ABC



Let us study the below example in order to understand the steps of calculating cost / driver (which is nothing but costs divided by activity volume).



Example

The estimated production overhead costs of Modern Plc over a period were TZS240,000,000. Total machine time during the period was 24,000 hours. The company used to follow traditional methods for overhead absorption. Accordingly, the machine hour rate for overhead absorption was TZS10,000 (i.e., TZS240,000,000/24,000 hours).

It was earlier assessed that each unit of product X and Y required two hours and three hours of machine time respectively. Therefore, production overhead costs absorbed / consumed by products X and Y was **TZS20,000** (i.e. TZS10,000 per machine hour x 2 machine hours) and **TZS30,000** (i.e., TZS10,000 per machine hour x 3 machine hours) respectively.

Continued on the next page

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The total production overheads were split into the following costs:

	TZS'000
Machine set-up cost	70,000
Machine operating cost	120,000
Depreciation	24,000
Inspection cost	26,000
Total production overheads	240,000

A detailed analysis of the indirect production costs of the company revealed that the entire indirect costs were not liable to increase or decrease with the number of machine hours. So, allocating the entire overheads based on machine hour was a major approximation. Accordingly, many irrelevant cost components were also absorbed by the products, leading to incorrect calculations of the product costs.

In the analysis, only machine operating costs and depreciation were found to be highly correlated with the number of machine hours. The other components of production overheads such as machine set-up costs and inspection costs did not show a significant correlation with machine time. Instead, they showed a strong correlation with the activities, namely the number of machine set-ups and the number of inspections.

In order to allocate overheads accurately, the company decided that each constituent of overhead costs would first be absorbed by the most appropriate activity. Each activity cost would then be absorbed by the products in the proportion in which each activity contributed to the production of each product, during the period under consideration.

It was assessed that in total, 100 machine set-ups and 1,000 inspections took place during the period under consideration.

Accordingly, costs per driver are calculated as follows:

Overhead Costs	TZS'000	Appropriate cost drivers	Total activity consumption	Cost per driver (TZS'000)
				(Col2 / Col4)
Set-up cost	70,000	No. of machine set-up	100	700
Machine operating cost	120,000	Machine hour	24,000	5
Depreciation	24,000	Machine hour	24,000	1
Inspection cost	26,000	Number of inspections	1,000	26

2.2 Calculation of costs per unit using ABC

Once costs per driver have been calculated, it is appropriate to know how much quantity of each activity is consumed to produce each unit of product or service. It is possible that a certain product may not use a certain activity at all. Then, total costs are allocated to the products as 'cost per driver x number of units of the relevant activity consumed by each product'. Ultimately, overhead cost per unit is derived as 'total overhead cost allocated to a product / number of units produced'.



Example

Continuing the previous example of Modern Plc

As a result of implementing ABC, the production overhead absorbed by products X and Y changed to **TZS21,600** and **TZS27,600** respectively

Clarification of how 'cost per unit' under the ABC system is calculated.

For the total production of 6,000 units of X and 4,000 units of Y, machine set-up and inspection activities were required in the same proportion i.e. for product X, 60 machine set ups and 600 inspections were required whereas, for product Y, 40 machine set-ups and 400 inspections were required.

Continued on the next page

The following table explains the steps:

Particulars	Product X (TZS'000)	Product Y (TZS'000)
Set-up cost (Cost/Set-up x No. of set-ups required) (TZS700,000 x 60); (TZS700,000 x 40)	42,000	28,000
Machine operating cost (Cost/Machine hour x No. of machine hours(W1)) (TZS5,000 x 12, 000); (TZS5,000 x 12,000)	60,000	60,000
Depreciation (Cost/Machine hour x No. of machine hours) (TZS1,000 x 12,000); (TZS1,000 x 12,000)	12,000	12,000
Inspection Cost (Cost/Inspection x No. of inspections required) (TZS26,000 x 600); (TZS26,000 x 400)	15,600	10,400
Total production overhead assigned (a)	129,600	110,400
Number of units produced (b)	6,000	4,000
Production overhead per unit (a/b)	21.60	27.60

The ABC system uses the cost of each activity as the basis for assigning costs to the products. This is a more realistic allocation of production overheads. Under traditional costing, the overhead cost of products X and Y was TZS20,000 and TZS30,000 per unit respectively.

On the other hand, under ABC system the overhead cost of product X has gone up to TZS21,600 per unit whereas the overhead cost of product Y has decreased to TZS27,600 per unit.

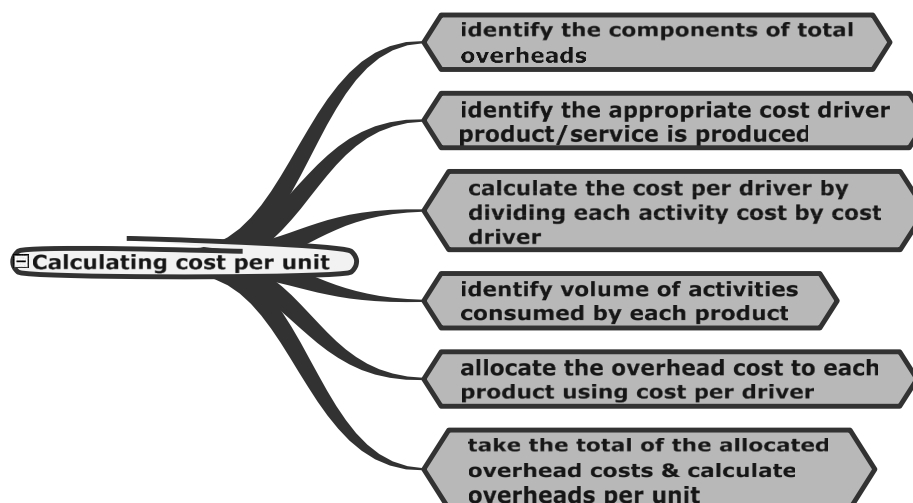
Working

W1 Calculation of machine hours

For Product X = 2 hours x 6,000 units = 12,000 hours

For product Y = 3 hours x 4,000 units = 12,000 hours

SUMMARY



Test Yourself 2

Donald Company has identified the following overhead cost pools and cost drivers:

Cost Pools	Activity cost TZS'000	Cost drivers
Machine setup	180,000	1,500 setup hours
Materials handling	50,000	12,500 pounds of materials
Electric power	20,000	20,000 kilowatt-hours

Continued on the next page

58: Cost Accounting Techniques

The following cost information pertains to the production of products X and Y:

	X	Y
Production (units)	4,000	20,000
Direct material cost (TZS'000)	20,000	25,000
Direct labour cost (TZS'000)	12,000	20,000
Number of setup hours	100	120
Pounds of materials used	500	1,500
Kilowatt-hours	1,000	2,000

Required:

Use the activity-based costing approach to calculate the unit cost for each of the two products.

3. Compare ABC and traditional methods of overhead absorption based on production units, labour hours or machine hours.

[Learning Outcome c]

3.1 The **similarities and differences** between traditional methods of overhead absorption based on production units, labour hours or machine hours and the activity-based costing system are:

- Both, the traditional method and the ABC system use a **two stage allocation process**. In the first stage, the traditional system allocates overheads to the production and service department and, in the second stage, re-allocates the costs of the service department to the production department. On the other hand, an ABC system assigns overheads to each major activity (rather than departments) first and then reallocates these costs to the products or services. The ABC system employs a greater number of cost centres compared to the traditional system.
- In the ABC system, many activity-based cost centres (known as activity cost pools) are established, whereas in the traditional system, overheads tend to be pooled by departments (not activities). The departments are normally described as cost centres in the traditional system.
- Each activity consists of different tasks. An activity can be categorised as a production process activity, or a support activity.
 - Production process activities (the activities that are essential to running the production process and hence directly correlated to the production volume) include machining, assembling, etc.

In the production process, activity cost centres used by ABC are often identical to the cost centres used by traditional systems.

- Support activities are necessary to facilitate production but are not directly correlated to the volume of production. Examples of support activities are 'machine set-up', 'material movement', 'material purchase', 'inspection of items', etc. Support activities are also sometimes identical to the cost centres used by traditional systems. For e.g. the 'purchase department' and 'materials purchase activity' are both treated as cost centres.

These activities are treated as cost centres by the ABC system but are not recognised as cost centres by the traditional systems.

- The second stage of the two stage allocation process allocates costs from cost centres (pools) to products or services.
 - Traditional costing systems allocate overheads to products using a small number of allocation bases, known commonly as overhead allocation rates. These allocation bases vary directly with the volume produced. Examples of the most commonly-used allocation bases in traditional systems are 'direct labour hour' and 'machine hour'.
 - The ABC system uses both volume based cost drivers, such as 'machine hour' and 'direct labour hour' and non-volume-based cost drivers, such as 'number of machine set ups', 'number of purchase orders', 'number of inspections', etc.

5. **Traditional systems** normally **allocate service department costs to production cost centres**. Their costs are merged with production cost centre costs and thereby included in the production centre overhead rates to be allocated to products / services. On the other hand, **ABC systems** establish separate cost drivers for support centres and **assign the cost of support activities directly to cost objects** without any reallocation to production centres.



Example

Let us consider a production process involving two activities, to compare the rates for allocating the overheads under **activity-based costing** with the rates under **traditional methods of costing**:

	Under ABC	Under Traditional Method
Production overhead costs allocated to set-ups	TZS300,000,000	NIL
Number of set-ups	500	Not applicable
Production overhead cost per set-up	TZS600,000	NIL
Total production overhead costs	TZS2,000,000,000	TZS2,000,000,000
Less: Costs allocated to machine set-ups (TZS600,000 x 500 set-ups)	TZS300,000,000	NIL
Production overhead costs allocated to machine hours	TZS1,700,000,000	TZS2,000,000,000
Machine hours (MH)	100,000	100,000
Production overhead costs per MH	TZS17,000	TZS20,000
Production Overhead Cost Allocations	TZS600,000 set-up cost per batch + TZS17,000 per MH	TZS20,000 per MH

Now, let us see what impact these two allocation techniques and overhead rates would have on the cost per unit of a specific unit of output. Assume that a company manufactures a batch of **5,000** units and it produces **50** units per machine hour. Here is how the cost assigned to the units with activity-based costing and without activity-based costing compares:

	Under ABC	Under Traditional Method
Production overhead for setting up machine	TZS600,000	NIL
No. of units in batch	5,000	Not applicable
Production overhead caused by set-up per unit	TZS120	Not applicable
Production overhead costs per machine hour	TZS17,000	TZS20,000
No. of units produced per machine hour	50	50
Production overhead per unit	TZS340	TZS400
Total Production Overhead Allocated per Unit	TZS460	TZS400

3.2 Advantages and disadvantages of Activity Based Costing

1. The following are the advantages of ABC:

In today's competitive environment, companies want to know the **true profitability** of products before taking a decision. ABC reveals a realistic profitability of each product by allocating, on a more realistic basis, all the activity's costs associated with its production.

ABC helps to know the **cost of each activity** consumed within an organisation in the manufacture of each product and thereby helps the person in-charge of the activity to control costs.

As it reveals all costs associated with the product more realistically, the minimum price **that is to be charged for the product** can be easily decided.

ABC helps to identify the activities which contribute value to the completion of products or services and which do not. This means that it reveals value-added and non-value added activities, which helps the management of the company to focus on those **non-value added activities**. It helps the management to know areas where cost can be reduced and controlled.

2. Criticisms of ABC are as follows:

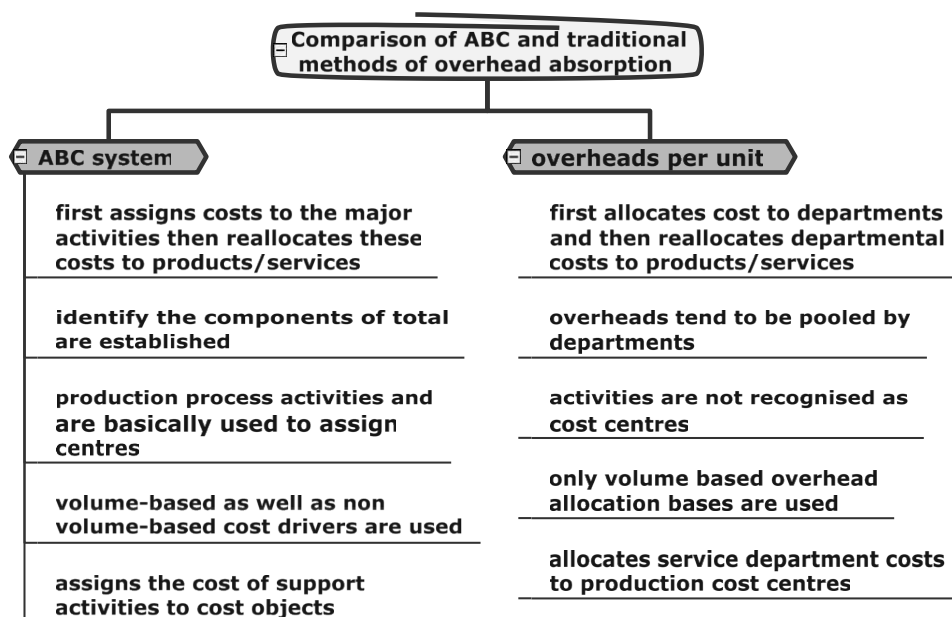
ABC system needs establishment of activities in detail. This may be a complex and time taking job. Implementation also requires significant cost.

The ABC system is time consuming as analysis of activities, determining the cost of those activities and identification of appropriate cost drivers takes a significant amount of time.

The ABC system may not justify the cost-benefit analysis. Cost incurred for the implementation and maintenance of ABC may go beyond the benefits gained from it.

It is often difficult to identify an appropriate cost driver for an activity in order to apportion the cost.

SUMMARY



Test Yourself 3

If a company manufactures a batch of 50,000 units and produces 50 units per machine hour, show how the cost would be assigned to the production of units under the ABC system, and under the traditional method, taking into consideration the above example.

Answers to Test Yourself

Answer to TY 1

COSTS	COST DRIVERS	
1. Depreciation	Machine hours	Volume based cost driver
2. Indirect labour cost	Direct labour hours	Volume based cost driver
3. Machine set up cost	No. of set ups	Non-volume based cost driver
4. Order placing cost	No. of purchases	Non-volume based cost driver
5. Inspection cost	No. of inspections	Non-volume based cost driver
6. Design cost	No. of product design	Non-volume based cost driver

Answer to TY 2**Under the ABC system**

Step 1 Donald Company calculates cost-allocation rates for each activity area. The activity rates are as follows:

Overhead allocation rate = Activity cost/cost driver

Cost Pools (i)	Activity cost (TZS'000) (ii)	Cost drivers (iii)	Overhead allocation ate (Cost per driver) (iv) = (ii)/(iii)
Machine setup	180,000	1,500 setup hours	TZS120,000 per setup hour
Materials handling	50,000	12,500 pounds of materials	TZS4,000 per pound of material
Electric power	20,000	20,000 kilowatt-hours	TZS1,000 per kilowatt

Step 2 Calculate the unit cost of both product X and Y

	X	Y
Production (units) (a)	4,000	20,000
Cost of goods sold	TZS'000	TZS'000
Direct material cost	20,000	25,000
Direct labour cost	12,000	20,000
Overhead costs		
Machine setup cost (W1)	12,000	14,400
Materials handling cost (W2)	2,000	6,000
Electric power cost (W3)	1,000	2,000
Cost of goods sold (b)	47,000	67,400
Cost per unit (b/a)	11.75	3.37

Workings (Amount in TZS'000)**W1 Machine setup cost**

For product X = 100 setup hours x 120 per setup hour = 12,000

For product Y = 120 setup hours x 120 per setup hour = 14,400

W2 Materials handling cost

For product X = 500 pounds materials used x 4 per pound of material = 2,000

For product Y = 1,500 pounds materials used x 4 per pound of material = 6,000

W3 Electric power cost

For product X = 1,000 kilowatt-hours x 1 per kilowatt-hour = 1,000

For product Y = 2,000 kilowatt-hours x 1 per kilowatt-hour = 2,000

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Answer to TY 3

	Under ABC Method	Under Traditional Method
Production overhead for setting up machine	TZS600,000	NIL
No. of units in batch	50,000	Not applicable
Production overhead caused by set-up (per unit)	TZS12	Not applicable
Production overhead costs per machine hour	TZS17,000	TZS20,000
No. of units produced per machine hour	50	50
Production overhead caused by production (per unit)	TZS340	TZS400
Total Production Overhead Allocated (per Unit)	TZS352	TZS400

Quick Quiz

1. What is meant by the term 'Activity'?
2. What is meant by the term 'Cost driver'?
3. What are 'Cost objects'?
4. What is meant by 'activity-based costing'?
5. State the concept of a 'Volume-based cost driver'.
6. State the concept of a 'Non volume-based cost driver'.
7. Briefly state how the cost per driver can be calculated.
8. How would you divide activities into 'production process activities' and 'support activities'?

Answers to Quick Quiz

1. An **'activity'** is an event, task, or unit of work with a specified purpose; for e.g. designing products, setting up machines, operating machines, procuring materials, etc.
2. In an activity-based costing system, the term **'Cost driver'** is used to mean a factor which determines the costs of an activity. It is a variable, such as level of activity or volume which has a 'cause and effect' relationship with costs in a given time span. Examples of cost drivers are 'number of machine set-ups', 'number of inspections', 'number of purchase orders' and 'number of machine hours', etc.
3. A product, service, department or activity for which a measurement of cost is necessary is termed as a **cost object**.
4. **Activity-based costing** is a system of cost allocation that identifies the activity centres in an organisation and assigns costs to products and services based on the number of activities involved in the process of providing a product or service.
5. **Volume-based cost drivers** address those activities which have a high correlation with the number of units produced, or the quantum of services rendered. Examples are 'number of machine hours' and 'number of direct labour hours'.
6. **Non volume-based cost drivers** do not take place each time a unit of the product or service is produced. Instead, these activities are correlated to the number of batches of production, number of purchases, etc. which take place in an organisation over a period. In other words, non-volume-based cost drivers do not show substantial correlation with the number of units produced or the quantum of services rendered.

7. The first step would be to identify the components of total overhead costs which have a 'cause and effect relationship' with one or more of the activities required for manufacturing a product. The next step is to identify the appropriate cost drivers for each component of cost. Ultimately, **cost per driver** for each item of overhead cost is calculated by dividing each cost item above, by the appropriate cost driver as identified.
8. Production process activities include machining, assembling, etc. In a production process, the activity cost centres used by ABC are often identical to the cost centres used by traditional systems.

Examples of support activity are 'machine set-up', 'material movement', 'material purchase', 'inspection of items', etc. Support activities are also sometimes identical to the cost centres used by traditional systems. For e.g. 'purchase department' and 'materials purchase activity' are both treated as cost centres.

Self Examination Questions

Question 1

Reliance Supermarkets (RS) has decided to increase the size of its London store. It wants information about the profitability of individual product lines: soft drinks, fresh produce, and packaged food. RS provides the following data for a year for each product line:

Items	Soft Drinks TZS'000	Fresh Produce TZS'000	Packaged Food TZS'000
Revenues	425,800	756,250	443,280
Cost of product sold	262,500	467,500	270,000
Cost of empty bottles returned	6,800	0	0
Number of purchase orders placed	315	285	210
Number of deliveries received	420	570	525
Hours of shelf-stocking time	250	1,425	1,050
Number of product sold	63,000	285,000	105,000

RS also provides the following information for the year:

Activity	Description of Activity	Total Costs (TZS'000)	Cost-Allocation Basis
Bottle returns	Returning of empty bottles to stores	6,800	Direct tracing to soft-drink line
Ordering	Placing of orders for purchases	81,000	810 purchases orders (315 + 285 + 210)
Delivery	Physical delivery and receipt	106,050	1,515 deliveries (420 + 570 + 525)
Shelf-stocking	Stocking of merchandise on store shelves and on-going restocking	55,875	2,725 hours of shelf stocking time (250 + 1,425 + 1,050)
Customer support	Assistance provided to customers, including checkout and bagging	135,900	453,000 items sold (63,000 + 285,000 + 105,000)
	Total	385,625	

Required:

- (a) Reliance Supermarket currently allocates store support costs (all costs other than cost of goods sold) to product lines on the basis of cost of goods sold of each product line. Calculate the operating income as a percentage of revenues for each product line.
- (b) If Reliance Supermarkets allocates store support costs (all costs other than cost of goods sold) to product lines using the ABC system, calculate the operating income and the operating income as a percentage of revenues for each product line.

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Question 2

Toyota Motors Inc produces electric motors. The company makes a standard electric-starter motor for a major car manufacturer and produces electric motors that are specially ordered.

The company has four essential activities: designing, ordering, machining, and marketing.

Toyota Motors incurs the following costs during the month of January to produce 10 standard motors and an equivalent number of special order motors:

	Standard Motors TZS million	Special Order Motors TZS million
Direct labour	1,000	200
Direct materials	3,000	1,000

Overhead	TZS million
Indirect labour	3,500
Depreciation on building	200
Depreciation on machine	1,000
Maintenance	300
Utilities	1,000
Total	6,000

In switching to ABC, activities are chosen and overhead costs are distributed to cost pools within these activities through cost drivers. Toyota Motors carries out the following activities: designing, ordering, machining, and marketing. Each activity has one cost pool. The overhead costs are distributed to the cost pools of the activities using the following resource drivers:

Overhead Accountant	Resource Driver
Indirect labour	Labour cost
Depreciation on building	Square feet area of building
Depreciation on machine	Machine hours
Maintenance	Square feet area of building
Utilities	Amps used

The usage of the resource drivers by activity are:

	Designing	Ordering	Machining	Marketing	Total
Labour Cost (TZS million)	100	20	100	130	350
Sq. ft. of building	50,000	30,000	100,000	20,000	200,000
Machine hours	0	0	50,000	0	50,000
Amps	200,000	100,000	1,600,000	100,000	2,000,000

Once the overhead costs have been distributed to the activity cost pools, activity drivers are chosen to apply the costs to the products. The following activity drivers are chosen:

Activity	Activity driver	Total driver usage
Designing	Design changes	12,250 changes
Ordering	Number of orders	6,500 orders
Machining	Machine time	1,525 hours
Marketing	Number of contracts with customers	7,000 contracts

Driver usage for each unit of the Standard motors and Special order motors is:

Product	Activity	Driver Usage
Standard	Designing	225 changes
	Ordering	150 orders
	Machining	100 hours
	Marketing	200 contracts
Special order	Designing	1,000 changes
	Ordering	500 orders
	Machining	52.5 hours
	Marketing	500 contracts

Required:

- Calculate overhead allocation to each type of motor under the traditional method.
- Find the overhead costs applied to each standard motor and to each special order motor under ABC.

Question 3

FG specializes in the manufacture of tablets, laptops and desktop PCs. FG currently operates a standard absorption costing system. Budgeted information for next year is given below:

Products	Tablets TZS'000	Laptops TZS'000	Desktop PCs TZS'000	Total TZS'000
Sales revenue	3,640	12,480	9,880	26,000
Direct material	800	2,800	2,200	5,800
Direct labour	300	1,200	800	2,300
Fixed production O/H	<u>1,456</u>	<u>4,992</u>	<u>3,952</u>	<u>10,400</u>
Gross profit	<u>1,084</u>	<u>3,488</u>	<u>2,928</u>	<u>7,500</u>

Fixed production overheads are currently absorbed based on a percentage of sales revenue.

FG is considering changing to an activity based costing system. The main activities and their associated cost drivers and overhead cost have been identified as follows:

Activity	Cost Driver	Production overhead cost TZS '000
Manufacturing scheduling	Number of orders	162
Parts handling	Number of parts	2,464
Assembly	Assembly time	4,472
Software installation & testing	Number of software applications	2,000
Packaging	Number of units	<u>1,302</u>
		<u>10,400</u>

Further details have also been ascertained as follows:

	Tablets	Laptops	Desktop PCs
Budgeted production for next year (units)	10,000	12,000	6,000
Average number of units per order	10	6	4
Number of parts per unit	20	35	25
Assembly time per unit (minutes)	20	40	30
Number of software applications per unit	2	3	4

Required:

- Calculate the total gross profit for each product using the proposed activity based costing system.
- Discuss the differences between the gross profits figures calculated in Part (a) Compared with those calculated under the current absorption costing system.

Explain how the information obtained from the activity based costing system could be used for cost management purposes.

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Question 4

Dodo Ltd manufactures three products, A, B and C. Data for the period just ended is as follows:

Product	A	B	C
Output in units	20,000	25,000	2,000
	TZS./unit	TZS./unit	TZS./unit
Direct material cost	5,000	10,000	10,000
Total production overheads	TZS. 190m		

Information for overhead absorption on a labour hours basis.

	A	B	C
Labour hours/unit	2	1	1
Labour is paid at the rate of TZS. 5,000 per hour			

Information for activity based costing.

	TZS. '000'
Machining	55,000
Quality control & Set-up costs	90,000
Receiving	30,000
Packing	15,000
	190,000

Cost Driver Data

	A.	B	C
Machine hour/unit	2	2	2
No. of production runs	10	13	2
No. of component receipts	10	10	2
No. of customer orders	20	20	20

Required:

Calculate the total cost per unit for each product using:

- Traditional absorption costing assuming production overheads are absorbed on the basis of labour hours;
- Activity based costing

Answers to Self-Examination Questions

Answer to SEQ 1

(a) Under Traditional Method

The following table shows the total operating income, and the operating income as a percentage of the revenues for each product line. All store support costs (all costs other than the cost of goods sold) are allocated to product lines using the cost of goods sold of each product line, as the cost -allocation basis.

Items	TZS'000
Cost of bottle returns	6,800
Cost of purchase orders	81,000
Cost of deliveries	106,050
Cost of shelf-stocking	55,875
Cost of customer support	135,900
Total Store Support Cost	385,625

Allocation rate for store support cost = Total support cost/Cost of goods sold
 = TZS385,625,000/TZS1,000,000,000
 = 38.56% of cost of goods sold.

To allocate support costs to each product line, RS multiplies the cost of goods sold of each product line by 0.3856.

	Soft Drinks	Fresh Produce	Packaged Foods	Total
	TZS'000	TZS'000	TZS'000	TZS'000
A. Revenue	425,800	756,250	443,280	1,625,330
Cost of goods sold	262,500	467,500	270,000	1,000,000
Store support cost (W1)	101,220	180,268	104,112	385,600
B. Total Costs	363,720	647,768	374,112	1,385,600
C. Operating income (A – B)	62,080	108,482	69,168	239,730
D. Operating income/Revenue	14.58%	14.34%	15.60%	14.75%

Workings (Amounts in TZS'000)

W1 Store support cost

For soft drinks, For	262,500 x 0.3856	101,220
fresh produce For	467,500 x 0.3856	180,268
packaged foods	270,000 x 0.3856	104,112
Total		385,600

(b) Under ABC system

RS identifies bottle-return costs as a direct cost because these costs can be traced to the soft drink product line. RS then calculates cost-allocation rates for each activity area. The activity rates are as follows:

Activity	Total costs TZS'000	Quantity of Cost – allocation bases	Overhead allocation rate (cost per driver) TZS'000
(i)	(ii)	(iii)	(iv) = (ii) / (iii)
Ordering	81,000	810 purchase orders	100 per purchase order
Delivery	106,050	1,515 deliveries	70 per delivery
Shelf-stocking	55,875	2,725 shelf-stocking hours	20.505 per stocking hours
Customer support	135,900	453,000 items sold	0.30 per item sold

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Store support costs for each product line by activity are obtained by multiplying the total quantity of the cost-allocation base for each product line, by the activity-cost rate. Operating income and operating income as a percentage of revenues for each product line are as follows:

Items	Soft Drinks TZS'000	Fresh Produce TZS'000	Packaged Food TZS'000	Total TZS'000
A. Revenue	425,800	756,250	443,280	1,625,330
Cost of goods sold	262,500	467,500	270,000	1,000,000
Store support cost	6,800	0	0	6,800
Ordering costs (W1)	31,500	28,500	21,000	81,000
Delivery costs (W2)	29,400	39,900	36,750	106,050
Shelf-stocking costs (W3)	5,126	29,219	21,530	55,875
Customer support costs (W4)	18,900	85,500	31,500	135,900
B. Total costs	354,226	650,619	380,780	1,385,625
C. Operating income (A – B)	71,574	105,631	62,500	239,705
D. Operating income/Revenue	16.81%	13.97%	14.10%	14.75%

Workings

W1 Ordering cost

		TZS'000
For soft drinks	315 orders x 100	31,500
For fresh produce	285 orders x 100	28,500
For packaged foods	210 orders x 100	21,000
	Total	81,000

		TZS'000
For soft drinks	420 orders x 70	29,400
For fresh produce	570 orders x 70	39,900
For packaged foods	525 orders x 70	36,750
	Total	106,050

W3 Shelf-stocking Cost

		TZS'000
For soft drinks	250 hours. x 20.505	5,126
For fresh produce	1,425 hours. x 20.505	29,219
For packaged foods	1,050 hours. x 20.505	21,530
	Total	55,875

W4 Customer support costs

		TZS'000
For soft drinks	63,000 units sold x 0.30	18,900
For fresh produce	285,000 units sold x 0.30	85,500
For packaged foods	105,000 units sold x 0.30	31,500
	Total	135,900

Answer to SEQ 2

(a) Traditional cost accounting would apply the overhead costs based on a single measure of activity. If direct labour costs were used, then the overhead rate would be 500% of direct labour cost.

$$\text{TZS6,000 million} / (\text{TZS1,000 million} + \text{TZS200 million}) \times 100 = 500\%$$

Hence, overhead for each standard motor = 500% of direct labour cost
 = 500% of TZS100 million
 = TZS500 million

Where, direct labour cost per motor is TZS100 million (i.e. TZS1,000 million/10)

Overhead for each special order motor = 500% of direct labour cost
 = 500% of TZS20 million
 = TZS100 million

Where, direct labour cost per motor is TZS20 million (i.e. TZS200 million/10)

(b) Overhead cost application under ABC

Note: In this problem, two categories of cost drivers have been referred to, namely, '**Resource cost driver**' and '**Activity cost driver**'. For easy understanding, let us first understand the meaning of the terms.

In ABC, the costs of resources are assigned to the products through a two stage allocation process.

First, the resource costs are assigned to activities, and then the costs as assigned to the activities are reallocated to products or services.

A **resource cost driver** is used as an allocation base in order to assign the cost of a resource (e.g., staff salary, electricity, advertising, etc.) to an activity. We may recall that, in ABC, activities are treated as cost pools.

In contrast, **activity cost drivers** are used as allocation bases in order to assign the activity costs to the cost objects (i.e. products or services).

We will have to allocate overheads to the products in two stages.

First, the overhead costs are assigned to the activities through resource cost drivers, and then the activity costs are assigned to the products through activity cost drivers.

The resource driver application rates are calculated by dividing overhead costs by total resource driver usage.

Overhead Accountant	Resource Driver	Overhead Costs (TZS million)	Total Driver Usage	Application Rate
Indirect labour	Labour cost	3,500	TZS350 million	1000% of Direct Labour Cost (or 10 times of direct labour cost)
Depreciation of building	Square feet of building	200	200,000 sq. ft.	TZS1,000/sq. ft.
Depreciation of machinery	Machine time	1,000	50,000 hours.	TZS20,000/hour.
Maintenance	Square feet of building	300	200,000 sq. ft.	TZS1,500/sq. ft.
Utilities	Amps used	1,000	2,000,000 amps	TZS500/amp

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By multiplying the application rate by the resource usage of each activity, overhead costs can be allocated to the different activities.

	Designing TZS million	Ordering TZS million	Machining TZS million	Marketing TZS million	Totals TZS million
Indirect labour (W1)	1,000	200	1,000	1,300	3,500
Depreciation on building (W2)	50	30	100	20	200
Depreciation on machinery (W3)			1,000		1,000
Maintenance (W4)	75	45	150	30	300
Utilities (W5)	100	50	800	50	1,000
Total	1,225	325	3,050	1,400	6,000

Workings

Amount allocated to each activity = Usage of the resource drivers by activities x Application rate

W1 For Indirect Labour

		TZS million
Designing activity	TZS100 million x 1000% of direct labour cost	1,000
Ordering activity	TZS20 million x 1000% of direct labour cost	200
Machining activity	TZS100 million x 1000% of direct labour cost	1,000
Marketing activity	TZS130 million x 1000% of direct labour cost	1,300
	Total	3,500

W2 For depreciation on building

		TZS million
Designing activity	50,000 sq. ft. x TZS1,000 /sq. ft	50
Ordering activity	30,000 sq. ft. x TZS1,000/sq. ft	30
Machining activity	100,000 sq. ft. x TZS1,000/sq. ft	100
Marketing activity	20,000 sq. ft. x TZS1,000/sq. ft	20
	Total	200

W3 For depreciation on machinery

		TZS million
Machining activity	50,000 hours x TZS20,000/hour	1,000

W4 For maintenance

		TZS million
Designing activity	50,000 sq. ft. x TZS1,500 /sq. ft.	75
Ordering activity	30,000 sq. ft. x TZS1,500 /sq. ft.	45
Machining activity	100,000 sq. ft. x TZS1,500 /sq. ft.	150
Marketing activity	20,000 sq. ft. x TZS1,500 /sq. ft.	30
	Total	300

W5 For utilities

		TZS million
Designing activity	= 200,000 amps x TZS500/amps	100
Ordering activity	= 100,000 amps x TZS500/amps	50
Machining activity	= 1,600,000 amps x TZS500/amps	800
Marketing activity	= 100,000 amps x TZS500/amps	50
	Total	1,000

Toyota Motors uses actual costs and activity levels to determine the application rates shown below:

$$\text{Application Rate} = \text{Cost of activity} / \text{Total driver}$$

Activity Drivers	Cost of Activity (TZS million)	Total Driver Usage	Application Rate (TZS million)
Design changes	1,225	12,250 changes	0.100/change
Number of orders	325	6,500 orders	0.050/order
Machine time	3,050	1,525 hours	2.000/hour
Machine of contracts	1,400	7,000 contracts	0.200/contract

The application rates are then multiplied by the cost driver usage for each product to determine the costs to be applied to each product.

Product	Activity	Application Rate (TZS million)	Driver Usage	Cost (TZS million)
Col.1	Col.2	Col.3	Col.4	Col.5 (Col.3 x Col.4)
Standard motor	Designing	0.100/change	225 changes	22.50
	Ordering	0.050/order	150 orders	7.50
	Machining	2.000/hour	100 hours	200.00
	Marketing	0.200/contract	200 contracts	40.00
Total overhead costs to be applied to each standard motor				270.00
Special Order Motor	Designing	0.100/change	1,000 changes	100.00
	Ordering	0.050/order	500 orders	25.00
	Machining	2.000/hour	52.5 hours	105.00
	Marketing	0.200/contract	500 contracts	100.00
Total overhead costs to be applied to each special order				330.00

Note: Activity cost assigned to each product = Application rate for each activity x Driver usage

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Answer to SEQ 3

(a)

	Tablets	Convertible Laptops	All-in-one PCs	Total
Budgeted production per annum (units)	10,000	12,000	6,000	28,000
Average number of units per order	10	6	4	
Number of orders	1,000	2,000	1,500	4,500
No of parts per unit	20	35	25	
Total number of parts	200,000	420,000	150,000	770,000
Assembly time per unit (minutes)	20	4	30	
Total assembly time (minutes)	200,000	480,000	180,000	860,000
Software applications per unit	2	3	4	
Total number of software applications	20,000	36,000	24,000	80,000

Activity	Activity cost TZS000	Cost driver	Cost driver rate
Manufacturing scheduling	162	Number of orders	TZS162,000 / 4,500 = TZS36 per order
Parts handling	2,464	Number of parts	TZS2,464,000 / 770,000 = TZS3.20 per part
Assembly	4,472	Assembly time	TZS4,472,000 / 860,000 = TZS5.20 per minute
Software installation & testing	2,000	Number of software applications	TZS2,000,000 / 80,000 = TZS25.00 per application
Packaging	1,302	Number of units	TZS1,302,000 / 28,000 = TZS46.50 per unit
	10,400		

	Tablets TZS000	Conv. Laptops TZS000	All-in-one PCs TZS000	Total TZS000
Manufacturing Scheduling	(1,000 x TZS36) 36	(2,000 x TZS36) 72	(1,500 x TZS36) 54	162
Parts handling	(200,000 x TZS3.20) 640	(420,000 x TZS3.20) 1,344	(150,000 x TZS3.20) 480	2,464
Assembly	(200,000 x TZS5.20) 1,040	(480,000 x TZS5.20) 2,496	(180,000 x TZS5.20) 936	4,472
Software Install. & testing	(20,000 x TZS25) 500	(36,000 x TZS25) 900	(24,000 x TZS25) 600	2,000
Packaging	(10,000 x TZS46.50) 465	(12,000 x TZS46.50) 558	(6,000 x TZS46.50) 279	1,302
Total production overhead costs	2,681	5,370	2,349	10,400

	Tablets TZS000	Convert. Laptops TZS000	All-in-one PCs TZS000	Total TZS000
Sales	3,640	12,480	9,880	26,000
Direct material	800	2,800	2,200	5,800
Direct labour	300	1,200	800	2,300
Production overheads	2,681	5,370	2,349	10,400
Gross profit	(141)	3,110	4,531	7,500

(b) Products

	Tablets	Convertible Laptops	All-in-one PCs
Current system of absorption costing (per unit)			
	TZS	TZS	TZS
Selling price	364	1,040	1,647
Production overhead cost	146	416	659
Gross profit	108	291	488
Gross profit %	29.8%	27.9%	29.6%
Activity based costing (per unit)			
Selling price	364	1,040	1,647
Production overhead cost	268	448	392
Gross profit	(14)	259	755
Gross profit %	(3.9%)	24.9%	45.9%

It can be seen from the figures in the table above that under the activity based costing system there is a completely different picture of the profitability of each of the products. Under the traditional absorption costing system each of the products was making a very similar gross profit margin of around 30%. However under the activity based costing system, Tablets are now shown to be loss making and all-in-one PCs are making a significantly higher gross profit margin, at 45.9%, than originally thought. The gross profit margin for convertible laptops has declined slightly from 27.9% to 24.9%.

Under the traditional absorption costing system, production overheads were charged to products based on sales revenue. This meant that Tablets which has a relatively low proportion of the total sales revenue (14%) was charged a relatively low level of fixed production overheads. When the activity based costing system is used and the actual consumption of activities is considered Tablets are charged significantly more production overheads than before. Whilst Tablets has the lowest number of cost drivers for most of the activities it also has a relatively lower selling price than the other products. For example the ratio of parts per unit is 20:35:25 for Tablets, convertible laptops and all-in-one PCs but the ratio of selling prices is 12:34:54. All-in-one PCs gross profit percentage is significantly higher under activity based costing since whilst it has the second highest number of cost drivers for parts per unit and assembly time per unit it has the highest selling price per unit compared to the other two products.

This information will be useful for the company when making decisions about product pricing and product mix.

(c) The activity based costing system provides information about the various activities and the cost drivers for each activity. The information about the cost of activities enables the company to focus on those activities with the highest costs and to determine whether they can be eliminated or performed more efficiently. Activities can be classified as value-added and non-value added. Companies can take action to reduce or eliminate the non-value added activities.

The information ascertained about the cost drivers will also be useful for cost control purposes. The company can try to reduce the number of cost drivers for each product through process or product redesign. The cost driver rate can also be used as a measure of cost efficiency.

Answer for SEQ 4

Total labour hours = $2 \times 20,000 + 1 \times 25,000 + 1 \times 2,000 = 67,000$

Overhead absorption rate = $\text{TZS } 190\text{m} / 67,000 = \text{TZS } 2,836 \text{ per hour}$

	A	B	C
	TZS/unit	TZS /unit	TZS/unit
Direct materials cost	5,000	10,000	10,000
Direct labour	10,000	5,000	5,000
Production overhead cost	<u>5,672</u>	<u>2,836</u>	<u>2,836</u>
Total cost	<u>20,670</u>	<u>17,840</u>	<u>17,840</u>

(a) Activity levels:

Total machine hours = $(20,000 + 25,000 + 2,000) = 94,000$

Total production runs = $10 + 13 + 2 = 25$

Total component receipts = $10 + 10 + 2 = 22$

Total customer order = $20 + 20 + 20 = 60$

Cost per cost driver

(i) Machine costs = $\text{TZS } 55\text{m} / 94,000 = \text{TZS } 585.11 \text{ per machine hour}$

(ii) QC & set up = $\text{TZS } 90\text{m} / 25 = \text{TZS } 3.6\text{m per production run}$

(iii) Receiving = $\text{TZS } 30\text{m} / 22 = \text{TZS } 1,363,636.40\text{m per component receipt}$

(iv) Packing = $\text{TZS } 15\text{m} / 60 = \text{TZS } 250,000 \text{ per customer order}$

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Working (W1)

	A	B	C	Total
Machine costs	23,404	29,256	2,340	55,000
QC & set – up	36,000	46,800	7,200	90,000
Receiving	13,636	13,636	2,728	30,000
Packing	<u>5,000</u>	<u>5,000</u>	<u>5,000</u>	<u>15,000</u>
Total overhead costs	78,040	94,692	17,268	190,000
Units produced	20,000	25,000	2,000	
Overhead per unit	3,902	3,788	8,634	

Cost per unit – ABC

	A	B	C
Add: Direct materials PU	5,000	10,000	10,000
Direct labour PU	<u>10,000</u>	<u>5,000</u>	<u>5,000</u>
Overhead cost (W ₁)	<u>3,902</u>	<u>3,788</u>	<u>8,634</u>
Total cost per unit	<u>18,902</u>	<u>18,78</u>	<u>23,634</u>

SECTION A4: TARGET COSTING

■ Get Through Intro

Target costing is a cost management tool that has been used very effectively by leading Japanese manufacturers. Examples of the companies that use target price and target costing include Daimler Chrysler, Ford, General Motors, Tata motors (Nano) and Toyota in the automobile industry, Matsushita, Panasonic and Sharp in the electronic industry and Compaq and Toshiba in the personal computer industry.

Companies use target costing tools to attain low costs to ensure low prices, with the objective to maintain market position, product leadership and even market penetration. **Target cost** is a financial goal for the full cost of a product. This is derived from estimates of the target selling price and the desired operating profits (which top management set on the basis of the firm's strategy and financial goals). Target costing as a management tool enhances the profitability to reach the overall expected profit per product, by increasing cost control at each step of the product life-cycle.

This section discusses the fundamental concept, process and implications of target costing. You need to absorb this as you may be actively involved in the exercise of 'target costing' as a management accountant of a company. Any misunderstanding about this on your part, will lead to costs moving in the wrong direction at each stage of the production process.

■ Learning Outcomes

- a) Derive a target cost for manufacturing and service industries.
- b) Explain the difficulties of using target costing in service industries.
- c) Suggest how a target cost gap might be closed.

1. Derive a target cost for manufacturing and service industries.

[Learning Outcome a]



Definition

Target costing is a technique which is aimed at reducing the life-cycle costs of new products, while ensuring quality, reliability, and other consumer requirements, by examining all possible ideas for cost reduction at the product planning, research and development, and prototyping phase of production. However, it is not just a cost reduction technique; it is part of a comprehensive strategic profit management system.

1.1 Deriving target cost for manufacturing and service industry

For both the manufacturing and service industry, the methodology of deriving target cost is similar. These steps are explained below:

1. Identifying the target price

Normally, a target costing technique is employed at the product development stage. The focus remains on the needs of potential customers. The challenge is to satisfy those needs. A manufacturer or service provider tries to assess the value of the product or service as would be perceived by potential customers. In order to assess the value perceived by potential customers, the manufacturer or service provider uses extensive market research. Potential prices are influenced by a number of functions attached to a product or service.

In a competitive environment, the competitors' price for a similar product or service is taken into consideration in order to determine the target price. For job orders, target price is the price which the customer is willing to pay for the product with certain specifications.

2. Ascertaining the target operating profit

Top management, on the basis of the firm's strategy and financial goals, determines the target profit. Instead of expressing the profit target as 'Return on Investment' (as it is done traditionally), the target profit is set as 'Return on Sales' (i.e., Operating profit / Revenue).

3. Deriving target cost by subtracting target profit from target price

Target cost per unit is the estimated long-run cost per unit of product or service, which enables the manufacturer or service provider to achieve the desired profit per unit when selling at the target price. In calculating target cost, we include all future costs, both variable and fixed. The rationale is that a firm's revenues must recover all its costs in the long run. Target cost per unit is often lower than the existing / estimated full cost per unit of the product or service.

$$\text{Target Cost per unit} = \text{Target price per unit} - \text{Desired (target) profit per unit}$$

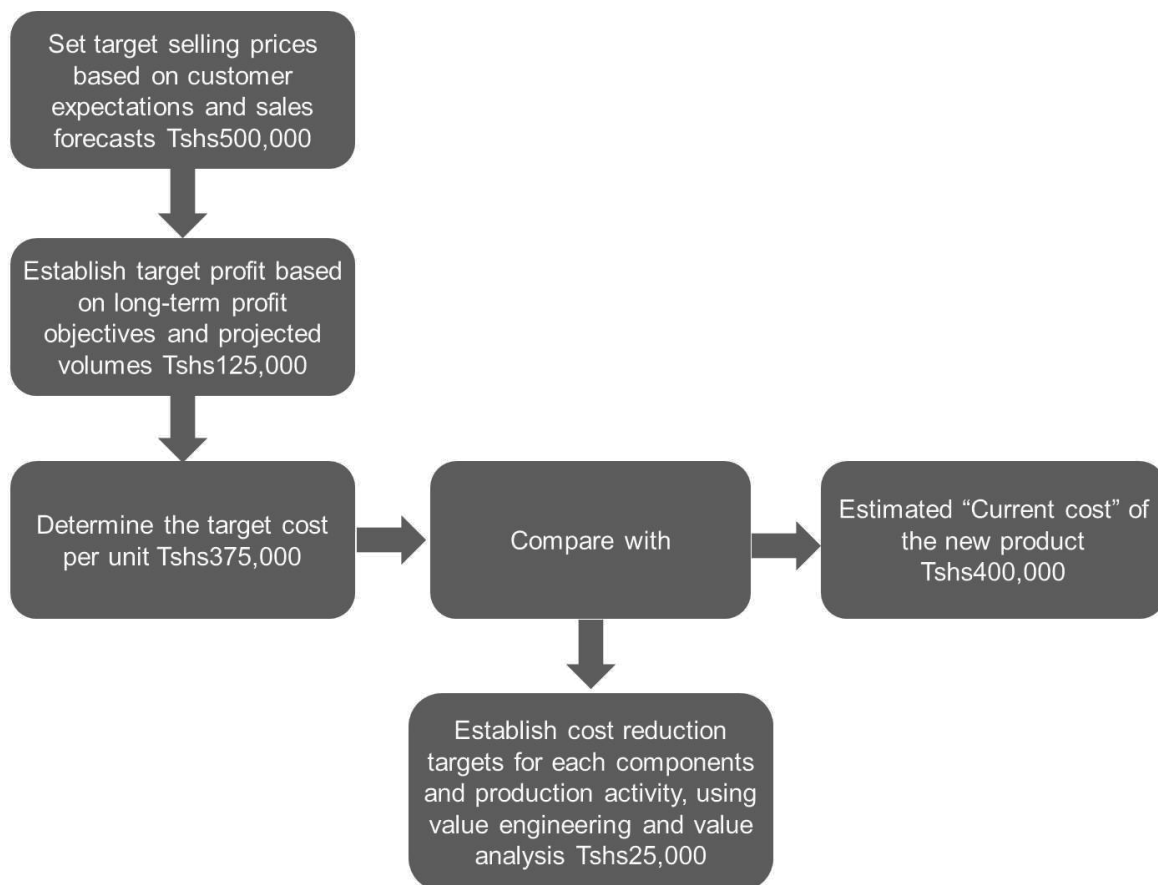


Example

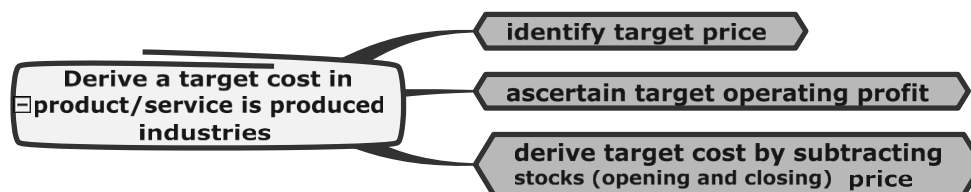
Futuristic Plc produces televisions amongst other electronic equipment. The company has decided on a fixed price of TZS500,000 per unit on its new range of televisions. The **target price** should be fixed considering the additional features of the new model and keeping an eye on the competitors' price for similar kinds of models.

The company's top management wishes to maintain a 'Return on Sales' of 25%. Therefore, the **target profit** per unit comes to 25% on TZS500,000 i.e., TZS125,000. Consequently, the **target cost** per unit of the new television model would be TZS375,000 (whereas the departmental estimate of the total cost of the product is TZS400,000).

Diagram 1: Steps in the target costing process



SUMMARY



Test Yourself 1

Funtoosh Ltd decided to launch a new sewing machine in the market. The management of the company expected to maintain an ROI of 25%. The initial investment required to launch the new machine was TZS6,250 million.

Annual sales level was estimated at 5,500 machines at TZS1.5 million per machine.

Required:

You are required to calculate the target cost per machine.

2. Explain the difficulties of using target costing in service industries.

[Learning Outcome b]

The whole concept of target costing was developed in the manufacturing industry with the objective of cost reduction. The cost reduction process takes place by employing "Value Engineering" (The term is explained in Para 3.3 in the next Learning Outcome). Value Engineering is a technique which is often used in the product design stage by the manufacturing industry. These techniques have rarely been utilised by the service industry. Therefore, the usefulness of target costing in the service industry remains questionable.

The major difficulties of using target costing in the Service Industry are:

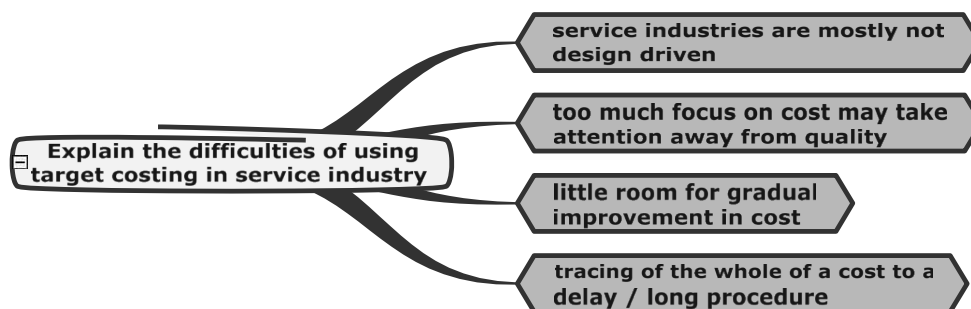
On the whole, the service industry is not design driven as services may differ from customer to customer. Therefore, the scope for the target costing mechanism to apply is limited.

Too much focus on cost may take attention away from quality. This is a problem for both the manufacturing as well as the service industry. However, this factor may affect the service industry more, as quality service is the essence of the service industry.

Target costing and thereby cost reduction is an iterative process. It takes a lot of effort to administer. In the service industry, there is almost no room for a gradual improvement in cost. It is usually the other way around. If we take the example of the aviation industry, we will find many instances where new entrants fix penetrative prices in order to gain market share. However, these prices can only be maintained for a short period.

Target costing is a long procedure, and can delay the sale of the product or service. It poses a real threat to the service industry, since there are possibilities of other competitors gaining the market share if a delay is seen.

SUMMARY



3. Suggest how a target cost gap might be closed.

[Learning Outcome c]

3.1 Understanding what a 'target cost gap' is

In a company, after deriving the **target cost** (as detailed in Learning Outcome 1) for a product, it is compared to the **estimated cost**. Cost estimates are made based on the current standard of material, labour and overheads. In most instances, the target cost is lower than the estimated cost. The gap between the two is known as the '**target cost gap**'. Companies face real challenges to reduce the gap.

Target Cost Gap = Estimated cost - Target cost



Example

Referring back to the example given in the introduction, for specifically designed Integrated Circuits (I.C.), the standard cost of Target Plc was estimated at TZS360 million.

However, the target cost for 10,000 units of I.C. derived by deducting target profit (TZS110 million) from target price (TZS440 million) was TZS330 million.

This indicates that the target costing gap for the company was TZS30 million (i.e., TZS360 million – TZS330 million). The financial goal of the company would be to close the gap.

3.2 Steps to close the 'gap'

To eliminate the 'gap', the cost management accountants help the engineering planners and designers to decompose the target cost into each cost element, according to their detailed production functions. The production engineers determine standards for material and parts usage, labour consumption, etc.

The 'struggle' to achieve the target cost takes place in and outside the company. As soon as the above-mentioned standards are established, purchasing staff negotiate with outside suppliers regarding the price of the purchased material and parts.

Negotiations also take place amongst design, engineering, marketing and other departments in the company, and compromises are made in their efforts to get within the target cost range.

Nevertheless, the fundamental mechanism resorted to by the Japanese manufacturers to reduce the **target cost gap is Value Engineering**.

3.3 Value Engineering as a cost reduction tool



Definition

Value engineering is a systematic analysis and evaluation of the techniques and functions in the various spheres of an organisation, with a view to exploring channels of performance improvement so that the value in a particular product can be improved. It aims at cost reduction from the point of view of value enrichment of a product.

Value engineering is a systematic inter-disciplinary assessment of factors affecting the cost of a product or service. Its objective is to reduce cost while satisfying customer needs. It can result in improvements in product design, changes in material specifications, or modifications in process methods.

The aim of value engineering is to achieve the assigned target cost by:

1. Identifying improved product designs that reduce the product's cost without sacrificing functionality and/or
2. Eliminating unnecessary functions that increase the product's costs and for which customers are not prepared to pay extra.



Test Yourself 2

Continuing the Test Yourself 1, the management of Funtoosh Ltd currently estimates the cost as TZS1,242,000 per machine, on the basis of standard of material, labour and overheads.

Required:

Calculate the target cost gap and suggest possible ways by which the company can close the gap.

Answers to Test Yourself

Answer to TY 1

	TZS'000
Target revenue (TZS1.5 million x 5,500)	8,250,000
Less: Target profit (TZS6,250 million x 25%)	1,562,500
Target cost	6,687,500

Therefore, the target cost per machine is TZS1,216,000 (TZS6,687.5 million/5,500 machines) i.e. TZS1.216 million

Answer to TY 2

Target cost gap is calculated as follows:

$$\begin{aligned}
 \text{Target cost gap} &= \text{Estimated product cost} - \text{Target cost} \\
 &= \text{TZS1,242,000} - \text{TZS1,216,000 per machine} \\
 &= \text{TZS26,000 per machine}
 \end{aligned}$$

The target cost gap of TZS26,000 can be eliminated in the following ways:

Analysing each cost element (such as material, labour, material consumption, overheads etc.) according to its detailed production functions.

Negotiating the price to reduce the cost:

purchasing staff negotiate with outside suppliers regarding the price of purchased material and parts design, engineering, marketing and other departments also negotiate with outsiders. Efforts are made to bring the price within the target cost range.

'Value engineering' can be used as a cost reduction tool by the company to reduce the target cost.

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Identifying improved product designs that reduce the product's cost without sacrificing functionality and/or

Eliminating unnecessary functions that increase the product's costs (functions which customers are not prepared to pay extra for).

Changing material specifications without affecting the quality of the material.

Quick Quiz

1. Briefly state the basis for setting target price.
2. How is target cost derived?
3. Explain in brief a few difficulties of using target costing in the service industry.
4. What is meant by the term 'target costing gap'?
5. Briefly state the concept of 'Value Engineering'.

Answers to Quick Quiz

1. Target price is normally influenced by a number of functions attached to a product or service. In a competitive environment, the competitor's price for a similar product or service is also taken into consideration before determining the target price. For job orders, the target price is the price which the customer is willing to pay for the product, with given specification.
2. Target cost per unit is the estimated long-term cost per unit of product or service that enables the manufacturer or service provider to achieve the desired profit per unit, when selling at the target price.

The formula is:

Target Cost per unit = Target price per unit – Desired (target) profit per unit

3. Major difficulties of using target costing in the service industry are:

The service industry is not really design driven. Therefore, there is limited scope for the target costing mechanism to be applied.

Too much focus on cost may take attention away from quality. This is a problem for both the manufacturing and service industry. However, this factor may affect the service industry more as quality service is the essence of the business.

4. The **target cost** is required to be compared to the **estimated cost** to arrive at the target cost gap. Cost estimates are made based on the current standard of material, labour and overheads. In most of the instances, the target cost is lower than the estimated cost and the difference between the two is the '**target cost gap**'.
5. **Value engineering** is a systematic inter-disciplinary assessment of factors affecting the cost of a product or service. Its objective is to reduce cost while satisfying customer needs. It can result in improvements in product design, changes in material specifications, or modifications in process methods.

Self Examination Questions

Question 1

The managers of Endure Plc are assessing a tender to enter the market for a single product having an estimated life cycle of four years.

- (i) The company has recently paid TZS200 million to a market research consultancy for work done in respect of the tender.
- (ii) The marketing chief has estimated that a sales volume amounting to 5% of the total market size can be achieved in year 1 if a selling price of TZS80,000 per unit is maintained throughout the year.
- (iii) The board of directors is in contract, and desires to maintain a 5% share by volume of the total market size in years 2 - 4.

(iv) The CFO uses cost of capital of 14%, to evaluate such proposals.

Required:

Define the use of target costing and explicate how it could be of assistance to Endure Plc following a decision by the directors to manufacture the product. Note: include a flow diagram to illustrate a target costing cycle.

Question 2

Ronald Pneumatics Inc uses a manufacturing costing system with one direct cost category (direct materials) and three indirect cost categories:

- (i) Setup, production order, and material-handling costs that vary with the number of batches.
- (ii) Manufacturing operation costs that vary with machine-hours.
- (iii) Cost of engineering changes that vary with the number of engineering changes made.

In response to competitive pressures at the end of 20X8, Ronald Pneumatics Inc employed value engineering techniques to reduce manufacturing costs.

Below is the actual information for 20X8 and 20X9:

	20X8 (TZS'000)	20X9 (TZS'000)
Setup, production-order, and materials-handling cost per batch	4,000	3,750
Total manufacturing operating cost per machine hour	27.50	25.00
Cost per engineering change	6,000	5,000

The management of Ronald Pneumatics Inc wants to evaluate whether value engineering has succeeded in reducing the target manufacturing cost per unit of its product, RP4, by 11%. Actual results for 20X8 and 20X9 for RP4 are:

	Actual Results	
	for 20X8	for 20X9
Units of RP4 produced	1,750	2,000
Direct materials cost per unit of RP4 (TZS'000)	600	550
Total number of batches required to produce RP4	35	40
Total machine-hours required to produce RP4	10,500	11,000
Number of engineering changes made	7	5

Required:

- (a) Calculate the manufacturing cost per unit of RP4 in 20X8.
- (b) Calculate the manufacturing cost per unit of RP4 in 20X9.
- (c) Did Ronald Pneumatics Inc achieve the target manufacturing cost per unit for RP4 in 20X9? Explain.
- (d) Explain how Ronald Pneumatics Inc reduced the manufacturing cost per unit of RP4 in 20X9.

Question 3

State how the value engineering process can contribute to eliminating the 'target cost gap'.

Answers to Self Examination Questions

Answer to SEQ 1

Born out of market driven philosophy, target costing is based on the price-down, cost-down strategy, which has allowed companies like Sony and Toyota to win a considerable share in their respective markets.

In its approach to attain target price and target profit (to achieve the desired level of return), it emphasises on cost reduction in each possible activity. Target costing necessitates the comparison of current estimated cost with allowable cost (which is derived as target price minus target profit), and where a gap exists between the two, it is essential to close this gap.

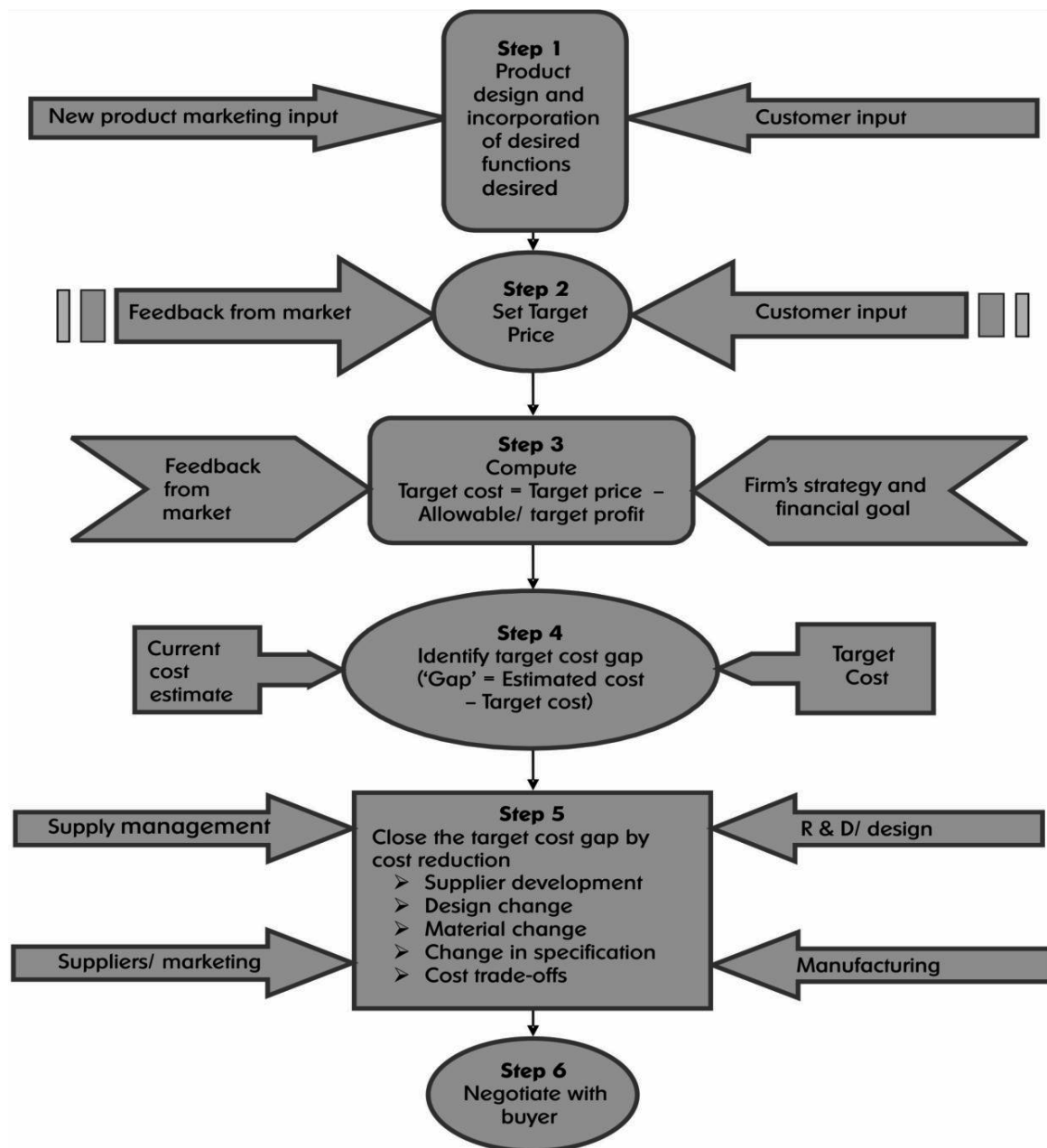
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In this case, it is apparent that if the market research findings regarding the market share have been accurately forecast at the appropriate selling price for the four-year life of the project, then the cost must be reduced from the currently estimated level, if the proposal is to be acceptable at a threshold rate of 14%.

The management of Endure Plc should accept that though the concept of target costing can be used throughout the product life cycle, it is primarily used and most effective in the pre-production stage. Thus cost reduction at this stage of a product's life cycle is of critical significance to business success. Emphasis should be given to identify the non-value added activities in order to eliminate them. An environment should be created that indulges innovation in all spheres of management. The management should determine where improvements in quality, efficiency, and productivity will have the highest pay offs.

The management of Endure Plc may resort to value engineering techniques to achieve the assigned target cost by identifying improved product designs. This will help to reduce the product's cost without sacrificing functionality and eliminating unnecessary (non-value added) functions.

The target costing process



Answer to SEQ 2**(a) Step 1** Determine the total manufacturing cost in 20X8

Particulars	TZS'000	TZS'000
A. Direct Cost: Direct materials (1,750 units x TZS600,000/ unit)		1,050,000
B. Indirect Costs:		
Setup cost (35 batches x TZS4,000,000/ batch)	140,000	
Operating cost (10,500 machine hrs. x TZS27,500/hr.)	288,750	
Cost of engineering change (7 engineering change x TZS6,000,000)	42,000	470,750
C. Total manufacturing cost (A + B)		1,520,750

Step 2 Compute the manufacturing cost per unit
Manufacturing cost per unit = Total manufacturing cost/Number of units produced

 Manufacturing cost per unit in 20X8 = TZS1,520,750,000/1,750 units = **TZS869,000**
(b)**Step 1** Determine the total manufacturing cost in 20X9

Particulars	TZS'000	TZS'000
A. Direct Cost: Direct materials (2,000 units x TZS550,000/unit)		1,100,000
B. Indirect Costs:		
Setup cost (40 batches x TZS3,750,000/batch)	150,000	
Operating cost (11,000 machine hrs. x TZS25,000/hr.)	275,000	
Cost of engineering change (5 engineering change x TZS5,000,000)	25,000	450,000
C. Total manufacturing cost (A + B)		1,550,000

Step 2 Determine the manufacturing cost per unit
 Manufacturing cost per unit in 20X9 = TZS1,550,000,000/2,000 units = **TZS775,000**
(c) The management of Ronald Pneumatics Inc wants to evaluate whether or not value engineering has succeeded in achieving the target manufacturing cost per unit of RP4 by 11%.

In 20X8, the manufacturing cost per unit of RP4 was TZS869,000

Therefore, the target cost per unit is 89% of TZS869,000 = TZS773,410

In 20X9, the manufacturing cost per unit of RP4 came down to TZS775,000

This clearly indicates that the company could almost reach the target cost by employing the value engineering technique.

However, there is still a small gap of TZS15,900 (TZS775,000 - TZS773,410) that can be wiped out if the sales team negotiates with the buyer to marginally increase the selling price.

(d) Ronald Pneumatics Inc almost achieved the target manufacturing cost per unit of RP4 in 20X9 by employing the value engineering technique successfully.

Value engineering has resulted in a reduction of direct material costs of TZS50,000 (TZS600,000 - TZS550,000) per unit. It was probably possible by eliminating the non-value added functions of the product.

We can once again see that the company has been successful in curtailing all the activity costs. Set up, production order, and material handling cost per batch has been reduced by TZS250,000. Operating cost per machine-hour reduced by TZS2,500 (TZS27,500 - TZS25,000) and cost per engineering change has reduced by TZS1,000,000 (TZS6,000,000 - TZS5,000,000) in absolute terms. In percentage terms, the changes are 6.25%, 9% and 16.66% respectively.

The reduction in activity costs have contributed substantially in reducing the indirect cost of the product.

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Moreover, it is significant that the machine hours required per unit was 6 hours in 20X8 whereas in 20X9, it came down to 5.5 hours. This evident improvement in production has contributed to a further reduction in the production cost.

Answer to SEQ 3

Value engineering is a systematic inter-disciplinary assessment of factors affecting the cost of a product or service. Its objective is to reduce cost while satisfying customer needs. It can result in improvements in product design, changes in material specifications, or modifications in process methods.

The aim of value engineering is to achieve the assigned target cost by:

- (a) Identifying improved product designs that reduce the product's cost without sacrificing functionality and/or
- (b) Eliminating unnecessary functions that increase the product's costs, for which customers are not prepared to pay extra.

The issues that are dealt with during the value engineering process, in order to reduce costs are normally the following:

Can any activity be removed from the production process? This involves scanning the whole production process to identify if there is any redundant activity. If such activities are removed, it will directly reduce the associated cost of the activity causing the production cost to be less.

Can the durability of a product be sacrificed to some extent? It is possible to design an excessive degree of durability into a product. For example, a television is manufactured to withstand electrical surges up to 280 volts, though in all probability such an incidence will not occur. The SMPS (switched mode power supply) of the television may be designed so that some components from the system may be removed to reduce the cost,

Can the design be made simple involving less features? If there are any features that do not add value to the product they can be removed. This subsequently reduces the cost of the raw material and direct labour during the production phase, which ultimately leads to a reduction in the cost of the product.

Can the product be designed for manufacture and assembly? It is to be determined whether the product design can be made in a specific manner. For example, a printer cartridge for a printer is designed in such a way that it can be inserted and fitted in the printer when it is correctly aligned with the specific socket in the printer; all other attempts to insert the cartridge will fail. When a product is assembled, this approach, if adopted, ensures that a product is not incorrectly manufactured or assembled.

Can the parts be substituted? Assessments are made to see whether the costly components or material can be substituted by less expensive ones without causing the product quality to be adversely affected. However, this step involves one extra activity: knowing the intentions of the suppliers regarding the future production of the parts; if the parts will not be available in the future, they must be eliminated from the product design.

Can the steps be combined? A detailed review of the production process sometimes reveals that some of the steps can be eliminated or maybe one person can perform more tasks which used to be performed by other personnel in different parts of the production process. By eliminating some of the steps from the production process, material movement and production time can be reduced, causing cost reduction.

Is there a better way? The core concept of value engineering is to challenge every process and to explore whether there is a better alternative. It does not look for incremental changes over the existing system, but suggests bringing in revolutionary changes throughout the production process. Product design may also be completely changed so as to make it value added and cost effective. Improvements resulting from this step have the largest favourable impact on cost. However, organisations may find it the most difficult to adopt.

A combination of the above stated value engineering steps needs to be applied to each product design and production process, to ensure that the maximum cost reduction takes place.

SECTION A5: BACKFLUSH COSTING

■ Get Through Intro

Back-flush costing is a way of accumulating manufacturing costs when processing speeds are very fast or products are being produced in small lots. It by-passes the routine cost accounting entries that are required in subsidiary records for job order and process cost accumulation, thereby saving considerable time in processing data. Moreover, it avoids detailed cost recording, allocation and apportionment of costs to individual production units at different stages of processing (e.g. raw materials, work-in-progress and finished goods). This mode of recording costs supports the **Just in time (JIT)** business process.

The section discusses the JIT system (which is in sharp contrast to the traditional concept of operational activities) and the cost recording mechanism thereof i.e. back-flush costing.

Knowledge about back-flush costing will enlighten students as to how an alternative way of recording costs can be successfully adopted in an organisation. It will open avenues for them, allowing them to work for organisations that employ innovative work methodology such as JIT and accordingly record its costs following back-flush costing. Many ERP packages (like SAP, Oracle) have built-in feature for back flushing the costs. This section will also enable students to answer the questions set in the examination properly.

■ Learning Outcomes

- a) Explain what back flush costing is.
- b) Explain the features of back flush costing.
- c) Explain the application of back flush costing.

1. Explain what back flush costing is.
2. Explain the application of back flush costing.

[Learning Outcomes a and c]

Back flush costing is a product costing system that focuses on output. To better understand the meaning and application of back flush costing, it is advisable to understand just-in-time (JIT) system.



Definition

Just-in-time is a system whose objective is to produce or procure products / components as and when they are required by a customer or for use, rather than for inventory. A Just-in-time system is a 'pull' system, which responds to demand, in contrast to a 'push' system in which inventories act as buffers between the different elements of the system, such as purchasing, production and sales.

1.1 Conceptualising Just-in-time (JIT) system

Just-in-time (JIT) has the elements of a philosophy as well as various practical elements. While the JIT philosophy is applicable to any type of organisation, the practical elements apply mainly to repetitive manufacturing operations such as the production and assembly of automobiles or appliances.

There is considerable support for the argument that successful implementation of a JIT system requires an entirely different mentality, or attitude, on the part of management and workers than the typical attitudes underlying traditional business practices and relationships.

It basically involves elimination of waste and excess resources. It also suggests performing activities only as and when customers need them at the next stage in the process. A just-in-time system always encourages production in response to the demand of a product and it strongly discourages production for creating inventory. It is in clear contrast with traditional production systems.

The JIT system suggests that, to ensure rapid production, individual materials will spend much less time in work in progress and accordingly, the total volume of work in progress will reduce.



Example

Mac Plc manufactures pipes and operates a JIT system. Hence it manufactures pipes only when they have a demand from the market. The production manager of Mac believes that inventory buffers are an evil because they hide problems such as defective parts, production bottlenecks, long machine setups etc.

Manufacturing in cells in JIT system causes reduction in defects and manufacturing lead time. Moreover, it ensures timely delivery of materials and enables purchasing, production and sales to occur in quick succession with minimum inventories.

Cells may be described as factories within a factory. These are small specialised manufacturing plants that are dedicated to the production of a small number of products. This idea applies mainly to repetitive manufacturing.

The advantages of arranging the factory into cells also include obtaining more accurate product costs. Some support services such as production scheduling, engineering, maintenance and human resource management are also decentralised which reduces the amount of indirect costs. Since the cells are dedicated production units for producing a product, these costs become direct costs (because of their easy traceability) to the products produced in the cell.



Example

A leading computer manufacturer uses JIT to minimise the need for computer inventories. The firm builds computers to specifications after the orders are received. This makes its inventories much lower, as the firm keeps 35 days of inventory on hand compared to 110 days for its rivals in the global computer market.

1.2 Comparing JIT with traditional method of manufacturing

Just-in-Time Manufacturing	Traditional Manufacturing
Reduces inventory	Increases inventory to protect against process problems
Reduces lead time	Increases lead time as a buffer against uncertainty
Reduces setup time	Disregards setup time as an improvement priority
Emphasises product-oriented layout	Emphasises process-oriented layout
Emphasises team-oriented employee involvement	Emphasises work of individuals following manager instructions
Emphasises demand pull manufacturing	Emphasises production push manufacturing
Emphasises zero defects	Tolerates defects
Emphasises supplier partners	Keeps suppliers at "arm's length," independent entries

1.3 What is 'Back-flush costing'?

Traditional cost accounting systems follow the sequence of raw materials and components moving through the production systems, and as a consequence are called '**sequential tracking systems**'.

The absence of inventories in JIT system makes inventory valuation methods (such as 'First-in, first-out' or 'Weighted average') or costing methods (such as absorption or marginal costing) unimportant. Accordingly, all manufacturing costs of the accounting period flow directly into the cost of goods sold. The rapid conversion of direct materials into finished products and immediate sale of the items in the JIT system greatly simplifies cost recording.

As JIT is an entirely different system, it requires its own cost accounting system, namely **back-flush accounting**. It is a product costing system that focuses on output. Based on the available accounting information, it assigns costs to products that are sold and to units in final inventory. With back-flush, accounting entries are normally made only when goods are completed.



Definition

Back-flush costing is a method of costing, related to JIT production systems, which applies costs to the output of a process. Costs do not mirror the flow of products through the production process, but are attached to the output produced (finished goods inventory and cost of sales), on the assumption that such back-flushed costs are a realistic measure of the actual costs incurred.

1.4 The process and application of back-flush costing

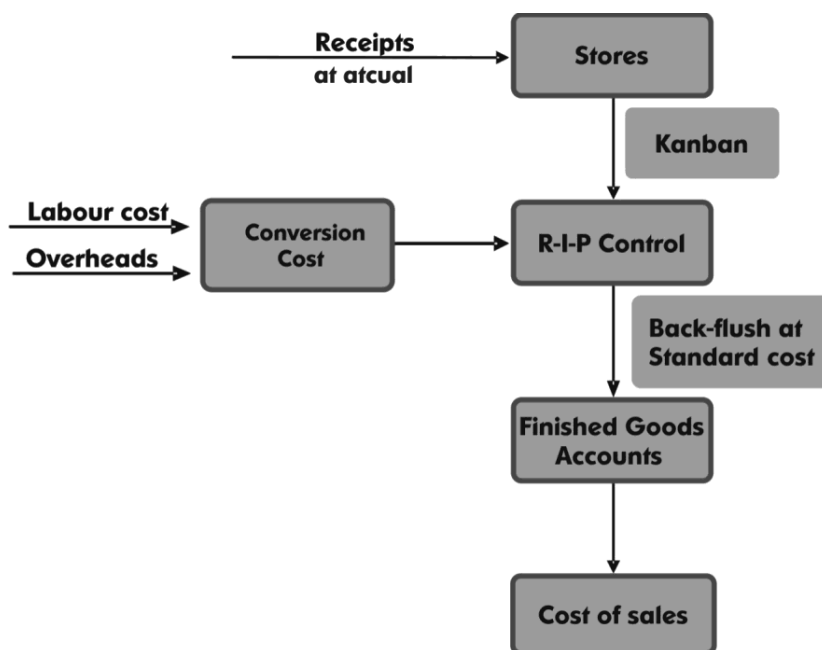
The adoption of JIT will result in a simple accounting system with a reduced number of accounting transactions. The considerations of back-flush costing are narrated below:

1. Unlike a traditional system, work orders are no longer used. The physical movement of raw materials and components from warehouse through WIP to finished goods is controlled by a pull production system known as '**Kanban**'.

The essence of the 'Kanban' concept is that a supplier or a warehouse should **only deliver components to the production line as and when they are needed**, so that **there is no storage in the production area**.

2. Raw materials and components are held in a **raw in-process (RIP)** account until the product is completed.
3. At that point, the individual materials and components in the product's bills of material are credited to the RIP account and the product's standard material cost is debited to the finished goods account (known as 'back-flush').
4. Actual conversion costs are recorded whenever they incur. When products are complete or when sale of finished goods takes place (as the case may be), conversion cost not applied to the products is carried forward at the year end.
5. Periodic counting of items in stores and WIP areas is necessary to detect material usage variance.
6. The income statement includes the standard material cost of sales plus the material variances and the actual labour and overhead costs for the period.
7. An adjustment will be required to reflect the labour and overhead content of WIP and finished goods inventory.

Diagram 1: A simplified form of flow diagram indicating the procedure of back-flush costing



1.5 Accounting procedure in back-flush costing

The accounting entries in back-flush costing are made at different trigger points (this refers to a stage in the cycle from purchase of direct materials to sale of finished goods). Contrary to traditional accounting, where every transaction is recorded as and when it occurs, in back-flush accounting the recording of costs is delayed until after the events have taken place, then standard costs are used to work backwards to flush out the manufacturing costs.

1. Accounting procedure when the **trigger points** are **purchase of direct materials, completion of finished goods** and **sale of finished goods** are:

- (a) Debit raw material purchase to 'Raw material in-process account' (no work-in-process inventory) at actual cost and credit payable accounts. Debit all actual labour and actual overheads to 'Conversion costs' and credit various payable accounts.

Record material purchase for the period

Dr	Raw material in-process account (at actual)	X	
Cr	Accounts payable		X

Actual labour and overheads for the period i.e. conversion cost incurred is recorded:

Dr	Conversion costs control account (at actual)	X	
Cr	Accounts payable		X

- (b) Calculate the standard conversion cost to be applied to the products and debit conversion costs to 'Raw material in-process account' to apply the cost to the products. Any under- or over-absorption of conversion costs is accounted for and adjusted with the cost of goods sold account at the period end.

Adjustment of conversion costs

In case of the under absorption of conversion costs

Dr	Conversion costs allocated account	X	
Dr	Cost of goods sold account	X	
Cr	Conversion cost control account		X

In case of the over absorption of conversion costs

Dr	Conversion costs allocated account	X	
Cr	Cost of goods sold account		X
Cr	Conversion cost control account		X

- (c) Determine the number of finished units

Record cost of finished goods for the period:

Dr	Finished goods control account	X	
	Cr Raw material in-process accounts (at standard)		X
	Cr Conversion Costs (as allocated)		X

Record cost of sales:

Dr	Cost of goods sold account (at standard)	X	
	Cr Finished goods control account		X

2. Accounting procedure when **trigger points** are **purchase of materials** and **sale of finished goods** are the same as the procedure stated in (a) except that costs are charged directly to cost of goods sold, when sale is made (there is no raw in-process or finished goods account). The journal entries in this case will be:

- (a) For purchase of direct materials

Dr	Material-in-process account (at actual)	X	
	Cr Accounts payable		X

- (b) For conversion cost incurred

Dr	Conversion Cost account (at actual)	X	
	Cr Accounts payable (for expenses)		X

- (c) The back-flush entry at the trigger point of sale of finished goods

Dr	Cost of goods sold account (actual sales at conversion cost)	X	
	Cr Material-in-process account		
	Cr Conversion Cost control account (as allocated)		X

Any under- or over-absorption of conversion costs is accounted for and adjusted with the cost of goods sold account at the period end.



Example

Just-in-time Ltd has the following transactions during the year 20X8:

Purchase of raw materials (TZS'000)	52,000
Conversion costs (TZS'000)	40,300
Production	3,100 units
Sales	3,000 units

There were no opening inventories of raw materials, WIP or finished goods. The standard cost per unit is TZS29,500 (Material cost TZS16,500 per unit plus conversion cost TZS13,000 per unit).

There was no closing WIP as at 31 December 20X8.

The journal entries for back-flush costing would be made at two trigger points (as shown in the second method):
the purchase of raw materials and components
the manufacture of finished goods

Journal entries for Back-flush costing system

	TZS'000	TZS'000
Dr RIP account	52,000	
Cr Payable account		52,000
Purchase of raw materials on credit		
Dr Conversion cost control account	40,300	
Cr Accounts payable		40,300
Conversion cost of TZS13,000 per unit incurred		
Dr Cost of goods sold	88,500	
Cr RIP account		49,500
Cr Conversion cost account		39,000
The back-flush entry for 3,000 units sold		

Continued on the next page

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If the company follows the first method for recording costs, i.e. if the trigger points are purchase of materials, completion of finished goods and sale of finished goods, the journal entry will be as follows:

	TZS'000	TZS'000
Dr RIP account	52,000	
Cr Accounts payable		52,000
Purchase of raw materials on credit		
Dr Conversion cost control account	40,300	
Cr Accounts payable		40,300
Conversion cost incurred		
Dr Finished goods control account	91,450	
Cr RIP account		51,150
Cr Conversion cost control account		40,300
Completion of finished goods of 3,100 units @ TZS29,500		
Dr Cost of goods sold	88,500	
Cr Finished goods control account		88,500
The back-flush entry for 3,000 units sold @ TZS29,500		

As at 31 December 20X8, there will be two separate inventory balances:

RIP account (52,000 - 51,150)	TZS850,000
Finished goods (100 units @ TZS29,500)	TZS2,950,000

1.6 Contrast of Back-flush cost accounting with traditional process accounting

Back-flush costing intends to reduce detailed accounting transactions. Rather than tracking the movement of materials through the production process, a back-flush costing system focuses first on the output of the organisation and then works backwards when allocating cost between cost of goods sold and inventories, with no separate accounting for WIP.

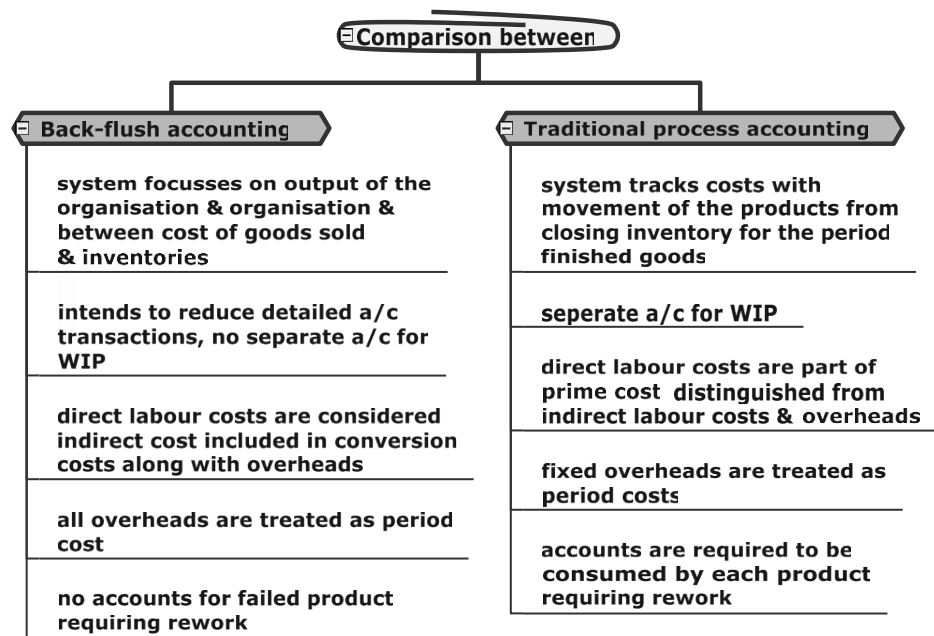
In contrast, traditional product costing systems track costs in synchronisation with the movement of the products from direct materials through WIP to finished goods.

In back-flush costing, direct labour is not considered a cost category. Instead, labour is considered an indirect cost and is included in conversion costs along with overheads. This is in contrast to traditional process accounting where direct labour costs are part of prime cost and distinguished from indirect labour costs and other overheads.

In back-flush costing, all overheads are treated as period costs whereas in a traditional accounting system, only the fixed overheads are considered to be period costs. Increased traceability of costs in back-flush costing method results in most of the indirect costs being treated like direct costs.

Wherever JIT is in practice, failed product requiring rework is, ideally, not tolerated and therefore no accounts for this exist in back-flush costing whereas they are required in traditional systems.

SUMMARY



Test Yourself 1

BF Plc uses a JIT system and back-flush costing. It does not use a raw material inventory control account. During March 20X8, 2,500 units were produced and sold. The standard cost per unit is TZS80,000. This includes materials of TZS30,000. During March, conversion costs TZS70 million were incurred.

Required:

What should be the debit balance on the cost of goods sold account for March 20X8?

3. Explain the features of back flush costing.

[Learning Outcome b]

The **features of back flush costing** are listed below:

1. The back-flush costing system is specifically designed for a manufacturing system where the JIT philosophy and practice is adopted. Since maintenance of inventory is discouraged, any wastage in the production process is easily identified.
2. The back-flush costing system discourages WIP and maintenance of a significant volume of inventory at any level. This simplifies inventory management and reduces the related inventory handling costs.
3. The back-flush costing system ensures fewer accounting entries and therefore saves clerical time to a large extent. Also, with fewer accounting entries, the need for supporting vouchers, work flow documents, etc. is also reduced. It is ideally suited to a rapid production system.
4. It avoids detailed cost recording, allocation and apportionment of costs to individual production units. Since production in a JIT system takes place in cellular manufacturing units, most of the costs incurred therein become traceable to a product and are therefore treated as direct costs. In this way, back-flush costing alleviates approximation in overhead accounting leading to a more accurate product cost.

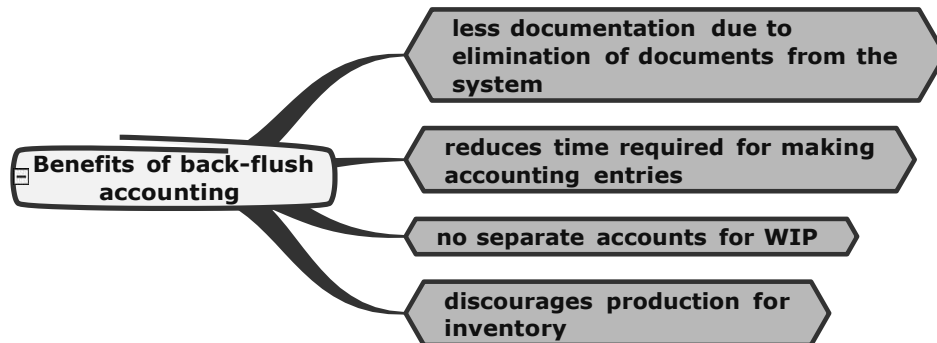
The **benefits of introducing back-flush costing** are the following:

1. Back-flush costing saves a considerable amount of documentation since documents such as material requisitions, time sheets, job cards, WIP records can be eliminated from the system. This, in turn, saves a considerable amount of time.
2. Back-flush costing substantially reduces the time required for making accounting entries since the number of entries is substantially reduced compared to a traditional system.

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3. It is simpler. Materials are not tracked through the production process as is done traditionally. There is no separate accounting for WIP.
4. Production for inventory is discouraged by the system. Working on material does not add value if it moves into inventory.

SUMMARY



Answer to Test Yourself

Answer to TY 1

The cost of goods sold will be debited with TZS200 million (2,500 units x TZS80,000). This figure includes TZS125 million (2,500 units x TZS50,000) for conversion costs. Conversion costs actually incurred were TZS70 million. Assuming that an adjustment is made at the end of each month for conversion costs that have been over-applied, TZS55 million will be adjusted in cost of goods sold in March 20X8. This will result in the cost of sales account having a debit balance of TZS145 million TZS200 million – TZS55 million).

$$\text{TZS80,000} - \text{TZS30,000} = \text{TZS50,000}$$

Therefore, the debit balance on the cost of goods sold account for March 20X8 will be TZS145 million.

Quick Quiz

1. A JIT system requires emphasis on the following:
 - A Continuous improvement
 - B Respect for people at all levels
 - C Quality at the source
 - D All of the above
2. A JIT system does not incorporate the following practice:
 - A Just-in-time purchasing
 - B Focussed factories
 - C Just-in-time production
 - D Complicated accounting process
3. A JIT environment does not advocate the following:
 - A A move towards zero inventory
 - B Removal of non-value added activities
 - C An emphasis on perfect quality i.e., zero defects
 - D A move towards big batch size
4. Benefits of introducing back-flush costing does not include:
 - A Reduction in documentation time.
 - B Time saving in recording transactions.
 - C It being a more complex system compared to a traditional accounting system.
 - D Discouraging production for inventory.

5. Identify the factor that is irrelevant in switching to back-flush costing from a traditional process control system:
- A** More importance to financial measures in lost control activity.
 - B** Having an accurate bill of material and inventory record.
 - C** Software in use in the system
 - D** Cultural environment
6. The back-flush costing system discourages WIP and maintenance of significant volume of _____ at any level. It is considered that working on material does not add value if it moves into inventory.
7. In fact, the impact of switching to JIT and back-flush costing from traditional system is multi-dimensional. The impact on the accounting system is likely to be mediated and influenced by the _____ and _____ environment into which the new philosophy as well as practice is introduced.

Answers to Quick Quiz

1. The correct option is **D**.
A JIT system requires emphasis on all the given options.
2. The correct option is **D**.
A JIT system does not incorporate complicated accounting process.
3. The correct option is **D**.
A JIT environment does not advocate a move towards big batch size
4. The correct option is **C**.
Benefits of introducing back-flush costing does not include being more complex than a traditional accounting system.
5. The correct option is **A**.
The factor that is irrelevant in switching to back-flush costing from a traditional process control system is more importance to financial measures in cost control activity.
6. Inventory
7. Organisational and cultural

Self Examination Questions

Question 1

Ronald Electrical Equipment's Ltd produces coffee makers. The budgeted manufacturing costs for the products are indicated below:

Types of Input	Unit Cost TZS'000
Direct material	20
Direct labour	2
Variable overhead	8
Fixed overhead (TZS12 million/1,000)	12
Total	42

To keep the problem simple, assume that there are no beginning inventories and that the actual costs of production are equal to budgeted costs.

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During the period, the company:

- (i) Purchased TZS20.2 million worth of direct materials.
- (ii) Incurred TZS22 million in conversion costs including TZS2 million direct labour, TZS8 million variable overhead and TZS12 million fixed overhead.
- (iii) Ending inventory included 5 finished units, 5 equivalent units in process and TZS300,000 worth of unused direct materials.

Required:

Show the necessary journal entries in back-flush costing.

Question 2

In a period In-Time Plc has the following transactions

	TZS'000		Units
Purchase of raw materials	58,500	Production	4,400
Conversion costs	39,600	Sales	4,300

There were no opening inventories of raw materials, WIP or finished goods. The standard cost per unit is TZS22,000 (TZS13,000 materials + TZS9,000 conversion cost). There was no closing WIP at the end of the period.

Required:

Show the Journal entries for a back-flush costing system using a Raw in process (RIP) account.

Question 3

Discuss the advantages and disadvantages of using just-in-time inventory management methods.

Answers to Self Examination Questions

Answer to SEQ 1

		TZS million	TZS million	
Dr	RIP account	20.2		
	Cr Payable accounts (creditors)		20.2	
	Purchase of direct materials			
Dr	Conversion cost	22		
	Cr Payable accounts (expenses)		22	Entire costs transferred to cost of sales
	Conversion cost incurred			
Dr	Cost of goods sold	42.2		
	Cr RIP account		20.2	
	Cr Conversion costs		22.0	Conversion cost carried forward for 5 equivalent units
	Cost assigned to finished products			
Dr	RIP account (given)	300		
Dr	Conversion costs (5 units x TZS22 million)	110		
Dr	Finished goods (5 units x TZS42 million)	210		
	Cr Cost of goods sold		620	
	Back-flush adjustments for the ending inventories consisting of RIP, conversion cost and finished goods			Completed units transferred to finished goods account

Answer to SEQ 2**Journal entries for Back-flush costing system**

		TZS'000	TZS'000
Dr	RIP a/c	58,500	
	Cr Payables a/c		58,500
Being purchase of raw materials on credit			
Dr	Finished goods inventory a/c	96,800	
	Cr RIP a/c (W1)		57,200
	Cr Conversion cost of control a/c		39,600
Being cost of 4,400 goods produced			
Dr	Cost of sales a/c	94,600	
	Cr Finished goods inventory a/c (W2)		94,600
Being cost of 4,300 goods sold			

At the end of the period there will be two separate inventory balances:

	TZS'000
RIP account (58,500 - 57,200)	1,300
Finished Goods (100 @ TZS22,000)	2,200

Notes

- All the entries shown above are at standard cost.
- For simplicity, the figures have been chosen so that no variances arise.

Workings

W1 RIP for 4,400 units = 4,400 x TZS13,000 = TZS57,200,000

W2 Cost of finished goods = 4,300 units x TZS22,000 = TZS94,600,000

Answer to SEQ 3

Just-in-time (JIT) stock management methods aim at elimination of wastes at every aspect of production by reducing excess resources (e.g. building, equipment, inventory, employees, etc.) of the company. Accordingly, stock levels (raw materials, WIP, finished goods) are kept to a minimum under the JIT system by improved work-flow planning, closer relationships with suppliers and by manufacturing the products according to customer specifications after the orders are received.

Advantages

One of the major advantages of JIT stock management methods is a stronger relationship between buyer and supplier. It ensures maintenance of stock at its lowest level, since the right quantity of materials is supplied at the right time. On the other hand, the supplier benefits from regular orders, continuing future business and more certain production planning. The buyer benefits from the lower holding costs of the inventory and lower investment in raw material inventory and work in progress. The buyer also gets rid of inventory management problems by shifting the responsibility of maintaining inventory to the supplier. The buyer may also benefit from bulk purchase discounts or lower purchase costs.

The emphasis on continuous improvement in quality in the production process reduces scrap, reworking and set-up costs, while improved production design can reduce or even eliminate unnecessary material movements. Also, emphasising on small batch size and continuous flow of production results in a smooth flow of material and work through the production system, with no hold ups or idle time.

Disadvantages

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In reality, the smooth running of a JIT production system may be hindered due to reasons beyond the control of the organisation such as an unforeseen delay in delivery of materials.

In addition, the quality of materials supplied by the supplier is another factor beyond the control of the organisation. If delivered quality is not up to the required standard, expensive downtime or a halt in production may arise, although the buyer can protect against this eventuality by stipulating clauses for guarantees and

penalties in the supplier's contract. If the supplier raises the price of supplies, the buyer may also find it difficult to get an alternative supplier who is capable of meeting his needs at short notice.

Moreover, lots of negotiations are required between the buyer and the seller. The JIT of the buyer may not coincide with the JIT of the seller. Delays may be caused due to unforeseen events which may affect the entire production schedule.

SECTION A6: LIFE-CYCLE COSTING

■ Get Through Intro

So far, we have come across accounting systems which report costs and revenue by splitting them into time periods such as a month, a year etc. This prevents consideration of the total profitability of an individual product from the stage of conceptualising the product and marketing it till the time it is completely withdrawn from the market and therefore does not allow the full picture to be seen.

'Life-cycle costing, on the contrary, traces all costs and revenue of a cost object (i.e., a product or service) from the stage of product planning to after sales service and ultimate abandonment and disposal (i.e., the period from 'Cradle to Grave').

This section will help learners to understand the cost consequences of developing and manufacturing a product and to identify areas in which cost reduction efforts are likely to be most effective during the entire product life-cycle.

You need to understand the concept of 'life-cycle costing' so that, as management accountants, you can find out and inform management whether the profits expected to be earned by a product during the manufacturing stage will be able to cover the costs incurred during the pre-manufacturing (development, design, etc.) and post-manufacturing stage (after sales service, product support, etc.).

■ Learning Outcomes

- a) Identify the costs involved at different stages of the life-cycle.
- b) Derive a life cycle cost in manufacturing and service industries.
- c) Identify the benefits of life cycle costing.

1. Identify the costs involved at different stages of the life-cycle.
2. Derive a life cycle cost in manufacturing and service industries.

[Learning Outcomes a and b]

The term '**life-cycle costing**' encompasses both the concepts of '**product life-cycle cost**' and '**customer life-cycle cost**'.

1.1 Conceptualising 'product life-cycle' (Life cycle cost in manufacturing and service industries)

The term 'product life-cycle' refers to the succession of stages a product goes through. It is claimed that every product has a life-cycle. It is conceptualised, then launched; it grows and may, at some point of time, die. The progression of a product through these stages is however, not certain. Some products seem to stay in one stage forever (e.g. milk).



Definition

Life-cycle costing refers to the system that tracks and accumulates every individual cost which is incurred during the whole life cycle of a product starting from its initial planning stage to the post sales service and abandonment stage.

A product life-cycle may be classified into four broad stages. Each of the stages includes at least one of the business functions namely, research and development, design, production, marketing, distribution and customer service. Every product goes through the various stages of the life cycle. When the product reaches the saturation stage, it gives way for research and development of a new product. For example desktops are giving way to laptops and palmtops, the walkman gave way to MP3 players, the camera gave way to handy-cams, and the television gave way to LCDs etc.

The stages of a life-cycle are:

1. The development and introduction stage

This stage includes business functions such as research and development and design. It is a stage where huge costs are incurred on the development and research of the product. The stage also includes expenses incurred on understanding the customers' needs for the product and the value that they perceive by owning or consuming it. At the introduction stage, the product starts to earn some revenue because the product is just introduced in the market.

2. The growth stage

This stage includes business functions such as production, marketing and distribution. At this stage, the product becomes well-known in the market. Due to increase in demand, it captures a bigger market and starts to make a profit. At this stage, cost of the initial investment is progressively recovered.

3. The maturity stage

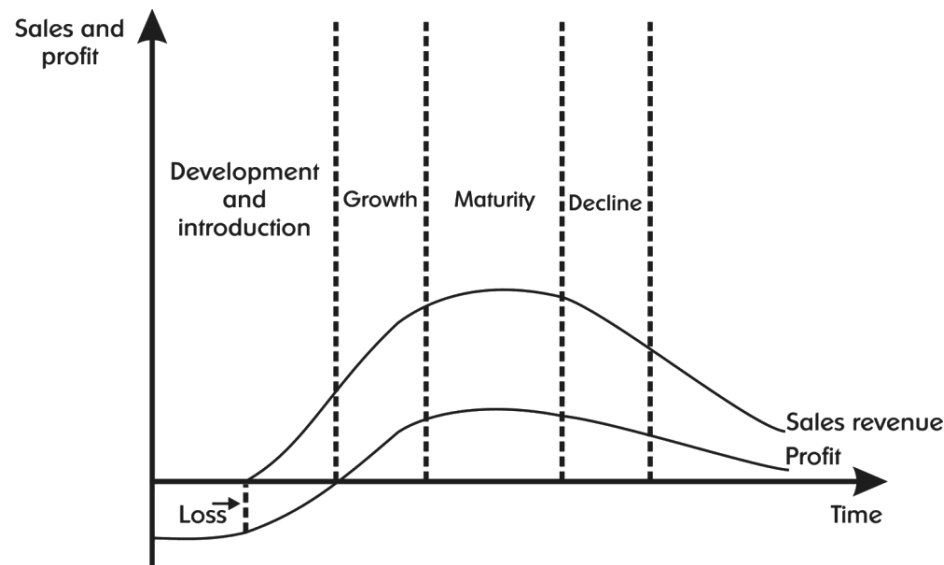
At this stage, demand for the product stabilises or the rate of growth slows down. It continues to be profitable. Expenses for marketing and distribution can be minimised at this stage. In order to sustain the demand, the product may be differentiated / modified. After-sales services can be provided to maintain the demand for the product.

4. The decline / saturation stage

A point comes where large / adequate quantities of the product have been sold in the market and the product, therefore, reaches a saturation point. At this stage the demand for the product starts to fall and marketing costs are cut down. The product may start making loss at this stage. The organisation may decide to discontinue the production and to develop a new product.

Not every product follows the same pattern (mentioned above) of life cycle. The level of revenue and profit generated by the products that go through the life cycle could be as follows:

Diagram 1: Level of sales and profit earned during a product life cycle



As studied earlier, all products and services go through a typical lifecycle - from introduction, growth and maturity to decline. Over time, volume of sales increases, becomes stable and then starts declining. Lifecycle costing estimates and accumulates the costs of a product / service over its entire lifecycle from the beginning to up to abandonment.

Use of lifecycle costing in manufacturing and service industries

1. Lifecycle costing helps to determine whether the profits generated during the production phase will cover the entire lifecycle costs.
2. It also helps management to make decisions about future product / service development and the need for cost control during the development phase.

1.2 Costs committed and costs incurred

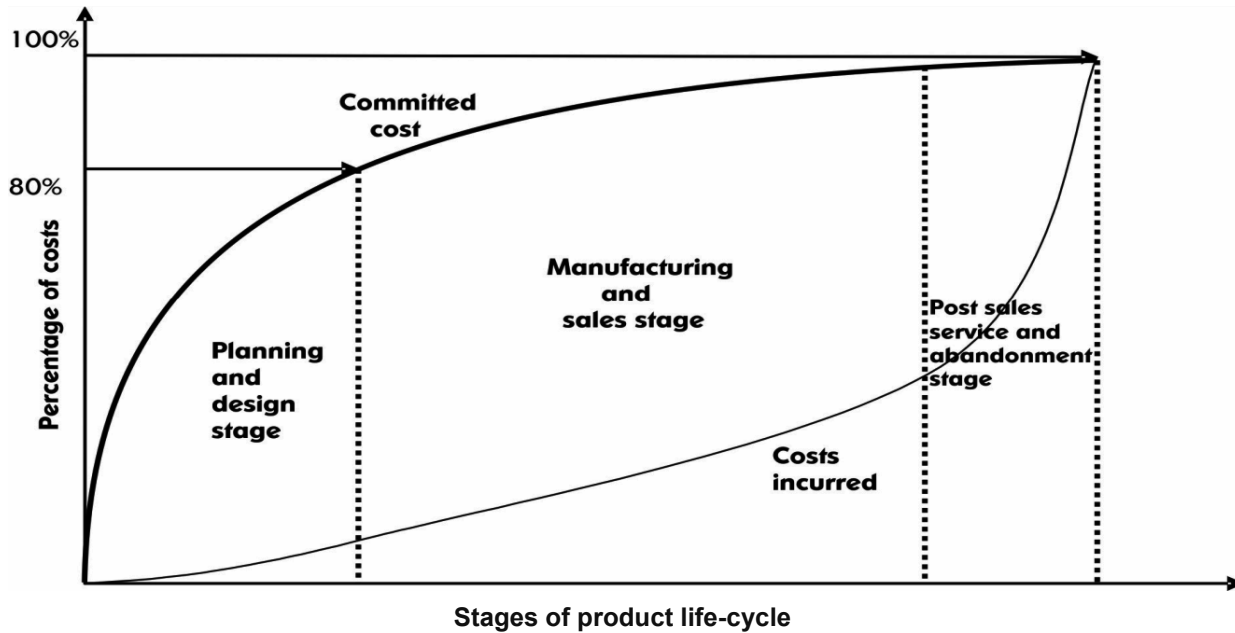
1. The costs that have not yet been incurred but will be incurred in the future on the basis of decisions that have already been taken are termed **committed costs**.

Studies show that about 80% of the life-cycle costs of a product are committed at its development and introduction stage. It is difficult to significantly alter costs after they have been committed.

The planning and design stage of a product determines its material and labour inputs and the production process. At this stage, costs become committed and broadly determine the future costs that will be incurred during the manufacturing stage.

2. Costs are incurred when a resource is used or sacrificed. The actual cost of a product is built up mostly in the manufacturing stage and in the service and abandonment stage. Costs incurred vis-à-vis the costs committed at different stages of the product life-cycle are compared in the following diagram:

Diagram 2: Comparison of costs committed and cost incurred in product life-cycle stages



1.3 Costs involved at different stages of product life-cycle in manufacturing and service industries

For each of the business functions at each stage of life-cycle of each product, costs keep on being incurred. Let us try to identify the possible costs at each stage of the life-cycle:

1. At the **introduction and development stage**: research and development cost, costs of product design, capital equipment etc.
2. At the **growth and maturity stage**: these stages witness both growth and maturity in sales. All the manufacturing, marketing (customer service, promotion etc), selling and distribution costs (transport and handling) are incurred at this stage.
3. At the **decline stage**: as discussed earlier, the demand for the product declines at this stage. The producers may be required to provide after sales service for the products sold in the past. Costs that are incurred in this stage include all costs relating to after sales service including provision of spares, expert services and costs of abandonment and disposal of the product.

1.4 Conceptualising customer life-cycle costing

A different notion of life-cycle costs is **customer life-cycle costs**. Customer life-cycle costs include the total costs incurred by a customer to acquire and use a product or service until it is replaced. Customer life-cycle costs for a car, for example, include the cost of car itself plus the costs of operating and maintaining the car less the disposal price of the car. Customer life-cycle costs can be an important consideration in the pricing decision.

The best way to understand customer life-cycle costing is to look at an example.



Example

Suppose you are shopping for a new water heater. Two systems, solar water heater and electric water heater are available in the market. The solar water heater has no operating cost; only maintenance cost of TZS50 per year is required to be incurred. Let's assume they can both last ten years. Due to the energy inflation, operating cost for the electric water heater will go on increasing every year.

Continued on the next page

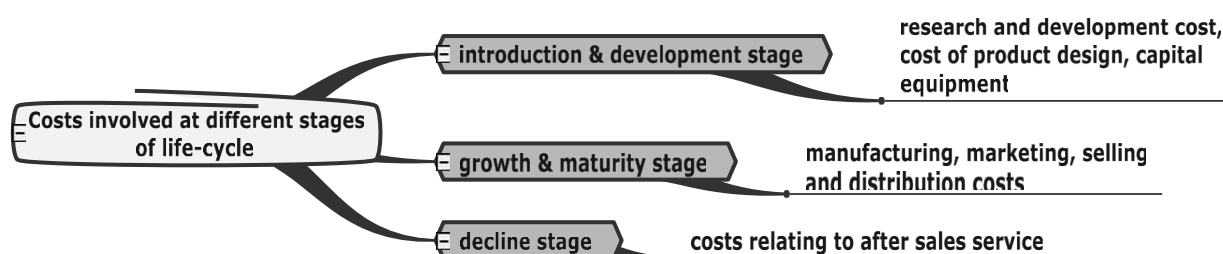
The following is a comparison between the two systems.

	Solar water heater	Electric water heater
Energy produced	4,300 kwh	4,300 kwh
	TZS'000	TZS'000
Installation costs	8,000	3,000
Maintenance cost per year	50	Nil
Operating costs		
1 st year	-	860
2 nd year	-	946
3 rd year	-	1,040
4 th year	-	1,144
5 th year	-	1,258
6 th year	-	1,384
7 th year	-	1,522
8 th year	-	1,674
9 th year	-	1,842
10 th year	-	2,026
Total cost	8,500	16,696

It is observed that the cost of the solar water heater, TZS8,500,000 is equal to the operating cost of the electric water heater after just 7.5 years. Since that is much more than the purchase cost difference, an initial investment of TZS5,000,000 more is worth it from your point of view as a consumer.

On the other hand, the manufacturer of the water heater may think of increasing its product price considering its much advantageous customer life-cycle cost.

SUMMARY



Test Yourself 1

Delta Plc is a computer software company developing new accounting software 'Count Me'. John Corbett, the management accountant of the company has provided the following budgeted information for Count Me over a five year product life cycle.

	Cost per package TZS'000	One-time costs TZS'000
Research and development	-	150,000
Design costs	-	100,000
Manufacturing costs	16	62,500
Marketing costs	15	43,750
Selling and distribution costs	10	31,250
After sales service costs	19	53,000

Prepare a life cycle income statement for Count Me for the following sales levels:

- 4,500 packages at a selling price of TZS250,000 per package
- 3,500 packages at a selling price of TZS300,000 per package

Note: R & D costs and design costs are expected to incur in the first two years of the product life cycle.

3. Identify the benefits of life-cycle costing.**[Learning Outcome c]**

The benefits of life-cycle costing are as follows:

1. Benefits of life-cycle costing in pricing

Most accounting systems report revenue, costs and profit on a periodic basis, and product profits are not monitored over their life-cycle. A failure to trace all costs of products over their life-cycle hinders management's understanding of product profitability, because a product's actual life-cycle profit is unknown.

Life-cycle costing estimates and accumulates costs over a product's entire life-cycle so as to determine whether the profits earned during the manufacturing phase will cover the costs incurred during the pre- and post-manufacturing stages. To estimate the life-cycle costs it is essential to identify the costs incurred through different stages of life-cycle of a product.

Only on knowing the life-cycle costs of a product, can one appropriately decide on its price.

Moreover, if viewed from the angle of customer life-cycle costs, the life-cycle costs provide input for pricing across the lifecycle.

**Example**

An automobile manufacturer's aim is to design cars that would minimise maintenance cost. The company expects to charge a higher price and / or gain greater market share by selling these cars. Similarly, manufacturers of washing machines and dishwashers charge higher prices for models that save electricity and have low maintenance costs.

2. Benefits of life-cycle costing in performance management

Life-cycle costing helps management to understand the cost consequences of developing and making a product and to identify areas in which cost reduction efforts are likely to be most effective.

Since life-cycle analysis highlights the committed costs of a product, it is possible, through emphasis on product planning, product design and development, to reduce product cost during its life-cycle. Life-cycle costing forms an input to evaluation processes such as value management, economic appraisal and financial appraisal.

The old proverb, 'time is money', still holds true. The management of time is immensely important if the profit of a product is to be maximised. The management of time is particularly emphasised in life-cycle costing. Since a reduction in time during the development stage causes a decrease in cost or an increase in revenue, it in turn causes an increase in profit.

3. Benefits of life-cycle costing in decision-making

The importance of life-cycle costing lies in the consideration of the whole life-cycle.

Life-cycle costing provides a long-term picture of product profitability, feedback on the effectiveness of initial planning and cost data to clarify the economic impact of alternatives chosen in the design, engineering phase etc. It is also considered a way to enhance the control of manufacturing costs.

When viewed as a whole, cost reduction and minimisation opportunities as well as revenue extension opportunities will present themselves. It provides premises for decision-making regarding product introduction, product mix and for discontinuation of the products.

**Test Yourself 2**

Explain briefly the importance of life cycle costing.

Answers to Test Yourself

Answer to TY 1

Budgeted product life cycle income statement for "Count Me"

Sales level (packages)	4,500	3,500
Selling price per package	TZS250,000	TZS300,000
	TZS'000	TZS'000
A. Life-cycle revenue B.	1,125,000	1,050,000
Life-cycle costs Research and development		
Design costs	150,000	150,000
Manufacturing costs (W1)	100,000	100,000
Marketing costs (W2)	134,500	118,500
Selling and distribution costs (W3)	111,250	96,250
After sales service costs (W4)	76,250	66,250
	138,500	119,500
Total life-cycle costs	(710,500)	(650,500)
C. Life-cycle operating income (A – B)	414,500	399,500

Workings

W1 Manufacturing Cost

For sales level (packages)	4,500	3,500
	TZS'000	TZS'000
Fixed cost (TZS'000)	62,500	62,500
Variable cost of package (4,500 units x TZS16,000), (3,500 x TZS16,000)	72,000	56,000
Total	134,500	118,500

W2 Total Marketing Cost

For sales level (packages)	4,500	3,500
	TZS'000	TZS'000
Fixed cost (TZS'000)	43,750	43,750
Variable cost of package (4,500 units x TZS15,000), (3,500 x TZS15,000)	67,500	52,500
Total	111,250	96,250

W3 Total Distribution Cost

For sales level (packages)	4,500	3,500
	(TZS'000)	(TZS'000)
Fixed cost (TZS'000)	31,250	31,250
Variable cost of package (4,500 units x TZS10,000), (3,500 x TZS10,000)	45,000	35,000
Total	76,250	66,250

W4 Total after sales-service Cost

For sales level (packages)	4,500	3,500
	(TZS'000)	(TZS'000)
Fixed cost (TZS'000)	53,000	53,000
Variable cost of package (4,500 units x TZS19,000), (3,500 x TZS19,000)	85,500	66,500
Total	138,500	119,500

Answer to TY 2**Importance of life cycle costing**

Life cycle costing provides a long term picture of product profitability, feedback on effectiveness of initial planning and cost data to clarify the economic impact of alternatives chosen in the R&D, design and engineering phases etc. It is also considered to be a method of enhancing the control of manufacturing costs.

When it is viewed as a whole, cost reduction and minimisation opportunities as well as revenue extension opportunities will present themselves. It provides premises for decision making regarding product introduction, product mix and for discontinuation of the products. Using life cycle costing, better decisions can be taken due to realistic and accurate evaluation of products' revenue and costs.

Quick Quiz

1. What is meant by the term 'product life-cycle costing'?
2. What is meant by the term 'customer life-cycle costing'?
3. State the concept of 'committed cost'.
4. Briefly state the stages of a 'product life-cycle'.
5. Briefly describe the implications of life-cycle costing on performance management.

Answers to Quick Quiz

1. **Product life-cycle costing** estimates and accumulates costs over a product's entire life-cycle (sometimes a span of several calendar periods). It helps to identify whether the profits earned during the manufacturing stage will cover the costs incurred during the pre- and post-manufacturing stages.
2. **Customer life-cycle costing** involves calculating the total costs incurred by a customer to acquire and use a product or service until it is replaced. Customer life-cycle costs for a car, for example, include the cost of the car itself plus the costs of operating and maintaining the car minus the disposal price of the car.
3. The costs that have not yet been incurred but will be incurred in the future on the basis of decisions that have already been taken are termed **committed costs** (e.g. depreciation of any non-current asset)
4. A product life-cycle may be classified into three broad stages. Each of the stages includes at least one of the business functions namely, research and development, design, production, marketing, distribution and customer service. The stages of a life-cycle are:
 - (a) **The planning and design stage.** This stage includes the following business functions:
 - Research and development
 - Design
 - (b) **The manufacturing and sales stage.** This stage includes the following business functions:
 - Production
 - Marketing
 - Distribution

(c) **The service and abandonment stage.** This stage includes the following business functions:

After sales service
Disposal of production facility

5. Life-cycle costing helps management to understand the cost consequences of developing and making a product and to identify areas in which cost reduction efforts are likely to be most effective.

Since life-cycle analysis indicates the committed costs of a product, it is possible, through emphasis on product planning, product design and development, to reduce product cost during its life-cycle. Life-cycle costing forms an input to evaluation processes such as value management, economic appraisal and financial appraisal.

Self Examination Questions

Question 1

Futuristic Software Inc, a computer software company is developing a new accounting package, "Future Accounting". The following are the budgeted amounts for the product over a six-year product life-cycle.

Year 1 and 2		TZS million
Research and development costs		360
Design costs		240

Year 3 to 6	One-Time Setup Costs TZS'000	Variable Cost per package TZS'000
Production costs	150,000	37.50
Marketing costs	105,000	36
Distribution costs	75,000	24
Customer-service costs	120,000	45

To be profitable, Futuristic Software Inc must generate revenues to recover costs of all six-business functions taken together and, in particular, its high non-production costs.

The company wants to decide between three alternative selling prices i.e., TZS350,000; TZS430,000 and TZS550,000; so as to maximise life-cycle operating income. Sales volumes at these prices have been estimated at 7,500 units, 6,000 units and 3,750 units respectively.

Required:

Identify which option maximises life-cycle operating income.

Question 2

Ace-soft Technologies Plc is examining the profitability and pricing policies of three of its recently developed software packages:

Electrical Genius: package for electrical engineers
Mechanical Genius: package for mechanical engineers
Industrial Genius: package for industrial engineers

Summary details for the packages over their two-year "cradle-to-grave" product lives are as follows:

Package	Selling Price TZS'000	Number of units sold	
		Year 1	Year 2
Electrical Genius	235	2, 150	8,100
Mechanical Genius	285	2,200	3,150
Industrial Genius	185	5,100	3,700

Assume that no inventory remains on hand at the end of year 2.

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Ace-soft Technologies is deciding which product lines to emphasise. In the past two years, profitability has been mediocre. Ace-soft Technologies is particularly concerned with the increase in R & D costs. An analyst pointed out that for one of its most recent packages (Industrial Genius), major efforts had been made to reduce R & D costs.

The engineering software manager decides to collect the following life-cycle revenue and cost information for the Electrical Genius, Mechanical Genius and Industrial Genius packages:

	Electrical Genius		Mechanical Genius		Industrial Genius	
	Year 1 TZS'000	Year 2 TZS'000	Year 1 TZS'000	Year 2 TZS'000	Year 1 TZS'000	Year 2 TZS'000
Revenues	505,250	1,903,500	627,000	897,750	943,500	684,500
Costs						
R & D cost	760,000	0	495,000	0	215,000	0
Design of product	215,000	25,000	115,000	7,750	83,500	12,000
Manufacturing	55,250	221,000	90,000	90,000	162,000	54,000
Marketing	155,000	395,000	132,000	153,000	224,000	198,000
Distribution	19,000	66,500	23,000	33,000	58,000	35,000
Customer service	45,000	270,000	33,000	99,000	202,000	322,000

Required:

- How does a product life-cycle income statement differ from a conventional income statement? What are the benefits of using a product life-cycle reporting format?
- Present a product life-cycle income statement for each software package. Which package is the most profitable, and which is the least profitable? Ignore the time value of money.
- How do the three software packages differ in their cost structure (the percentage of the total costs in each cost category)?

Question 3

Donald products make digital cameras. Donald is preparing a product life-cycle budget for a new digital camera, DC3. Development of the new digital camera is to start shortly. Estimates for DC3 are as follows:

Life-cycle units manufactured and sold	800,000 units
Selling price per camera	TZS80,000
Life-cycle costs	
R & D and design costs	TZS2,000 million
Manufacturing	
Variable cost per camera	TZS30,000
Variable cost per batch	TZS1,200,000
No. of batches	1,000
Fixed costs	TZS3,600 million
Marketing	
Variable cost per camera	TZS6,400
Fixed costs	TZS2,000 million
Distribution	
Variable cost per batch	TZS560,000
No. of batches	320
Fixed costs	TZS1,440 million
Customer-service costs per camera	TZS3,000

Ignore the time value of money.

Required:

- Calculate the budgeted life-cycle operating income for the new digital camera.
- What percentage of the budgeted total product life-cycle costs will be incurred by the end of the R & D and design stages?
- An analysis reveals that 80% of the budgeted total product life-cycle costs of the new digital camera will be committed at the R & D and design stages. What are the implications for managing DC3's costs?
- Donald's Market Research Department estimates that reducing DC3's price by TZS6,000 will increase life-cycle unit sales by 10%. If unit sales increase by 10%, manufacturing and distribution batch sizes will be increased by 10% as well. Assume that all variable costs per camera, variable cost per batch, and fixed costs will remain the same. Should Donald reduce DC3's price by TZS6,000? Show your calculations.

Answers to Self Examination Questions**Answer to SEQ 1**

Statement showing comparison of alternative life-cycle revenue, life-cycle costs and life-cycle operating income

	Alternative Selling Price/ Sales-Quantity Combination		
	A	B	C
Selling price per package (TZS'000)	350	430	550
Sales quantity in units	7,500	6,000	3,750
	(TZS'000)	(TZS'000)	(TZS'000)
A. Life-cycle revenues	2,625,000	2,580,000	2,062,500
B. Life-cycle costs			
R & D costs	360,000	360,000	360,000
Design cost of product / process	240,000	240,000	240,000
Production costs (W1)	431,250	375,000	290,625
Marketing costs (W2)	375,000	321,000	240,000
Distribution costs (W3)	255,000	219,000	165,000
Customer-service costs (W4)	457,500	390,000	288,750
Total life-cycle costs	2,118,750	1,905,000	1,584,375
C. Life-cycle operating income (A - B)	506,250	675,000	478,125

Clearly, alternative B with a selling price per package of TZS430,000 and a sales volume of 6,000 units yields the highest operating income.

Workings**W1 Production costs**

For A, TZS150 million + (7,500 units x TZS37,500/package) = TZS431,250,000
 For B, TZS150 million + (6,000 units x TZS37,500/package) = TZS375,000,000
 For C, TZS150 million + (3,750 units x TZS37,500/package) = TZS290,625,000

W2 Marketing Costs

For A, TZS105 million + (7,500 units x TZS36,000/package) = TZS375,000,000
 For B, TZS105 million + (6,000 units x TZS36,000/package) = TZS321,000,000
 For C, TZS105 million + (3,750 units x TZS36,000/package) = TZS240,000,000

W3 Distribution costs

For A, TZS75 million + (7,500 units x TZS24,000/package) = TZS255,000,000
 For B, TZS75 million + (6,000 units x TZS24,000/package) = TZS219,000,000
 For C, TZS75 million + (3,750 units x TZS24,000/package) = TZS165,000,000

W4 Customer-service costs

For A, TZS120 million + (7,500 units x TZS45,000/package) = TZS457,500,000

For B, TZS120 million + (6,000 units x TZS45,000/package) = TZS390,000,000

For C, TZS120 million + (3,750 units x TZS45,000/package) = TZS288,750,000

Note

Life-cycle costs provide useful information for strategically evaluating pricing decisions.

While calculating life-cycle revenue and life-cycle costs, it may be noted that calculation of annual revenue or annual cost is meaningless.

Here, the revenue and the costs for the entire life-cycle of the product will have to be considered.

Again, in annual accounts, the non-production costs such as research and development cost and design cost are normally considered deferred cost and are amortised during the useful life of the product.

However, so as to know the life-cycle revenue and costs of the product, one needs to consider revenue and costs for the whole life-cycle.

Answer to SEQ 2

(a) Difference between a product life-cycle income statement and a conventional income statement

A product life-cycle income statement considers all revenue earned and all costs incurred during the life-cycle of a product. The life-cycle of the product may span a number of years.

On the other hand, in a conventional accounting system, income statements are prepared periodically, i.e. product costs and revenues are reported period-wise.

This prevents consideration of the total profitability of an individual product or any other cost object and does not allow the full picture to be seen.

Moreover, the life-cycle costs will include research and development costs and design costs.

In contrast, in a conventional accounting system, the non-production costs such as research and development cost and design cost are normally considered to be deferred costs and are amortised during the useful life of the product.

The benefits of using a product life-cycle reporting format:

Life-cycle costing provides a long-term picture of product profitability, feedback on effectiveness of initial planning and cost data to clarify the economic impact of alternatives chosen in the design and engineering phase etc.

It is also considered a way to enhance the control of manufacturing costs.

When viewed as a whole, cost reduction and minimisation opportunities as well as revenue extension opportunities will present themselves.

It provides premises for decision-making regarding product introduction, product mix and for discontinuation of the products.

(b)

Although not desired in the problem, a conventional income statement has been prepared so as to show the difference between the conventional income statement and the product life-cycle income statement.

Step 1

Prepare the conventional income statement

Conventional Income Statement

	Electrical Genius		Mechanical Genius		Industrial Genius	
	Year 1 TZS'000	Year 2 TZS'000	Year 1 TZS'000	Year 2 TZS'000	Year 1 TZS'000	Year 2 TZS'000
Revenues	505,250	1,903,500	627,000	897,750	943,500	684,500
Costs:						
R & D cost	760,000	0	495,000	0	215,000	0
Design of product	215,000	25,000	115,000	7,750	83,500	12,000
Manufacturing	55,250	221,000	90,000	90,000	162,000	54,000
Marketing	155,000	395,000	132,000	153,000	224,000	198,000
Distribution	19,000	66,500	23,000	33,000	58,000	35,000
Customer service	45,000	270,000	33,000	99,000	202,000	322,000
Total cost	1,249,250	977,500	888,000	382,750	944,500	621,000
Net operating income	(744,000)	926,000	(261,000)	515,000	(1,000)	63,500

Step 2

Prepare the product life-cycle income statement by taking the total of revenue and cost incurred over a product life cycle for each of the above products.

Product Life-Cycle Income Statement

	Electrical Genius TZS'000	Mechanical Genius TZS'000	Industrial Genius TZS'000
Revenues	2,408,750	1,524,750	1,628,000
Costs:			
R & D cost	760,000	495,000	215,000
Design of product	240,000	122,750	95,500
Manufacturing	276,250	180,000	216,000
Marketing	550,000	285,000	422,000
Distribution	85,500	56,000	93,000
Customer service	315,000	132,000	524,000
Total cost	2,226,750	1,270,750	1,565,500
Net operating income (for the life-cycle)	182,000	254,000	62,500

From the life-cycle net operating income, it is apparent that 'Mechanical genius' is the most profitable package. On the other hand, 'Industrial Genius' is the least profitable package.

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(c) The cost structures of different software packages are displayed below in percentage terms

	Electrical Genius		Mechanical Genius		Industrial Genius	
	Costs (TZS'000)	%	Costs (TZS'000)	%	Costs (TZS'000)	%
Planning and design costs						
R & D cost	760,000	34.13	495,000	38.95	215,000	13.73
Design of product	240,000	10.78	122,750	9.66	95,500	6.10
Manufacturing and sales cost						
Manufacturing	276,250	12.41	180,000	14.16	216,000	13.80
Marketing	550,000	24.70	285,000	22.43	422,000	26.96
Distribution	85,500	3.84	56,000	4.41	93,000	5.94
Service and abandonment cost						
Customer service	315,000	14.15	132,000	10.39	524,000	33.47
Total	2,226,750	100	1,270,750	100	1565,500	100

Answer to SEQ 3

(a) Product Life-cycle Income Statement

Particulars	TZS'000
Life-cycle units manufactured and sold	800,000 units
Selling price per camera	80
A. Life-cycle revenue	64,000,000
B. Life-cycle costs:	
R & D and design costs	2,000,000
Manufacturing (W1)	28,800,000
Marketing (W2)	7,120,000
Distribution (W3)	1,619,200
Customer-service costs (W4)	2,400,000
Total Life-cycle costs	41,939,200
C. Life-cycle operating income (A - B)	22,060,800

Workings

W1 Total Manufacturing Cost

	TZS'000
Fixed cost	3,600,000
Variable cost of camera (800,000 cameras x TZS30,000/camera)	24,000,000
Variable cost of batch (1000 batches x TZS1,200,000/batch)	1,200,000
Total	28,800,000

W2 Total Marketing Cost

	TZS'000
Fixed cost	2,000,000
Variable cost of camera (800,000 cameras x TZS6,400/camera)	5,120,000
Total	7,120,000

W3 Total Distribution Cost

	TZS'000
Fixed cost	1,440,000
Variable cost of batch (320 batches x TZS560,000/batch)	179,200
Total	1,619,200

W4 Total Customer-service Cost

(800,000 cameras x TZS3,000/camera) = **TZS2,400,000,000**

(b) The percentage of the budgeted total product life-cycle costs that will be incurred by the end of the R & D and design stage is:

$$\begin{aligned}
 &= (\text{R \& D and design cost} / \text{Total product life-cycle costs}) \times 100 \\
 &= (\text{TZS2,000,000,000} / \text{TZS41,939,200}) \times 100 \\
 &= 4.77\%
 \end{aligned}$$

Note:

Although the costs committed at the research and development and design stage are normally 80% (approximately) of the budgeted total product cost, the actual costs incurred are only 4.77%.

(c) It had been revealed that the committed costs at the R & D and design stage for the product DC3 were 80% of the total budgeted costs. This implies that the R & D and design stage itself determines what the manufacturing cost of the product will be. If an appropriate product design is made by employing the techniques of value engineering, the actual costs in the subsequent stages of the product life-cycle can be greatly reduced. To manage DC3's costs, it is necessary, in the design stage itself, to identify the product features which are non-value added and accordingly to curtail these features.

(d) If the price of DC3 is reduced by TZS6,000; the proposed selling of the product will be TZS(80,000 – 6,000) = TZS74,000

Accordingly, the quantity sold will increase by 10%, i.e., number of units to be sold during the life-cycle will be 800,000 x 110% = 880,000 units. Batch size of manufacturing and distribution would also increase to 1,100 (1,000 x 110%) and 352 (320 x 110%).

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Product Life-cycle Income Statement

Particulars	TZS'000
Life-cycle units manufactured and sold	880,000 units
Selling price per camera	74
A. Life-cycle revenue	65,120,000
B. Life-cycle costs:	
R & D and design costs	2,000,000
Manufacturing (W1)	31,320,000
Marketing (W2)	7,632,000
Distribution (W3)	1,637,120
Customer-service costs (W4)	2,640,000
Total Life-cycle costs	45,229,120
C. Life-cycle operating income (A - B)	19,890,880

Comment

If the sales increase by 10%, the total life-cycle cost would increase by **TZS3,289,920,000** or **7.85%** ($\text{TZS3,289,920,000} / \text{TZS41,939,200,000} \times 100$). This means that the total cost would not be increased drastically. However, if the selling price reduces by TZS6,000 per camera, the operating income will decrease by **TZS2,169,920,000**. Therefore, it is concluded that Donald should not reduce the selling price of the camera by TZS6,000.

Workings

W1 Total Manufacturing Cost

	TZS'000
Fixed cost	3,600,000
Variable cost of camera (880,000 cameras x TZS30,000/camera)	26,400,000
Variable cost of batch (1,100 batches x TZS1,200,000/batch)	1,320,000
Total	31,320,000

W2 Total Marketing Cost

	TZS'000
Fixed cost	2,000,000
Variable cost of camera (880,000 cameras x TZS6,400/camera)	5,632,000
Total	7,632,000

W3 Total Distribution Cost

	TZS'000
Fixed cost	1,440,000
Variable cost of batch (352 batches x TZS560,000/batch)	197,120
Total	1,637,120

W4 Total Customer-service Cost

(880,000 cameras x TZS3,000/camera) = **TZS2,640,000,000**

SECTION B1: COST VOLUME PROFIT ANALYSIS

Get Through Intro

It is the dream of every entrepreneur to build a successful business. For the success of any business, a businessman needs to understand the impact of business decisions on financial results. CVP analysis is the fundamental tool allowing an entrepreneur to assess a large number of business parameters.

CVP analysis helps in understanding:

1. What will happen if the sales volume drops?
2. To what extent a businessman can reduce prices in order to increase the sales volume.
3. How much more the business needs to sell, in order to earn the desired level of profits.

This section discusses how to apply cost volume / profit (CVP) analysis to single product situations. A good understanding of CVP analysis will help you to take decisions which will have a favourable impact on the financial statements, and of course this will help you score well in the examination!

Learning Outcomes

- a) Evaluate the nature of cost-volume-profit (CVP) analysis.
- b) Evaluate the assumptions of CVP analysis.
- c) Calculate the contribution margin ratio (P/V) in single and multi-product situations and demonstrate an understanding of its use.
- d) Compute the breakeven point.
- e) Calculate the level of sales needed to achieve a desired target profit.
- f) Compute the margin of safety and explain its significance.
- g) Prepare and interpret cost-volume-profit (CVP) graphs.
- h) Compute the degree of operating leverage at a particular level of sales and explain how the degree of operating leverage can be used to predict changes in net operating income.
- i) Compute the breakeven point for a multiple product company.
- j) Describe the differences between the accountant's and economist's model of CVP analysis.
- k) Discuss the limitations of CVP analysis for planning and decision making.

1. Evaluate the nature of cost-volume-profit (CVP) analysis.
2. Evaluate the assumptions of CVP analysis.

[Learning Outcomes a and b]

1.1 Fundamental concepts of cost-volume-profit analysis



Definition

Cost-volume-profit (CVP) analysis is the study of the effects on future profit of changes in fixed cost, variable cost, sales price, quantity and mix.

CIMA Official Terminology, 2005

This concept is mainly useful for manufacturing companies that produce and sell single or multiple products. It is applied as a diagnosing and planning tool and aims to study the relationship amongst the cost structure of the company (i.e. the proportion of variable and fixed costs to the total costs), the selling price/s of its product/s, and the volume of sales. In the case of a multi-product firm, the sales mix of the various products is included in the analysis.

The purpose of the CVP analysis is to understand the relationship amongst the aforesaid variables to forecast profits, determining the volumes to be achieved to meet target profit, and such other short term decisions. The CVP analysis is based on the premise of marginal costing.

The marginal costing technique recognises variable costs as product costs and fixed costs as period costs. The principle is that only variable costs will change with a change in the volume of production & sales, but the fixed costs will remain the same.

1.2 Underlying assumptions behind CVP analysis

1. Sales price per unit is constant within the activity range. Accordingly, total sales value varies proportionately with production / volume.
The term activity range is used to refer to the output range at which the firm expects to operate in the future. The activity range also broadly represents the output levels which the firm has had experience operating in the past, and for which cost information is available.
2. All costs can be categorised into fixed and variable elements. The semi-variable costs can easily be decomposed into fixed and variable components.
3. Within the activity range, fixed costs will remain constant regardless of the volume of output. Variable costs are related to activity and vary proportionately with volume of production / sales. Variable cost per unit remains constant throughout the activity level.
4. All costs and revenues behave in a linear fashion within the activity range.
5. The inventory is valued at marginal cost or there is no change in the inventory level.
6. The production / sales volume can only affect costs and revenues.

3. Compute the breakeven point.
4. Compute the margin of safety and explain its significance.

[Learning Outcomes d and f]

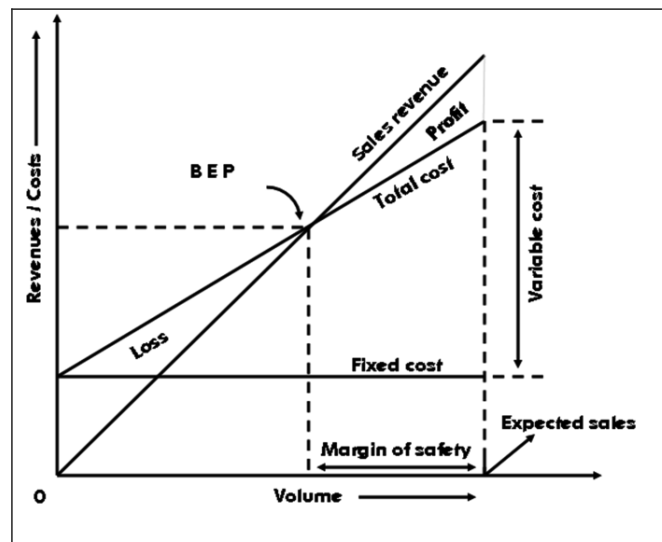
So far we have come across the concepts of marginal cost and contribution. We have also learnt about cost behaviour and the necessity of classifying the costs into variable and fixed components. Based on the knowledge that we have already acquired we will now leap forward to grasp the techniques of cost-volume-profit analysis.

Cost-volume-profit (CVP) analysis is a systematic approach of examining the relationship between changes in volume and changes in total sales, expenses and net profit. The underlying objective of CVP analysis is to know the effect of a fluctuation in the activity volume on the financial results.

The following is a typical cost-volume-profit diagram that depicts how sales revenue, fixed costs and variable costs respond to changes in the volume of sales and production.

The volume of production and sales is measured by the x-axis and revenue, costs and profit (loss) are measured by the y-axis in the CVP chart.

Diagram 1: Break-even point



The short-run decisions where CVP analysis may be useful include choice of product mix, product pricing, special order acceptance, shut down of a plant etc.

2.1 Marginal cost equations

Contribution signifies an alternative measure of profit, which is computed as sales less total variable cost of sales.

Accordingly, **Contribution = Sales – Variable costs**

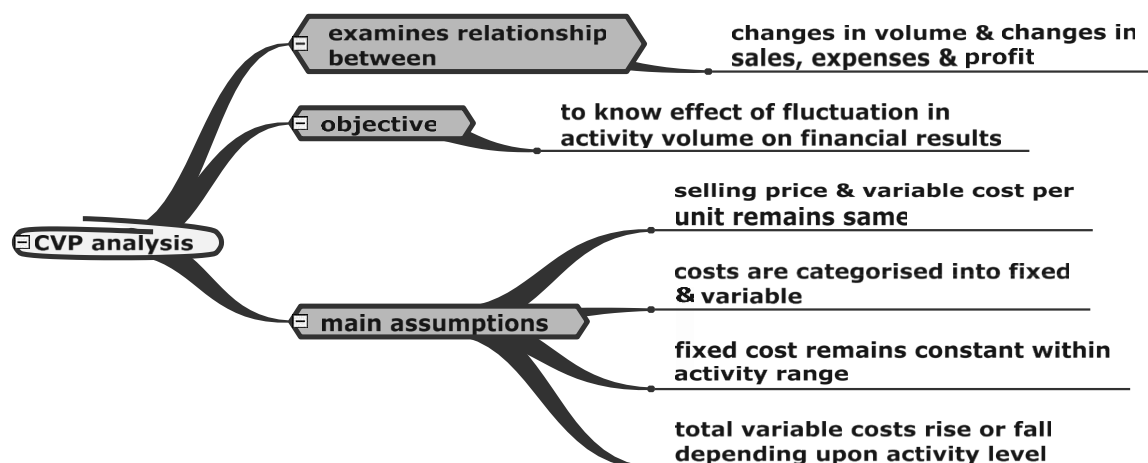
Contribution for the period provides a pool (since it recognises a surplus generated by sales revenue over variable costs) out of which fixed costs for the period are met and any surplus constitutes the profit. It is called contribution because it literally contributes towards fixed costs and profit.

Therefore alternatively, **Contribution = Fixed costs + Profit**

By combining these two equations,

$$\text{Sales} - \text{Variable cost} = \text{Fixed cost} + \text{Profit}$$

SUMMARY



This equation can also be rearranged in the following ways:

1. Sales – Fixed cost – Profit = Variable cost
2. Sales – (Variable cost + Fixed cost) = Profit



Example

The variable cost of a calculator is TZS5,000, whereas the per annum fixed cost is TZS50 million. As contribution contributes to fixed cost and profits, if the business does not produce and sell a single unit during the budget period, then there is no contribution to cover fixed costs. Therefore the loss is equal to the fixed costs of TZS50 million.

If any three of the factors in the marginal cost equation are known, the fourth factor can easily be computed.



Example

A business produces 10,000 units per month. The selling price of the product is TZS10,000 per unit and the variable cost is TZS6,000 per unit. Fixed expenses incur monthly to the extent of TZS34,400,000. The monthly profit of the business may be computed as follows:

Profit = (Sales – Variable costs) – Fixed costs

	TZS'000
Sales (10,000 units x TZS10,000)	100,000
Less: Variable costs (10,000 units x TZS6000)	60,000
Contribution	40,000
Less: Fixed cost	34,400
Profit	5,600



Example

A business produces 5,000 units per month. The selling price is TZS20,000 per unit and the variable cost is TZS12,000 per unit. The business earns a profit of TZS10 million per month.

The fixed cost incurred per month will be as follows:

Sales - variable cost	= Fixed cost +
profit	
5,000 (TZS20,000 - TZS12,000)	= Fixed cost + TZS10 million
TZS40 million - TZS10, million	= Fixed cost
Fixed cost	=
TZS30,million	

2.2 Calculating and interpreting a break-even point

Whenever a new product is going to be introduced in the market, it is obvious that the organisation needs to know the sales level at which the sales revenue would be sufficient to recover the entire costs. This is a vital indicator because any additional quantity of sales beyond this level would make a profit for the organisation.

Knowing the break-even point is also important for any product which has undergone any change in its cost structure, whose price has been revised or which is going to be launched in a different sales territory. As sales revenue grows with every additional unit of sales, the contribution also grows in tandem and at a certain level of sales; contribution just covers the fixed cost. At this level of sales, the amount of contribution must match the amount of fixed costs exactly. This is known as the breakeven point.

The break-even point may either be expressed in terms of sales units or in terms of sales value (i.e. in monetary terms) as follows:

$$\text{Break - even point sales in units} = \frac{\text{Total fixed costs}}{\text{Contribution per unit}}$$

$$\text{Break-even point in terms of sales value} = \text{Fixed costs} / \text{C/S ratio}$$

$$\text{Break-even point in terms of sales value} = \text{Break-even point in units} \times \text{Sales price per unit}$$

If the business continues to produce a product over and above the break-even point, it starts contributing to profits only because at this stage the entire fixed costs are already recovered.



Example

Green Plant Inc manufactures herbal creams. The variable cost per unit is TZS5,000 and the sales price per unit is TZS9,000. The total fixed cost is TZS28 million per month.

In this situation the break-even point is calculated as follows:

$$\begin{aligned} \text{Break - even point (in units)} &= \frac{\text{Total fixed costs}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS28 million}}{(\text{TZS9,000} - \text{TZS5,000})} \\ &= 7,000 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Break-even point (in terms of sales value)} &= 7,000 \text{ units} \times \text{TZS9,000} \\ &= \text{TZS63 million} \end{aligned}$$

Alternatively, by using the C/S ratio, the break-even point in terms of the sales value may be computed as follows:

$$\begin{aligned} \text{C/S ratio} &= \frac{(\text{Sales} - \text{Variable cost})}{\text{Sales price per unit}} \times 100 \\ &= \frac{\text{TZS9,000} - \text{TZS5,000}}{\text{TZS9,000}} \times 100 \\ &= 44.444\% \end{aligned}$$

$$\begin{aligned} \text{Break - even point in revenue} &= \frac{\text{Total fixed costs}}{\text{C/S ratio}} \\ &= \frac{\text{TZS28 million}}{44.444\%} \\ &= \text{TZS63 million} \end{aligned}$$

So, Green Plant Inc must produce and sell 7,000 units per month, in order to reach the situation of no profit or no loss, i.e. **break-even**.



Test Yourself 1

Time Ltd manufactures watches. The cost structure for the products is as follows:

	TZS'000
Raw material	10
Labour	5
Variable overheads	2

Other pertinent information:

- (a) The sales price is TZS25,000 per unit
- (b) Total fixed cost is TZS80 million (per annum)

Required:

How many units should the company produce and sell during the year so that there will be a no profit or no loss situation?

2.3 Calculate and interpret a margin of safety (MOS)

Sales beyond the break-even volume bring in profits. The margin of safety is the difference between the budgeted sales or actual sales and the break-even point. It measures the soundness of a business.

A high margin signifies that the break-even point is far below the sales level under consideration so that even if there is a fall in sales, there will still be a profit. On the other hand, a small margin suggests a difficult position as sales may not totally cover fixed costs.

If a low margin is coupled with high fixed costs and a high contribution to the sales ratio, action needs to be taken to reduce the fixed cost or increase the sales volume. If both the margin of safety and the contribution to the sales ratio are low (the fixed cost being reasonable), then efforts should be taken to reduce the variable cost or the selling price should be increased.

Margin of safety in absolute terms:

Margin of safety = Budgeted / expected sales – Sales at break-even point

Margin of safety expressed as a ratio or percentage:

Margin of safety (%) = ((Budgeted / expected sales – Sales at break-even point) / Sales) x 100



Example

Pentagon Ltd gives the following financial information about its product:

	TZS million
Fixed costs	9
Variable costs	15
Sales	30
Units sold	10,000 units

From the above information the margin of safety is calculated as below:

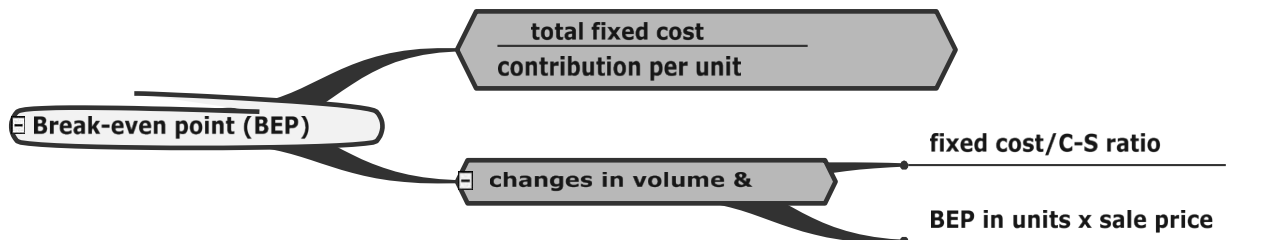
$$\begin{aligned} \text{Break-even point (units)} &= \frac{\text{Fixed cost}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS9 million}}{\text{TZS1,500 (W1)}} \\ &= 6,000 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Margin of safety} &= \text{Actual sales or expected sales volume} - \text{Break-even point volume} \\ &= 10,000 \text{ units} - 6,000 \text{ units} \\ &= 4,000 \text{ units} \end{aligned}$$

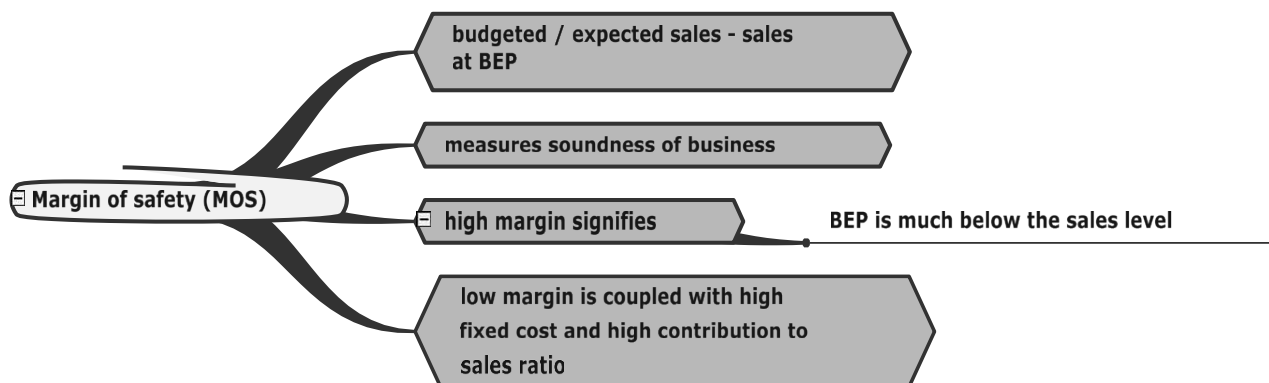
W1

$$\begin{aligned} \text{Contribution per unit} &= \text{sales price per unit} - \text{variable cost per unit} \\ &= (\text{TZS30million}/10,000) - (\text{TZS15million}/10,000) \\ &= \text{TZS3,000} - \text{TZS1,500} \\ &= \text{TZS1,500} \end{aligned}$$

SUMMARY



SUMMARY



With the help of the information below, show the calculation of margin of safety as a percentage and in units.

Per unit sales price	TZS100,000
Per unit variable cost	TZS78,000
Break-even point	35,000 units
Expected level of activity	42,100 units

5. Calculate the contribution margin ratio (P/V) in single and multi-product situations and demonstrate an understanding of its use.
6. Compute the breakeven point for a multiple product company.

[Learning Outcomes c and i]

Contribution to sales ratio (C/S ratio) ratio is also termed **profit-volume ratio (P/V ratio)**. Usually the contribution to the sales ratio is expressed as a percentage. The contribution to the sales ratio remains constant if the selling price and variable cost of an organisation remain constant. C/S ratio is a measure of profitability. A high contribution to the sales ratio is indicative of high profitability. An increase in the ratio signifies that contribution grows more quickly compared to an increase in the sales level.

**Tip**

C/S ratio is an indicator of the profitability of the business.

Calculation of contribution to sales ratio**3.1 Under single product scenario**

$$\begin{aligned}\text{Contribution to sales ratio} &= \frac{\text{Total contribution}}{\text{Sales value}} \times 100 \\ &= \frac{(\text{Sales} - \text{Variable costs})}{\text{Sales value}} \times 100\end{aligned}$$

**Example**

Blackberry Plc has given the following details about its cost structure:

	Amount (TZS'000)
Direct materials	8
Direct labour	4
Variable overheads	3

The sales price of its sole product is \$22,000 per unit and the fixed costs per annum are \$85 million. During the period, 18,000 units of the product were produced and sold. With the help of information given by Blackberry Plc the C/S ratio is calculated as follows:

$$\begin{aligned}\text{C/S ratio} &= \frac{18,000 \text{ units} \times (\text{TZS}22,000 - \text{TZS}15,000)}{18,000 \text{ units} \times \text{TZS}22,000} \times 100 \\ &= \frac{\text{TZS}126 \text{ million}}{\text{TZS}396 \text{ million}} \times 100 \\ &= 31.818\%\end{aligned}$$

C/S ratio can be calculated on the basis of the per unit sales price and sales value.

$$\begin{aligned}\text{C/S ratio} &= \frac{\text{Contribution per unit}}{\text{Sales price per unit}} \\ &= \frac{\text{TZS}22,000 - \text{TZS}15,000}{\text{TZS}22,000} \times 100 \\ &= 31.82\%\end{aligned}$$

A high contribution to the sales ratio is indicative of high profitability. The C/S ratio as computed may not be considered to be very high. The C/S ratio also indicates that contribution is 31.82% of total sales and variable cost is 68.18% of total sales. It implies that the company will have low profitability per unit.



Tip

As we know, Sales – Variable cost = Contribution.

If the **contribution to the sales ratio** is **80%** this implies that variable cost is 20% (100 -80) of sales i.e. the **variable cost to sales ratio** is **20%**.

Use of the C/S ratio

1. To know the **variable cost** incurred for a product for any sales level.

$$\begin{aligned} \text{Contribution to sales ratio} &= \frac{\text{Contribution}}{\text{Sales}} \\ &= \frac{\text{Sales} - \text{Variable costs}}{\text{Sales}} \\ &= 1 - \frac{\text{Variable costs}}{\text{Sales}} \end{aligned}$$

By rearranging the equation, we get:

$$\text{Variable cost to sales ratio} = 1 - \text{Contribution to sales ratio}$$

Once variable cost to sales ratio and total sales revenue is known, variable cost may be computed as '**variable cost to sales ratio x total sales revenue**'.



Example

Diego Plc is a single product company and has a C/S ratio of 30%. The sales value of the product is TZS140 million. That the C/S ratio is equal to 30% implies that the variable costs for producing the product are 70% (100 – 30) of the sales revenue.

Therefore, when the sales value is TZS140 million, with a C/S ratio of 30%, variable cost
 = TZS140 million x 70%
 = TZS98 million.

2. The C/S ratio can be used to determine the **break-even point** in monetary terms. A break-even point is where an organisation is neither in a loss nor making a profit (we will discuss the concept at length later in this learning outcome).
3. The C/S ratio for each product or for each sales area can be calculated separately. This helps in determining a most **profitable business line / product**.



Test Yourself 3

The following information pertains to Six Sigma Inc:

	TZS'000
Per unit selling price	30
Direct material cost	8
Direct labour cost	7
Variable overhead	5
Fixed cost (per annum)	90,000

Determine the C/S ratio for Six Sigma Inc:

3.2 Under multi-product scenario

The contribution to sales ratio calculation, as explained above, holds good only for an organisation producing and selling a single product. In reality, firms normally deal in multiple products. Such multiple products could be complementary to each other (e.g. a computer printer manufacturer producing cartridges for the printer as well) or independent products (a company may be engaged in manufacturing of different types of furniture items). In the case of a multi-product company, while the individual product-wise C/S ratio is an important consideration for certain decision situations, it would be beneficial to perform a BEP analysis for the entire company using the overall C/S ratio.

This can be calculated as weighted average of the C/S ratios of all the products the company deals in. Such analysis is, however, based on the assumption that sales mix remains constant. The break-even point will shift either upwards or downwards if the sales mix changes. In that sense, the weighted average C/S ratio has limited application. But it certainly provides a ballpark break even figure for planning purposes.

Fixed costs are one of the important aspects of the CVP analysis. In a multi-product scenario, there could be some fixed costs that are product specific while the others are common to all products. The product specific costs can be avoided if that product is not produced at all. But common fixed costs cannot be avoided. Hence, when a certain quantity of each product is sold, the contribution earned is first adjusted against the product-specific fixed costs and then towards the common fixed costs.

Under the multi-product scenario, weighted average contribution margin is derived by multiplying the product's contribution ratio with the proportion of the product in total sales.

Weighted average contribution margin (WACM) = (C/S ratio of product 1 x Proportion of product 1 in total sales) + (C/S ratio of product 2 x Proportion of product 2 in total sales) x x (C/S ratio of product n x Proportion of product n in total sales)

Break-even point (in terms of units) = $\frac{\text{Fixed Costs}}{\text{Weighted average contribution margin per unit}}$

Or

Break-even point (in terms of sales revenue) = $\frac{\text{Fixed Costs}}{\text{Weighted average contribution margin ratio}}$



Example

The Smiles Curvature Store produces two products, lipsticks and lip-gloss. These account for 40% and 60% of the total sales of the company respectively. Variable costs (as a percentage of sales) are 40% for lipsticks and 50% for lip-gloss. Total fixed costs are TZS540 million.

Weighted average contribution margin can be calculated as below:

The contribution margin ratio for lipsticks is 60% of sales and the contribution margin ratio for lip-gloss is 50% of sales.

The weighted average contribution margin ratio is

= (C/S ratio of lipsticks x Proportion of lipsticks in total sales) + (C/S ratio of lip-gloss x Proportion of lip-gloss in total sales)

= 60% x 40% + 50% x 60%

= 24% + 30%

= 54%

Break-even point (in terms of sales revenue) = $\frac{\text{Fixed Costs}}{\text{Weighted average contribution margin ratio}}$

Break-even point (in terms of sales revenue) = $\frac{\text{TZS540 million}}{54\%} = \text{TZS1,000 million}$

7. Calculate the level of sales needed to achieve a desired target profit.

[Learning Outcome e]

4.1 Required sales level to achieve a desired target profit / revenue

Target profit is the profit that the business **expects** to earn under the given circumstances in a budget period. The target revenue for an organisation is determined keeping in mind the organisation's profit target.

1. Target profit / revenue in single product situations

The marginal cost equation can be used to determine the sales required to accommodate the target profits and fixed costs.

$$\text{Target sales volume} = \frac{(\text{Fixed cost} + \text{target profit})}{\text{Contribution per unit}}$$

$$\text{Target revenue} = \text{Target sales volume} \times \text{Expected selling price}$$



Example

We continue with the above example of Blackberry Plc.

The company targets a profit of TZS41 million to be achieved during the year.

The management of the company wants to know the volume of sales at which the target profit can be achieved.

$$\begin{aligned} \text{Target contribution} &= \text{Fixed cost} + \text{Profit} \\ &= \text{TZS85 million} + \text{TZS41 million} \\ &= \text{TZS126 million} \end{aligned}$$

$$\begin{aligned} \text{Target sales volume} &= \frac{\text{Target contribution}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS126 million}}{\text{TZS7,000} - \text{TZS5,000}} \\ &= \text{TZS22,000} - \text{TZS15,000} = 18,000 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Target revenue} &= \text{Target sales volume} \times \text{Expected selling price} \\ &= 18,000 \text{ units} \times \text{TZS22,000} \\ &= \text{TZS396 million} \end{aligned}$$



Test Yourself 4

Pastry Inc has set a target to produce 50,000 units of its product. The variable cost per unit of the product is TZS5,000 and the per annum fixed cost is TZS50 million.

The company expects to earn a profit of TZS25 million. **What should be the per unit selling price?**

2. Target profit or revenue in multi-product situations

Here, sales mix will be derived by using the following formulae:

$$\text{Target sales mix} = \frac{\text{Fixed costs} + \text{Target profit}}{\text{Weighted average contribution per unit}} \quad (\text{In terms of sales units})$$

$$\text{Target sales mix} = \frac{\text{Fixed costs} + \text{Target profit}}{\text{Weighted average contribution margin}} \quad (\text{In terms of sales revenue})$$

After deriving the total sales mix, it needs to be divided into individual products in the proportion of the budgeted sales mix as shown in the example below:



Example

The following are the two products from which a company needs to earn a profit of TZS50 million, after deducting fixed costs of TZS90 million.

	Selling price per unit (TZS'000)	Variable cost per unit (TZS'000)	Budgeted sales (Units)
Product X	100.00	64.00	500
Product Y	150.00	76.50	1,250

The proportion of budgeted sales mix = 500:1,250 i.e. 2:5

Weighted average contribution per unit

Product X = TZS100,000 - TZS64,000 = TZS36,000

Product Y = TZS150,000 - TZS76,500 = TZS73,500

WACM = (Contribution per unit of product X x Proportion of product X in total sales) + (Contribution per unit of product Y x Proportion of product Y in total sales)

= (TZS36,000 x 2/7) + (TZS73,500 x 5/7)

= TZS10,286 + TZS52,500

= TZS62,786

Target sales mix = $\frac{\text{Fixed costs} + \text{Target profit}}{\text{Weighted average contribution per unit}}$

Target sales mix = $\frac{\text{TZS90 million} + \text{TZS50 million}}{\text{TZS62,786}} = 2,230 \text{ units}$

Product X = 2,230 x 2/7 = 637 units

Product Y = 2,230 x 5/7 = 1,593 units

8. Prepare and interpret cost-volume-profit (CVP) graphs.

[Learning Outcome g]

5.1 The elements in a traditional break-even chart (in a single product situation)

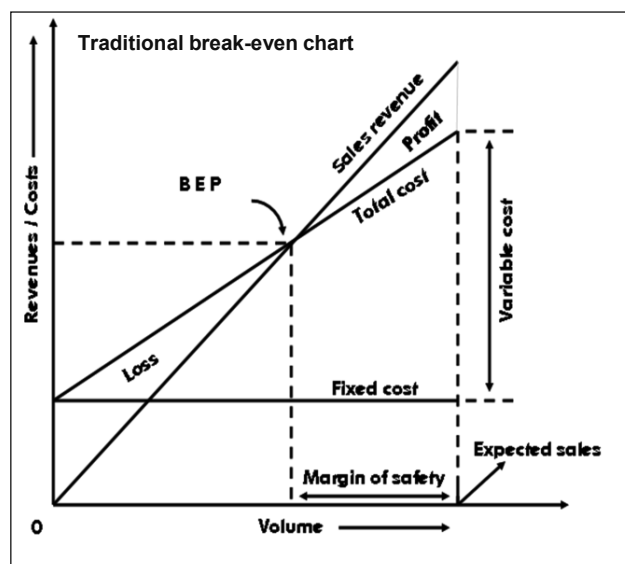
A traditional break-even chart records **revenues** and **costs** on the **vertical axis** and **volume of activity** on the **horizontal axis**.

The lines representing total costs, fixed costs and revenues are drawn.

The point of intersection of the lines representing sales revenue and total cost signifies break-even point.

At any volume level, the space between the total cost line and fixed cost line signifies variable cost.

In a traditional chart, the fixed cost line is drawn first and thereupon the variable cost line is drawn in order to signify total costs.

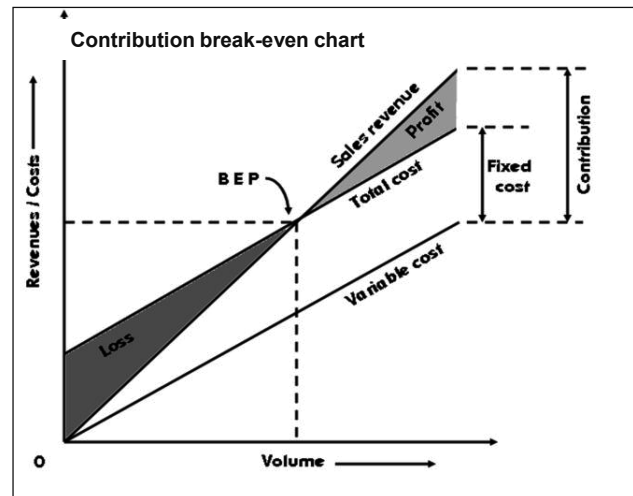


5.2 The contribution break-even chart (in a single product situation)

The basic elements of a contribution break-even chart are the same as that of the traditional break-even chart. The only difference is that it shows the variable cost line instead of the fixed cost line. This is done in order to overcome the major problem with the traditional break-even chart that it is not possible to read contribution directly from the chart.

The same lines for total cost and sales revenue are shown so the break-even point and profit can be interpreted in the same way as with a conventional chart.

The contribution can be read as the difference between the sales revenue line and the variable cost line.



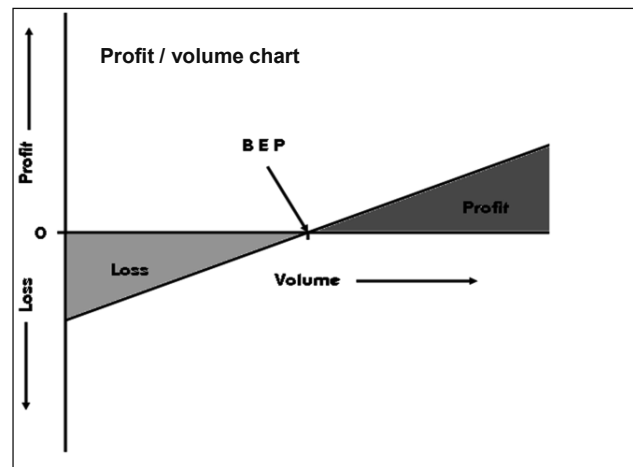
5.3 Profit / volume chart (in a single product situation)

This is yet another mode of presentation of the break-even chart. This chart is also known as 'contribution-volume graph'.

In this, a single line is drawn depicting the profit or loss at each level of activity.

The point of intersection of the line and the horizontal axis is the break-even point.

The basic feature of this chart is that the vertical axis indicates profits and losses and the horizontal axis is drawn at zero profit or loss.



Example

Pentagon Ltd gives the following financial information about its product. Present the data in a graphical form (traditional break-even chart) and show the break-even point. Selling price and variable cost per unit is TZS20,000 and TZS8,000 respectively. Total fixed cost for the period is assumed to be TZS240 million. Expected sales are 25,000 units.

Relevant calculations are as follows:

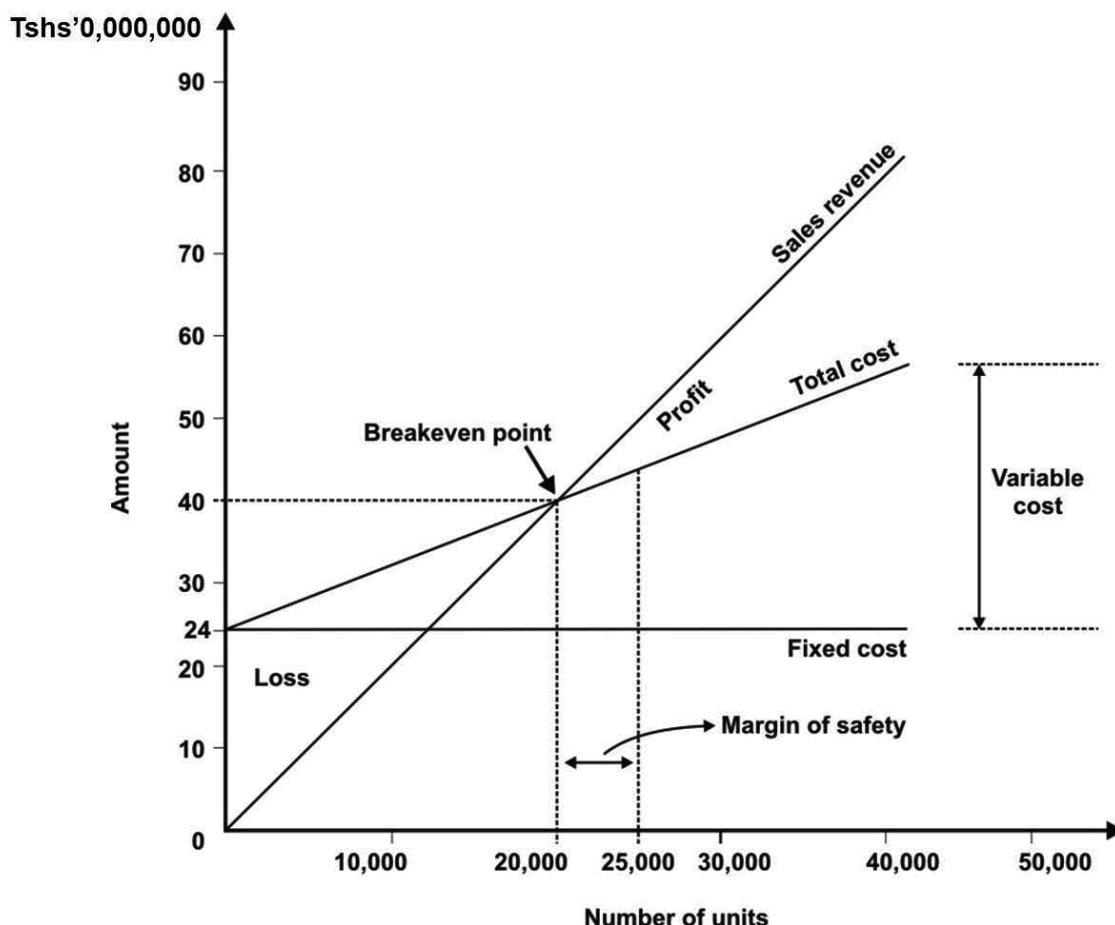
No. of units	10,000	20,000	30,000	40,000	50,000
Sales revenue (@ TZS20,000) (TZS'000)	200,000	400,000	600,000	800,000	1,000,000
Variable cost (@TZS8,000) (TZS'000)	80,000	160,000	240,000	320,000	400,000
Fixed cost (TZS'000)	240,000	240,000	240,000	240,000	240,000
Total cost (TZS'000)(Variable cost + Fixed cost)	320,000	400,000	480,000	560,000	640,000

Interpretation of the graph

It can be seen that at the sales level of 20,000 units, the total revenue line and total cost line intersect each other. The point of intersection is known as the break-even point.

At the expected sales of 25,000 units, sales revenue will be TZS500 million. The margin of safety is 5,000 units (i.e. 25,000 – 20,000 units).

Continued on the next page



5.4 Break-even charts for multi-product scenario

As studied in the earlier paragraphs, the graphical presentation of the cost volume relation facilitates better understanding of the products for future analysis. This analysis is based on the principle of break-even point for the firm; it can be in any combination of sales mix for the two products.

After knowing the break-even point of each product, the combination sales mix is easy to identify in a graphical form.



Example

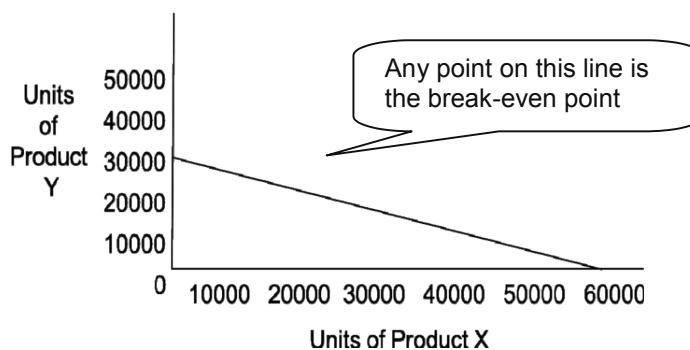
Consider the following data for the two products, product X and product Y:

Product	X (TZS million)	Y (TZS million)
Selling price	1.50	2.00
Variable cost per unit	1.20	1.40
Contribution per unit	0.30	0.60
Fixed costs	18.00	

$$\text{Break-even point} = \frac{\text{Fixed costs}}{\text{Contribution per unit}}$$

$$\text{Break even point of X} = \frac{\text{TZS } 18 \text{ million}}{\text{TZS } 0.30 \text{ million}} = 60,000 \text{ units}$$

$$\text{Break even point of Y} = \frac{\text{TZS } 18 \text{ million}}{\text{TZS } 0.60 \text{ million}} = 30,000 \text{ units}$$



Continued on the next page

The given graph implies that all possible combinations of break-even points lie on (and only on) the line adjoining the individual break even points for the two products.

This analysis shows that break even for two products can be achieved by many possible combinations of product mixes, specifically, all those product mix combinations that fall on the line segment in the given graph.

The above chart works only when there are two products. For more than two products, this graph is not applicable.

Usually, in the case of multi-products (more than two), different break-even charts need to be prepared for each product.

However, individual break-even points for each of the multi-products constituting a particular sales mix can be shown on the same graph.

The following example will give you an understanding of the individual break even points for different multi-products.



Example

Consider the following data for four types of products at the given sales and cost levels:

Products	A	B	C	D
Selling price per unit (TZS'000)	10	12	12	8
Variable cost per unit (TZS'000)	5	9	10	6

Assume that fixed costs for the period are TZS30 million.

For depicting the points in the graph, total cost and total sales need to be calculated at different sales levels.

Amounts in TZS'000

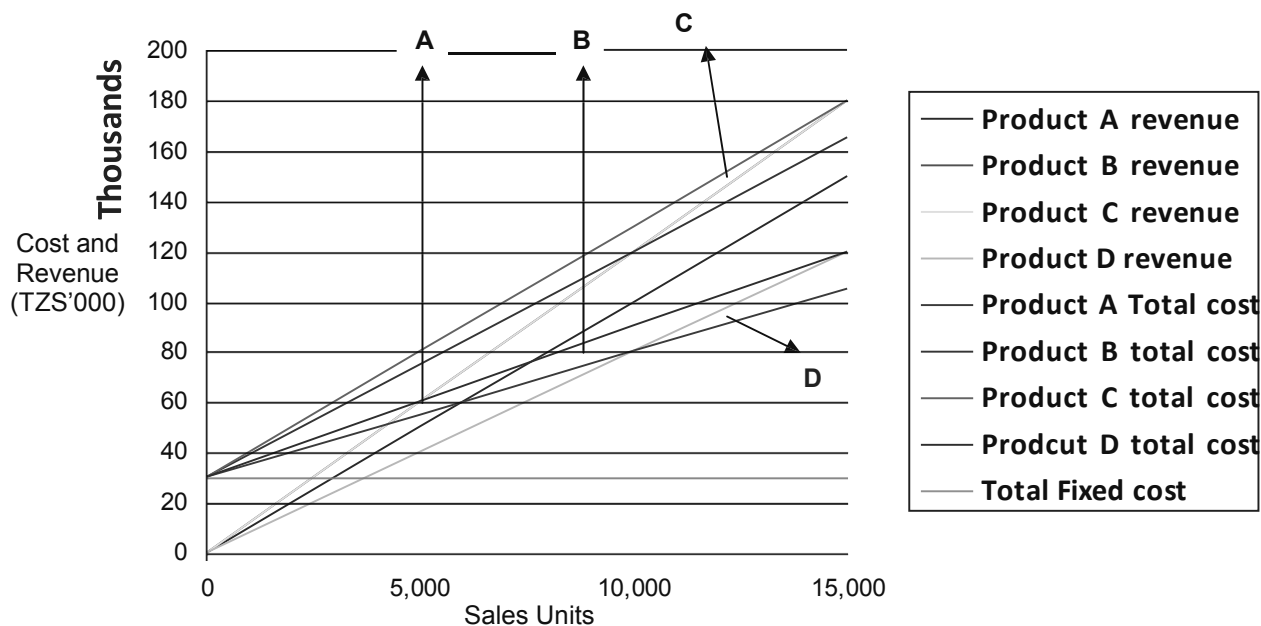
Type of products	Sales volume	Selling price per unit	Sales revenue	Fixed cost	Variable cost per unit	Variable cost	Total cost
A	5,000	10	50,000	30,000	5	25,000	55,000
B	5,000	12	60,000	30,000	9	45,000	75,000
C	5,000	12	60,000	30,000	10	50,000	80,000
D	5,000	8	40,000	30,000	6	30,000	60,000

A	10,000	10	100,000	30,000	5	50,000	80,000
B	10,000	12	120,000	30,000	9	90,000	120,000
C	10,000	12	120,000	30,000	10	100,000	130,000
D	10,000	8	80,000	30,000	6	60,000	90,000

A	15,000	10	150,000	30,000	5	75,000	105,000
B	15,000	12	180,000	30,000	9	135,000	165,000
C	15,000	12	180,000	30,000	10	150,000	180,000
D	15,000	8	120,000	30,000	6	90,000	120,000

A	20,000	10	200,000	30,000	5	100,000	130,000
B	20,000	12	240,000	30,000	9	180,000	210,000
C	20,000	12	240,000	30,000	10	200,000	230,000
D	20,000	8	160,000	30,000	6	120,000	150,000

Continued on the next page



Interpretation of graph

From the above revenue and cost lines, breakeven points are as follows:

Point A – 6,000 units
 Point B – 10,000 units
 Point C – 15,000 units
 Point D – 15,000 units

As it is cumbersome, in practice, algebraic methods are used to derive break-even points.

5.5 Profit path chart

Instead of determining separate break-even points for individual products, there is another combined or overall break-even for product mix, known as the profit path chart. In this chart, the profit point starts from the fixed cost point and increases up to the highest profit point of the product. From the ending line of the first product, the second product line starts. In this way the charting is continued until the profit point for the last product is reached. The overall profit path chart starts from the fixed cost line to the profit point of the last product. The break-even point for the product mix is the point where the total profit line intersects the sales volume line.



Example

Consider the following example:

(Amount in TZS'000)				
Products	A	B	C	D
Units sold	10,000	10,000	10,000	10,000
Sales revenue (Units x TZS10,000)	100,000	120,000	120,000	80,000
Variable cost (@ TZS5,000; TZS8,000; TZS9,000 and TZS11,000)	50,000	80,000	90,000	110,000
Contribution (TZS'000)	50,000	40,000	30,000	(30,000)
C/S ratio = (Contribution/Sales x 100)	50	33	25	(38)
Fixed cost (TZS'000)	30,000	30,000	30,000	30,000
Profit (TZS'000)	20,000	10,000	0	(60,000)

Continued on the next page

Statement showing cumulative sale and cumulative profit

(Amount in TZS'000)

Products	A	B	C	D
Sales revenue	100,000	120,000	120,000	80,000
Contribution	50,000	40,000	30,000	(30,000)
Cumulative sales	100,000	220,000	340,000	420,000
Cumulative contribution	50,000	90,000	120,000	90,000
Fixed cost	30,000	30,000	30,000	30,000
Cumulative profit	20,000	60,000	90,000	60,000

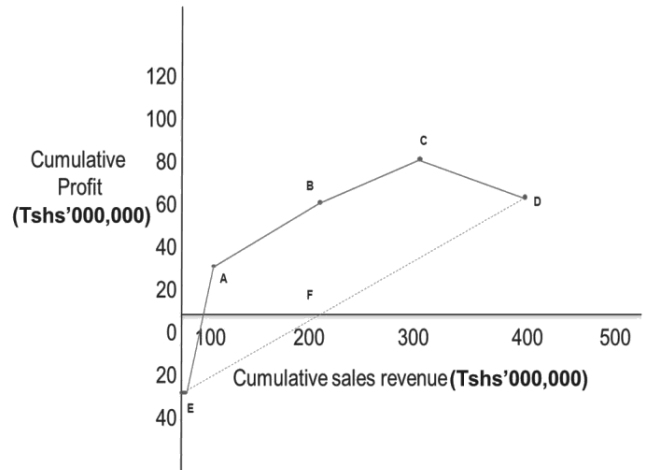
Interpretation of graph

On the X-axis, the amount of cumulative sales and on the Y-axis, the amount of cumulative profit / loss is presented.

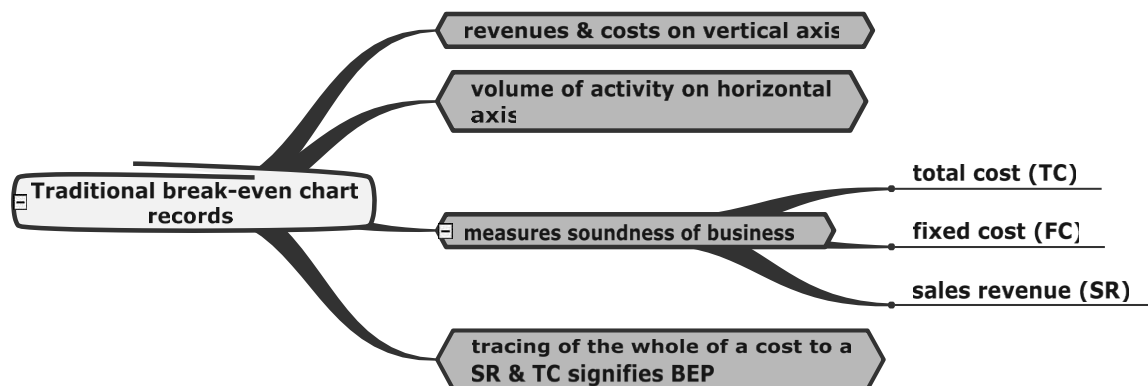
The area of ABCDE is the profit path. It shows the relative profit position of products A, B, C and D. EFD is the total profit line.

It intersects the sales line OR at point F.

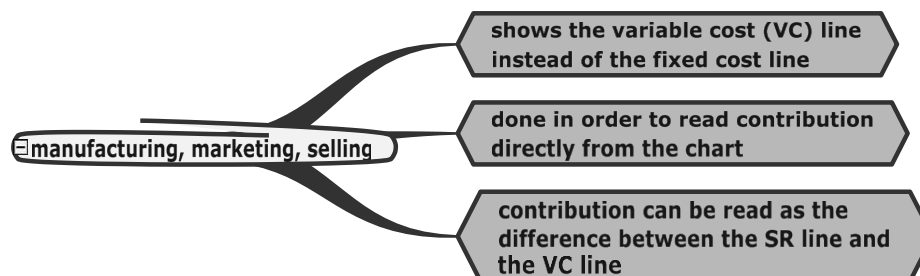
This is the break-even point (sales of TZS'000).



SUMMARY



SUMMARY





Test Yourself 5

Beauty Company sold 200,000 units of its only beauty cream at TZS40,000 per unit. Variable costs are TZS28,000 per unit (out of which manufacturing costs are TZS22,000 and selling costs are TZS6,000). Fixed costs are TZS1,584 million (manufacturing fixed costs of TZS1,000 million and selling costs of TZS584 million). There is no opening or closing inventory.

- What is the break-even point for this product?
- What is the number of units the company must sell to earn a net income before taxes of TZS120 million?
- If the income tax rate is 40%, what is the number of units that must be sold to earn an income after tax of TZS180 million?



Test Yourself 6

Seashore Ltd is planning to sell 200,000 units of its product. The fixed costs are TZS500 million and the variable costs are 70% of the selling price. In order to realise an operating income before tax of TZS160 million, what would the selling price per unit have to be?

9. Compute the degree of operating leverage at a particular level of sales and explain how the degree of operating leverage can be used to predict changes in net operating income. [Learning Outcome h]

Operating leverage is the relationship between a company's sales revenue and its operating income (i.e. EBIT - earnings before interest and taxes). Operating leverage indicates the firm's ability to use the fixed operating costs to extend the effects of changes in sales on its EBIT.

A firm invests in fixed assets expecting that the profits generated from those assets would cover the fixed costs of operating them as well as the variable costs incurred.



Example

Assume selling price per unit as TZS100,000, variable cost per unit as TZS50,000 and fixed operating costs as TZS25 million.

	Month 1	Month 2	Month 3
Sales volume	500	1,000	1,500
	TZS'000	TZS'000	TZS'000
Sales revenue	50,000	100,000	150,000
Less: Variable costs	25,000	50,000	75,000
Contribution	25,000	50,000	75,000
Less: Fixed operating costs	25,000	25,000	25,000
EBIT / Operating income	NIL	25,000	50,000

From month 2 to month 3, an increase in sales by 50% (from TZS100 million to TZS150 million) resulted in an increase in EBIT by 100% (from TZS25 million to TZS50 million).

From month 2 to month 1, a decrease in sales by 50% (from TZS100 million to TZS50 million) resulted in a decrease in EBIT by 100% (from TZS25 million to TZS0).

This relationship between the increase/decrease in sales and change in EBIT is called operating leverage.

1. Degree of operating leverage (DOL)

Degree of operating leverage can be expressed as the percentage change in EBIT divided by the percentage change in sales.

$$\text{Degree of operating leverage} = \frac{\% \text{ change in EBIT}}{\% \text{ change in sales}}$$



Tip

If the proportionate change in EBIT as a result of a given change in sales is more than the proportionate change in sales, operating leverage exists.

If $DOL > 1$, operating leverage exists

The greater the DOL, the higher is the operating leverage.

2. Use of degree of operating leverage to predict changes in net operating income:



Example

Continuing with the above example,

Percentage change (from month 3 to month 2) in EBIT = $(TZS50 \text{ million} - TZS25 \text{ million}) / TZS25 \text{ million} \times 100 = 100\%$

Percentage change (from month 3 to month 2) in Sales = $(TZS150 \text{ million} - TZS100 \text{ million}) / TZS100 \text{ million} \times 100 = 50\%$

$$\text{Degree of operating leverage} = \frac{\% \text{ change in EBIT}}{\% \text{ change in sales}} = \frac{100\%}{50\%} = 2$$

An operating leverage of 2 indicates that for every TZS1 change in sales there would be a TZS2 change in EBIT in the same direction.



Tip

Sometimes, in the examination, data is given only for one period. At that time, in the absence of comparative data, DOL can be calculated using the following formula:

$$\text{Degree of operating leverage} = \frac{\text{Contribution}}{\text{Net operating income}}$$

The Degree of Operating Leverage Ratio helps a company to understand the effects of operating leverage on the company's probable earnings.



Example

Seasons Co provides the following information:

	TZS million
Sales revenue	550
Less: Variable costs	220
Contribution	330
Less: Fixed costs	210
Operating Income	120

Use of the operating leverage approach to determine the change in profit, if sales decrease by 26%:

$$\text{Operating leverage} = \frac{\text{Contribution}}{\text{Net operating income}} = \frac{TZS330 \text{ million}}{TZS120 \text{ million}} = 2.75$$

Prediction of change in profit: $2.75 \times 26\% = 71.5\%$

Continued on the next page

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Seasons will experience a 71.5% fall in profit if its sales decrease by 26%.

Seasons' revised profit will be: $[100.00\% - 71.5\%] \times \text{TZS}120 \text{ million} = \text{TZS}34.2 \text{ million}$

To cross-check the above calculation, an income statement can be prepared which reflects the 26% decrease in sales.

Because fixed costs in total do not change when sales activity levels change, we hold fixed costs at TZS210 million. The new operating income is now TZS34.2 million as determined above and as proved in the below income statement:

	TZS million
Sales revenue (TZS550 million x 74%)	407.00
Less: Variable costs (TZS220 million x 74%)	162.80
Contribution	244.20
Less: Fixed costs (No change)	210.00
Operating Income	34.20

Decrease in sales by 26% will eventually result in decrease in contribution by 26%

3. Percentage change in EBIT is always more than the percentage change in sales

The greater the percentage of fixed costs in a company's structure, the greater the increase in profit from a stated percentage increases in revenue and the greater the decrease in profit from a stated percentage decrease in revenue.

After the company reaches its break-even point, every unit sold contributes directly to an increase in profit because fixed costs have already been covered.

A larger fluctuation in profit occurs for companies with high operating leverage due to the higher contribution margin ratio, which generates more profit out of each additional dollar of sales. The opposite occurs when sales decline.



Tip

A business with higher operating leverage is riskier than an equivalent business with lower operating leverage.

High operating leverage indicates that a large proportion of the company's major costs are fixed costs whereas low operating leverage indicates that a large proportion of the company's major costs are variable costs.



Test Yourself 7

Sahara Corporation has provided its contribution format income statement for the month of July 20X3.

	TZS'000
Sales	100,000
Less: Variable costs	60,000
Contribution	40,000
Less: Fixed costs	25,000
Net operating income	15,000

Required:

Calculate the degree of operating leverage (DOL) and using DOL, estimate the percentage change in net operating income that would result from 20% increase in sales.

10. Describe the differences between the accountant's and economist's model of CVP analysis.

[Learning Outcome j]

As discussed in the earlier Learning Outcomes, cost-volume profit (CVP) analysis is used for managerial decisions when forecasting production levels. For effective use of the CVP model, the management looks at different scenarios of output, prices and costs, and determines the point at which the model forecasts the output level to reach break-even point.

Accountants and economists have completely contrary views of CVP behaviour. Hence, it is important to differentiate between the different applications of the accountants' and economists' interpretations. However, it should be noted that only the accountants' CVP model is suitable to aid management with decision making.

7.1 Economists' CVP analysis

For an economist, the total cost and total revenue functions are represented as curves. This is because they believe that:

total revenue increases, but the increase would be proportionally less and less
total costs increase but the increase would be proportionally less and less

1. The economist says that as the marginal revenue (selling price) increases, the **total revenue will continue to increase, but the increase would be proportionally less and less.**

This continues up to a point where the decrease in selling price starts to have less and less impact on volume which results in a decline in total revenue.

It can be understood that, according to the economists' CVP model, total revenue curve increases vertically but becomes gradually less vertical until it eventually flattens out and then falls away.

2. Total costs comprise fixed costs and variable costs (also termed marginal costs). As volumes increase, total costs increase.

The economists assume that fixed costs continue to be unaffected, and when volumes increase the per unit costs decrease since the fixed cost is spread amongst a greater number of products.

Therefore, **the total costs increase, but the increase is proportionately less and less.**

3. Apart from this, the economist says that the total costs further benefit from decreases in variable costs as volume increases. This happens as a result of economies of scale. Economies of scale continue until further economies are not possible, and we begin to see diminishing returns.

Economies of scale are the **cost advantages** that a business can yield by **expanding their scale of production.**

This happens when variable costs start growing, which may be because of the overcapacity of processes at high volumes, leading to breakdowns, interruptions, and bottlenecks.

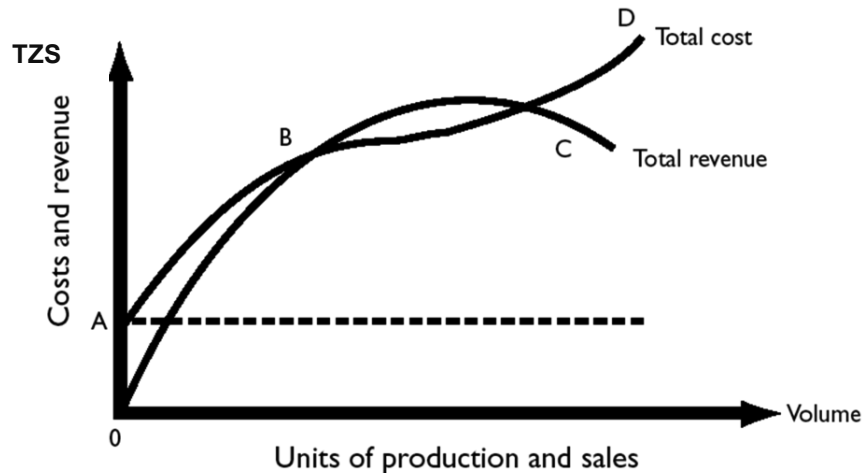
Primarily, the total cost curve does not rise vertically because of the effect of the fixed costs and the positive impact of economies of scale on variable costs.

As the business reaches its most efficient volume level, further economies of scale are not possible and the total cost curve quickly begins to rise as a result of the adverse impact of reducing returns on variable costs.



Example

Economists' CVP graph can be illustrated as follows:



From this graph, we can say that:

- The curvilinear graph results in two break-even points, i.e. point B and point C.
- The shape of the total cost function is: initial vertical rise (from point A to point B), levelling off (from point B to point C), followed by a further steep rise (from point C to point D).
- The total revenue line initially rises steeply (from point O to point B), then levels off (from point B to point C) and declines (point C onwards)

This contrasts with the accountant's view of costs, volumes, and break-even.

7.2 Accountants' CVP analysis

For an accountant, the total cost and total revenue functions are represented as straight lines, not as curves. The following assumptions are made by accountants to support the straight line equation:

- Fixed costs may remain static over a specific range of volumes. However, these costs increase in steps over higher ranges of volumes. This is because when volumes are significantly increased additional fixed costs are incurred on items like new plant and machinery, factories, etc. The accountant considers a short-term relevant range of volumes over which fixed costs remain unchanged.
- Over the short-term, the per unit selling price and the per unit variable costs may be considered to be constant.

The result of these assumptions is that, unlike the economist, the accountant shows income from sales (total revenue) and total cost as straight lines over the relevant short-term period. This means that profit continues to increase as volume increases.

Profit is maximised at the volume where maximum capacity is reached.

Also, there is only one point where the total revenue and total cost lines cross and so for the accountant there is **only one break-even point**.

The differences can be summarised as follows:

- The economic model covers **a range of production / sales levels** sufficient to cause significant changes in efficiency whereas the accountant's model is simpler for cost-volume relationships assuming validity for a **smaller activity range**.
- The economist's break-even chart employs **non-linear relationships** and shows **two break-even points** whereas the accountant's break-even chart employs **linear relationships** and shows **only one break-even point**.

- (iii) In the economists' break even chart, the **total cost line** is not a straight line that increases at a constant rate as in the accountant's break-even chart. This is because of increase in marginal costs with the increase in output; given short-term capacity constraints
- (iv) In the economists' break even chart, the **revenue line** is not a straight line that rises at a constant selling price as in the accountant's break-even chart. This is because of reduction in selling price per unit in order to achieve higher sales volume.
- (v) The economist's approach produces a common analytical model which is aimed to produce **predictions about market variables'** (e.g. price, volume, etc.) behaviour whereas the accountant's model has a specific objective of attempting to provide practical assistance for **decision-making within a given organisation**.

11. Discuss the limitations of CVP analysis for planning and decision making.
[Learning Outcome k]

As discussed in the earlier Learning Outcomes, CVP analysis is an important management tool for the decision making process.

However, it has its own **limitations**. They are mentioned below:

1. It can be time consuming and difficult to prepare a break even chart.
2. The analysis can only be applied to a single product. However, almost all businesses usually provide more than one product. Moreover, the sales mix is also not constant, but continually changes due to changes in demand.
3. Where there is difficulty in classifying costs between fixed and variable, it is difficult to apply break even analysis. The basic approach for cost relationships is that total costs are divided into fixed and variable costs. In reality, costs cannot be split easily, even into variable and fixed costs.
4. At all levels of output, it assumes that fixed costs are fixed or constant. However, fixed costs do not remain constant beyond certain ranges.
5. At all levels of output, it assumes that the per unit variable costs are the same or fixed.
6. At all levels of output, it assumes that sales prices are fixed or constant.
7. Inventory is not taken into consideration.
8. It is not useful for production planning.
9. CVP analysis assumes that there is no uncertainty. However, in the real world, there is a lot of uncertainty involved in the prediction of costs and sales.
10. The time value of money is not taken into consideration.
11. CVP analysis relies on an assumption that output is the only factor affecting costs. Practically, there may be other factors, including inflation, efficiency and economic and political factors.

Answers to Test Yourself

Answer to TY 1

To know the level of activity at which there will be a no profit no loss situation, we need to calculate the break-even point.

Calculation of per unit contribution:

	TZS'000
Selling price (per unit)	25
Less: Variable costs (10 + 5 + 2)	17
Contribution (per unit)	8

$\text{Break - even point (in units)} = \frac{\text{Total fixed costs}}{\text{Contribution per unit}}$

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$$\begin{aligned}\frac{\text{TZS80 million}}{\text{TZS8,000}} \\ = 10,000 \text{ units}\end{aligned}$$

Time Ltd must produce and sell 10,000 watches so that there will be a no loss no gain situation.

Answer to TY 2

$$\begin{aligned}\text{Margin of safety (in units)} &= \text{Expected sales} - \text{Break-even point} \\ &= 42,100 \text{ units} - 35,000 \text{ units} \\ &= 7,100 \text{ units}\end{aligned}$$

$$\begin{aligned}\text{Margin of safety (as a percentage)} &= \frac{\text{Margin of safety in volume}}{\text{Expected sales}} \times 100 \\ &= \frac{7,100}{42,100} \times 100 \\ &= 16.86\%\end{aligned}$$

Answer to TY 3

$$\begin{aligned}\text{Total per unit variable cost} &= \text{TZS}(8,000 + 7,000 + 5,000) \\ &= \text{TZS}20,000\end{aligned}$$

$$\begin{aligned}\text{C/S ratio} &= \frac{\text{Contribution per unit}}{\text{Sales price per unit}} \times 100 \\ &= (\text{TZS}30,000 - \text{TZS}20,000) / \text{TZS}30,000 \times 100 \\ &= 33.33\%\end{aligned}$$

Answer to TY 4

$$\begin{aligned}\text{Required contribution} &= \text{Fixed cost} + \text{Expected profits} \\ &= \text{TZS}50 \text{ million} + \text{TZS}25 \text{ million} \\ &= \text{TZS}75 \text{ million}\end{aligned}$$

$$\text{Per unit required contribution} = \text{TZS}75 \text{ million} / 50,000 \text{ units} = \text{TZS}1,500$$

$$\begin{aligned}\text{Per unit sales price} &= \text{Per unit contribution} + \text{Per unit variable cost} \\ &= \text{TZS}1,500 + \text{TZS}5,000 \\ &= \text{TZS}6,500\end{aligned}$$

Answer to TY 5

(a) Calculation of break-even point

$$\begin{aligned}\text{Break - even point (in units)} &= \frac{\text{Fixed expenses}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS}1,584 \text{ million}}{\text{TZS}12,000} \\ &= 132,000 \text{ units}\end{aligned}$$

W1 Calculation of per unit contribution

$$\begin{aligned}\text{Contribution per unit} &= \text{Per unit sales price} - \text{Per unit variable price} \\ &= \text{TZS}40,000 - \text{TZS}28,000 \\ &= \text{TZS}12,000\end{aligned}$$

(b) Calculation of the number of units the company must produce to earn a net income before tax of TZS120 million.

$$\begin{aligned}\text{Calculation of required number of units to cover required contribution} &= \frac{\text{Required contribution (W2)}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS}1,704 \text{ million}}{\text{TZS}12,000} \\ &= 142,000 \text{ units}\end{aligned}$$

W2 Calculation of required contribution

A net income of TZS120 million before tax is a target profit.

$$\begin{aligned}\text{Required contribution} &= \text{Fixed cost} + \text{Target profit} \\ &= \text{TZS1,584 million} + \text{TZS120 million} \\ &= \text{TZS1,704 million}\end{aligned}$$

(c) Calculation of the number of units the company must produce to earn a net income after tax of TZS180 million

Calculation of required profit before tax

Given tax rate is 40% and required profit after tax is TZS180 million.

When profit before tax is 100, tax is 40 then profit after tax will be 60 (100 - 40) i.e. TZS180 million/60% = TZS300 million

Calculation of required number of units to cover required contribution

$$\begin{aligned}&= \frac{\text{Required contribution (fixed costs + target profits)}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS1,584 million} + \text{TZS300 million}}{\text{TZS12,000}} \\ &= 157,000 \text{ units}\end{aligned}$$

Answer to TY 6

Calculation of required contribution

$$\begin{aligned}\text{Required contribution} &= \text{Target profit} + \text{Fixed cost} \\ &= \text{TZS160 million} + \text{TZS500 million} \\ &= \text{TZS660 million}\end{aligned}$$

As the variable cost ratio is 70%, the contribution margin ratio is 30%.

Calculation of sales revenue

$$\text{Sales} = \text{TZS660 million} / 30\% = \text{TZS2,200 million}$$

Calculation of selling price per unit

$$\text{Per unit sales price} = \frac{\text{Sales revenue}}{\text{Number of units}} = \frac{\text{TZS2,200 million}}{200,000 \text{ units}} = \text{TZS11,000}$$

Answer to TY 7

$$\text{Degree of operating leverage} = \frac{67}{\text{Net operating income}} = \text{TZS15,000,000}$$

Percent increase in net operating income = Percent increase in sales x Degree of operating leverage

$$\begin{aligned}&= 20\% \times 2.67 \\ &= 53.4\%\end{aligned}$$

Quick-Quiz

1. Which of the sentences below is correct regarding the break-even point?

- A Break-even point = $\frac{\text{Total fixed cost}}{\text{Number of units produced}}$
- B At the break-even point contribution is equal to variable cost.
- C At BEP of activity, there is neither a loss nor a profit.
- D None of the above

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2. Paper Ltd had given the following information. Based on the information, suggest to them how much they should produce per year so that all the fixed cost is recovered.

	TZS'000
Selling price (per unit)	50
Variable cost (per unit)	40
Total fixed cost (per year)	120,000

- A 10,000 units
B 12,000 units
C 3,000 Units
D 2,400 units
3. Doll Co runs a toy manufacturing unit. The company's target for 20X9 is to manufacture 30,000 units. The per unit selling price of the product is TZS12,000. The total variable cost of the product is TZS6,000. During 20X9 the company expects to earn a profit of TZS48 million.

What must be the company's per annum fixed cost?

- A TZS132 million
B TZS18 million
C TZS78 million
D None of the above
4. Baby Care Co is a company that manufactures baby shampoo. It recently launched a special new shampoo for babies. The cost structure for the product is as follows:

	TZS'000
Direct material cost	18
Direct labour cost	12
Variable overhead	7
Fixed cost (per annum)	147,000

The selling price of the product is TZS50,000 per unit. In this situation, the C/S ratio of the company is:

- A 62%
B 40%
C 26%
D None of the above
5. Comfort Co is a company that manufactures mattresses. In 20X9 the company expects to earn a profit of TZS34,000. The selling price of the product is TZS50,000 and the variable cost per unit is TZS41,000. Fixed cost per annum is TZS110 million. What should be the sales revenue to earn the expected profits?
- A TZS611.11 million
B TZS188.89 million
C TZS422.22 million
D TZS800.00 million
6. Pioneer Ltd has given the following information:
The margin of safety of the company is 10% of the budgeted sales.
Budgeted sales of the company for 20X9 are 40,000 units.
Per unit budgeted contribution is TZS10,000.

What should be the fixed cost for the budgeted period?

- A TZS400 million
B TZS360 million
C TZS20 million
D None of the above

7. Wilson Inc prepared the following preliminary budget for the production of a particular product, Gala, for 20X9 assuming no expenditure on advertising:

Selling price per unit	TZS20,000
Unit sales	50,000
Variable costs	TZS600 million
Fixed costs	TZS250 million

Based on a market study in December 20X8, Wilson estimated that it could increase the unit selling price by 15% and increase the unit sales volume by 10% if TZS200 million was spent on advertising.

Assuming that Wilson Inc considers these changes in its 20X9 budget, what should be the operating income from the production of Gala?

- A TZS155 million
 B TZS190 million
 C TZS205 million
 D TZS355 million
8. Bear Plc produces a single product which it sells for TZS24,000 per unit. The C/S ratio is 45%. The fixed costs are TZS29.7 million and this month it plans to manufacture and sell 3,000 units. The margin of safety (units) this month will be:
- A 250
 B 525
 C 675
 D 825

9. The cost card of Mili Plc is given below:

	TZS'000
Direct material	5
Direct labour	15
Factory overheads	
Fixed overheads	2
Variable overheads	2

The budgeted activity level is 15,000 units and the budgeted sales price is TZS30,000. What is the break-even point?

Answers to Quick-Quiz

1. The correct option is **C**.

$$\text{Break-even point} = \frac{\text{Total fixed cost}}{\text{Number of units produced}}$$

The break-even point is a no loss no profit situation. At the break-even point, contribution is just enough to recover fixed costs. Any activity below the BEP, the firm will make a loss, while above this level it will make a profit.

2. The correct option is **B**.

From the given information we may compute the sales as follows.

$$\begin{aligned} \text{Contribution} &= \text{Sales} - \text{Variable cost} \\ &= \text{TZS50,000} - \text{TZS40,000} \\ &= \text{TZS10,000} \end{aligned}$$

$$\begin{aligned} \text{Break-even point (units)} &= \frac{\text{Total fixed cost}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS120 million}}{\text{TZS10,000}} \\ &= 12,000 \text{ units} \end{aligned}$$

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3. The correct option is **A**.

The contribution per unit will have to be computed from the given data as

$$\begin{aligned}\text{Contribution per unit} &= \text{Selling price per unit} - \text{Variable cost per unit} \\ &= \text{TZS}12,000 - \text{TZS}6,000 \\ &= \text{TZS}6,000\end{aligned}$$

$$\begin{aligned}\text{Fixed cost} &= \text{Required contribution} - \text{Profits} \\ &= (30,000 \times \text{TZS}6,000) - \text{TZS}48 \text{ million} \\ &= \text{TZS}132 \text{ million}\end{aligned}$$

4. The correct option is **C**.

$$\begin{aligned}\text{C/S ratio} &= \frac{(S - V)}{S} \times 100 \\ &= \frac{\text{TZS}50,000 - (\text{TZS}18,000 + \text{TZS}12,000 + \text{TZS}7,000)}{\text{TZS}50,000} \times 100 \\ &= 26\%\end{aligned}$$

In the above solution we have deducted all the costs of direct material, direct labour and variable overheads from the selling price of TZS50,000 to arrive at the contribution.

5. The correct option is **D**.

$$\begin{aligned}\text{C/S ratio} &= \frac{(S - V)}{S} \times 100 \\ &= \frac{\text{TZS}50,000 - \text{TZS}41,000}{\text{TZS}50,000} \times 100 \\ &= 18\%.\end{aligned}$$

$$\text{Expected sales revenue} = \frac{\text{Required contribution}}{\text{C/S ratio}}$$

$$\begin{aligned}&= (\text{TZS}110 \text{ million} + \text{TZS}34 \text{ million})/18\% \\ &= \text{TZS}800 \text{ million}\end{aligned}$$

6. The correct option is **B**.

The margin of safety is given at 10% of the budgeted sales i.e. 10% of 40,000 units. Hence, margin of safety in units is 4,000 units.

$$\text{Margin of safety} = \text{Budgeted sales} - \text{Break-even point}$$

$$4,000 \text{ units} = 40,000 \text{ units} - \text{Break-even point}$$

$$\text{Break-even point} = 36,000 \text{ units}$$

(Break-even point is at 36,000 units. Therefore, contribution at break-even point is **TZS360 million** (36,000 x TZS10,000 per unit))

Break-even point is a state of business where there is a no loss no profit situation. In other words we can say contribution at break-even point equals fixed cost. Hence, the fixed cost of the business for the budgeted period is TZS360 million.

7. The correct option is **A**.

Calculation of budgeted operating income for 20X9

	TZS million
Sales (55,000 x TZS23,000)	1,265
Less: Variable cost (TZS600 million/50,000 x 55,000)	660
Contribution margin	605
Less: Fixed costs (TZS250 million + TZS200 million)	(450)
Operating income	155

Workings

W1 Selling price and sales volume

$$\begin{aligned}\text{Estimated selling price} &= \text{TZS}20,000 + 15\% \\ &= \text{TZS}23,000\end{aligned}$$

$$\begin{aligned}\text{Estimated sales volume} &= 50,000 + 10\% \\ &= 55,000\end{aligned}$$

8. The correct option is **A**.

$$\text{Contribution per unit} = \text{TZS}24,000 \times 0.45 = \text{TZS}10,800$$

$$\text{Break-even point (units)} = \frac{\text{Fixed cost}}{\text{Contribution per unit}} = \frac{\text{TZS}29.7 \text{ million}}{\text{TZS}10,800} = 2,750 \text{ units}$$

$$\begin{aligned}\text{Margin of safety (units)} &= \text{Expected sales volume} - \text{BEP sales volume} \\ &= (3,000 - 2,750) = 250 \text{ units}\end{aligned}$$

The break-even point is **3,750**.

Step 1 Calculation of per unit contribution

	TZS'000
Per unit sales price	30
Less: Variable cost	
Direct material	5
Direct labour	15
Overheads	2
Contribution	8

Step 2 Calculation of total fixed cost

$$\begin{aligned}\text{Total fixed cost} &= \text{Per unit fixed cost} \times \text{Budgeted units of production} \\ &= \text{TZS}2,000 \times 15,000 \text{ units} \\ &= \text{TZS}30 \text{ million}\end{aligned}$$

Step 3 Calculation of break-even point

$$\text{Break-even point} = \frac{\text{Total fixed cost}}{\text{Contribution per unit}} = \frac{\text{TZS}30 \text{ million}}{\text{TZS}8,000} = 3,750 \text{ units}$$

Self-Examination Questions

Question 1

Sigma Ltd manufactures and sells Walkmans at TZS15,000 per unit.

In a period, if it produces and sells 8000 Walkmans, it incurs a loss of TZS5,000 per Walkman.

If the volume is raised to 20,000 Walkmans, it earns a profit of TZS4,000 per Walkman.

Required:

- Calculate the amount of margin of safety for both the situations.
- What will be the sale volume of Walkmans for Glory Ltd to achieve the target profit of TZS7,000 per Walkman in the next financial year, i.e. 20Y1?

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Question 2

Theta Corp manufactures and sells three electronic products: televisions, CD players and DVD players.

Details of the product mix are as follows:

	Television	CD Player	DVD Player
Per unit raw material (kg)	10	6	15
Per unit labour hours (wages per hour TZS1,000)	15	25	20
Selling price per unit (TZS'000)	125	100	200
Maximum possible production units	6,000	4,000	3,000

Budgeted fixed costs are TZS127.40 million which needs to be allocated on the basis of production. Total 90,000 kg of raw materials is available in the market at a price of TZS10,000 per kg.

Required:

Derive an optimal product mix and profit statement

Question 3

Sun Ltd has produced and sold three products during a year:

	Product A	Product B	Product C
	TZS'000	TZS'000	TZS'000
Catalogue price (subject to 20% trade discount)	30	50	40
Marginal cost per unit	14	25	40
Required labour per unit	2.5	5	2.4
Number of units sold	16,000	12,000	10,000

Total fixed expenses of all three products are TZS175 million. Due to shortage of labour, the available working hours for the next year are estimated to be only 75,000 hours.

Required:

Suggest a suitable sales-mix for the next year:

(a) When there is enough demand for all the products

(b) When the potential demand is as under:

Product A - 18,000
Product B - 13,000
Product C - 20,000

Show the profitability of Sun Ltd in each case.

Question 4

Stitch Textile Mills manufactures shirts, trousers and t-shirts. The wholesale prices and relevant costs of the products are as below:

Products	Shirts	Trousers	T-shirts
	TZS'000	TZS'000	TZS'000
Selling price per unit	15.00	20.00	10.00
Less:			
Direct materials per unit	(3.75)	(5.00)	(2.50)
Direct wages per unit	(1.75)	(2.00)	(1.50)
Other variable overheads per unit	(2.00)	(3.00)	(0.75)
Production margin per unit	7.50	10.00	5.25
Less:			
Variable selling and administration costs	(2.50)	(4.00)	(1.25)
Contribution per unit	5.00	6.00	4.00
Budgeted sales mix in units	20%	30%	50%
Production fixed overheads	TZS60 million		
Selling and administration fixed overheads	TZS36 million		

Required:

- Calculate the break-even point in units for the entire products based on the budgeted sales mix.
- In order to earn a target net profit of TZS66 million (after 45%taxation), how many units of each product will be required to be manufactured by Stitch Textile Mills?
- In order to earn 11% budgeted return on sales after 45% taxation, how many units of each product will be required to be manufactured by Stitch textile Mills?

Question 5

Warm-Rich Inc produces six types of electric iron with the following budgeted sales prices, unit variable costs and sales mix ratios.

Product	A	B	C	D	E	F
Selling price per iron (TZS'000)	50	60	70	80	90	100
Budgeted mix ratios based on units	15%	15%	20%	30%	12%	8%

Variable costs are 60% of the sales. Total fixed costs for the budgeted period are TZS293.2 million and the rate of corporate tax is 35%.

Required:

- Determine the budgeted unit sales for each iron needed to generate a desired net income after taxes equal to 10% of sales dollars.
- Suppose the mix ratios for products B and F were reversed i.e. 8% for B and 15% for F:
 - What will be the impact on sales mix?
 - What will be the impact on net income?
 - What will be the impact on BEP?

Question 6

Wind Charm Ltd manufactures inverters to be used for domestic purposes. Each inverter has a rechargeable battery and a built-in charging circuit. Wind Charm sells an inverter for TZS360,000. The annual sale is 30,000 inverters.

The variable and fixed cost data is given below:

Variable expenses	TZS252,000 per inverter
Fixed expenses	TZS2,700 million per year

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Required:

- (a) Prepare contribution margin income statement and calculate the degree of operating leverage.
- (b) In the next year, the sales volume of inverters is expected to increase by 7,500 units. Calculate the expected percentage increase in net operating income and the expected total net operating income for the next year. (Do not prepare an income statement; use the degree of operating leverage to work out the solution.)

SEQ Question 7

A company is developing a new product. During its expected life it is forecast that 6,400 units of the product will be sold for TZS70 per unit.

The direct material and other non-labour related costs are expected to be TZS45 per unit throughout the life of the product.

Production is expected to be in batches of 100 units throughout the life of the product. The direct labour cost is expected to reduce due to the effects of learning throughout the life of the product. The total direct labour cost of the first batch of 100 units is expected to be TZS6,000 and an 80% learning effect is expected to occur.

Fixed costs specific to this product are expected to be TZS60,000 in total for the life of the product.

Note: The value of the learning index for an 80% learning curve is -0.3219

Required:

- (d) **Calculate** the total direct labour cost of the first:
 - (i) 800 units
 - (ii) 1,600 units
 - (iii) 3,200 units
 - (iv) 6,400 units
- (e) **Apply** the results from part (a) to **advise** the company management of the approximate break-even level of sales of the product.
- (f) **Explain** the effect on the break-even level of sales if the rate of learning was 90%. (No calculations are required.)

SEQ Question 8

- (a) What is break-even analysis?
- (b) List seven (7) assumptions made under cost volume profit analysis.
- (c) A company makes a single product with a sales price of TZS50 and a marginal cost of TZS30. Fixed cost are TZS300, 000 per annum.

REQUIRED:

Calculate the following:

- (i) Number of units at break even point.
- (ii) Sales at break even point.
- (iii) Contribution to sales ratio (C/S ratio).
- (iv) Number of units need to be sold to achieve a profit of TZS100,000 per annum.
- (v) Level of sales amount to achieve a profit of TZS100,000 per annum.
- (vi) Number of units need to be sold to achieve a profit of TZS100,000 per annum with a 20% tax rate.
- (vii) Because of increasing costs, the marginal cost is expected to rise to TZS 35 per unit and fixed costs to TZS 350,000 per annum. If the selling price cannot be increased what will be the number of units required to maintain a profit of TZS100,000 per annum. (Ignore tax).

*SEQ Question 9

Mtambaswala Press Ltd is considering launching a new monthly magazine at a selling price of **TZS1** per copy. Sales of the magazine are expected to be 500,000 copies per month, but it is possible that the actual sales could differ quite significantly from this estimates.

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

	Method A	Method B
Variable costs	0.55 per copy	0.50 per copy
Specific fixed costs	TZS 80,000 per month	TZS 120,000 per month

Semi – variable costs:

The following estimates have been obtained:

350,000 copies	TZS 55,000 per month	TZS 47,500 per month
450,000 copies	TZS 65,000 per month	TZS 52,500 per month
650,000 copies	TZS 85,000 per month	TZS 62,500 per month

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

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

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

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

REQUIRED:

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

***SEQ Question 10**

A building company constructs a standard unit which sells for TZS 30 000. The company's costs can be readily identifiable between fixed and variable costs.

Budgeted data for the coming six months includes the following:

	Sales (in units)	Profit (TZS)
January	18	70,000
February	20	100,000
March	30	250,000
April	22	130,000
May	24	160,000
June	16	40,000

You are told that the fixed costs for the six months have been spread evenly over the period under review to arrive at the monthly profit projections.

Required:

- Prepare a graph for total sales, costs and output for the six months under review that shows:
 - The break-even points in units and revenue
 - Total fixed costs
 - The variable cost line.
 - The margin of safety for the total budgeted sales.
- The company is worried about the low level of sales. The sales director says that if the selling price of the unit was reduced by TZS 5,000 the company would be able to sell 10% more units. All other costs would remain the same you are told. Determine whether the company should reduce the selling to attract new sales in order to maximize profit. Clearly show any workings.
- Evaluate whether the assumption that costs are readily identifiable as either fixed or variable throughout a range of production is realistic. Give examples of any alternative classification.

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*SEQ Question 11- ACCA (2012)

Hair Co manufactures three types of electrical goods for hair: curlers (C), straightening irons (S) and dryers (D). The budgeted sales prices and volumes for the next year are as follows:

	C	S	D
Selling price	TZS 110	TZS 160	TZS 120
Units	20,000	22,000	26,000

Each products is made using a different mix of the same materials and labour. Product S also uses new revolutionary technology for which the company obtained a ten-year patent two years ago. The budgeted sales volumes for all the products have been calculated by adding 10% to last year's sales.

The standard cost card for each product is shown below.

	C	S	D
	TZS	TZS	TZS
Material 1	12	28	16
Material 2	8	22	26
Skilled labour	16	34	22
Unskilled labour	14	20	28

Both skilled and unskilled labour costs are variable.

The general fixed overheads are expected to be TZS 640,000 for the next year.

Required:

- Calculate the weighted average contribution to sales ratio for Hair Co. Note: round all working to 2 decimal places. (6 marks)
- Calculate the total break-even sales revenue for the next year for Hair Co. Note: round all working to 2 decimal places. (2 marks)
- Using the graph paper provided, draw a multi-product profit-volume (PV) Chart showing clearly the profit/loss lines assuming:
 - You are able to sell the products in order of the ones with the highest ranking contribution to sales ratios first; and
 - Your sell the products in a constant mix. Note: only one graph is required. (9 marks).
- Briefly comment on your findings in (c). (3 marks) (20 marks)

*SEQ Question 12

Tennet Ltd is a manufacturer of a household cleaning product. It employs the services of a specialist sales company called Sellit Ltd to undertake its sales and marketing activities. Sellit Ltd receives a commission of 9% on Tennet Ltd's sales for providing this service. The following budgeted income statement has been prepared in respect of the forthcoming financial year.

Tennet Ltd – Budgeted Income Statement		
		TZS
Sales		850,000
Cost of goods sold		
Direct materials	170,000	
Direct labour	51,000	
Fixed manufacturing costs	127,500	348,500
Gross profit		501,500
Selling and Distribution costs		
Commission – Sellit Ltd	76,500	
Variable distribution costs	34,000	
Fixed distribution costs	92,000	202,500
Fixed administration costs		130,000
Budgeted profit		169,000

Management at Tennet Ltd are currently considering discontinuing the arrangement with Sellit Ltd and employing an in-house sales and marketing team instead. The management accountant has identified the costs associated with this option. It would be necessary to employ two sales representatives, each of whom would receive a basic salary of TZS 22,000. These sales representatives would also require a commission of 2% on sales achieved. Tennet Ltd would also have to spend an additional TZS 10,000 per annum on advertising if it employs its own in-house sales and marketing team.

REQUIREMENT:

- Discuss the assumptions which underpin the CVP Model
- Calculate the BEP in sales revenue for the forthcoming financial year if Tennet Ltd continues to avail of Sellit Ltd's services.

- c) Calculate the level of sales revenue that Tennet Ltd would need to earn to achieve the budgeted profit of TZS 169,000 for the forthcoming financial year if the company employs its own in-house sales and marketing team.
- d) team.
- e) Calculate the level of sales revenue at which profits would be the same whether Tennet Ltd continues to avail of Sellit Ltd's service or employs its own in-house sales and marketing team.
(You may round your calculations to the nearest TZS where necessary)

Answers to Self-Examination Questions

Answer to SEQ 1

At the sales level of 8,000 Walkmans, Sigma incurs a loss of TZS40 million.
At the sales level of 20,000 Walkmans, Sigma incurs a profit of TZS80 million.

	Situation 1 TZS million	Situation 2 TZS million
Sales (No. of Walkmans x \$15,000)	120	300
Profit / Loss	(40)	80

(a) Margin of safety

Margin of safety = Actual sales – Sales at break-even point

For Situation 1:

Margin of safety = TZS120 million – TZS180 million = (TZS60 million) i.e. **no margin of safety**

For Situation 2:

Margin of safety = TZS300 million – TZS180 million = TZS120 million

Where,

$$\begin{aligned} \text{Break - even point} &= \frac{\text{Fixed expenses}}{\text{Contribution to sales ratio}} \\ &= \frac{\text{TZS120 million}}{66.67\%} \\ &= \text{TZS180 million} \end{aligned}$$

Where,

$$\begin{aligned} \text{Contribution to sales ratio} &= \frac{\text{Change in profit}}{\text{Change in sales}} \times 100 \\ &= \frac{\text{TZS}(80 \text{ million} - (\text{TZS} - 40 \text{ million}))}{\text{TZS}(300 \text{ million} - 120 \text{ million})} \times 100 \\ &= \frac{\text{TZS120 million}}{\text{TZS180 million}} \times 100 \\ &= 66.67\% \end{aligned}$$

Hence, the proportion of variable costs in the sales would be 33.33%.

And,

Calculation of fixed costs

$$\begin{aligned} \text{Fixed costs} &= \text{Contribution} - \text{Profit} \\ &= \text{TZS}(120 \text{ million} \times 66.67\%) - (-40 \text{ million}) \\ &= \text{TZS}(80 \text{ million} + 40, \text{ million}) \\ &= \text{TZS120 million} \end{aligned}$$

Here, for the calculation of fixed costs, financial year situation 1 is taken as base. Even if, situation 2 shall have been taken as a base, the amount would have arrived at TZS120 million

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(b) Required sales in the financial year 20Y1 to achieve the target profit of TZS7,000 per Walkman

Suppose Glory produces and sells X no. of Walkmans.

Sales = X Walkmans x TZS15,000 = TZS15,000X

Target profit = X Walkmans x TZS7,000 = TZS7,000X

Now,

$$\text{Required sales} = \frac{\text{Fixed expenses} + \text{Target Profit}}{\text{Contribution to sales ratio}}$$

$$\text{TZS15,000X} = \frac{\text{TZS120 million} + \text{TZS7,000X}}{66.67\%}$$

$$\text{TZS15,000X} \times 66.67\% = \text{TZS120 million} + \text{TZS7,000X}$$

$$\text{TZS10,000X} = \text{TZS120 million} + \text{TZS7,000X}$$

$$= \text{TZS120 million}$$

$$\text{Hence } X = \text{TZS120 million} / \text{TZS3,000} = 40,000 \text{ Walkmans}$$

Answer to SEQ 2

	Television	CD Player	DVD Player
	TZS'000	TZS'000	TZS'000
Selling price per unit	125	100	200
Less: Variable cost per unit			
Cost of raw material (kg x TZS10,000)	100	60	150
Cost of labour (hour x TZS1,000)	15	25	20
	115	85	170
Contribution per unit	10	15	30

At first glance, it seems that the contribution per unit is the highest for DVD players and hence production should be prioritised in the following ascending order:

1. DVD player
2. CD player
3. Television

However, production priority can be decided on the basis of contribution per limiting factor, which is calculated as below:

$$\text{Contribution per limiting factor} = \frac{\text{Contribution per unit}}{\text{Required kg of material per unit}}$$

For Television: Contribution per limiting factor = TZS10,000/10 kg = TZS1,000

For CD player: Contribution per limiting factor = TZS15,000/6 kg = TZS2,500

For DVD player: Contribution per limiting factor = TZS30,000/15 kg = TZS2,000

Considering the contribution per limiting factor of raw materials, production priority should be in the following order:

1. CD player
2. DVD player
3. Television

	kg
Total available raw materials	90,000
Less: Required materials for CD players (6 kg x 4,000 units)	24,000
Available materials for DVD players and televisions	66,000
Less: Required materials for DVD players (15 kg x 3,000 units)	45,000
Available materials for televisions	21,000
Less: Possible production of televisions (21,000 kg/10 kg per unit = 2,100 units)	21,000

Optimal product mix considering scarcity of raw materials in the market

Television 2,100 units
CD player 4,000 units
DVD player 3,000 units

Profit statement

	Television	CD Player	DVD Player	Total
	TZS'000	TZS'000	TZS'000	TZS'000
Sales	262,500	400,000	600,000	1,262,500
Less: Variable costs	241,500	340,000	510,000	1,091,500
Contribution	21,000	60,000	90,000	171,000
Less: Fixed costs (W1)	29,400	56,000	42,000	127,400
Profit	(8,400)	4,000	48,000	43,600

Workings

W1 Allocation of fixed costs on the basis of production units

Fixed cost per unit = Total fixed costs/No. of units produced
= TZS127.4 million/(2,100 + 4,000 + 3,000) units
= TZS127.4 million/9,100 units
= TZS14,000

Fixed costs for television = 2,100 units x TZS14,000 = TZS29.4 million
Fixed costs for CD player = 4,000 units x TZS14,000 = TZS56 million
Fixed costs for DVD player = 3,000 units x TZS14,000 = TZS42 million

Answer to SEQ 3

(a) When there is enough demand for all the products, sales mix and profitability would be:

Contribution per unit

	A	B	C
	TZS'000	TZS'000	TZS'000
Selling price per unit (net of discount)	24	40	32
Less: Variable cost per unit	14	25	40
Contribution per unit	10	15	(8)

Since contribution per unit for product C is negative, Sun Ltd should manufacture only two products, product A and product B.

Contribution per limiting factor = $\frac{\text{Contribution per unit}}{\text{Required labour hour per unit}}$

For Product A: Contribution per limiting factor = TZS10,000/2.5 hours = TZS4,000
For Product B: Contribution per limiting factor = TZS15,000/5 hours = TZS3,000

Considering the contribution per limiting factor of raw materials, production priority should be in the following order:

1. Product A
2. Product B

	Hours
Total available labour hours	75,000
Less: Required hours for product A (2.5 hours x 16,000 units)	40,000
Available labour hours for product B	35,000
Less: Possible production of product B (35,000 hours/5 hours per unit = 7,000 units)	35,000

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Optimal sales mix considering the scarcity of labour hours in the market

Product A 16,000 units
Product B 7,000 units

Profitability of Sun Ltd

Profit = Total Contribution – Fixed costs
= (16,000 units x TZS10,000 + 7,000 units x TZS15,000) - TZS175 million
= (TZS160 million + TZS105 million) - TZS175 million
= TZS265 million - TZS175 million
= TZS90 million

(b) When potential demand for all the products is 18,000 units, 13,000 units and 20,000 units respectively, sales mix and profitability would be:

	Hours
Total available labour hours	75,000
Less: Required hours for product A (2.5 hours x 18,000 units)	45,000
Available labour hours for product B	30,000
Less: Possible production of product B (30,000 hours/5 hours per unit = 6000 units)	30,000

Optimal sales mix considering the scarcity of labour hours in the market

Product A 18,000 units
Product B 6,000 units

Profitability of Sun Ltd

Profit = Total Contribution – Fixed costs
= (18,000 units x TZS10,000 + 6,000 units x TZS15) - TZS175 million
= (TZS180 million + TZS90 million) - TZS175 million
= TZS270 million - TZS175 million
= TZS95 million

Answer to SEQ 4

(a) Break-even point based on the budgeted sales mix

Budgeted sales mix: 20%: 30%: 50%

Contribution per unit is TZS5,000, TZS6,000 and TZS4,000 for shirts, trousers and t-shirts respectively.

Hence, weighted average contribution margin (WACM) per unit can be calculated as follows:

WACM per unit = (Per unit contribution of shirts x Proportion of budgeted sales mix for shirts) + (Per unit contribution of trousers x Proportion of budgeted sales mix for trousers) + (Per unit contribution of t-shirts x Proportion of budgeted sales mix for t-shirts)
= (TZS5,000 x 0.20) + (TZS6,000 x 0.30) + (TZS4,000 x 0.50)
= TZS1,000 + TZS1,800 + TZS2,000
= TZS4,800

Break-even point (in terms of units) = $\frac{\text{Fixed expenses}}{\text{Contribution per unit}}$
= $\frac{\text{TZS60 million} + \text{TZS36 million}}{\text{TZS4,800}}$
= 20,000 total mixed units

BEP on the basis of budgeted sales mix:

Shirts: 20,000 units x 20% = 4,000 units

Trousers: 20,000 units x 30% = 6,000 units

T-shirts: 20,000 units x 50% = 10,000 units

(b) In order to earn a target net profit of TZS66 million

Net profit after taxation = TZS66 million

Hence, net profit before taxation = TZS66 million/0.55 = TZS120 million

$$\begin{aligned} \text{Target sales (in terms of units)} &= \frac{\text{Fixed expenses} + \text{Target Profit}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS96 million} + \text{TZS120 million}}{\text{TZS4,800}} \\ &= 45,000 \text{ total mixed units} \end{aligned}$$

Required sales units based on the budgeted sales mix:

Shirts: 45,000 units x 20% = 9,000 units

Trousers: 45,000 units x 30% = 13,500 units

T-shirts: 45,000 units x 50% = 22,500 units

(c) In order to earn a budgeted return of 11%

$$\begin{aligned} \text{Weighted average selling price} &= \text{TZS15,000}(0.20) + \text{TZS20,000}(0.30) + \text{TZS10,000}(0.50) \\ &= \text{TZS3,000} + \text{TZS6,000} + \text{TZS5,000} \\ &= \text{TZS14,000} \end{aligned}$$

$$\text{Target sales (in terms of units)} = \frac{\text{Fixed expenses} + \text{Target Profit}}{\text{Contribution per unit}}$$

Profit per unit = (0.11 x TZS14,000/0.55)

Hence, for X units, profit = TZS2,800X

Contribution = Fixed costs + Profit

TZS4,800X = TZS96 million + TZS2,800X

TZS4,800X - TZS2,800X = TZS96 million

TZS2,000X = TZS96 million

X = 48,000 total mixed units

Required sales units on the basis of budgeted sales mix:

Shirts: 48,000 units x 20% = 9,600 units

Trousers: 48,000 units x 30% = 14,400 units

T-shirts: 48,000 units x 50% = 24,000 units

Answer to SEQ 5

(a) The budgeted unit sales to generate a desired net income after taxes equal to 10% of sales dollars

WACM per iron

Product	A	B	C	D	E	F	Total
Contribution per iron (TZS) (40% of selling price)	20,000	24,000	28,000	32,000	36,000	40,000	180,000
Budgeted mix ratios based on units (%)	0.15	0.15	0.20	0.30	0.12	0.08	1.00
WACM	3,000	3,600	5,600	9,600	4,320	3,200	29,320

$$\begin{aligned} \text{Break-even point (in terms of units)} &= \frac{\text{Fixed expenses}}{\text{Contribution per unit}} \\ &= \frac{\text{TZS293.2 million}}{\text{TZS29,320}} \\ &= 10,000 \text{ irons} \end{aligned}$$

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Product	A	B	C	D	E	F	Total
Budgeted mix ratios based on units (%)	0.15	0.15	0.2	0.3	0.12	0.08	1
Budgeted sales mix at BEP	1500	1500	2000	3000	1200	800	10,000

In order to achieve a target net profit of 10% on sales revenue:

Suppose irons sold = X

Profit per iron = Weighted average selling price x 10% profit

$$\begin{aligned}
 &= (\text{TZS}50,000 \times 0.15 + \text{TZS}60,000 \times 0.15 + \text{TZS}70,000 \times 0.20 + \text{TZS}80,000 \times 0.30 + \\
 &\text{TZS}90,000 \times 0.12 + \text{TZS}100,000 \times 0.08) \times 10\% \\
 &= (\text{TZS}7,500 + \text{TZS}9,000 + \text{TZS}14,000 + \text{TZS}24,000 + \text{TZS}10,800 + \text{TZS}8,000) \times 10\% \\
 &= \text{TZS}73,300 \times 10\% \\
 &= \text{TZS}7330
 \end{aligned}$$

Hence total profit = TZS7,330X

Profit before taxation = TZS7,330X/0.65 = TZS11,277X (approx.)

Required sales to achieve target profit (in terms of units) = $\frac{\text{Fixed expenses} + \text{Target profit}}{\text{Contribution per unit}}$

$$X = \frac{\text{TZS}293,200,000 + \text{TZS}11,277X}{\text{TZS}29,320}$$

$$\text{TZS}29,320X = \text{TZS}293,200,000 + \text{TZS}11,277X$$

$$\text{TZS}293,200,000 = \text{TZS}18,043X$$

$$X = \text{TZS}293,200,000 / \text{TZS}18,043$$

$$X = 16,250 \text{ irons (approx)}$$

This can be cross verified as follows:

Product	A	B	C	D	E	F	Total
Contribution per iron (TZS) (40% of selling price)	20000	24000	28000	32000	36000	40000	180000
Budgeted mix ratios based on units (%)	0.15	0.15	0.2	0.3	0.12	0.08	1
Number of irons produced	2438	2438	3250	4875	1950	1300	16250
Contribution	48,750,000	58,500,000	91,000,000	156,000,000	70,200,000	52,000,000	476,450,000
Less: Fixed Costs							(293,200,000)
Profit							183,250,000
Less: Taxation @ 35%							(64,137,500)
Net profit							119,112,500

Total contribution is TZS476,450,000 and hence total sales = TZS476,450,000/0.40 = TZS1,191,125,000

Net profit margin on sales = TZS119,112,500/TZS1,191,125,000 x 100 = 10%

(b) Suppose the mix ratios for products B and F were reversed

WACM per iron

Product	A	B	C	D	E	F	Total
Contribution per iron (TZS) (40% of selling price)	20,000	24,000	28,000	32,000	36,000	40,000	180,000
Budgeted mix ratios based on units (%)	0.15	0.08	0.2	0.3	0.12	0.15	1
WACM	3,000	1,920	5,600	9,600	4,320	6,000	30,440

$$\begin{aligned}
 \text{Breakeven point (in terms of units)} &= \frac{\text{Fixed expenses}}{\text{Contribution per unit}} \\
 &= \frac{\text{TZS}293,200,000}{\text{TZS}30,440} \\
 &= 9,632 \text{ irons}
 \end{aligned}$$

Product	A	B	C	D	E	F	Total
Budgeted mix ratios based on units (%)	0.15	0.08	0.2	0.3	0.12	0.15	1
Budgeted sales mix at BEP	1445	771	1926	2890	1156	1445	9,632

Impact on BEP

BEP will go down by 368 irons (i.e. 10,000 irons – 9,632 irons). This is because contribution per unit has increased as a result of the change in sales mix of B and F.

Impact on sales mix at BEP

Budgeted mix ratios based on units (%)	0.15	0.15	0.20	0.30	0.12	0.08	1
Budgeted sales mix at BEP	1,500	1,500	2,000	3,000	1,200	800	10,000
Budgeted mix ratios based on units (%)	0.15	0.08	0.20	0.30	0.12	0.15	1
Budgeted sales mix at BEP	1,445	771	1,926	2,890	1,156	1,445	9,632
Difference	55	729	74	110	44	(645)	368

In order to achieve a target net profit of 10% on sales revenue:

Suppose irons sold = X

$$\begin{aligned}
 \text{Profit per iron} &= \text{Weighted average selling price} \times 10\% \text{ profit} \\
 &= (\text{TZS}50,000 \times 0.15 + \text{TZS}60,000 \times 0.08 + \text{TZS}70,000 \times 0.20 + \text{TZS}80,000 \times 0.30 + \\
 &\quad \text{TZS}90,000 \times 0.12 + \text{TZS}100,000 \times 0.15) \times 10\% \\
 &= (\text{TZS}7,500 + \text{TZS}4,800 + \text{TZS}14,000 + \text{TZS}24,000 + \text{TZS}10,800 + \text{TZS}15,000) \times 10\% \\
 &= \text{TZS}76,100 \times 10\% \\
 &= \text{TZS}7,610
 \end{aligned}$$

Hence total profit = TZS7,610X

Profit before taxation = TZS7,610X/0.65 = TZS11,708X

$$\text{Required sales to achieve target profit (in terms of units)} = \frac{\text{Fixed expenses} + \text{Target profit}}{\text{Contribution per unit}}$$

$$X = \frac{\text{TZS}293,200,000 + \text{TZS}11,708X}{\text{TZS}30,440}$$

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$$\text{TZS}30,440X = \text{TZS}293,200,000 + \text{TZS}11,708X$$

$$\text{TZS}293,200,000 = \text{TZS}18,732X$$

$$X = \text{TZS}293,200,000 / \text{TZS}18,732$$

$$X = 15,652 \text{ irons (approx.)}$$

This can be cross verified as follows:

Product	A	B	C	D	E	F	Total
Contribution per iron (TZS) (40% of selling price)	20,000	24,000	28,000	32,000	36,000	40,000	180,000
Budgeted mix ratios based on units (%)	0.15	0.08	0.2	0.3	0.12	0.15	1
Number of irons produced	2,348	1,252	3,130	4,696	1,878	2,348	15,652
Contribution	46,956,000	30,051,840	87,651,200	150,259,200	67,616,640	93,912,000	476,446,880
Less: Fixed Costs							(293,200,000)
Profit							183,246,880
Less: Taxation @ 35%							64,136,408
Net profit							119,110,472

Total contribution is TZS476,446,880 and hence total sales = $\text{TZS}476,446,880 / 0.40 = \text{TZS}1,191,117,200$

Net profit margin on sales = $\text{TZS}119,110,472 / \text{TZS}1,191,117,200 \times 100 = 10\%$

Answer to SEQ 6

(a) Contribution margin income statement

	Total (TZS million)	Per unit (TZS'000)
Sales (30,000 inverters)	10,800	360
Less: Variable expenses (30,000 inverters)	7,560	252
Contribution	3,240	108
Less: Fixed expenses	2,700	
Net operating profit / EBIT	540	

Degree of operating leverage = Contribution margin/Net operating income
= $\text{TZS}3,240 \text{ million} / \text{TZS}540 \text{ million}$
= 6

(b) Expected increase in net operating income

The degree of operating leverage is 6. The net operating income is expected to increase 6 times the sales of Wind Charm Ltd.

Expected percentage increase in net operating income

= Percentage change in sales x 6
= $25\% \times 6$
= 125%

$$7,500 / 30,000 \times 100 = 25\%$$

Expected increase in total net operating income

= $\text{TZS}540 \text{ million} \times 125\%$
= TZS675 million

Answer to SEQ 7

(a)				
No of units	No of batches	Average direct labour cost	Total direct labour cost	
		TZS	TZS	
100	1	6,000	6,000.00	
200	2	4,800	9,600.00	
400	4	3,840	15,360.00	
800	8	3,072	24,576.00	Ans (i)
1,600	16	2,457.60	39,321.60	Ans (ii)
3,200	32	1,966.08	62,914.56	Ans (iii)
6,400	64	1,572.86	100,663.30	Ans (iv)

(b)			
No of units	3,200	6400	
	TZS	TZS	
Sales	224,000.00	448,000.00	
Direct material and other			
Non-labour related costs	144,000.00	288,000.00	
Direct labour cost	62,914.56	100,663.30	
Fixed cost	60,000.00	60,000.00	
Total costs	266,914.56	448,663.30	
(Loss)	(42,914.56)	(663.30)	

As can be seen from the table above the breakeven point seems to be slightly above 6,400 units.

(c) If the rate of learning were to be 90% instead of 80% this means that the labour time (and hence labour cost) per unit would reduce more slowly. Assuming that all other data remained unchanged then costs would be higher and hence the break-even level of sales would also be higher.

Answer to SEQ 8

(a) What is break even analysis?

Break even analysis is sometime known as CVP analysis which is the application of marginal costing and seeks to study the relationship between costs, volume and profit at differing activity levels and can be useful guide for short term planning and decision making.

It is more relevant where the proposed changes in activity are relatively small so that established cost patterns and relationships are likely to hold good. With greater changes in activity and over the longer term, existing cost structures, e.g. the amount of fixed costs and the marginal cost per unit are likely to change so C-V-P analysis is unlikely to produce useful guidance.

Typical short run decisions where CVP analysis may be useful include choice of sales mix, pricing policies, multi shift working and special order acceptance.

(b) Seven (7) assumption made under cost volume profit analysis

- (i) All costs can be resolved into fixed and variable elements.
- (ii) Fixed costs will remain constant and variable costs vary proportionately with activity.
- (iii) Over the activity range being considered costs and revenues behave in a linear fashion.
- (iv) That the only factor affecting costs and revenues is volume.
- (v) That technology, production methods and efficiency remain unchanged.
- (vi) Particularly for graphical methods, that the analysis relates to one product only.
- (vii) There are no stock level changes or that stocks are valued at marginal cost only.

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(c) To calculate:

$$\begin{aligned}
 \text{(i) Break-even point (in units)} &= \text{Fixed cost/contribution per unit} \\
 \text{Contribution} &= \text{selling price} - \text{marginal cost} \\
 &= \text{TZS50} - \text{TZS30} \\
 &= \text{TZS20}
 \end{aligned}$$

$$\begin{aligned}
 \text{BEP (units)} &= \text{TZS300,000/TZS20} \\
 &= 15,000 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) Break-even point (Sales)} &= \text{Units} * \text{Selling price} \\
 &= 15,000 * \text{TZS50} \\
 &= \text{TZS750,000}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii) CS ratio} &= (\text{Contribution per unit/Sales price per unit}) * 100 \\
 &= (20/50) * 100 \\
 &= 40\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv) Number of units for target profit} &= (\text{Fixed cost} + \text{Target profit}) / \text{Contribution per} \\
 &\quad \text{Unit} \\
 &= (\text{TZS300,000} + \text{TZS100,000}) / 20 \\
 &= 20,000 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{(v) Sales for target profit} &= ((\text{Fixed costs} + \text{Target profit}) * \text{Sales} \\
 &\quad \text{value/contribution}) \\
 &= 20,000 * \text{TZS50} \\
 &= \text{TZS1,000,000}
 \end{aligned}$$

(Alternatively, this figure can be deduced by the following reasoning. After break-even point the contribution per unit becomes net profit per unit, so that as 15,000 units were required at break-even point. 5,000 extra units would be required to make TZS100,000 profit.

Therefore, total units = 15,000 + 5,000 = 20,000 units * TZS50 = TZS1,000,000

$$\begin{aligned}
 \text{(vi) Number of units for target profit with 20% tax} &= (\text{Fixed cost} + (\text{Target profit} / (1 - \text{tax rate})) / \text{Contribution per unit} \\
 &= (\text{TZS300,000} + (100,000 / (1 - 0.20)) / \text{TZS20} \\
 &= 25,000 \text{ units}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vii) Note that the fixed costs, marginal cost and contribution have changed. Number of units for target} & \\
 \text{profit} &= (\text{TZS350,000} + \text{TZS100,000}) / \text{TZS15} \\
 &= 30,000 \text{ units}
 \end{aligned}$$

Note: The C/S ratio is sometimes known as PV ratio

SECTION B2: RELEVANT INFORMATION FOR DECISION MAKING

■ Get Through Intro

Decision-making is one of the most important managerial functions. It may involve choosing between alternatives. A cost benefit analysis has to be carried out in order to weigh each alternative. While doing so, it is very important to consider only those costs and benefits that are **relevant** to the concerned alternative.

This section discusses the concepts of relevant costs and opportunity costs and helps calculate them for a decision situation. The relevant costs for material, labour, and overheads are discussed.

This section will also help you, as a management accountant, to ascertain the above costs relating to a decision involved. A thorough understanding of these topics will help you solve the related exam questions correctly.

■ Learning Outcomes

- a) Explain the meaning of relevant costs and revenue.
- b) Differentiate between relevant costs and irrelevant costs.
- c) Evaluate the importance of qualitative factors in decision making.
- d) Identify the characteristics of relevant information.
- e) Identify and calculate relevant costs for specific situations from given data.

1. Explain the meaning of relevant costs and revenue.
2. Differentiate between relevant costs and irrelevant costs.

[Learning Outcomes a and b]

A management decision of any sort ultimately boils down to a 'cost-benefit analysis' which involves weighing up the different alternatives. In order to arrive at the best possible solution, the decision-maker needs to know which costs are really relevant to a decision and therefore merit consideration. The concept of relevant cost / revenue and the situations where a cost is relevant are discussed at length below:

1.1 Relevant cost / revenue for decision making



Definition

Relevant costs / revenues are the costs / revenues pertinent to the making of a specific managerial decision. These are essentially the future costs / revenues and should differ amongst the possible alternative courses of action.

Relevant costs and revenues are required for special studies such as:

1. Product-mix decisions when capacity constraints exist
2. Decisions on replacement of equipment
3. Special selling price decisions
4. Outsourcing (make or buy) decisions
5. Discontinuation decisions
6. Further processing decision

1.2 The features of relevant costs (note that relevant costs are broadly recognised by their features) are:

1. **The differential (incremental) costs** amongst the alternative courses of action are relevant.



Definition

Differential costs are the differences in total cost between alternatives; calculated to assist decision-making.

CIMA official terminology, 2005

In simple terms differential or incremental cost is the expenditure which will be incurred or can be avoided as a result of making a decision. The main difference between these two costs is that the **incremental cost** measures the additional unit cost for an addition in output. The incremental cost is expressed as cost per unit whereas the differential cost is measured in total. Both these costs are useful in planning and decision making and thereby help to choose the best alternative.

A cost that will remain the same irrespective of the alternatives is not a relevant cost.



Example

Albert goes to the office in his own car. One day he meets Julia, his friend, on the way to his office. She wants to go to the same place. Albert does not need to change his route to drop her at her destination. If Albert wants to charge Julia for the lift, how much should he charge?

Obviously the additional cost incurred by him for giving Julia a lift in his car is a justifiable cost that he could charge. Here, as he went by the usual route and didn't have to incur any additional cost. That is he will not incur any loss if he does not charge Julia for the lift.

On the other hand, if in order to drop Julia at her desired place, Albert needs to change his route and, in doing so, incurs an additional cost, the cost that he could charge Julia justifiably is the additional fuel cost (signifying the relevant cost) he incurs for diverting the route.

2. Future costs are relevant

Expected future costs that are a direct outcome of a decision are the only relevant costs in taking the decision and any cost that has already been incurred is not at all relevant. Whenever a decision is taken to do a job or to take up an activity, the costs related to that job or activity are future costs, and therefore, obviously relevant.

However, had a cost been incurred before taking the decision, the decision-maker would not need to consider that cost any longer and therefore the past costs (or **sunk costs**) are not relevant to the decision.



Example

Lindsey owned two houses. She lived in one and the other was empty. Even though the other house was empty, she needed to pay property taxes of TZS1 million every year for the house.

In the year 20X9, Lindsey decided to rent out the other house at TZS12 million per annum. The payment of TZS1 million as property taxes is unaffected by the decision to rent out the house. These taxes are incurred irrespective of whether or not the house is rented out. Therefore these costs are irrelevant to the decision-making. However, the net gain of TZS12 million (from rent) is a relevant cost for decision-making.

3. Only cash costs are relevant

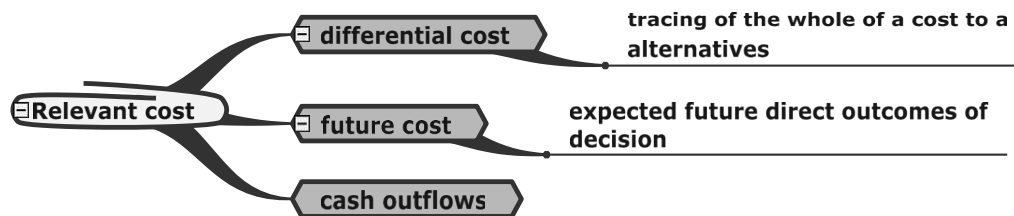
The relevant costs are cash outflows only; implying that the costs that do not reflect any cash expenditure are not considered when taking a decision.



Example

The non-cash costs include depreciation, notional costs (rent, interest and other fixed costs), and absorbed overheads.

SUMMARY



It is necessary to **distinguish relevant costs and irrelevant costs** as not each and every cost is important to management for decision making. As discussed above, relevant costs are future costs. An irrelevant cost is an indication of the past.

1.3 Irrelevant costs for decision making

The following costs are not considered while making a decision.

1. **Sunk costs** are costs that have already been incurred in the past. They are irrelevant for decision making, because they cannot be changed. For example depreciation on machinery is a sunk cost. This is because the cost of purchasing the machinery has already been incurred when the machinery was purchased and it does not affect any future action.
2. **Committed costs** are costs that will occur in the future due to management's decision in the prior period and is not subject to management control on a short term basis. Just like sunk costs these costs cannot be changed and therefore are irrelevant to a decision making process.

1.4 Fixed costs – relevant or irrelevant?

Usually, fixed costs are irrelevant when deciding on a future course of action, assuming that they are actually fixed and cannot be changed over the short-term. However, fixed costs indicate details about the business capacity like building space, available machine hours, available man hours, etc.



Example

A firm pays annual rent of TZS500 million for 50,000 square feet of space. It is a fixed cost, which gives an idea of the total space. If a firm is using only 40,000 square feet of space, it can use the remaining space when required with no extra rent (apart from TZS500 million) to be paid. And hence, this cost is irrelevant.

In some cases, fixed costs are relevant if they differ between the alternatives. Fixed cost matters only when an entity wants to decide whether or not to start a new business.



Example

In the case of two vehicles, one old and one new, when assuming the incremental cost of the new (more expensive) vehicle, the relevant costs would be the purchase price of the new vehicle (net of the resale value of the old vehicle) and the increases in the fixed costs of insurance and automobile tax and license.

Fixed costs are relevant as long as they are avoidable.

In short, the difference between relevant costs and irrelevant costs can be summarised as:

Relevant costs / revenues are essentially the future costs / revenues and should differ amongst the possible alternative courses of action and pertinent for managerial decision making whereas irrelevant costs / revenues are based on historical data and unaffected by management's actions.



Example

If a company is considering expanding the business, and for this, it will have to rent another office, the rent amount (i.e. the fixed cost) is relevant.

However, if it wants to launch a new product and will not need to rent new space, the rent that it is already paying is not relevant.



Test Yourself 1

Pancard Ltd has decided to start a new manufacturing unit. On 20 November 20X8 it placed an order for a metal-cutting machine. The company paid an advance of TZS10 million. The date of delivery was decided as 31 January 20X9. At the time of delivery, Pancard Ltd was supposed to make the full and final payment.

Accordingly the company received the delivery and made the final payment. On 1 February 20X9 the company decided not to start the manufacturing activity.

Is the machinery cost relevant to the decision not to start the manufacturing unit?



Test Yourself 2

Cargo Ltd had given an advance of TZS1 million to Garry, a tailor, for sewing uniforms for the staff. However, Garry became insolvent. Cargo Ltd received neither the uniforms nor the money it had paid to Garry. In the next month Cargo Ltd decided to purchase new uniforms.

Is the cost (advance given to Garry) relevant to the decision to purchase new uniforms?

3. Identify and calculate relevant costs for specific situations from given data.
 4. Evaluate the importance of qualitative factors in decision making.
- [Learning Outcome c and e]

2.1 Relevant costs for materials

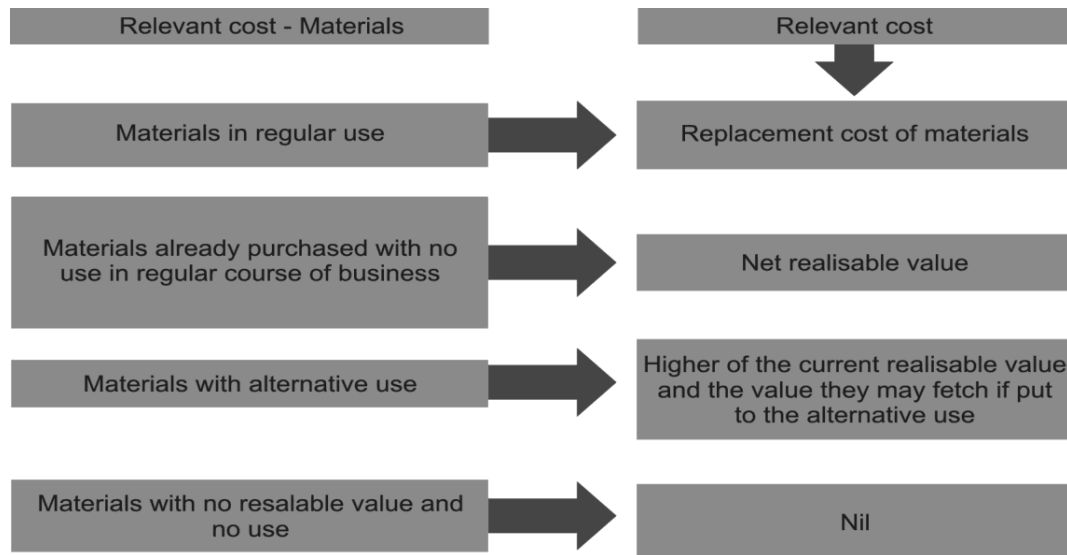
The relevant cost of materials is their **current replacement cost**. It may be noted that the costs of materials already purchased are not relevant and are considered to be sunk costs.

For the materials that are already purchased but do not have any use in the regular course of the business, the relevant cost is their **current realisable value**.

In cases where the materials have an alternative use, the relevant cost will be the higher of their current realisable value and the value they may fetch if put to the alternative use.

If there is no realisable value and no other alternative use, the relevant cost of the materials will be nil.

Diagram 1: Relevant cost of materials



Example

Special Ltd has been approached by a customer who would like a special job to be done for him and is willing to pay TZS22 million for it. The job would require the following materials:

Material	Total Units required	Units already in inventory units	Book value of units in inventory TZS'000 / unit	Realisable value TZS'000 / unit	Replacement cost TZS'000/ unit
A	1,500	0			9
B	1,500	900	3	3.75	7.50
C	1,500	1,050	4.50	3.75	6
D	300	300	6	9	13.50

- (i) Material B is used regularly by Special Ltd and if inventories are required for the job they would need to be replaced to meet other production demands.
- (ii) Material C and D are in inventory as a result of excess purchase and they have restricted use. No other use can be found for material C but material D can be used in another job as a substitute for 450 units of material E which currently costs TZS7,500 per unit (of which the company has no units in inventory at the moment).

What are the relevant costs of material in deciding whether or not to accept the contract? Assume all other expenses on this contract to be specially incurred. In addition, the relevant cost of material is TZS8.25 million.

Continued on the next page

Answer

- (a) Material A is not in inventory. It would have to be purchased in full at the replacement cost of TZS9,000 per unit, which is the relevant cost. Therefore the total cost would be $1,500 \times \text{TZS}9,000 = \text{TZS}13.50$ million
- (b) Material B is used regularly by the company. There is an existing inventory of 900 units but if it is used for the contract, further 900 units would have to be purchased to replace the current inventory. Therefore the existing inventory is of no relevance. The relevant costs are therefore 1,500 units at the replacement cost of TZS7,500 per unit i.e. $1,500 \times \text{TZS}7,500 = \text{TZS}11.25$ million.
- (c) Material C: 1,050 units are in inventory. Therefore the balance of 450 units ($1,500 - 1,050$) will have to be purchased at TZS6,000 per unit to meet the total requirement of 1,500 units. Hence the relevant cost will be $450 \times \text{TZS}6,000 = \text{TZS}2.70$ million

Since the existing inventory will be utilised for the contract, it will lose the opportunity of being sold at TZS3,750 per unit.

Therefore, relevant cost = $\text{TZS}1.05 \text{ million} \times \text{TZS}3,750 = \text{TZS}3.9375$ million

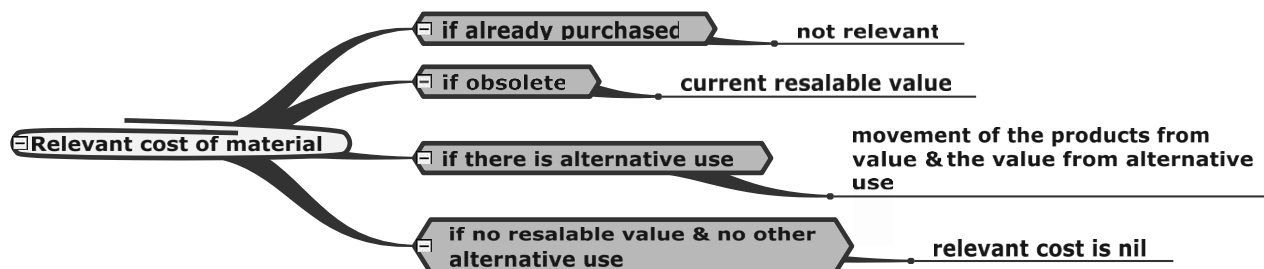
Total relevant cost = $\text{TZS}2.70 \text{ million} + \text{TZS}3.9375 \text{ million} = \text{TZS}6.6375$ million

- (d) Material D: This is already in inventory and will not be replaced. If used for the contract, it will lose the opportunity of:

- (i) Sale of the inventory at TZS9,000 per unit = $300 \times \text{TZS}9,000 = \text{TZS}2.70$ million
 (ii) Avoiding other purchase of material E = $450 \times \text{TZS}7,500 = \text{TZS}3.375$ million

The higher of (i) and (ii) i.e. TZS3.375 million is the relevant cost.

Total relevant cost for all material = TZS million ($13.5000 + 11.2500 + 6.6375 + 3.3750$) = TZS34.7625 million

SUMMARY**2.2 Relevant costs for labour**

If the existing workforce is idle and a decision is being made as to whether or not to use this workforce for a project / job, the labour cost is not relevant and should not be considered for evaluating whether the project / job is to be pursued or not.

**Example**

Move Fast Ltd, an aircraft manufacturing company, received an enquiry from Decision Ltd, a courier company. The enquiry was for two carrier aircrafts that would have to be made to order. For this special order, 1,000 labour hours are required and presently spare labour capacity is available.

In this situation the direct labour cost incurred will remain the same for all the alternatives (i.e. irrespective of whether the special order is accepted or not). Hence, the labour cost is not relevant to the decision of whether to supply the made-to-order aircraft or not.

If the workers are hired out for a job, the labour cost is relevant. In cases where, in order to execute a job / project, workers are required to work overtime, the **overtime payment** is the relevant cost.

If the existing workforce is engaged in any other job and they are being considered for a different project / job (if the employees can be shifted without affecting the job in which they are currently engaged), the relevant cost would be the higher amount between the labour cost payable to the workforce and the labour cost that needs to be paid if outside labourers are hired.



Example

Software Solutions Plc is in the process of developing software for two different clients simultaneously. The job for client 2 needs the service of two additional programmers. They may be hired out temporarily from the market at a remuneration of TZS5 million each per month or they may be taken from the team engaged in the job for client 1. The monthly salaries are TZS4.5 million each for the two programmers who are on roll and can be shifted to the job for client 2 from the job for client 1. In such a situation, the relevant cost of the two programmers to be considered in the job for client 2 is TZS10 million each (i.e. TZS5 million x 2).

Apart from the situations stated above, yet another situation might occur where spare labour capacity is not available; additional labour cannot be hired out and at the same time overtime work is not possible.

In this situation, labour required for a specific job can be obtained by switching the workers over from the jobs in which they are working at present. This arrangement would help to fulfil the commitments for executing the special order but at the cost of not executing the job in which the workers were originally engaged. **The resultant loss in contribution (known as opportunity cost) would be the relevant cost for the special order.**



Example

Entertainment Ltd manufactures computers. It has received an enquiry for a bulk order from Think Ahead Ltd for which 5,000 labour hours are required. Labour is currently in short supply and overtime work is not possible. The details of the cost and selling price of the computer are as follows:

	TZS'000	TZS'000
Selling price		200
Less:		
Direct labour (10 hours at TZS12,000 per hour)	120	
Other variable costs	48	(168)
Contribution		32

To accept this order the only available alternative is to reduce the existing production.

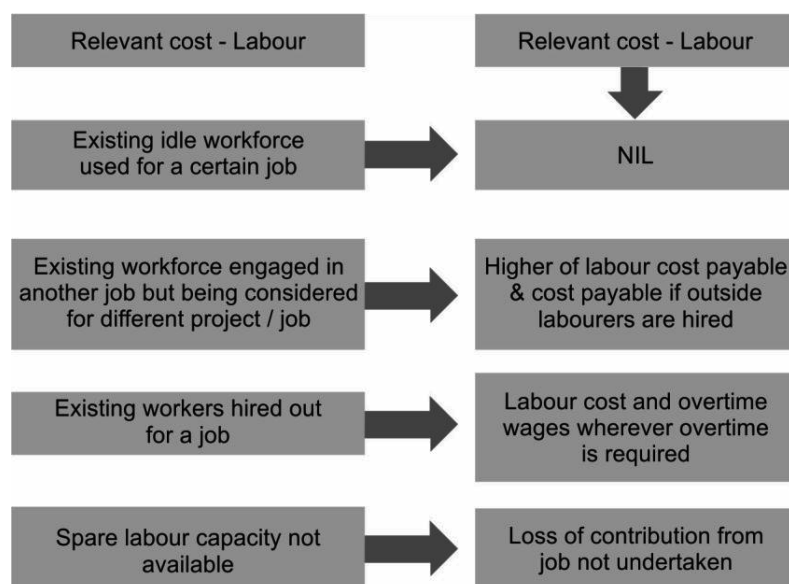
For this order, the required labour hours are 5,000. Hence, the required reduction in existing production is $5,000/10 = 500$ units.

Therefore, the total loss of contribution / opportunity cost = $500 \times \text{TZS}32,000 = \text{TZS}16 \text{ million}$

Hence, total relevant cost of the offer if accepted from Think Ahead Ltd is as follows:

	TZS million
Labour cost (5,000 hours at TZS12,000 per hour)	60
Opportunity cost	16
Total	76

Diagram 2: Relevant cost of labour



Test Yourself 3

Benchmark Ltd is a furniture manufacturing company. The standard cost card of the company is as follows:

	TZS'000
Direct material (5 kilograms at TZS10,000)	50
Direct labour (7 hours at TZS12,000)	84
Other variable costs	10
Total cost	144
Selling price	170
Contribution (selling price – total variable cost)	26

In addition to regular orders, Benchmark is considering a new job assignment for which 20 labour hours are required. In this situation:

- What is the relevant cost of labour if it is the policy of the company to hire labour on an hourly basis at the same cost (TZS12,000)?
- What is the relevant cost of labour if the company has spare capacity?
- What is the cost of labour if the labour is in short supply and overtime is not possible?



Test Yourself 4

- Glory Ltd is a supplier of cotton for Wonder Textiles. Glory sold 5,000 kg of cotton in March 20Y0 at a price of TZS4,000 per kg. In May 20Y0, Wonder received a contract for readymade shirts, which would require 8,000 kg of cotton that is used regularly in normal production.

The cotton purchased from Glory in the last financial year has not been used in the production process till date and is included in the amount of opening inventory. Glory Ltd has increased its selling price per unit by 3% since the last month.

Required:

What will be the relevant cost of materials for the project?

- Wonder Textiles has a 10 year old sewing machine with a cost price of TZS5 million. The rate of depreciation on the sewing machine is 10% per annum. The scrap value is TZS0.75 million. It has not been used in the operations for some months. The resale value of that machine is TZS1.20 million. It can be used for 8 months, for the contract which Wonder has received. At the end of eight months, after the contract, it would have no saleable value. The cost of disposal and dismantling of the sewing machine would be TZS0.60 million.

Continued on the next page

Required:

What will be the relevant cost of the sewing machine to the contract?

- (c) For the contract which is under consideration, the labour hours required are 1,200. There are 675 hours of spare labour capacity for which the workers are still being paid the normal rate of pay. The remaining hours required for the contract can be obtained either by working overtime, paid at 50% above the normal rate of pay, or by diverting labour from the manufacture of trousers. If the contract is undertaken and labour is diverted, then sales of trousers will be lost.

The production of trousers takes eight labour hours per unit to manufacture and makes a contribution of TZS24,000 per unit. The normal rate of pay for labour is TZS10,000 per hour.

Required:

What is the total relevant labour cost to the contract?

2.3 Relevant costs for overheads

For overheads, **the cardinal rule** is that the variable overheads are relevant to decision-making while the fixed costs are irrelevant. However, there are exceptions to this rule. Hence, each item of variable and fixed costs needs to be analysed to identify its relevancy.

The situations where **variable costs** are not relevant:

- Depreciation** is never relevant even in a situation where it might have been charged on an activity basis and classified as a variable cost.



Tip

The depreciation charged on a machine specifically bought for a new assignment would also be treated as an irrelevant cost. The cost of the machine would be a relevant cost but the depreciation, being a sunk cost, would be irrelevant.

- Indirect labour**, although variable, may be of the nature of a committed cost (i.e. although the cost would be incurred in the future, its occurrence is certain irrespective of the decision to pursue the job or not).

The situations where **fixed overheads** are relevant:

- In order to take up any job / project, if any fixed cost is stepped up, the increase in the fixed cost is relevant.
- In the case of considering discontinuation of a product / activity, if a part of the fixed costs can be avoided, the reduction in the fixed cost is relevant.



Example

The rent of a plant taken on hire is a fixed cost. If production in the plant is discontinued, the plant will no longer be in use and so the money spent on rent will be saved. When taking the decision to discontinue the product, the rent of the plant is a relevant cost.



Test Yourself 5

Campco Ltd needs 10,000 units of a certain part to use in its production cycle. The following information is available:

Standard cost card for the part

	TZS'000
Direct material	2
Direct labour Variable	8
overheads Absorbed fixed	4
overheads Total cost	5
	19

The company can buy this part from the open market for TZS17,000. Expenditure on fixed overheads will remain the same irrespective of the decision. Advise the company whether it should buy from the market instead of making the part.

2.4 Relevant costs associated with non-current assets

The carrying amount of the historical cost (i.e. the book value) of the non-current costs is a sunk cost and is of no relevance in decision-making. The **residual value** or the **realisable value** of a non-current asset is relevant. The **replacement cost** of an asset is also relevant.

If capital expenditure (investment in non-current assets) remains unchanged under different alternatives, then such expenditure is considered to be irrelevant to a decision.



Example

For executing a special order, if the existing infrastructure is found to be sufficient (i.e. if additional cash outflow is not required), the book value of the non-current asset is not relevant.

Depreciation on a non-current asset is **not relevant** in decision-making as depreciation does not result in a future cash flow.

If a non-current asset is sold, cash flows must be considered for decision making.

Ultimately, to calculate the relevant cost of a non-current asset one must consider the amount of money an organisation would like to receive (known as deprival value) if it were deprived of the asset in order not to be worse off than it presently is.

The **deprival value of a non-current asset** can be derived in two steps:

Find the **higher value** of the **residual value** and the **revenue expected to be generated** if the asset continues in operation.

Compare the resultant figure of step 1 with the **replacement cost** of the asset. The **lower value** of the two is the deprival value.



Example

A machine was bought five years ago at a cost of TZS20 million. The residual value (net of the costs of disposal) of the machine is TZS5 million. If the machine continues to operate, it is expected to generate revenue of TZS7 million. An equivalent machine in the same condition is available in the market at TZS6 million. What is the relevant cost of the machine?

Answer

The cost of the machine is past / sunk cost and hence not relevant.

The relevant cost of the machine (i.e. the deprival value of it) is:

The higher value of (a) the residual value i.e. TZS5 million and (b) expected revenue i.e. TZS7 million.

The lower value of (a) the replacement cost TZS6 million and (b) the higher value as calculated (i.e. TZS7 million) gives the relevant cost of the machine.

Therefore the relevant cost of the machine is TZS6 million.

3. Evaluate the importance of qualitative factors in decision making.

[Learning Outcome c]

Quantitative factors provide a numerical basis for decision making. The management takes the following quantitative factors into consideration for decision making:

- Incremental cost
- Incremental revenue
- Initial outlay
- Tax rates, etc.

The following quantitative techniques are used by organisations to evaluate the impact of the above mentioned quantitative factors:

- Break even analysis
- Market research
- Sales forecasting
- Decision trees
- Investment appraisal
- Critical path analysis

Importance of qualitative factors in decision making

However, quantitative data discloses only part of the story, other qualitative factors also need to be taken into account. Qualitative factors are the factors relevant to a decision that are difficult to measure in terms of money. Qualitative factors may include:

- Effect on employee morale, schedules and other internal elements;
- Relationships with and commitments to suppliers;
- Effect on present and future customers; and
- Long-term future effect on profitability.



Example

The cost of manufacturing a component internally may be more expensive than buying it from an outside supplier. In such circumstances, it would be beneficial for companies to buy that component from the market rather than manufacturing it in-house. In case a company decides to buy that component from the market on a permanent basis, it might need to close down its internal manufacturing unit.

This decision could result in decline in employees' morale. Moreover, it may also adversely affect their quality of work.

If a company decides not to buy the component from the market, it may adversely impact the relationship with its supplier since it will not be buying the component from the supplier. As a result, the supplier might decide to increase prices for subsequent contracts. This could affect future profits.

Furthermore, if the supplier does not deliver goods on time, the company may not be able to meet customer requirements on time.

The following qualitative techniques are used by organisations to evaluate the impact of the above mentioned qualitative factors:

SWOT analysis: this is a strategic planning tool used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project, a business venture or in any other situation requiring a decision in pursuit of an objective.

PEST (political, environmental, social, technological) analysis: this is a useful strategic tool for understanding market growth or decline, business position, potential and direction for operations.

HRM (human resource management): this refers to a strategic and coherent approach to the management of an organisation's most valued assets - the employees who individually and collectively contribute to the achievement of the objectives of the business.

Stakeholder analysis: this refers to identifying all persons, groups and institutions that may have an interest in a project and taking steps to manage their interests and expectations so that the project runs as well as possible. Stakeholder analysis is closely linked to risk management and change management.

In some decision-making situations, qualitative aspects are more important than immediate financial benefit from a decision.

4. Identify the characteristics of relevant information.

[Learning Outcome d]

Good quality of information forms the foundation of good planning. To formulate effective plans, one needs to have the appropriate information at hand. The **characteristics of relevant information are as follows:**

- Accuracy
- Comprehensiveness
- Clarity (should be clear and easy to understand)
- Relevance (should be relevant; only pertinent information to be provided)
- Reliable (should be from authentic sources)
- Channel of communication (to be suitable for the recipient and nature of information)
- Timely (information to be provided at appropriate time)
- Cost effective
- Appropriate recipient
- Volume (should be concise)

For decision making purposes, **relevant information** should have the following characteristics:

1. Relevance
2. Timeliness
3. Completeness
4. Accuracy
5. Cost effectiveness
6. Reliability

1. Relevance

Pertinent information is an important attribute of any good information. Irrelevant information will cloud the issue and annoy the reader. The provider of the information should ensure that they understand the purpose and supply only that information which is **necessary to fulfil the purpose**.



Example

Information was requested for the sales of product A for the last two months. However the information supplied described the attributes of product A, its market penetration, and concluded with the information on sales for the previous two months. The first two sets of information were not necessary to the recipient in this instance.

The extra details supplied wasted the readers' and the preparers' time unnecessarily as the readers' only interest was to know the sales during the last two months.

2. Timely

Information given to the user must be given at an **appropriate time**. The time frame for preparation of information should match that of the decision making process. Monthly management meetings require monthly management information and not weekly.



Example

'Besco bakers' is a bakery which has been successfully running its bakery business for the last twenty years. It sells, on average, 20,000 loaves of bread per week. If at any time they run out of bread, customers will not wait, but go to a competitor. Therefore it is important that whenever bread levels go below a certain level, e.g. 3,000 loaves, bread must be re-ordered. If this does not happen, Besco bakers will soon run out of the bread stock and a stock-out can occur.

3. Accuracy

Inaccurate information can lead to poor and misguided decision making. However, information only needs to be **accurate for the purpose**. Pointless accuracy affects clarity and timeliness.



Example

The HR manager of Royal Motors Company has been informed by the departmental manager that there are 175 agency staff working on an urgent project and there is a need for 25 additional agency staff to complete the work on time. But in reality 178 agency staff were working and the additional requirement was for only 18 staff. Therefore the company incurred the **extra cost** of 7 agency staff because of **inaccurate reporting**.

4. Completeness

Decisions based on incomplete or inadequate information can turn out to be bad decisions. **At times decision making** becomes impossible on the basis of incomplete information.



Example

The decision to sell soft drinks based on incomplete data about the demography of the region can turn out to be disastrous if the youth population in the region, who are the major customers for soft drinks, is only 20%.

5. Cost Effective

The **beneficial value** of information communicated should be more than the cost incurred to generate and convey that information.

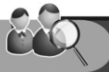


Example

If the cost of maintaining records for the reimbursement of personal telephone calls made from office is more than the cost of telephone call expenses itself, it is advisable not to maintain such records. So, if it costs an administrator TZS20,000 per hour to go through the records, and this takes 3 hours, it costs the company TZS60,000. However if the personal calls made are only worth TZS10,000 then the company is losing money performing this exercise.

6. Reliable

Information should be generated from reliable data. In other words, information should be **authentic**, that is obtained from **reliable sources**. To enhance the confidence of the user the information should be supported with documents. If any **assumptions** are made, they should be **stated clearly**.



Example

If an 'Annual Report' of a company says that the company has made a 20% profit, it should be supported by the detailed financial statements authenticated by an auditor's seal and signature. This increases the user's confidence in the financial statements.

However, if the same profit is broadcast on a website it will not be as credible as users feel the site may or may not be authentic and reliable.

Answers to Test Yourself

Answer to TY 1

Expenditure to be incurred in future as a result of a past decision is known as a **committed cost**. This is not relevant to decision-making.

Pancard Ltd had given a commitment to pay the balance amount on the delivery of the machine and accordingly it was paid. This cost does not affect the decision not to start the manufacturing unit.

Answer to TY 2

Since Garry became insolvent, Cargo Ltd could not receive its TZS1 million. This cost is therefore a sunk cost. Sunk costs are not relevant for decision-making as the money is already spent and cannot be recovered.

Answer to TY 3

(a) Relevant cost where the labour is hired on hourly basis

The company will have to hire labour for the exact hours required for production.
Hence, the relevant labour cost = 20 hours x TZS12,000 = TZS240,000.

(b) Relevant cost when the company has spare labour hours

Where the company has spare labour capacity, the direct labour cost will remain the same in all alternatives (i.e. whether special order is accepted or not). Hence, the labour cost is not relevant in decision-making. Hence relevant labour cost is 'zero'.

(c) Relevant cost of labour where labour is in short supply

In this situation the company will have to spare the existing labour from their current jobs so that they can fulfil the additional order. Therefore the opportunity cost of labour in this case will include not only the cost of labour but also the contribution lost when the labour is moved away from the current job.

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One unit of computer requires 7 labour hours, hence the contribution earned per labour hour

$$\begin{aligned}
 &= \frac{\text{Contribution per unit of production}}{\text{Required labour hours per unit}} \\
 &= \frac{\text{TZS}26,000}{7} \\
 &= \text{TZS}3714.28
 \end{aligned}$$

Relevant labour cost of new job

	TZS'000
Direct labour cost (20 hours at TZS12,000)	240,000.00
Add: Opportunity cost (20 hours at TZS3714.28)	74285.60
Total relevant labour cost	314,285.60

Answer to TY 4

(a) Relevant cost of materials to the contract = Required quantity of materials x Current purchase price per unit
 = 8,000 kg x (TZS4,000 x 1.03)
 = 8,000 kg x TZS4,120
 = TZS32,960,000

(b) Relevant cost of the sewing machine to the contract = Today's opportunity cost + Cost of disposal at the end of 8 months
 = TZS1.20 million + TZS0.60 million
 = TZS1.80 million

(c) Labour hours required 1200 hours
 Shortfall labour hours = 1200 hr - 675hrs
 = 525 hrs

Working overtime cost = 525 hrs x TZS10,000 x 1.5
 = TZS 7,875,000

Relevant cost of labour to the contract = Required additional labour hours for the contract x (Pay per hour + Opportunity costs of trousers)
 = 525 hours x (TZS10,000 + TZS3,000)
 = TZS6,825,000

Therefore, Diverting labour from manufacturing result into lower cost of TZS 6,825,000

Workings

W1 Required additional labour hours

Wonder has an idle capacity of 675 hours; hence additional 525 hours will be required for the production of shirts.

W2 Contribution from trousers per labour hour

$$\begin{aligned}
 \text{The contribution per labour hour from the production of trousers} &= \frac{\text{Contribution per trouser}}{\text{Required labour hours per trouser}} \\
 &= \frac{\text{TZS}24,000}{8 \text{ hours}} \\
 &= \text{TZS}3,000
 \end{aligned}$$

Answer to TY 5

If Campco Ltd decides to manufacture the part, it will have to incur the following costs:

	TZS'000
Direct material	2
Direct labour	8
Variable overheads	4
Total cost	14

The company is going to incur fixed overheads irrespective of the decision taken. Hence, the cost of fixed overheads is irrelevant to the decision.

The cost of production comes to TZS14,000 (excluding fixed overheads absorbed) and the cost of buying the part from the market is TZS17,000. Therefore the company should manufacture the part in its own factory.

Quick Quiz

- Kelly Co has been making a machine for a customer to order. However, the customer has gone into liquidation and there are no chances of recovering anything from the customer. The costs incurred to date in manufacturing the machine are TZS41 million. The marketing department has found another company which is ready to buy the machine for TZS20 million after some modifications. The cost of modification is as follows:

- 1 million which is already in stock and has no other alternative use
- Labour cost TZS2.5 million (workers are appointed on an hourly basis)

If the company decides to sell this machine for TZS20 million what are the relevant costs involved in the decision?

- A** TZS3.5 million **B** TZS2.5 million **C** TZS44.5 million **D** TZS20 million

- Jumbo Ltd has been approached by Giant Ltd who wants a special job done. Giant Ltd is ready to pay only TZS51 million. This special order requires the following material:

Material	Required units	Book value of units available in inventory (TZS'000)	Realisable value (TZS'000)	Replacement cost per unit (TZS'000)
A	500	0	0	3
B	100	200	0	20
C	230	230	8	10

- Material B is not regularly used by Jumbo Ltd. It has been lying in inventory for the past two years and now it is no longer saleable.
- Material C is regularly used by Jumbo Ltd. If the material is required for this special job, it needs to be replaced in order to meet other production demands.

What are the relevant costs of the materials, in deciding whether or not to accept the special job?

- A** Material A - TZS1.5 million Material B - 0 Material C - TZS2.3 million
B Material A - TZS1.5 million Material B - 2 million Material C - TZS2.3 million
C Material A - TZS1.5 million Material B - TZS02 million Material C - TZS1.84 million
D Material A - 0 Material B - TZS02 million Material C - TZS2.3 million

- Giga Ltd had given its annual requirement of material 'A' as 240,000 units. If Giga Ltd gives a single order for 240,000 units it will get a discount of 5%. Otherwise the company can continue to give monthly orders for 20,000 units. However, in that case the company can invest surplus funds with a bank at the rate of 5% per annum.

What is the opportunity cost assuming Giga Ltd gives a one-time order for 240,000 units at the beginning of the year?

- A** Discount received
B Interest foregone
C Discount received – interest that would have been received
D None of the above

- Smile Ltd runs a mall. The building of the mall is owned by the company. Budgeted revenues and costs for the mall are given below:

Annual sales	TZS500 million
Cost of sales	TZS440 million
Maintenance cost of building	TZS25 million

Smile Ltd can lease this building to another company for TZS5 million per month.

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What is the opportunity cost if the company wants to continue its business and not give the building on lease?

- A TZS60 million
- B TZS35 million
- C TZS25 million
- D None of the above

5. Which of the following is considered a relevant cost in decision-making?

- A Sunk cost
- B Committed cost
- C Incremental cost
- D none of the above

6. Dolly purchased a car for official use. She does not travel by car all the time. Sometimes she travels by train or by air. State whether the following costs are relevant in the decision to travel by train:

- A Cost of car insurance
- B Petrol cost

7. A sunk cost is:

- A A cost that may be saved by not adopting an alternative
- B A cost that is not relevant in decision-making
- C A cost that can be postponed to the future with no effects on the current decision
- D None of the above

8. An entity requires 120 litres of raw material P. It already has 45 litres of P in its inventory which it purchased 6 months ago at a cost of TZS16,000 per litre. The entity no longer needs material P for its production and wants to dispose it of at a minimum price of TZS12,000 per litre. The current purchase price of the product is TZS16,000 per litre. State the total relevant cost of raw material P for the project.

- A TZS1,385,000
- B TZS1,740,000
- C TZS1,360,000
- D TZS1,450,000

9. Bee Ltd bought an asset many years ago at a cost of TZS15 million. The value of the asset is now TZS3 million. The asset is no longer used for production purposes and needs to be disposed of for at least TZS2.4 million. However, currently Bee Ltd is working on a project which would require this particular asset for production for at least six months. So Bee Ltd is planning to sell the asset, after using it for the project, at a cost of TZS1.5 million.

State the relevant cost of the asset for the project.

- A TZS0.6 million
- B TZS0.9 million
- C TZS1.5 million
- D TZS3.0 million

Answers to Quick Quiz

1. The correct option is B.

The cost that Kelly Co had incurred on the machine is not relevant in the decision as it is a sunk cost (a cost which was incurred in the past). In modifying the machine the company is going to use material that is not saleable. Hence, the material cost is also not relevant to the decision.

Kelly Company is going to appoint labour for the amount of hours required for the modification work. The labour cost will increase if the offer is accepted and it will reduce if the offer is not accepted. Hence, the labour cost is relevant to the decision.

The total relevant cost in the decision to sell the machine for TZS20 million is only the labour cost i.e. TZS2.5 million.

2. The correct option is **A**.

Relevant cost of using the material for the special order:

Material A is not available in inventory. Jumbo Ltd needs to purchase the material from the market. Hence, the cost of purchase is the relevant cost i.e. $(500 \times \text{TZS}3,000 = \text{TZS}1.5 \text{ million})$.

Material B is available in the inventory but it is no longer saleable. Its realisable value is zero. This material is not regularly used in production and therefore it need not be replaced. The cost that is already incurred is not relevant. Hence, the relevant cost of material B is 0.

Material C is available in inventory but it is also used in the production of other products. If material C is used for this special order then it needs to be replaced so as to meet other production demands. Hence, replacement cost is relevant in the decision i.e. $(230 \times \text{TZS}10,000 = \text{TZS}2.3 \text{ million})$.

3. The correct option is **B**.

Opportunity cost is the value of an opportunity foregone. In the case of Giga Ltd, if the company opts for the alternative to give a single order for 240,000 units then the company will get a discount of 5%. However, at the same time the company will lose the opportunity to invest the surplus funds as the funds will get blocked in the inventory. Hence the opportunity cost will be the interest foregone.

4. The correct option is **A**.

In the case of Smile Ltd, when the company decides to continue with the present business it will lose the opportunity of giving the mall building on lease. The company will have to forgo the lease income of TZS60 million $(\text{TZS}5 \text{ million} \times 12)$. Therefore the opportunity cost is TZS60 million.

5. The correct option is **C**.

Incremental costs are relevant because they are the direct outcome of the decision taken.

Sunk costs and committed costs cannot be changed or recovered and thereby are irrelevant to decision-making.

6. The correct option is **B**.

Dolly, being the owner of the car, had paid insurance premium for it. The decision to use the car or not, does not have any effect on the payment of insurance and hence it is a sunk cost. However, the cost of petrol is relevant as it is bound to vary with the decision. If Dolly travels by car, she has to spend on petrol. Hence petrol cost is a relevant cost.

7. The correct option is **B**.

A sunk cost is also known as a past cost. These costs do not have any cash flows in the current period when the decision is being taken. Hence, these are irrelevant to a decision.

Alternatives 'A' and 'C' are not correct as sunk costs are incurred in the past. Therefore we cannot save the costs that are already incurred in the past nor can we postpone the costs already incurred to the future.

8. The correct option is **B**.

45 litres of material P is already in inventory and the current requirement is 120 litres. Hence the relevant cost will be calculated as follows

		TZS
Cost of buying $(120-45 = 75)$ litres	$75 \times \text{TZS}16,000$	1,200,000
Contribution lost from 45 litres	$45 \times \text{TZS}12,000$	540,000
Total relevant cost		1,740,000

9. The correct option is **B**.

Relevant cost = lost sales revenue = $\text{TZS}2.4 \text{ million} - \text{TZS}1.5 \text{ million} = \text{TZS}0.9 \text{ million}$

Self Examination Questions

Question 1

Plasma Plc deals in plastic buckets and bottles. It uses polystyrene for manufacturing buckets, and polyethylene terephthalate for manufacturing bottles. For every unit of bucket and bottle, it requires 0.5 kg of the required raw material each.

Plasma has received a bulk order for 1,000 buckets and 800 bottles, and is evaluating this order. The data relating to the raw material requirements are as follows:

	Polystyrene	Polyethylene terephthalate
Required quantity for the order	500 kg	400 kg
Inventory in hand	150 kg	80 kg
Original cost of inventory in hand (TZS'000/kg)	60	80
Current purchase price of the materials (TZS'000/kg)	65	74
Current resale price of the materials (TZS'000/kg)	66	60

Polystyrene is regularly used by the company in the normal production of buckets. However, Plasma has decided to stop the production of bottles, and so polyethylene terephthalate is no longer in use by the company and it has no alternative use within the business.

Required:

Compute the total relevant cost of materials for the project.

Question 2

Paradise Inc is in the business of manufacturing steel furniture. It is small scale business. The management of Paradise is considering undertaking a one-off contract which, if accepted, needs to be executed after three months.

Bank overdraft of TZS8 million would be required for the project duration of three months as finance. The overdraft would be repaid at the end of the period. Paradise uses a cost of capital of 20% to appraise projects. The bank's overdraft rate is 18%. In order to determine the profitability of the received order, the management asked their recently joined accountant, Jim, to prepare a cost sheet specifying relevant costs for this special order.

Jim submitted a report comprising a cost sheet and other additional information to the management.

Jim has mentioned in his report that:

- (i) The stock of inventory worth 4,000 kg is no longer in use and can be sold as scrap in the market at TZS4,200 per kg. In the received order, out of this unused inventory, 3,000 kg can be utilised. The replacement cost of total required materials of 3,000 kg would be TZS13.35 million.
- (ii) For this special order, transfer of four skilled labourers from another department would be required for three months. They all are fully occupied in their department, and if transferred for this special order, the work already allotted to them would have to be outsourced. The cost of outsourcing their work for that determined period would be TZS12.8 million. If the labour work related to the special order is outsourced, the associated costs would amount to TZS12.52 million.
- (iii) The book value of machinery which will be utilised for the special job is TZS46 million. The rate of depreciation on the machinery is 8% per annum. It is expected that additional machine maintenance costs of TZS200,000 will be incurred.
- (iv) Machinery overheads are charged at TZS3,000 per hour. It is estimated that 2,400 hours will be required for the special order. The machine has 1,600 hours of available capacity. The further 800 hours that are required will have to be taken from the existing job. This arrangement will result in a loss of contribution of TZS2,000 per hour.

- (v) Administration overheads include apportionment and incremental costs of TZS1,200,000 and TZS400,000 respectively.
- (vi) Supervisor's salary includes TZS3.2 million regular pay and TZS1.4 million additional pay for working on the special order. For the three months, the supervisor would not be working on his routine tasks and hence will not get his regular incentives of TZS1 million.

Cost sheet

	TZS'000
Materials	13,600
Labour	11,400
Prime cost	25,000
Depreciation on machinery	920
Overheads of machinery	7,200
Factory costs	33,120
Administration overheads	1,600
Supervisor's salary	4,600
Cost for special order	39,320

The management has heard that for special orders such as this, relevant costing should be used that also incorporates opportunity costs.

They have approached you as a cost accountant, to create a revised costing schedule based on relevant costing principles.

Required:

Prepare a revised costing schedule for the special project based on relevant costing.

Note: your answer should be supported by necessary workings.

Question 3

Bright Plc manufactures spare parts for automobile industries. It has spare production capacity; using this capacity, it is willing to accept an offer.

The contract is for 10,000 units, manufactured by a complex assembly operation, to be produced and delivered in the next financial year at a price of TZS55,000 each.

The requirements of the contract are as follows:

Required labour hours per unit	4 hours
Material A	4 kg
Material B	3 kg
Rent of hired equipment for the special contract	TZS100 million

Additional information

- (i) Some of the skilled labour is currently under-utilised. The estimated non-productive time (about 75,000 hours per annum) is charged to fixed production overhead at a current rate of pay, at TZS5,000 per hour.
- (ii) Material A is regularly used by the company. It is readily available in the market and hence only a small quantity is held in inventory and is replenished regularly. Material B was specially purchased in expectation of an order which did not materialise. It is, therefore, surplus to requirements and the 50,000 units which are in inventory may have to be sold at a loss. An estimate of alternative values for materials A and B provided by the material planning department:

	A TZS'000 per unit	B TZS'000 per unit
Book value	4	10
Replacement cost	5	11
Net realisable value	3	8

- (iii) It is a company policy to apply overhead costs on a labour hour basis. Variable overhead is charged at TZS1,000 per hour worked. Before the contract was in the picture, provisionally, fixed overheads were budgeted for the next year at TZS1,780 million, for productive direct labour hours of 520,000. There is sufficient time available to revise the budgeted overhead rate.

Required:

Analyse the information and advise Bright Plc on the desirability of the contract.

QUESTION 4 - CIMA (2011)

RFT, an engineering company, has been asked to provide a quotation for a contract to build a new engine. The potential customer is not a current customer of RFT, but the directors of RFT are keen to try and win the contract as they believe that this may lead to more contracts in the future. As a result they intend pricing the contract using relevant costs.

The following information has been obtained from a two-hour meeting that the Production Director of RFT had with the potential customer. The Production Director is paid an annual salary equivalent to TZS1,200 per 8-hour day.

110 square metres of material A will be required. This is a material that is regularly used by RFT and there are 200 square metres currently in inventory. These were bought at a cost of TZS12 per square metre. They have a resale value of TZS10.50 per square metre and their current replacement cost is TZS12.50 per square metre.

30 litres of material B will be required. This material will have to be purchased for the contract because it is not otherwise used by RFT. The minimum order quantity from the supplier is 40 litres at a cost of TZS9 per litre. RFT does not expect to have any use for any of this material that remains after this contract is completed.

60 components will be required. These will be purchased from HY. The purchase price is TZS50 per component. A total of 235 direct labour hours will be required. The current wage rate for the appropriate grade of direct labour is TZS11 per hour. Currently RFT has 75 direct labour hours of spare capacity at this grade that is being paid under a guaranteed wage agreement. The additional hours would need to be obtained by either (i) overtime at a total cost of TZS14 per hour; or (ii) recruiting temporary staff at a cost of TZS12 per hour. However, if temporary staff are used they will not be as experienced as RFT's existing workers and will require 10 hours supervision by an existing supervisor who would be paid overtime at a cost of TZS18 per hour for this work.

25 machine hours will be required. The machine to be used is already leased for a weekly leasing cost of TZS600. It has a capacity of 40 hours per week. The machine has sufficient available capacity for the contract to be completed. The variable running cost of the machine is TZS7 per hour.

The company absorbs its fixed overhead costs using an absorption rate of TZS20 per direct labour hour.

REQUIRED:

- (a) **Calculate** the relevant cost of building the new engine.

You should present your answer in a schedule that clearly shows the relevant cost value for each of the items identified above. You should also explain each relevant cost value you have included in your schedule and why the values you have excluded are not relevant.

- (b) HY, the company that is to supply RFT with the components that are required for this contract, is another company in the same group as RFT. Each component is being transferred to RFT taking account of HY's opportunity cost of the component. The variable cost that will be incurred by HY is TZS28 per component.

Discuss the factors that would be considered by HY to determine the opportunity cost of the component.

- (c) When there is no external market for the item being supplied between divisions of a company the transfer price is often based on the supplying division's cost.

- Illustrate**, using a numerical example, the performance measurement problem that can arise when using a transfer price based on actual cost.
- Explain** how using standard costs rather than actual costs as the basis of the transfer price would solve the problem identified in (i) above.

Question 5

Your printing company is in the process of quoting for production of a programme for a local village fair. The work would be carried out in addition to the normal work of the company. Because of existing commitments, some weekend working would be required to complete the printing of the programme. An accounts assistant has prepared the following cost estimate based upon the resources as specified by the production manager:

Cost item	TZS
Direct materials	
Paper (book value)	5,000,000
Inks (purchase price)	2,400,000
Direct labour	
Skilled [250 hours at TZS 4,000]	1,000,000
Unskilled [100 hours at TZS 3,500]	350,000
Variable overheads [350 hours at TZS 4,000]	1,400,000
Printing press depreciation [200 hours at TZS 2,500]	500,000
Fixed production costs [350 hours at TZS 6,000]	2,100,000
Estimating department costs	400,000
	13,150,000

You are aware that considerable publicity could be obtained for the company if you are able to win this order and the price quoted must be very competitive.

The following are relevant to the cost estimate above:

- 1] The paper to be used is currently in stock at a value of TZS 5,000,000. It is of an unusual colour which has not been used for some time. The replacement price of the paper is TZS 8,000,000, while the scrap value of that stock is TZS 2,500,000. The production manager does not foresee any alternative use for the paper if it is not used for the village fair programmes.
- 2] The inks required are not held in stock. They would have to be purchased in bulk at a cost of TZS 3,000,000. 80% of the ink purchased would be used in printing the programme. No other use is foreseen for the remainder.
- 3] Skilled direct labour is in short supply, and to accommodate the printing of the programmes, 50% of the time required would be worked at weekends, for which a premium of 25% above the normal hourly rate is paid. The normal hourly rate is TZS 4,000.
- 4] Unskilled labour time is presently under-utilized, and at present 200 hours per week are recorded as idle time. If the printing work is carried out at a weekend, 25 unskilled hours would have to occur at this time, but the employees concerned would be given two hours time off [for which they would be paid] in lieu of each hour worked.
- 5] Variable overheads represents the costs of operating the printing press and binding machines
- 6] When not being used by the company, the printing press is hired to outside companies for TZS 6,000 per hour. This earns a contribution of TZS 3,000 per hour. There is unlimited demand for this facility.
- 7] Fixed production costs are those incurred by and absorbed into production, using an hourly rate based on budgeted activity.
- 8] The cost of the estimating department represents time spent in discussion with the village committee concerning the printing of its programme.

Required:

- A] Prepare a revised cost estimate using the opportunity cost approach, showing clearly the minimum price that the company should accept for the order. Give reasons for each resource valuation in your estimate.
- B] Explain why contribution theory is used as a basis for providing information relevant to decision-making.
- C] Explain the relevance of opportunity costs in decision-making.

QUESTION 6

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

		Note	(TZS)
Direct materials:	Steel 10 m ² at TZS 5.00 per sq. metre	1	50
Brass fittings		2	20
Direct labour Skilled	25 hours at TZS8.00 per hour	3	200
Semi-skilled	10 hours at TZS5.00 per hour	4	50
Overhead	35 hours at TZS10.00 per hour	5	350
Estimating time	6	100	
			770
Administrative overhead at 20% of production cost		7	154
			924
Profit at 25% of total cost		8	231
Selling price			1,155

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Notes

1. The steel is regularly used, and has a current stock value of TZS5.00 per sq. metre. There are currently 100 sq. metres in stock. The steel is readily available at a price of TZS5.50 per sq. metre.
2. The brass fittings would have to be bought specifically for this job: a supplier has quoted the price of TZS20 for the fittings required.
3. The skilled labour is currently employed by your company and paid at a rate of TZS8.00 per hour. If this job were undertaken it would be necessary either to work 25 hours overtime which would be paid at time plus one half or to reduce production of another product which earns a contribution of TZS13.00 per hour.
4. The semi-skilled labour currently has sufficient paid idle time to be able to complete this work.
5. The overhead absorption rate includes power costs which are directly related to machine usage. If this job were undertaken, it is estimated that the machine time required would be ten hours. The machines incur power costs of TZS0.75 per hour. There are no other overhead costs which can be specifically identified with this job.
6. The cost of the estimating time is that attributed to the four hours taken by the engineers to analyze the drawings and determine the cost estimate given above.
7. It is company policy to add 20% on to the production cost as an allowance against administration costs associated with the jobs accepted.
8. This is the standard profit added by your company as part of its pricing policy.

Required:

- a. Prepare, on a relevant cost basis, the lowest cost estimate that could be used as the basis for a quotation. Explain briefly your reasons for using each of the values in your estimate.
- b. There may be a possibility of repeat orders from The Accountant plc. which would occupy part of normal production capacity. What factors need to be considered before quoting for this order?

Question 7- ACCA (2011)

The Telephone Co (T Co) is a company specializing in the provision of telephone systems for commercial clients. There are two parts to the business:

- Installing telephone systems in businesses, either first time installations or replacement installations.
- Supporting the telephone systems with annually renewable maintenance contracts.

T Co has been approached by a potential customer, Push Co, who wants to install a telephone system in new offices it is opening. Whilst the job is not a particularly large one, T Co is hopeful of future business in the form of replacement systems and support contracts for Push Co. T Co is therefore keen to quote a competitive price for the job. The following information should be considered:

1. One of the company's salesmen has already been to visit Push Co, to give them a demonstration of the new system, together with a complimentary lunch, the costs of which totaled TZS400.
2. The installation is expected to take one week to complete and would require three engineers, each of whom is paid a monthly salary of TZS4,000. The engineers have just had their annually renewable contract renewed with T Co. One of the three engineers has spare capacity to complete the work, but the other two would have to be moved from contract X in order to complete this one. Contract X generates a contribution of TZS5 per engineer hour. There are no other engineers available to continue with Contract X if these two engineers are taken off the job. It would mean that T Co would miss its contractual completion deadline on Contract X by one week. As a result, T Co would have to pay a one-off penalty of TZS500. Since there is no other work scheduled for their engineers in one week's time, it will not be a problem for them to complete Contract X at this point.
3. T Co.'s technical advisor would also need to dedicate eight hours of his time to the job. He is working at full capacity, so he would have to work overtime in order to do this. He is paid an hourly rate of TZS40 and is paid for all overtime at a premium of 50% above his usual hourly rate.
4. Two visits would need to be made by the site inspector to approve the completed work. He is an independent contractor who is not employed by T Co, and charges Push Co directly for the work. His cost is TZS200 for each visit made.
5. T Co.'s system trainer would need to spend one day at Push Co delivering training. He is paid a monthly salary of TZS1,500 but also receives commission of TZS125 for each day spent delivering training at a client's site.
6. 120 telephone handsets would need to be supplied to Push Co. The current cost of these is TZS18.20 each, although T Co already has 80 handsets in inventory. These were bought at a price of TZS16.80 each. The hand sets are the most popular model on the market and frequently requested by T Co.'s customers.
7. Push Co would also need a computerized control system called 'Swipe 2'. The current market price of Swipe 2 is TZS10,800, although T Co has an older version of the system, 'Swipe 1', in inventory, which could be modified at a cost of TZS4,600. T Co paid TZS5,400 for Swipe 1 when it ordered it in error two months ago and has no other use for it. The current market price of Swipe 1 is TZS5,450, although if T Co tried to sell the one they have, it would be deemed to be 'used' and therefore only worth TZS3,000.

8. 1,000 metres of cable would be required to wire up the system. The cable is used frequently by T Co and it has 200 metres in inventory, which cost TZS1·20 per metre. The current market price for the cable is TZS1·30 per metre.
9. You should assume that there are four weeks in each month and that the standard working week is 40 hours long.

Required:

- a. Prepare a cost statement, using relevant costing principles, showing the minimum cost that T Co should charge for the contract. Make DETAILED notes showing how each cost has been arrived at and EXPLAINING why each of the costs above has been included or excluded from your cost statement.
- b. Explain the relevant costing principles used in part (a) and explain the implications of the minimum price that has been calculated in relation to the final price agreed with Push Co.

Question 8

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

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

- (i) Material requirements:
 3 kg material M1 – see note 1 below
 2 kg material P2 – see note 2 below
 1 Part No. 678 – see note 3 below
 Note 1: Material M1 is in continuous use by the company. 1000 kg are currently held in stock at a book value of TZS 4.70 per kg but it is known that future purchases will cost TZS 5.50 per kg.
 Note 2: 1200 kg of material P2 are held in stock. The original cost of this material was TZS 4.30 per kg but as the material has not been required for the last two years it has been written down to TZS 1.50 per kg. scrap value. The only foreseeable alternative use is as a substitute for material P4 (in current use) but this would involve further processing costs of TZS 1.60 per kg. The current cost of material P4 is TZS 3.60 per kg.
 Note 3: It is estimated that the Part No. 678 could be bought for TZS 50 each.
- (ii) Labour requirements: Each component would require five hours of skilled labour and five hours of semi-skilled. An employee possessing the necessary skills is available and is currently paid TZS 5 per hour. A replacement would however, have to be obtained at a rate of TZS 4 per hour for the work which would otherwise be done by the skilled employee. The current rate for semi-skilled work is TZS 3 per hour and an additional employee could be appointed for this work.
- (iii) Overhead: JB Limited absorbs overhead by a machine hour rate, currently TZS 20 per hour of which TZS 7 is for variable overhead and TZS 13 for fixed overhead. If this contract is undertaken it is estimated that fixed costs will increase for the duration of the contract by TZS 3,200. Spare machine capacity is available and each component would require four machine hours. A price of TZS 145 per component has been suggested by the large company which makes aircraft.

You are required to:

- (a) State whether or not the contract should be accepted and support your conclusion with appropriate figures for presentation to management;
- (b) Comment briefly on three factors which management ought to consider and which may influence their decision.

Answers to Self Examination Questions

Answer to SEQ 1

Relevant costs are the costs related to a future decision.

As mentioned in the given case, Plasma has stopped the production of bottles and the related raw materials have no alternative use. Hence, it can be said that those materials can be sold in the market.

However, Plasma has received a bulk order for buckets and bottles. Hence, those materials will be used for the production of the bulk order.

The relevant cost of the required raw materials can be calculated as follows:

	TZS'000
Cost of raw materials required for the production of buckets (500 kg x TZS65,000)	32,500
Cost of raw materials required for the production of bottles (320 kg x TZS74,000)	23,680
Opportunity cost of raw materials required for the production of bottles (80 kg x TZS60,000)	4,800
Relevant costs	60,980

Opportunity cost is the cost of expected revenue from the sales of bottles which has been given up for this production

Answer to SEQ 2

Revised cost schedule for the special contract

	TZS'000	Workings
Materials	12,600	W1
Labour	12,520	W2
Prime cost	25,120	
Maintenance cost	200	W3
Overheads on machinery	8,800	W4
Factory cost	34,120	
Supervisor's remuneration	400	W5
Administration overheads	400	W6
Interest on bank overdraft	360	W7
Total costs for special order	35,280	

Workings

W1 Materials

The cost of 4,000 kg of materials which are already in inventory is a sunk cost and therefore, irrelevant. Again, the replacement cost of TZS13.35 million is irrelevant as it is not a future cost that will be incurred because Paradise will not need to buy the materials - it already has them in inventory. However, this would be relevant if the material was in regular use by Paradise. There is an opportunity cost; there are two courses of action to choose from. Paradise can either use the material for the special contract or can sell it and receive TZS4,200 per kg.

The relevant cost is $3,000 \times \text{TZS}4,200 = \text{TZS}12,600,000$ as this represents the benefit sacrificed by choosing to accept the contract rather than selling the materials.

W2 Labour

There are two options.

1. Labourers can be borrowed from their usual department; it would cost TZS12.8 million to replace them.
2. Or sub-contractors could be hired to do the special order at a cost of TZS12.52 million.

Both of these costs are future costs that will be affected by the decision and are therefore relevant. The choice between the two alternatives is relatively simple; to incur a cost of either TZS12.8 million or TZS12.52 million. It is desirable for the accountant to minimise costs and therefore to choose to **hire the sub-contractors at TZS12.52 million**.

W3 Depreciation on machinery

The normal depreciation for three months has been charged at TZS920,000. The accountant would have charged the same amount for that period whether or not Paradise used the machine for the special contract. It is only a book value and does not represent true cash flow to the business. Therefore, it is not a relevant cost.

However, if Paradise does accept the special contract and uses the machine, it will incur **maintenance costs of TZS200,000**. These future costs are a direct result of the decision and should be included in the costs.

W4 Machinery overheads

	TZS'000
Running cost of machinery for special contract (2,400 machine hours x TZS3,000)	7,200
Opportunity costs (the benefit forgone by choosing the special contract over the existing job) (800 machine hours x TZS2,000 lost contribution)	1,600
Relevant machinery overheads	8,800

W5 Supervisor's remuneration

1. The supervisor's normal salary is TZS3.2 million and this will be paid whether or not the company takes on the special contract. This is a fixed cost to the business and is unaffected by the decision.
2. However, the TZS1.4 million - additional bonus is relevant as it is dependent on the decision to accept the special contract.
3. In addition, if the company takes on the special contract it will not have to pay the TZS1 million incentive payment.

Therefore, the net relevant cost of the supervisor's remuneration to the business is **TZS0.4 million** (i.e. **TZS1.4 million – TZS1.0 million**)

W6 Administration overheads

1. Apportioned costs, i.e. general fixed overheads, remain the same whether the special contract is undertaken or not.
2. Incremental overheads are extra overheads, incurred as a direct result of undertaking the special project. These could include additional costs for power or premises. The costs of **TZS400,000** are relevant to the project.

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W7 Overdraft interest

The finance charges for the three month period incurred as a result of undertaking a special contract are future cost because of the decision being made, and therefore, should be included as relevant cost TZS8 million x 18% x 3/12 = **TZS0.36 million**.

Answer to SEQ 3

Advice on the contract will be based on the relevant costs or incremental costs incurred for the contract using the values provided in the question.

	TZS million
Materials (W1)	
A	200
B	240
Labour costs (W2)	0
Variable overheads (W3)	40
Total variable costs	480
Fixed overheads (additional rent of equipment)	100
Total relevant costs	580

Relevant revenue = 10,000 units x TZS55,000 selling price per unit
= TZS550 million

A surplus of costs over revenue of TZS30 million is revealed, so the contract would not be beneficial.

Workings

W1 Materials

Material A will be replenished at the current replacement cost.

Cost of Material A = 10,000 units x TZS5,000 per kg x 4 kg per unit = TZS200 million

Material B is valued at its opportunity cost, i.e. disposable or realisable value as it is already in inventory and has no alternative use.

Cost of Material B = 10,000 units x TZS8,000 per kg x 3 kg per unit = TZS240 million

W2 Labour costs

Labour will be paid anyway as non-productive time so the incremental cost is zero.

W3 Variable overheads

Variable overhead is incurred in relation to the direct labour hours worked.

Direct labour hours per unit = 4 hours

Variable cost per hour = TZS1,000

Total variable costs for the contract = 10,000 units x 4 hours x TZS1,000 = TZS40 million

The remaining expenses are common and unavoidable in all situations.

Answer to SEQ 5

a)

Revised cost estimate	TZS (000)	Note
Direct material- Paper	2,500	(1)
-ink	3,000	(2)
Direct labour (Tzs 500 + TZS 625)	1,125	(3)
Unskilled labour	-	(4)
Variable overhead	1,400	(5)
Printing	600	(6)
Printing press depreciation	-	(7)
Fixed production costs	-	(7)
Estimating department costs	-	(8)
	8,625	

Notes:

- (1) The alternative use of the paper is to sell for TZS 2,500. Therefore the cashflow impact is TZS 2,500
 - (2) The incremental cost of undertaking the work is TZS 3,000
 - (3) It is assumed that 125 hours not undertaken at weekends is in scarce supply and the decision to undertake the work will result in a lost contribution. The relevant cost is the hourly labour rate plus the lost contribution per hour. The lost contribution is not given in the question and therefore cannot be ascertained. The hourly labour rate consisting of 125 hours at Tzs 4 per hour is included in the above answer. It is assumed that the weekend hours represent an incremental cost and do not involve a lost contribution. The incremental cost of weekend work is TZS 625 (125 hours * TZS 5)
 - (4) At present 200 unskilled hours are recorded as idle time and the work to be undertaken entails 100 plus 50 hours time off in lieu. Therefore idle time will be reduced but no additional expenditure will be incurred.
 - (5) It is assumed that TZS 1,400 is an incremental cost of undertaking the work.
 - (6) The lost contribution of TZS 600 (200 hours at Tzs 3 per hour) is included in the cost estimate. It is assumed that the variable cost of the printing press hours have already been included in the cost estimate.
 - (7) Fixed overheads and depreciation are fixed costs and therefore do not involve incremental cash flows.
 - (8) The cost of estimating time has already been incurred and is a sunk cost.
- b) In short term decision making, resources usage is best measured by using variable cost which change in proportion to change in output. When variable cost is matched with the sales revenue with which it is associated, the resulting difference or contribution gives a good indication of the expected benefit to the organisation of any course of action.
If fixed costs are unaffected by a decision, contribution will be close approximation of cash flow and, therefore, it is a very real figure which may also be usefully used as a basis for ranking alternatives where limiting factors are involved.
- c) For evaluating the economic benefit derived from a product, it is necessary to match the revenue generated with the cost incurred. Opportunity cost represent the benefit foregone for taking one course of action rather than other alternative. It gives a measure of sacrifice made in order to generate income.
Opportunity costs may be derived from internal or external sources depending on such factors as whether there are alternative uses for internal resources consumed and whether, if used, they would be replaced.

Answer to SEQ 8

a) The relevant costs for the production of 400 components are as follows:

Materials:	TZS	TZS
M1 (1,200 kg at 5.5 replacement)	6,000	
P2 (800 kg at TZS 2 per kg) ^a	1,600	
Part no. 678 (400 at TZS 50 replacement)	20,000	28,200
Labour:		
Skilled (2,000 hours at TZS 4 per hour)	8,000	
Semi – skilled (2,000 hours at TZS 3 per hour)	6,000	14,000
Overheads:		
Variable (1600 machine hours at TZS 7 per hour)		11,200
Fixed: incremental fixed costs		3,200
Total relevant cost		56,600
Contract price (400 components at TZS 145 per component)		58,000
Contribution to general fixed costs		1,400

The incremental revenues exceed the incremental costs. Therefore the contract should be accepted subject to the comments in (b) below

NOTE:

^a If materials P2 are not used on the contract, they will be used as a substitute for material P4. Using P2 as a substitute for P4 results in a saving of TZS 2 (TZS 3.6 – TZS 1.6) per kg. Therefore the relevant cost of P2 consists of the opportunity cost of TZS 2 per kg.

SECTION B3: THROUGHPUT ACCOUNTING

■ Get Through Intro

The theory of constraints (TOC) evolved from optimised production technology (OPT), a production scheduling software. OPT is based on the principle that profits can be enhanced by increasing the throughput of the plant.

Eli Goldratt developed the 'Theory of constraints' in which the maximisation of 'throughput' was advocated to be the most significant factor in increasing profitability. According to Goldratt and Cox (1993), 'Throughput is the rate at which the system generates money through sales'.

Many authors have viewed the 'Theory of constraints' and 'Throughput accounting' to be a paradigm shift in management thinking.

In their book (The Goal) on the subject, Goldratt and Cox reconsidered the basic accounting principles. They concluded that so as to attain the organisational goal, managers should know how much money the company generates, how much money is getting invested in the form of inventory and how much money the company would require to spend to operate it.

To be familiar with the new management concept and to find answers to the questions raised by Goldratt and Cox, potential management accountants need to read this section very carefully. This section will also help the students to answer the questions set in the examination.

■ Learning Outcomes

- a) Calculate and interpret a throughput accounting ratio (TPAR).
- b) Suggest how a TPAR could be improved.
- c) Apply throughput accounting to a multi-product decision-making problem.

1. Calculate and interpret a throughput accounting ratio (TPAR).**[Learning Outcome a]****1.1 Elementary concepts of 'Theory of constraints'**

The theory of constraints (TOC) is a management philosophy developed by Eliyahu M. Goldratt. Conceptually the theory of constraints is based on the idea that every company has identifiable constraints, hence management should identify the most binding constraints and manage them so that its resources are used most efficiently.

The goal is simply to make money, now and in the future. According to Goldratt, the way to make money is to maximise an overall measure referred to as 'throughput', while minimising two other overall measures referred to as 'inventory' and 'operating expenses'. The basic idea is to focus on these overall measures rather than focussing on narrow, or subsystem measurements.

Maximising throughput according to the theory of constraints involves the following five continuous steps (the steps are discussed in detail in Learning Outcome 2):

1. Identify the bottlenecks (i.e. constraints) of the system.
2. Decide how to exploit the system's constraints (i.e. the bottlenecks).
3. Subordinate everything else to the above decision.
4. Elevate the system's bottlenecks.
5. If, in the preceding steps, a constraint has been broken, go back to step 1, but do not allow inertia to cause a system constraint.

1.2 Concepts of throughput accounting

Throughput accounting is not a costing system. It is also an accounting method. It actually involves assessing how effectively a firm utilises its constraints. There is no calculation, estimation, approximation, apportionment, judgement, evaluation or prediction of costs of products in throughput accounting.

Three measures are identified by Goldratt in order to know how much money the company generates, how much money is getting invested in the form of inventory and how much money the company would require to spend to operate it. They are 'throughput', 'inventory' and 'operational expenses'.

Throughput is the rate at which the system generates money through sales. According to Goldratt, throughput is defined as sales revenue less direct material costs.

Inventory is all the money that the system invests in purchasing things which it intends to sell. It may be noted that Goldratt also considered all non-current assets under the category of inventory.

Operational expenses are all the money the system spends in order to turn inventory into throughput.

Throughput accounting acknowledges only **material cost to be truly variable. All other costs are treated as period costs and deducted as expenses of the period.**

**Example**

Direct production labour cost and variable indirect production cost are considered to be period costs and are deducted as expenses of the period.

Therefore, in throughput accounting, the smallest amount is held in inventory compared to both absorption costing and marginal costing.

The advocates of throughput accounting are of the opinion that it offers less incentive to produce inventory than either absorption costing or marginal costing.

1.3 Calculate throughput accounting ratio and interpret

Throughput is the rate at which a firm generates money by spending an hour of a bottleneck resource. Therefore,

$\text{Throughput} = \text{Sales price} - \text{Material cost per unit}$



Example

Coco Company manufactures and sells a single product. The company has recorded a contribution of TZS553 million during a year. The contribution / sales ratio and material cost of the sales for the year were 70% and 10% respectively.

Throughput for the company is calculated as follows:

$$\begin{aligned}\text{Throughput} &= \text{Sales revenue} - \text{Material cost} \\ &= \text{TZS790 million (W1)} - (\text{TZS790 million} \times 10\%) \\ &= \text{TZS711 million}\end{aligned}$$

Working

$$\text{Sales revenue} = \frac{\text{Contribution}}{\text{C/S ratio}} = \frac{\text{TZS553 million}}{70\%} = \text{TZS790 million}$$

In the case of a bottleneck resource, performance is assessed by throughput accounting ratio for each unit of the resource consumed.

Throughput accounting ratio = Return per factory hour / cost per factory hour

A product showing a higher throughput accounting ratio generates more money and hence is preferred for production. A **throughput accounting ratio of one** indicates that the **return per factory hour is just equal to the cost per factory hour**. A **throughput accounting ratio of more than one** indicates that the **factory is generating money at a higher rate than it spends** and a **ratio lower than one** indicates that **the factory is losing money**.

In throughput accounting, product returns are measured as:

Return per factory hour = (Sales price – Material cost)/Time on key resources (i.e. the bottlenecks)

It may be noted that **sales price less material cost is throughput**.

And product costs are measured as:

Cost per factory hour = Total factory cost/Total time available on key resources (i.e. the capacity of the bottleneck activity in terms of hours)

In throughput accounting, it is considered that all costs other than cost of material are period costs and hence fixed in nature. These period costs are grouped together and called total factory costs.



Example

Continuing the example of Coco Company

Total sales made and operating expenses incurred during the year are 177,750 units and TZS553 million respectively. Labour hours are restricted to 158,000 hours.

The throughput accounting ratio is calculated as follows:

$$\text{Throughput per hour} = \text{TZS711 million} / 158,000 \text{ hours} = \text{TZS4,500 per hour}$$

$$\text{Cost per hour} = \text{TZS553 million} / 158,000 \text{ hours} = \text{TZS3,500 per hour}$$

$$\begin{aligned}\text{Throughput accounting ratio} &= \text{Return per factory hour} / \text{cost per factory hour} \\ &= \text{TZS4,500} / \text{TZS3,500 per hour} = 1.29\end{aligned}$$

As TPAR is more than one, the company generates money at a higher rate than it spends.

SUMMARY





Test Yourself 1

Delight Ltd manufactures product P which goes through process LP. The company has identified processing time of the process as a limiting factor, i.e. 12,200 hours per month. The company sells the product at a price of TZS10,000 per unit and direct material cost per unit is 15% of the selling price. During a month, actual production and sales were 3,240 units of Product P. Actual factory cost incurred during the month was TZS30,518,000.

Required:

- (a) Calculate return per factory hour.
- (b) Calculate throughput accounting ratio.

2. Suggest how a TPAR could be improved.

[Learning Outcome b]

Throughput accounting ratios can be improved by increasing the return per factory (bottleneck) hour and/or by reducing the cost per factory (bottleneck) hour. Increasing return and reducing costs in a factory is only possible if the following steps are observed.

1. Identify the production bottlenecks

A production bottleneck is a resource that limits production to less than market demand. Identification of a bottleneck is the key to success for increasing throughput. A bottleneck has been defined in the book 'The Goal' (written by Eli M. Goldratt) as a resource whose capacity is equal to or less than the demand placed upon it.

2. Determine the most efficient utilisation of each bottleneck

Maximise flow through the constraint by reducing machine setups, lot size of production and focus on throughput rather than efficiency.

Instead of balancing the capacity of the machines and the overall plant with demand the target should be to balance the flow of the product through the plant.

3. Ensure that the flow of production is maintained through the bottleneck resource

All resources are co-ordinated to keep the constraint (i.e. the bottleneck resource) busy without a build-up of work in process. The effect of this may be unavoidable idle capacity in some non-bottleneck operations.

As Galloway and Waldron have stated, 'If the resource cannot be exploited fully because of the bottleneck's limited capacity then letting it stand idle when it has completed the work required, costs nothing'.

4. Add capacity to the bottleneck resource

Increasing the capacity of the bottleneck is worthwhile if it increases throughput to a level greater than the cost of investment. Overall plant capacity can be increased by effective utilisation of bottleneck operations.

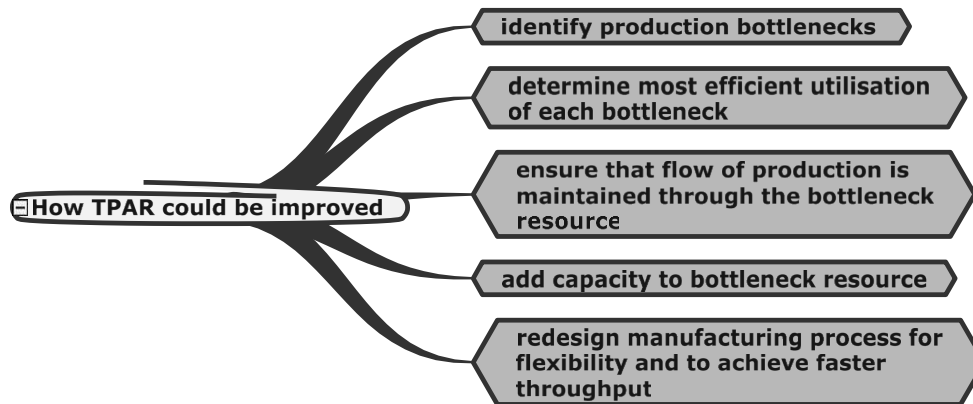
Some of the ways to increase capacity at the bottlenecks are: minimising down-time within the bottlenecks, ensuring that the bottlenecks are only engaged in working on quality products so as not to waste time and relieving the workload by outsourcing some of the jobs.

5. Redesign the manufacturing process for flexibility and to achieve faster throughput

The entire manufacturing process needs to be re-oriented in order to ensure that the return per bottleneck hour increases and the cost per factory hour decreases resulting in faster throughput.

To achieve faster throughput, the steps needed to be taken include: introduction of new manufacturing technology, deletion of some hard-to-manufacture products, and redesign of some products for greater ease of manufacturing or simply removing one or more minor features of a given product.

SUMMARY



3. Apply throughput accounting to a multi-product decision-making problem.

[Learning Outcome c]

Traditionally, marginal costing techniques used to be applied to resolve any multi-product decision-making problem. The decision criterion for identifying the most profitable product is contribution per unit. A product earning the highest contribution per unit is considered to be the most profitable and therefore prioritised for production.

In throughput accounting, instead of calculating contribution, throughput is calculated.

The throughput accounting ratio (TPAR) indicates the ratio of return per factory hour divided by the cost per factory hour. If the TPAR for a particular product is less than one, this indicates that the product, if produced, would require more money to be spent on it than the product would be able to generate. Accordingly, an organisation would like to continue to produce only those products which have a TPAR of more than one. Obviously, if the TPAR is higher for a product compared to the other products in the product line, it is given higher priority for production.

The following example can be used to **demonstrate the throughput accounting ratio and its application in multi-product decision-making.**



Example

A factory produces two products P1 and P2. Both the products have raw material content of TZS1,300 and sales price of TZS2,300.

The sales for each product per period are:

P1 TZS12 million

P2 TZS8 million

The production process that each product follows is slightly different. Set out below is the time, in minutes, that the products spend in each operation:

Operation	1	2	3	4	5	6	Total minutes
Capacity	6,400	5,000	6,500	6,750	6,200	6,100	
Product P1	0.2	0.3	0.15	0.24	0.2	0.14	1.23
Product P2	0.2	0.15	0.25	0.25	0.25	0.2	1.30

Operation 2 is the bottleneck because it has the least relative capacity.

Total factory cost for each period comprises the following:

Direct labour TZS3,600,000

Production overhead TZS6,516,000

Factory administration overhead TZS7,596,000

The number of labour hours per period is 600 (i.e. TZS6,000 per hour).

Continued on the next page

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The traditional margin on each product is:

Amounts in TZS

	A	B
Raw materials Direct	1,300.00	1,300.00
labour (W1) Production	123.00	130.00
overhead (W2)	222.63	235.30
Factory administration overhead (W3)	259.53	274.30
	1,905.16	1,939.60
Sales price	2,300.00	2,300.00
Contribution	394.84	360.40

This indicates that P1 is a more profitable product than P2. However, throughput accounting provides a different analysis.

	P1	P2
Throughput ratio = $\frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$	$\frac{\text{TZS3,333.33}}{\text{TZS3542.40}}$	$\frac{\text{TZS6,666.67}}{\text{TZS3542.40}}$
	= 0.94	= 1.88

The result shows that product P2 generates more money although its contribution per unit is less than that of product P1. Also, it is revealed that the throughput ratio for product P1 is less than one indicating that the factory loses money when producing this product. Accordingly, it is advisable to produce product P2 in greater numbers and to try to improve the TPAR of product P1.

Workings

W1 Direct Labour		
	P1	P2
Direct labour consumption per unit	1.23 minute	1.30 minute
Direct labour rate per hour is TZS6,000	$\text{TZS6,000} \times 1.23/60$	$\text{TZS6,000} \times 1.3/60$
Direct labour cost per unit	= TZS123	= TZS130
W2 Production overhead		
Total direct labour hour for the period is 600 hours.		
Production overhead absorbed per direct labour time (minutes)		
Production overhead per unit	$\text{TZS6,516,000} \times 1.23 / (600 \times 60)$ = TZS222.63	$\text{TZS6,516,000} \times 1.3 / (600 \times 60)$ = TZS235.30
W3 Factory administration overhead		
Factory administration overheads are absorbed as a percentage of production overhead.		
Factory administration overhead is $\text{TZS7,596,000} \times 100 / \text{TZS6,516,000} = 116.575\%$ of production overhead.		
Factory administration overhead per unit	TZS259.53	TZS274.30
W4 Return per factory hour		
Return per factory hour = $\frac{\text{Selling price} - \text{Material cost}}{\text{Time on key resource}}$	$\frac{\text{TZS1,000}}{0.3}$ = TZS3333.33	$\frac{\text{TZS1,000}}{1.5}$ = TZS6666.67
Cost per factory hour = $\frac{\text{Total factory cost}}{\text{Total time available on key resources}}$	$\frac{\text{TZS}(3,600,000 + 6,516,000 + 7,596,000)}{5,000}$ = TZS3,542.4	



Test Yourself 2

Supreme Engineers manufactures three products Alfa, Beta and Gamma. Each product goes through two major processes i.e. machining and assembling. The following are the details of selling price, cost and requirement of resources for each product.

Products	Selling price / unit (TZS'000)	Material cost / unit (TZS'000)	Machine time / unit (hours)	Assembling time / unit (hours)	Annual sales (units)
Alfa	200	106	40	20	1,000
Beta	160	53	20	10	1,250
Gamma	400	226	60	30	950

Machine time is the bottleneck and its capacity is restricted to 114,000 hours per annum. The total factory costs amount to TZS513 million per annum.

Required:

Calculate the TPAR for each product using the optimal production plan.

Answers to Test Yourself

Answer to TY 1

(a) Return per factory hour = (Selling price – Material cost)/Time on key resource (i.e. process time)
 = ((TZS10,000 – TZS1,500) per unit x 3,240 units)/12,200 hours
 = TZS2,260 per hour

(b) Throughput accounting ratio = Return per factory hour/Cost per factory hour (W1)
 = TZS2,260 per hour/ TZS2,500 per hour
 = 0.904

The throughput accounting ratio (TPAR) is less than one which indicates that the factory is losing money.

Working

W1 Cost per factory hour = TFC/Hours on bottleneck
 = TZS30,518,000/12,200 hours = TZS2,500 per hour

Answer to TY 2

As machine time is restricted to 114,000 hours per annum, we need to calculate the optimal plan as follows:

	Alfa TZS'000 per unit	Beta TZS'000 per unit	Gamma TZS'000 per unit
Selling price	200	160	400
Less: Material cost	(106)	(53)	(226)
Throughput per unit	94	107	174
Machine time per unit (hours)	40	20	60
Throughput per hour	2.35	5.35	2.90
Ranking	III	I	II

Throughput per machine hour is calculated as follows:

	Beta TZS'000 per unit	Gamma TZS'000 per unit	Alfa TZS'000 per unit
Sales (units)	1,250	950	800 (bal)
Machine time per unit (hours)	20	60	40
Total machine time (hours)	25,000	57,000	32,000
Throughput per hour	5.35	2.90	2.35
Total throughput	133,750	165,300	75,200

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Throughput ratio for each product is calculated as:

$$\text{Throughput ratio} = \frac{\text{Return per factory hour}}{\text{Cost per factory hour}}$$

$$\text{For Alfa} = \frac{\text{TZS}2,350}{\text{TZS}4,500} = 0.52$$

$$\text{For Beta} = \frac{\text{TZS}5,350}{\text{TZS}4,500} = 1.19$$

$$\text{For Gamma} = \frac{\text{TZS}2,900}{\text{TZS}4,500} = 0.64$$

Workings

W1 Return per factory hour

$$\text{Return per factory hour} = \frac{\text{Selling price} - \text{Material cost}}{\text{Time on key resource}}$$

$$\text{For Alfa} = \frac{\text{TZS}75,200,000}{32,000 \text{ hrs}} = \text{TZS}2,350$$

$$\text{For Beta} = \frac{\text{TZS}133,750,000}{25,000 \text{ hrs}} = \text{TZS}5,350$$

$$\text{For Gamma} = \frac{\text{TZS}165,300,000}{57,000 \text{ hrs}} = \text{TZS}2,900$$

W2 Cost per machine hour

$$\begin{aligned} \text{Cost per machine hour} &= \frac{\text{Total factory cost}}{\text{Total time available on key resources}} \\ &= \frac{\text{TZS}513 \text{ million}}{114,000 \text{ hrs}} = \text{TZS}4,500 \end{aligned}$$

Quick Quiz

Fill in the blanks

1. According to Goldratt, the way to make money is to maximise an overall measure referred to as 'throughput', while minimising two other overall measures referred to as _____ and _____.
2. Throughput is the rate at which the system generates money through sales. According to Goldratt, throughput is defined as sales revenue less _____.
3. Throughput Accounting Ratio = _____ / Cost per factory hour.
4. A bottleneck has been defined in the book 'The Goal' (written by Elli M. Goldratt) as a resource whose capacity is equal to or less than the _____.
5. If the TPAR for a particular product is _____, this indicates that the product, if produced, would require more money to be spent on it than the product would be able to generate.

Answers to Quick Quiz

1. 'Inventory', 'operating expenses'
2. Direct material costs
3. Return per factory hour
4. Demand placed upon it
5. Less than one

Self-Examination Questions

Question 1

A factory has identified Plant A as a limiting factor which is available for 9,390 minutes per period. The following projected data relating to two products, X and Y, are given below:

Products	Selling price/unit TZS'000	Material cost/unit TZS'000	Time in Plant A (minutes)
P	10.5	6	1.5
Q	10.5	5.25	3

Budgeted factory costs per week:

	TZS'000
Direct labour	7,500
Indirect labour	3,750
Power	525
Depreciation	6,750
Space costs	2,400
Engineering	1,050
Administration	1,500

Required:

- Total Factory Costs (TFC)
- Cost per factory minute
- Return per factory minutes for both products
- TA ratios for both products

Question 2

Explain two aspects in which the concept of 'contribution' in throughput accounting differs from its use in marginal costing.

Question 3

Jeremy Ltd manufactures computer components. Health and safety regulations mean that one of its processes can only be operated for 8 hours a day. The hourly capacity of this process is 600 units per hour.

The selling price of each component is TZS0.15 million and the unit material cost is TZS0.09 million. The daily total of all factory costs (conversion costs) is TZS150 million, excluding materials.

Expected production is 4,000 units per day.

Required:

Calculate

- Total profit per day
- Return per factory hour
- Efficiency of bottleneck use
- Throughput accounting ratio

QUESTION 4

Ngozi Ltd is engaged in the manufacturing and selling of leather accessories. Three different types of leather accessories are produced (leather wallets, leather belts and smartphone leather cases). The following information relates to the budget of Ngozi for the year to 31st December 2017.

1. budgeted selling price and cost for each type of leather accessory is as given below:

	Leather Wallets	Leather Belts	Smartphone Leather Cases
	TZS	TZS	TZS
Selling price	30,000	25,000	20,000
Material cost	12,000	8,250	7,200
Direct labour	4,000	1,700	2,000
Variable overhead	1,000	750	800

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- Budgeted fixed cost relates to rental charges of the leased plant and other administration expenses totaling to TZS 400,000,000 per annum.
- Expected demand is as follows:

Leather Wallets	Leather Belts	Smartphone Leather Cases
1,000 units	12,500 units	57,000 units

- Each leather accessory will have to undergo three processes (cutting, sandling and saddle stitching) before it is completed. The time that will be spent by each of the three processes on each leather accessory is as follows:

	Hours per Leather Wallets	Hours per Leather Belts	Hours per Smartphone Leather Cases
cutting	0.30	0.30	0.30
sandling	0.25	0.15	0.25
Saddle stitching	0.60	0.40	0.40

- Ngozi Ltd has two machines of which each can perform all of the three processes. Each machine can only operate for 10 hours each day for 6 days in a week and 50 weeks in a year, leaving 2 weeks for repair and maintenance.
- Ngozi Ltd operates a Just In Time (JIT) manufacturing system with regard to the manufacture of leather accessories and aims to hold very little work in progress and nil finished stock whatsoever.

Required:

- Using marginal costing principles, calculate the mix (units) of each type of leather which will maximize profit and state the value of that profit. (8 marks)
- If it estimated that direct labour cost per annum will amount to TZS 48,000,000 and that of overhead TZS 35,000,000, calculate the throughput accounting ratio for each type of Leather accessory and briefly discuss when it is worth producing a product where throughput accounting principles are in operation.
- Assuming that the TPAR of all the three leather accessories is less than 1. Explain how Ngozi Ltd could improve their TPAR and show the consequences of each improvement measure.

QUESTION 5

Saint Mary University is a private Univeristy offering three types of CPA (T) review classes known as Level A, Level B, and Level C. Saint Mary University currently rent lecture rooms from a neighbouring government University. Saint Mary University has lecture rooms on its premises, but it has never been put into use since it would cost TZS100,000,000 to equip. The Managing Director of Saint Mary University is keen to maximize profits and has heard of something called 'throughput accounting', which may help him to do this. The following information is available:

- All Students do five subjects irrespective of which levels they are having:
 - Course 1: Financial Reporting;
 - Course 2: Public Finance and Taxation;
 - Course 3: Auditing and Assurance;
 - Course 4: Performance Management;
 - Course 5: Financial Management
- The fee of review classes A, B and C is TZS540,000, TZS700,000 and TZS 800,000 respectively per student.
- The only materials' costs relating to the review classes are for Financial Reporting, Public Finance and Taxation and Performance Management. These are as follows:

	Level A	Level B	Level C
	TZS per Student	TZS per Student	TZS per Student
Financial Reporting	1,400	1,600	2,000
Public Finance and Taxation	7,000	8,000	9,000
Performance Management	5,000	5,000	5,000

- There are five members of staff employed by Saint Mary University. Each works a standard 40-hour week for 50 weeks of the year, a total of 2,000 hours each per annum. Their salaries are as follows:

Lecturer	Salary per annum TZS
Financial Reporting	4,000,000
Public Finance and Taxation	3,600,000
Auditing and Assurance	7,000,000
Performance Management	9,000,000
Financial Management	5,000,000

The only other Saint Mary University cost (comparable to 'factor costs' in a traditional manufacturing environment) are general overheads, which include the lecture room rental costs, amount to TZS20,000,000 per annum.

5. (a) Maximum annual demands for level A, level B and level C are 700, 800 and 1,200 students respectively. Time spent by each of the five different staff members on each CPA (T) review class level is as follows:

Lecturer of:	Level A	Level B	Level C
	Hours per student	Hours per student	Hours per student
Financial Reporting	0.25	0.25	0.25
Public Finance and Taxation	0.27	0.25	0.30
Auditing and Assurance	0.24	0.28	0.30
Performance Management	0.75	1	1.25
Financial Management	0.60	0.70	0.74

Part hours are shown as decimals e.g. 0.25 hours = 15 minutes (0.25 x 60).

Lecturer of Performance Management's hours have been correctly identified as the bottleneck resource.

REQUIRED:

- (a) Calculate
- (i) Throughput accounting ratio for Level C. (Note: use hours as provided in the table)
 - (iii) Optimum product mix and the maximum profit per annum.
 - (b) Assume that your calculations in part (a)(ii) above showed that, if the optimum product mix is adhered to, there will be excess demand for Level C of 660 students per annum. In order to satisfy this excess demand, the company is considering equipping and using its own lecture room, as well as continuing to rent the existing lecture rooms. The company cannot rent any more lecture rooms time at either the existing lecture rooms or any other rooms in the area, so equipping its own lecture rooms is the only option. An additional Performance Management Lecturer would be employed to work in the newly equipped lecture rooms.
 - (c) Discuss whether the overall profit of the company could be improved by equipping and using the extra lecture room. (Note: Some basic calculations may help your discussion)

***QUESTION 6 (ACCA DECEMBER 2013)**

Solar System Co (S Co) makes two types of solar panels at its manufacturing plant: large panels for commercial customers and small panels for domestic customers. All panels are produced using the same materials, machinery and a skilled labour force. Production takes place for five days per week, from 7 am until 8 pm (13 hours), 50 weeks of the year. Each panel has to be cut, moulded and then assembled using a cutting machine (machine C), a moulding machine (Machine M) and an assembly machine (Machine A).

As part of government scheme to increase renewable energy sources, **S Co** has guaranteed not to increase the price of small or large panels for the next three years. It has also agreed to supply a minimum of 1,000 small panels each year to domestic customers for this three-year period.

Due to poor productivity levels, late orders and declining profits over recent years, the finance director has suggested the introduction of throughput accounting within the organisation, together with 'Just in Time' system of production. Material costs and selling prices for each type of panel are shown below.

	Large Panels	Small Panels
	TZS	TZS
Selling price per unit	12,600	3,800
Material costs per unit	4,300	1,160

Total factory costs, which include the cost of labour and all factory overheads, are TZS 12 million each year at the plant.

Out of the 13 hours available for production each day, workers take a one hour lunch break. For the remaining 12 hours, machine C is utilized 85% of the time and machine M and A are utilised 90% of the time. The unproductive time arises either as a result of routine maintenance or because of staff absenteeism, as each machine needs to be manned by skilled workers in order for the machine to run. The skilled workers are currently only trained to work on one type of machine each. Maintenance work is carried out by external contractors who provide a round the clock service (that is, they are available 24 hours a day, seven days a week), should it be required.

The following information is available for machine M, which has been identified as the bottleneck resource:

	Large Panels Hours per unit	Small Panels Hours per unit
Machine M	1.4	0.6

There is currently plenty of spare capacity on machine C and A. Maximum annual demand for large panels and small panels is 1,800 units and 1,700 units respectively.

REQUIRED:

- Calculate the throughput accounting ratio for large panels and for small panels and explain what they indicate to S Co about production of large and small panels.
- Assume that your calculations in part (a) have shown that large panels have a higher TPAR than small panels.
Required:
Using throughput accounting, prepare calculations to determine the optimum production mix and maximum profit of S Co for the next year.
- Suggest and discuss **THREE** ways in which S Co could try to increase its production capacity and hence increase throughput in the next year without making any additional investment in machinery.

Answers to Self-Examination Questions**Answer to SEQ 1**

$$\begin{aligned}
 \text{(a) Total factory costs} &= \text{Total of all costs except materials (amount in TZS'000)} \\
 &= 7,500 + 3,750 + 525 + 6,750 + 2,400 + 1,050 + 1,500 \\
 &= 23,475
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) Cost per Factory Minutes} &= \text{TFC/minutes available in bottleneck} \\
 &= \text{TZS}23,475,000/9,390 \\
 &= \text{TZS}2,500
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) Return per bottleneck minute for product P} &= \frac{\text{Selling price} - \text{Material cost}}{\text{Minutes in bottleneck}} \\
 &= \text{TZS}(10,500 - 6,000)/1.5 \\
 &= \text{TZS}3,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Return per bottleneck minute for Product Q} &= \text{TZS}(10,500 - 5,250)/3 \\
 &= \text{TZS}1,750
 \end{aligned}$$

$$\begin{aligned}
 \text{(d) Throughput Accounting (TA) Ratio for Product P} &= \frac{\text{Return per minute}}{\text{Cost per minute}} \\
 &= \text{TZS}3,000/\text{TZS}2,500 \\
 &= 1.2
 \end{aligned}$$

$$\begin{aligned}
 \text{Throughput Accounting ratio for Product Q} &= \text{TZS}1,750/\text{TZS}2,500 \\
 &= 0.7
 \end{aligned}$$

The TA ratios show that if we made Product Q only, we would make a loss as its TA ratio is less than 1, whereas if we produced Product P we would make profits.

Answer to SEQ 2

Under marginal costing a contribution is determined as the difference between sales revenue and variable costs. On the contrary, in throughput accounting, a contribution (called 'throughput') is determined as the difference between sales revenue and material costs. All costs other than raw material costs are considered to be fixed costs in throughput accounting whereas direct labour cost and a part of the overheads are considered to be variable under marginal costing. As a consequence, the contribution calculated under throughput accounting is higher than that calculated under marginal costing.

In both marginal costing and throughput accounting, the contribution per unit of the bottleneck resource is calculated in order to ascertain product profitability and accordingly to identify the ranking of the products for priority of production.

Answer to SEQ 3

(a) Total profit per day = Throughput contribution - Conversion costs

$$\begin{aligned}
 &= (4,000 \text{ units} \times \text{TZS million } (0.15 - 0.09) - \text{TZS150 million}) \\
 &= \text{TZS240 million} - \text{TZS150 million} \\
 &= \text{TZS90 million}
 \end{aligned}$$

(b) Return per factory hour = $\frac{\text{Selling price} - \text{Material cost}}{\text{Usage of bottleneck resources in hours (factory hours)}}$

$$\begin{aligned}
 &= \frac{\text{TZS0.15 million} - \text{TZS0.09 million}}{1 \text{ hour} / 600 \text{ units}} \\
 &= \text{TZS36 million}
 \end{aligned}$$

(c) Throughput cost per day = No. of units produced x Factory cost (Conversion cost) per time taken to produce one unit

$$\begin{aligned}
 &= 4,000 \times (\text{TZS0.15 million} / (8 \times 600)) \\
 &= \text{TZS125 million}
 \end{aligned}$$

$$\begin{aligned}
 \text{Efficiency of bottleneck resource usage} &= \frac{\text{Throughput cost per day}}{\text{Total factory cost per day}} \\
 &= \frac{\text{TZS125 million} \times 100\%}{\text{TZS150 million}} \\
 &= 83\%
 \end{aligned}$$

d) Throughput accounting ratio = $\frac{\text{Return per factory hour}}{\text{Total factory cost per factory hour}}$

$$\begin{aligned}
 &= \frac{\text{TZS36 million}}{\text{TZS150}/8} \\
 &= 1.92
 \end{aligned}$$

(a) Answer to SEQ 4 **PRODUCTION MIX USING CONTRIBUTION MARGIN APPROACH**
Step 1: Determining C.M/unit for each type leather accessory

	Leather wallet	Leather Belt	Smartphone leather cases
Selling price	30,000	25,000	20,000
Less: V. cost			
D. Material	12,000	8,250	7,200
D. Labour	4,000	1,700	2,000
Variable OHD	1,000	750	800
C.M/unit	13,000	14,300	10,000

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Step 2: Determine contribution per limiting Hrs

C.M	13,000	14,300	10,000
÷ Saddle stitching Hours *	0.60Hrs	0.4Hrs	0.4Hrs
	_____	_____	_____
Contribution per stitching hours	21,667/Hrs	35,750/Hrs	25,000/Hrs
RANKING	2nd	1st	3rd

*Bottleneck Process:

	Leather wallet hours	Leather Belt hours	Smartphone leather cases
Cutting	20,000	20,000	20,000
Sanding	24,000	40,000	24,000
Saddle stitching	10,000	15,000	15,000

Total hour each process can be operated
= (10 Hrs x 6 days x 50 weeks) x 2 machines

= 6,000 Hrs per annum are available

∴ Saddle Stitching the Bottleneck process and Hrs for saddle stitching are the limiting Hrs.

PRODUCTION PLAN

Ranking	Product	(units)Hrs/unit	Hrs/unit	Total Hrs
1 st	Leather Belt	12,500	0.4 Hrs	5,000 Hrs
2 nd	Smartphone case	2,500	0.4 Hrs	1,000 Hrs
				6,000 Hrs

PROFIT

	Leather wallet	Leather Belt	Smartphone leather cases	TOTAL
C.M/unit	13,000	13,300	10,000	
X Units	1,000	12,500	2,500	
Total contribution margin	13,000,000	178,750,000	25,000,000	203,750,000
Less: Fixed costs				(400,000,000)
Loss				(196,250,000)

(b) TAR

TAR	Leather	Leather	Smartphone
S. Price	30,000	25,000	20,000
D. Material	(12,000)	(8,250)	(7,200)
Throughput contribution	18,000	16,750	12,800
÷ Bottleneck process	÷ 0.6Hrs	÷ 0.4Hrs	÷ 0.4hrs
Hrs/unit	_____	_____	_____
Return/factory Hr	30,000	41,875	32,000
÷ Total conversion cost	80,500	80,500	80,500
Per factory Hr (W1)	_____	_____	_____
TAR =	0.37 =====	0.52 =====	0.39 =====

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(ii) Analysis of Decision

	Level A	Level B	Level C
Sales price/unit	540,000	700,000	800,000
Material cost/unit	(13,400)	(14,600)	(16,000)
Throughput/unit	526,600	685,400	784,000
Hours/unit of bottleneck	0.75	1	1.25
Throughput per hour	702,133.3	685,400	627,200
Rank	1	2	3

(iii) Optimum Product Mix & Profit

	Hours		
A – 700 students x 0.75 = 525	x 702,133.3	=	368,619,982.5
B – 800 students x 1 = 800	x 685,400	=	548,320,000
C – 540 students x 1.25 = 675	x 627,200	=	423,360,000
Available	2000	Total throughput	1,340,299,982.5
		Less: Fixed costs	48,600,000
		Profit	<u>1,291,699,982.5</u>

(b) Throughput Returns from additional 660 students for level C:

= 660 x 1.25 x 627,200	=	517,440,000
Less: Cost of equipping the lecture room	=	100,000,000
Salary of new P.M. lecturer	=	<u>9,000,000</u>
Additional profit from the decision to Equip and using extra lecture room		<u>408,440,000</u>

Hence as calculation shown above, it is profitable to equip extra lecture room to satisfy the excess demand of 660 students of level C.

SECTION B4: DECISION MAKING UNDER ENVIRONMENT OF CERTAINTY

Get Through Intro

To make or to buy is one of the most frequently taken decisions in everyday life. This decision involves weighing up the costs of the 'make' or 'buy' options with the assumption that exactly the same quality of goods / services can be obtained from both the alternatives. The alternative which provides more benefits for less cost is selected. The decision to outsource may seem to be a new dimension to business, but in fact, it is just a new focus on the traditional 'make or buy' decision.

Nowadays, most companies outsource their functions. However, before deciding to outsource, a company should ensure that the decision has been made judiciously and not just in an attempt to follow the trend.

This section explains how businesses decide which particular course of action to select out of the available alternatives. Through reading this section, you will become acquainted with the management accounting tools and techniques used to take an appropriate decision. In your future career as a management accountant, you will be able to apply these tools and techniques in decision-making situations. Moreover, the topics covered by the section are important from an examination point of view and therefore you should go through it carefully.

Learning Outcomes

- a) Identify limiting factors in a scarce resource situation and select appropriate techniques
- b) Determine the optimal production plan where an organisation is restricted by a single limiting factor
- c) Formulate and solve multiple scarce resource problems both graphically and using simultaneous equations
- d) Interpret the final simplex table and simplex methods.
- e) Evaluate the factors affecting the make vs. buy outsourcing decision.
- f) Calculate and compare make costs with buy in costs and make appropriate decision using comparative analysis.
- g) Make financial analysis and decide whether to replace an old equipment
- h) Calculate incremental costs of processing further a product and make an appropriate decision to process further or sell
- i) Identify costs relevant for shut down and shut down point
- j) Apply relevant costing principles in situations involving shut down and extra shifts
- k) Compute the financial impact of product/operation shut down, and make appropriate decision
- l) Prepare an analysis showing whether a special order should be accepted

1. Identify limiting factors in a scarce resource situation and select appropriate techniques. [Learning Outcome a]

1.1 Conceptualising what 'limiting factor' (scarce resource) is:

A limiting factor is a factor of production (or of any other activity) that is in short supply and that prevents an organisation from expanding its production (or activities) and maximising its profit. It refers either to a scarce resource needed for production or to a limited market demand for the items produced.

The most common limiting factors for organisations are the demand for their products and services, availability of materials, labour supply, and machine capacity etc. The scarcity of most of the factors of production (or activities) may be a short term phenomenon which can be overcome in the long run.



Example

Machine capacity or the availability of skilled labourers may be limited for one year or so until steps are taken to enhance machine capacity or to hire more skilled labourers

1. Identifying the optimum alternative in a situation where resources are available in abundance

Decision-making lies in a situation where there are alternatives and one has to choose amongst those alternatives. In a situation where all the resources needed to optimise the decision objective (e.g., maximising contribution / profit or minimising cost, etc.) are available in abundance, the highest unit contribution margin (or lowest unit cost) provided by the alternative is to be chosen.



Example

Atlanta Company has met all production requirements for the current month and has an opportunity to produce additional units of a product with its excess capacity. Unit selling prices and unit costs for three models of one of its product lines are as follows:

	Plain Model (TZS'000 per unit)	Regular Model (TZS'000 per unit)	Super Model (TZS'000 per unit)
Selling price	120	130	160
Direct material cost	36	40	38
Direct labour cost (TZS10,000 per hour)	20	30	40
Variable overhead	16	24	32
Fixed overhead	32	10	30

Variable overhead is applied on the basis of direct labour hours while fixed overheads are applied on the basis of machine hours. There is sufficient demand for additional production of any model of the product line.

If Atlanta Company has excess machine capacity and can add more labour as needed (i.e. neither capacity nor labour is a constraint), the excess production capacity should be devoted to producing the model with the highest unit contribution margin (since demand, machine capacity and labour are not constraints).

The unit contribution margin has been shown as follows:

	Plain Model (TZS'000 per unit)	Regular Model (TZS'000 per unit)	Super Model (TZS'000 per unit)
A. Selling Price	120	130	160
Variable costs:			
Direct materials	36	40	38
Direct labour (@TZS10,000 per hour)	20	30	40
Variable overheads	16	24	32
B. Total Variable Cost per unit	72	94	110
C. Unit Contribution Margin (A – B)	48	36	50

Since Super model generates the maximum unit contribution out of the three models; its production should be optimised so as to maximise overall profitability.

2. Identify the optimum alternative in a situation when one of the resources is scarce

The unit contribution margin provides a good indication of how to prioritise an alternative in order to optimise profit (or other object function) when the resources are available in abundance. However, this is not a sufficient measure to optimise objective function when the resources are scarce. When any one of the resources is scarce but other resources are available in abundance, the contribution margin per unit of the scarce resource most appropriately identifies the best possible solution amongst the different alternatives. To maximise contribution, the scarce resource needs to be allocated to those products that earn the most contribution per limiting factor.



Example

Continuing the above example of Atlanta Company

If Atlanta Company has unlimited machine capacity but a limited amount of labour time available, the excess production capacity should be devoted to producing the model with the highest **contribution margin per hour of labour**. It can be calculated as 'contribution margin/direct labour hour per unit'.

Plain model	$\text{TZS}48,000/(\text{TZS}20,000/10,000) = \text{TZS}24,000$ per hour
Regular model	$\text{TZS}36,000/(\text{TZS}30,000/10,000) = \text{TZS}12,000$ per hour
Super model	$\text{TZS}50,000/(\text{TZS}40,000/10,000) = \text{TZS}12,500$ per hour

The above calculation indicates that Plain model has the highest contribution per limiting factor (i.e., direct labour hour) and therefore, maximising production of this model will optimise the utilisation of the scarce resource and thereby maximise profit.

3. Identify the optimum alternative in a situation when there are multiple scarce resources

In multiple scarce resource situations, the contribution margin per unit of each of the scarce resources may present conflicting priorities while selecting the appropriate alternative for maximising an objective function. So as to resolve the impasse in identifying the optimum solution when there are multiple scarce resources, managers need to resort to **linear programming**.



Example

Continuing the previous example of Atlanta Company

If it has a limited availability of direct material along with a limited availability of labour time, and if the raw material requirements per unit of Plain model, Regular model and Super model are 4 kilograms, 2 kilograms and 5 kilograms respectively, then the **contribution margins per kilogram of raw materials** would be as follows:

For Plain model:	$\text{TZS}48,000/4 \text{ kilograms} = \text{TZS}12,000$ per kilogram of raw materials
For Regular model:	$\text{TZS}36,000/2 \text{ kilograms} = \text{TZS}18,000$ per kilogram of raw materials
For Super model:	$\text{TZS}50,000/5 \text{ kilograms} = \text{TZS}10,000$ per kilogram of raw materials

Contribution margin per kilogram of raw materials is found to be the highest in the case of Regular model followed by Plain and Super model respectively. The priorities for producing the models set according to contribution margin per labour hour and contribution margin per kilogram of raw material are, therefore, conflicting.

1.2 Linear programming: elementary concept and assumptions



Definition

Linear programming is a mathematical technique used for selecting the optimum decision variable in circumstances where a business problem contains a number of constraints i.e. scarce resources (e.g. money, manpower, material, machine and other facilities). A decision variable refers to any activity (e.g. a product, a project) that is competing with other activities to get allocation of the limited resources.

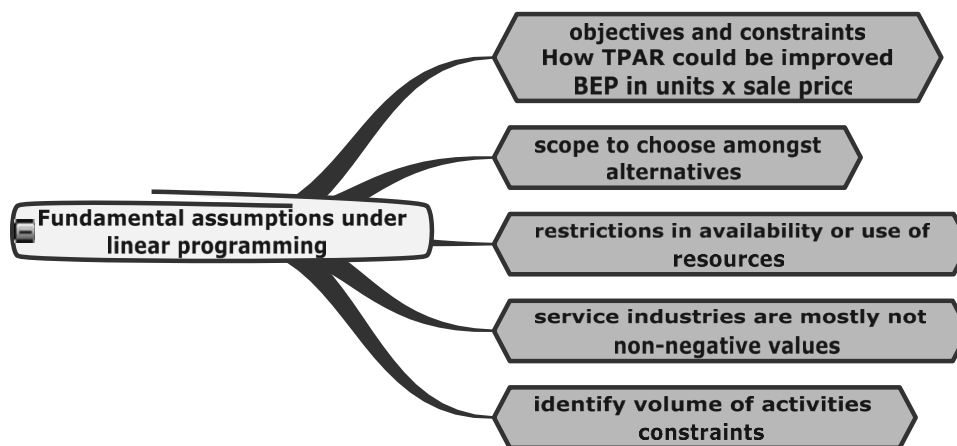
Fundamental assumptions for applying linear programming technique are:

1. The objectives (profit maximisation or cost minimisation) and constraints (limiting factors) are expressed as **linear** functions / equations or inequalities.

A relationship, given corresponding increment in one variable for every increment in the other, is said to be linear and can be graphically represented as a straight line (e.g. if the number of labour hours employed in a factory increases, the production in the factory will also increase proportionately).

2. There must be scope to choose amongst the alternatives. In other words, there must be activities (e.g. products, projects, etc.) competing for allocation of the limited resources.
3. There must be restriction in availability or use of resources which are to be allocated amongst the various competing activities.
4. All decision variables must assume non-negative values (as negative values of physical quantities are an impossible assumption).
5. There must be a finite number of activities and constraints. Although this is only a mathematical consideration, it is quite realistic to presume that typical business problems always involve a finite number of activities and constraints.

SUMMARY



2. Determine the optimal production plan where an organisation is restricted by a single limiting factor.

[Learning Outcome b]

A limiting factor is any factor which limits the organisation from expanding its activities because of its scarce supply. Limiting factors are also known as key factors. They can be man hours, machine hours, raw materials, demand for the product etc.



Example

Rambo Plc needs 5 kg of plastic and 6 man hours to produce one bucket. The estimated production for December 20Y0 is 25 buckets. In all, 200 man hours and 100 kg of plastic are available in the market.

Here,

Required man hours = 25 buckets x 6 man hours per bucket = 150 hours

Required plastic = 25 buckets x 5 kg plastic per bucket = 125 kg

The available man hours are sufficient but the raw material i.e. plastic is scarce. In this situation, plastic is a limiting factor because only a maximum of 20 buckets can be produced (100 kg plastic/5kg per bucket).

The concept of contribution can also be used to make decisions regarding the best use of a limited resource.



Example

Continuing the previous example of Rambo Plc

If Rambo Plc has two choices: manufacturing buckets or cans, and each can requires 2.5 kg of plastic and 3 man hours, consider the figures given below and identify which product is more profitable for Rambo.

	TZS'000
Selling price of bucket	160
Selling price of can	78
Materials - price per kg	10
Wages – per hour	15

Calculation of contribution per unit

	Bucket	Can
	TZS'000	TZS'000
Selling price	160	78
Less: Variable costs		
Materials (kg x TZS10,000)	()	(25)
Labour (hours x TZS15,000)	(90)	(45)
Contribution	20	8

Contribution per limiting factor (plastic) = $\frac{\text{Contribution per unit}}{\text{Required kg per unit}}$

For buckets: TZS20,000/5 = TZS4,000

For cans: TZS8,000/2.5 = TZS3,200

As the contribution per limiting factor for a bucket is (20,000 per unit) higher than for that for a can, Rambo should manufacture plastic bucket in order to maximise its profits.

2.1 Determination of product mix

Normally, a product mix decision is made on the basis of the contribution per unit of each product. However, in the case of limited supply of key resources such as machine hours, materials, etc. contribution per key factor should be considered.



Example

The following production details relate to Rainbow Plc.

	Product X	Product Y	Total
Selling price per unit (TZS'000)	15	20	
Variable cost per unit (TZS'000)	10	14	
Fixed costs for the budgeted period (TZS'000)	-	-	80,000
Required machine hours per unit	2.5	3.5	
Budgeted production / sales (units)	10,000	20,000	30,000

Advise the management of Rainbow on the appropriate product mix, and compute the product will be more profitable in the following circumstances:

- (i) Available machine hours - 100,000
- (ii) Available machine hours - 50,000

For prioritising the products, the required machine hours and contribution per unit / per key factor needs to be calculated.

Required machine hours

For producing 10,000 units of X and 20,000 units of Y, total required machine hours are:

Product X: 10,000 units x 2.5	25,000
Product Y: 20,000 units x 3.5	70,000
Total	95,000

Continued on the next page

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Contribution per unit

Product X: Contribution = Selling price – Variable cost = TZS15,000 - TZS10,000 = TZS5,000

Product Y: Contribution = Selling price – Variable cost = TZS20,000 - TZS14,000 = TZS6,000

Contribution per key factor (machine hours)

Product X: Contribution per unit/Machine hour per unit = TZS5,000/2.5 = 2,000

Product Y: Contribution per unit/Machine hour per unit = TZS6,000/3.5 = 1,710

Situation (i)

Available machine hours > Required machine hours, hence, Rainbow can produce both the products.

Income statement of Rainbow Plc

	Product X	Product Y	Total
Sales (units)	10,000	20,000	30,000
Contribution per unit (TZS'000)	5	6	
Total contribution (TZS'000)	50,000	120,000	170,000
Less: Fixed costs (TZS'000)			80,000
Profit (TZS'000)			90,000

Situation (ii)

Available machine hours < Required machine hours, hence, Rainbow should prioritise the production of the product earning a higher contribution of the key factor.

Total machine hours	50,000
Less: Machine hours for product X (10,000 units x 2.5 hours)	25,000
Remaining machine hours will be utilised for the production of product Y	25,000

Considering the availability of 25,000 machine hours, and that 3.5 hours are required per unit of product Y, only 7,143 units can be produced (i.e. 25,000/3.5).

Income statement of Rainbow Plc

	Product X	Product Y	Total
Sales (units)	10,000	7,143	17,143
Contribution per unit (TZS'000)	5	6	
Total contribution (TZS'000)	50,000	42,858	92,858
Less: Fixed costs (TZS'000)			80,000
Profit (TZS'000)			12,858



Tip

Contribution per unit may be higher at first look. However, in the case of limiting factors, contribution per key factor needs to be considered. In this example, contribution per unit is higher for product Y, but for the purpose of decision making, the contribution per key factor is relevant.

$$50,000/3.5$$

Here, a decision would have to be taken based on the contribution per unit.

Total machine hours are 50,000, out of which only 14,285 units of product Y can be produced.

Income statement of Rainbow Plc

	Product X	Product Y	Total
Sales (units)	NIL	14,285	14,285
Contribution per unit (TZS'000)		6	
Total contribution (TZS'000)		85,710	85,710
Less: Fixed costs (TZS'000)			80,000
Profit (TZS'000)			5,710

Profit is much lower than TZS12,858,000

3. Formulate and solve multiple scarce resource problems both graphically and using simultaneous equations as appropriate and simplex methods

[Learning Outcome c]

3.1 Steps of formulating a linear programming model in multiple scarce resource situations:

1. Determining the objective variable and objective function

An objective variable represents the quantity given the notation x_1, x_2, x_3 , etc.) of an alternative item or course of action that is required to attain the optimum solution. An objective function is the quantification of an objective, usually expressed as maximising profit or minimising cost. It is a structured description of what one wants to do.

An objective function expressed in a structured form but in English will be: **Maximise contribution margin or Minimise costs**

To solve a linear accounting problem, the objective function needs to be expressed in terms of algebraic symbols, such as: Maximise $Z = c_1x_1 + c_2x_2 + \dots + c_nx_n$; where, c_1, c_2 , etc. are constants representing per unit contribution to the objective function.

Similarly, an objective function may be constructed for minimising costs also when c_1, c_2 , etc. would signify costs per unit.



Example

Radiant Television Company produces two types of TV sets, 'Romantic' and 'Elegant'. The company has a capacity to produce 60 sets per day of the 'Romantic' and 50 sets per day the 'Elegant'. The labour requirement for the 'Romantic' set is 1 man-hour, whereas 'Elegant' requires full 2 man-hours of labour. Presently, there is a maximum of 120 man-hours of labour per day that can be assigned to the production of the two types of sets. The contribution margins are TZS20,000 and TZS30,000 for each 'Romantic' and 'Elegant' set respectively.

The **objective function** may be expressed mathematically as follows: **Maximise $20,000X_1 + 30,000X_2$**

When contribution margin is measured in shillings which are TZS20,000 and TZS30,000 respectively for Romantic and Elegant, and X_1 and X_2 represent the quantity of Romantic and Elegant to be produced in a day.

2. Constructing constraint statements

The multiple scarce resources, i.e. limiting factors, need to be expressed as linear inequalities or equations in terms of the above defined decision variables.

The constraint statement can be expressed using algebraic symbols as:

$$a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \text{ or } b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \text{ or } b_2$$

$$a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \text{ or } b_m$$

$$x_1, x_2, \dots, x_n \geq 0$$

where $b_1, b_2, \dots, b_m$ etc. are indicative of constraint requirements or availability.



Example

Continuing the example of Radiant Television Company

Capacity constraint

Romantic's production less-than-or-equal-to capacity for Romantic measured in units)

Elegant's production less-than-or-equal-to capacity for Elegant measured in units)

Labour Hour constraint

Labour used less-than-or-equal-to labour availability measured in man-hours)

The can be expressed as follows:

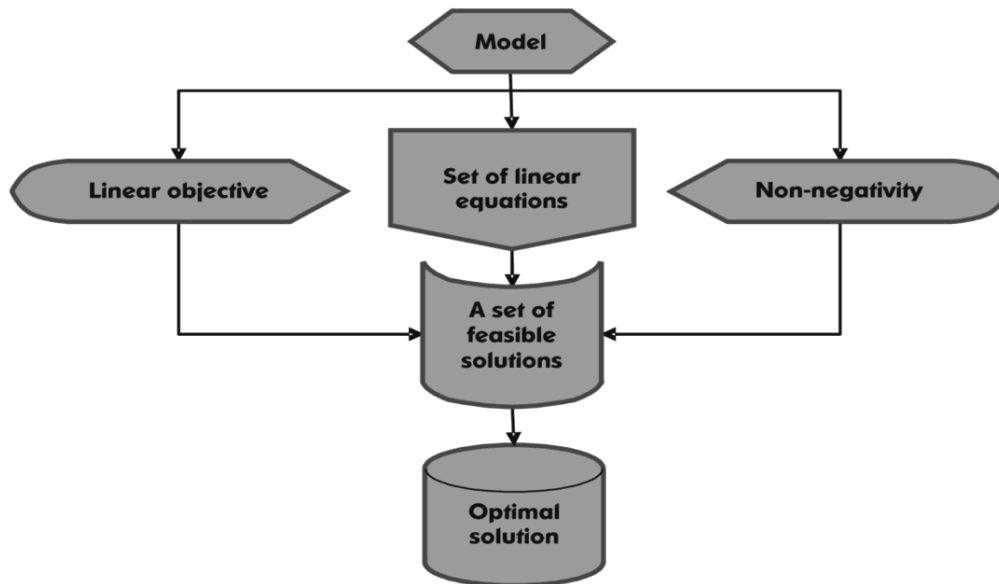
$$X_1 \leq 60 \text{ (Romantic's capacity)}$$

$$X_2 \leq 50 \text{ (Elegant's capacity)}$$

$$X_1 + 2X_2 \leq 120 \text{ (Labour in man-hours)}$$

(Where, $X_1, X_2 \geq 0$ this is the non-negativity assumption)

Diagram 4: Ingredients of LP model



3. Solve a multiple scarce resource problem graphically

A multiple scarce resource problem can be solved graphically only if the number of decision variables is two or less. On the other hand, the graphical method of solving a linear programming problem can deal with any number of constraints but as each constraint is represented by a line on the graph, a large number of lines may make the graph difficult to read.

Despite the above characteristic features, graphical methods are the simplest methods of solving a linear programming problem and are therefore used extensively. The method of solving a linear programming problem graphically is as follows:

- Formulate the appropriate linear programming problem.
- Treat the inequalities as equalities and draw a line for each equation on a piece of graph paper. To draw the lines representing the equations, select the two points that intersect the axes and connect them with a straight line.
- Note that a constraint of the 'less than' type will have a feasible region on its left or below the line. Conversely, in the case of a constraint of the 'more than' type, the feasible region will be on the right hand side of the line representing the constraint. The feasible region also includes the line concerned, if it is an equation or an inequality of the 'less than or equal to' or the 'more than or equal to' type.
- Identify the solution space or feasible region that satisfies all the constraints simultaneously. The feasible region must be bounded by the lines drawn and the axes. If the region is not bounded, there is no solution to the problem.
- Evaluate the objective function at each of the corner points of the feasible region and accordingly, identify the optimal value of the objective function. It should be noted that the optimal solution lies at any of the corner points of the feasible region).



Example

The problem of Radiant Television Company is solved graphically in the following steps.

Step 1: Formulate the Linear Programming Problem as follows:

Objective function: Maximise $20,000X_1 + 30,000X_2$

Subject to Constraints

X_1 60 (Romantic's capacity)

X_2 50 (Elegant's capacity)

$X_1 + 2X_2$ 120 (Labour in man-hours)

Where, $X_1, X_2 \geq 0$

Continued on the next page

Step 2: Remember, straight lines will have to be drawn for each constraint. And the decision variable of the objective function is shown on each of the by x-axis and y-axis. We will show the variable ' X_1 ' on x-axis and ' X_2 ' on y-axis

For drawing the straight line, we must convert the inequalities into equalities as follows:

$$\begin{aligned} X_1 &= 60 \\ X_2 &= 50 \text{ and} \\ X_1 + 2X_2 &= 120 \end{aligned}$$

Hence there will be in all three equation lines plotted on the graph.

The first line will be $X_1 = 60$ will go parallel to y-axis and the second line $X_2 = 50$ will be parallel to the X-axis. For the third line we will have to select the points and then join them to get the line for $X_1 + 2X_2 = 120$. This is shown below:

So as to obtain the points of intersection with the axes, put $X_1 = 0$ in the equation $X_1 + 2X_2 = 120$
i.e. $0 + 2X_2 = 120$

$$X_2 = 60$$

Again, put $X_2 = 0$ in the equation $X_1 + 2X_2 = 120$
i.e. $X_1 + 2 \times (0) = 120$

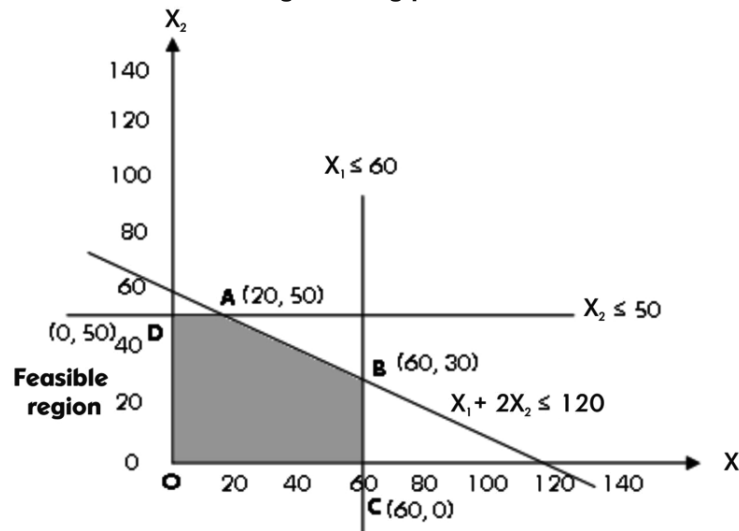
$$X_1 = 120$$

Alternatively, the equation $X_1 + 2X_2 = 120$ may be expressed into intercept form to be presented as

$$\frac{X_1}{120} + \frac{X_2}{60} = 1 \text{ by dividing both the sides of the equation by the constant term i.e. (120).}$$

Accordingly, we can directly infer that the straight line intersects the horizontal axis at (120,0) and the vertical axis at (0,60) points.

Step 3: Graphical presentation of Linear Programming problem



Step 4: Feasible region

The shaded portion shown in the graph reflects the feasible solution area i.e. ODABC

Find out the co-ordinates of all corner points of the feasible region

Co-ordinates of point A

The $X_2 = 50$ line intersected the $X_1 + 2X_2 = 120$ line. Therefore, by putting the value of X_2 into the equation $X_1 + 2X_2 = 120$, we get $X_1 = 20$

Therefore, the co-ordinates of point A are (20,50)

Continued on the next page

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Co-ordinates of point B

The $X_1 = 60$ line intersected the $X_1 + 2X_2 = 120$ line. Therefore, by putting the value of X_1 into the equation $X_1 + 2X_2 = 120$, we get $X_2 = 30$
Therefore, the co-ordinates of point B are (60,30)

Co-ordinates of point C

Find out the points of intersection of the equation $X_1 = 60$
First this inequality is converted into the equation $X_1 = 60$
The equation line is parallel to X_2 i.e. this line is at a 60 units distance from the X_2 axis)
Therefore, the co-ordinates of point C are (60,0)

Co-ordinates of point D

Find out the points of intersection of the equation $X_2 = 50$
First this inequality is converted into the equation $X_2 = 50$
The equation line is parallel to X_1
Therefore, the co-ordinates of point D are (0,50)

Step 5: Find out the optimum profit of Radiant Television Company by putting the value of the coordinates of the corner points of the feasible region into the objective function $Z = 20X_1 + 30X_2$

Corner Point	Coordinates of corner point	Objective function $Z = 20,000X_1 + 30,000X_2$	Value TZS
O	(0, 0)	$Z(O) = 20,000 \times (0) + 30,000 \times (0)$	0
D	(0, 50)	$Z(D) = 20,000 \times (0) + 30,000 \times (50)$	1,500,000
C	(60, 0)	$Z(C) = 20,000 \times (60) + 30,000 \times (0)$	1,200,000
A	(20, 50)	$Z(A) = 20,000 \times (20) + 30,000 \times (50)$	1,900,000
B	(60, 30)	$Z(B) = 20,000 \times (60) + 30,000 \times (30)$	2,100,000

Out of the five corner points, the fifth point i.e. for point (B), gives the maximum profit of TZS2,100,000 indicating the optimum profit for the business. The optimum profit will be achieved when 60 units per day of the Romantic model are produced and 30 units per day of the elegant model are produced.

5.2 Iso-contribution line

Iso-contribution line is actually a short-cut method to find out the optimal solution. Iso means similar and iso-contribution line means a line that is similar (but not exactly the same) to a contribution line, i.e. a line that has the same slope as a contribution line would have.



Example

In the above example of Radiant Television Company, the objective function (i.e. the contribution function) is $20,000X_1 + 30,000X_2$. To find out the iso-contribution line, multiply the coefficient of the two variables together.

In our contribution function, i.e. $20,000X_1 + 30,000X_2$, X_1 and X_2 are two variables and the coefficient of X_1 is 20,000 whereas the coefficient of X_2 is 30,000.

Simply multiply these coefficients ($20,000 \times 30,000$) to get the number that is to be used to convert the function into an equation. This will be the equation of the iso-contribution line.

Therefore: $20,000X_1 + 30,000X_2 = 600,000,000$

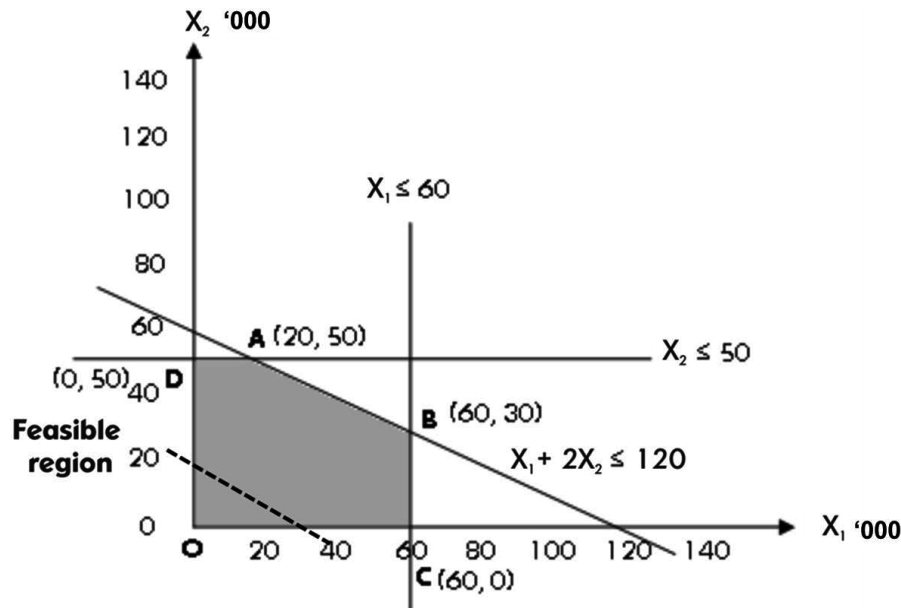
We now have the equation of the iso-contribution line. We can use this to find the coordinates of X_1 and X_2 and draw the iso-contribution line.

By solving the above equation:

$X_1 = 30,000$ when $X_2 = 0$

$X_2 = 20,000$ when $X_1 = 0$

Continued on the next page



The optimal point can be easily determined using the iso-contribution line. You need to place a ruler on this line and move slowly up parallel to the line. While moving up, the ruler will touch the points in the feasible region ODABC one by one. The last point that is touched before leaving the feasible region is called the optimal point.

It is very important to note that you need to move the iso-contribution line outwards for profit maximisation and inwards for cost minimisation.



Test Yourself 4

Tiny Ltd makes only two products. The production constraints representing two machines and their maximum hours available are as follows:

Machine 1: $2X + 3Y \leq 18$

Machine 2: $2X + Y \leq 10$

Where X = Number of units of the first product

Y = Number of units of the second product

If the objective function is to maximise total contribution margin of TZS4,000 X + TZS3,000 Y , determine the most possible contribution margin.

5.3 Solve a multiple scarce resource problems using simultaneous equations

A linear programming problem can be solved by converting the constraints into equations wherever these are inequalities) and solving these simultaneous equations to find the values of the decision variables. The values of the decision variables will satisfy all the constraint conditions. By substituting the values of the decision variables in the objective function, the optimum value of the objective function can be obtained.

This method can be used to solve linear programming problems only if the number of constraints and the number of decision variables are limited i.e. not exceeding two. In cases where the numbers go beyond two, finding the solution under this method becomes difficult and solving the L.P.P. by adopting other methods e.g. graphical or simplex) is preferred.



Example

Continuing the example of Radiant Television Company

The three constraints in this case are:

$X_1 \leq 60$ ('Romantic' capacity);

$X_2 \leq 50$ ('Elegant' capacity);

$X_1 + 2X_2 \leq 120$ (labour in man-hours)

The objective function is to maximise $20,000X_1 + 30,000X_2$

Continued on the next page

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To solve the problem using simultaneous equations, the first step is to convert the constraints into equations as follows:

$$X_1 = 60 \dots\dots\dots(i)$$

$$X_2 = 50 \dots\dots\dots(ii)$$

$$X_1 + 2X_2 = 120 \dots\dots\dots(iii)$$

By substituting the value of X_1 in equation (iii) with the value obtained from equation (i), we get,

$$60 + 2X_2 = 120$$

$$\text{Or, } 2X_2 = 60$$

$$\text{Or, } X_2 = 30$$

Again, by substituting the value of X_2 in equation (iii) with the value obtained from equation (ii), we get,

$$X_1 + 2 \times 30 = 120$$

$$\text{Or, } X_1 + 60 = 120$$

$$\text{Or, } X_1 = 60$$

At point (60, 30) the profit will be (TZS20,000 $\times$ 60 + TZS30,000 $\times$ 30) = TZS2,100,000

If $X_2 = 50$ is substituted in equation (iii), we get

$$X_1 + 2(50) = 120$$

$$X_1 = 20$$

Again, by substituting the value of X_1 in equation (iii), we get,

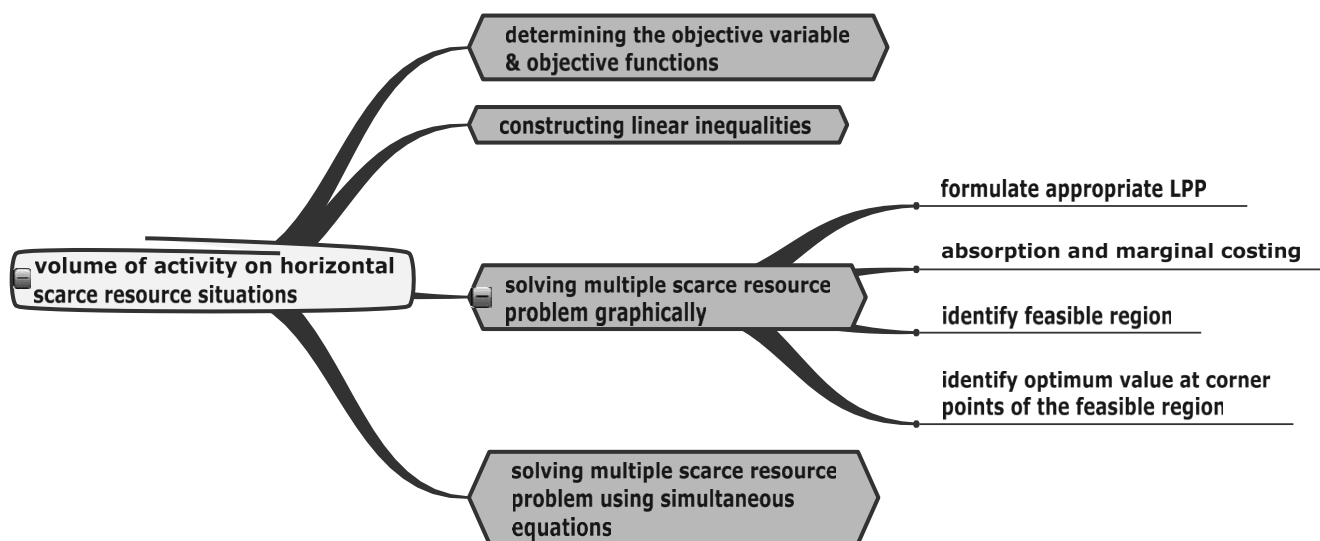
$$20 + 2X_2 = 120$$

$$X_2 = 50$$

At the point (20,50), the profit will be (TZS20,000 $\times$ 20 + TZS30,000 $\times$ 50) = TZS1,900,000.

This signifies that the optimum solution will be reached when 60 units per day of the 'Romantic' model and 30 units per day of the 'Elegant' model are produced.

SUMMARY



Test Yourself 5

Solve the problem of Tiny Ltd using the simultaneous equation method.

4. • Interpret the final simplex table**[Learning Outcome d]****SIMPLEX METHOD using algebraic algorithm process**

The simplex method involves making tedious calculations, but there are standard computer program that will complete the task within a few minutes.

To apply the simplex method, we must formulate the LP – model in the standard form, by formulating the model that does not includes inequalities.

- This is done by introducing slack variable slack variable represent unused resources and slack variable have zero coefficient in the objective function.

Simplex Method: Manual Solution

- In 1947, George Dantzig developed the simplex algorithm for solving linear programming problems. The simplex algorithm proceeds as follows:
 - Step (1): Convert the linear programming problem to standard form.
 - Step (2): Obtain a basic feasible solution (bfs), if possible, from the standard form.
 - Step (3): Determine whether the current bfs is optimal.
 - Step (4): If the current bfs is not optimal, then determine which non-basic variable should become a basic variable and which basic variable should become a non-basic variable to find a new bfs with a better objective function value.
 - Step (5): Find the new bfs with the better objective function value. Go back to step (3).

Example 1

BABITO co produces and sells two types of cars namely POSH and NIVA the following are production requirements per unit, selling price and maximum available resources for productions.

	POSH	NIVA
	TZS	TZS
Selling price (million)	40 million	48 million
Variable costs	30 million	42 million
Fixed cost budgeted at TZS.38,000,000		

Each unit of POSH and NIVA requires 2 units and 1 unit of material respectively, and each unit of POSH and NIVA requires 4 hours and 3hrs of specialized engineers respectively.

There is unlimited demand of each type of the car par weeks. But the maximum labour hour for specialized engineer per week is 85 hours, while the maximum available material P per week is 35 units.

Required:

- Formulate LP model
- Use simplex — LP method to determine the optimal product mix and maximum profit
- Determine the shadow price for scare production resources.

Solution

1st Formulate linear programming model:

Let X be number of POSH cars to be produced

Y be number of NIVA cars to be produced

1	POSH (X)	NIVA (Y)	MAXIMUM
1. Selling price: “000”	40	48	
Variable cost ‘000’	(30)	(42)	
Contribution	10	6	
2. Material (units)	2	1	35
3. Labour hrs	4	2	85

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Then LP model will be:

Max contribution $C=10X + 6y$

contribution

Such that:

$$2X + Y \leq 35$$

material

$$4X + Y \leq 85$$

labour

$$X \geq 0 \quad Y \geq 0$$

non- negativity

2nd Convert the LP model into standard form by introducing artificial variables (slack variables) which represents amount of resources not used.

That is

$$C = 10X + 6Y$$

$$2X + Y + S_1 = 35$$

$$4X + Y + S_2 = 85$$

Where S_1 and S_2 are slack variables for material and labour constraints respectively.

3rd Determine initial solution:

$$C = 10X + 6Y$$

$$S_1 = 35 - 2X - Y$$

$$S_2 = 85 - 4X - Y$$

- Entering variable will be X due to high contribution
- Leaving variable being a limiting factor

$$\text{Is } S_1 \leq \frac{35}{2} (17.5)$$

$$S_2 \leq \frac{85}{4} (21.25)$$

S_1 is leaving variable

$$\text{Then } X = \frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1$$

$$C = 10\left(\frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1\right) + 6Y$$

$$= 175 - 5Y - 5S_1 + 6Y$$

$$= 175 + Y - 5S_1$$

$$S_2 = 85 - 4\left(\frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1\right) - Y$$

$$= 85 - 70 + 2Y + 2S_1 - Y$$

$$= 15 - Y + 2S_1$$

$$X = \frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1$$

The second tableau will be:

In matrix form				
	Amount	Y	S_1	
$C = 175 + Y - 5S_1$	C:	175	1	-5
$X = \frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1$	X:	17.5	-0.5	-0.5
$S_2 = 15 - Y + 2S_1$	S_2 :	15	-1	2

But since in the contribution there is positive coefficient then the solution is not at optimal

From the second tableau to third tableau

Entering variable will be y and leaving variable will be: $X: Y \leq 35$ $S_2: Y \leq 15$

❖ Leaving variable will be S_2

$$Y = 15 + 2S_1 - S_2$$

$$C = 175 + Y - 5S_1$$

$$= 175 + 15 + 2S_1 - S_2 - 5S_1$$

$$X = \frac{35}{2} - \frac{1}{2}Y - \frac{1}{2}S_1$$

$$= \frac{35}{2} - \frac{1}{2}(15 + 2S_1 - S_2) - \frac{1}{2}S_1$$

$$= \frac{35}{2} - \frac{15}{2} - S_1 + \frac{1}{2}S_2 - \frac{1}{2}S_1$$

$$= 10 - 1.5S_1 + 0.5S_2$$

$$Y = 15 + 2S_1 - S_2$$

Third tableau and optimal

In tableau form				
	Amount	S_1	S_2	
$C = 180 - 3S_1 - S_2$				
$X = 10 - 1.5S_1 + 0.5S_2$	C:	180	-3	-1
$Y = 15 + 2S_1 - S_2$	X:	10	-1.5	0.5
	Y:	15	2	-1

Interpretation on final solution

Optimal product mix:

POSH (X) = 10 cars

NIVA (Y) = 15 cars

The maximum contribution TZS 180 million

After fixed cost of TZS 38 million

Maximum profit will be TZS 142 million

Shadow price

For material is TZS 3 million while

For labour is TZS 1 million.

5. Evaluate the issues surrounding a make vs. buy or outsourcing decision.

[Learning Outcome e]

The complexities of the modern production process have made it increasingly unlikely that an organisation will have the necessary knowledge to carry out all the stages of production from designing the products to manufacturing them in-house.

Moreover, organisations have finite resources and may not be able to afford to carry out all the activities in-house. Accordingly, an organisation often faces the dilemma of whether to keep technologies / processes in-house or purchase them from an outside supplier. This has increased awareness of the importance of the 'make or buy' decision.



Example

Modern Motors, a car manufacturer, has to take the decision of whether to make all the parts in-house or to buy some of the parts from an outside supplier. Usually, non-critical parts such as breaks, clutch, etc. are made in-house and critical parts such as the motor, engine etc. are outsourced.

(b) Only cash costs are relevant

The relevant costs are only cash outflows, implying that the costs that do not reflect any cash expenditure are not considered when taking a decision.



Example

Non-cash costs include depreciation, notional costs (rent, interest and other fixed costs), and absorbed overheads.

2. Opportunity cost



Definition

Opportunity cost is the value of the benefits sacrificed when one course of action is chosen, in preference to an alternative.

Opportunity cost is the contribution foregone by selecting one alternative over the next best alternative. It is the maximum benefit given up as a result of choosing one of the alternatives.



Example

Jill, a management accountant in Cosco, has two options. The first is to register for CPA under the sponsorship of the company and the other is a salary increase of Tsh75 million per year.

If she opts to register herself for CPA, the opportunity cost will be Tsh150 million (TZS75 million x 2 years), if it takes two years to complete CPA. This TZS150 million will be the opportunity cost for taking the decision of whether to accept the pay rise or to pursue CPA.

3. Outsourcing

Outsourcing involves the transfer of organisational functions to a third party to get the work done by them. The functions typically outsourced include information technology, human resources, facilities and real estate management and accounting. Many companies also outsource customer support and call centre functions, manufacturing and engineering.



Definition

Outsourcing is getting work done by a third party on a regular basis. It is done by way of transfer of an organisational function to a third party.



Example

Boots Company Plc, the UK health-care manufacturer and retailer, has outsourced its IT activities to another IT service providing company. Boots estimates that it will save costs to the extent of TZS10,000 million over ten years by outsourcing the IT facilities.

Therefore, the decision to outsource is taken on the basis of cost comparisons between 'to make' and 'to outsource'.

4. Avoidable costs



Definition

Avoidable costs are the specific costs of an activity or sector of a business which would be avoided if that activity or sector did not exist.

Avoidable costs may be fixed or variable costs. Most of the time, fixed costs are not fully avoidable, but variable costs are fully avoidable when a decision not to produce an item is taken. Avoidable costs are usually associated with shut down, discontinuing production of one or more products or disinvestment decisions.



Example

Coco Ltd has stopped production of one of its products. The variable costs related to that product such as material, labour etc. can be totally avoided, but administration costs would continue to be incurred.

3.2 Factors affecting the 'make or buy' and outsourcing decisions

The 'make or buy' and outsourcing decisions are influenced by certain quantitative as well as qualitative factors.

1. Quantitative factors

Quantitative factors include both financial as well as non-financial factors. The following are the quantitative factors that affect a 'make or buy' decision:

(a) Cost

In order to take a decision on whether to 'make or buy' a product, the important cost-related factors that should be considered are:

- the volume of units to be made or bought
- the variable cost per unit of making the product
- the fixed cost that can be saved if opted for buying
- the per unit landed cost of buying the item

(b) Idle capacity

The availability of idle production capacity is one of the critical factors for deciding whether to 'make or buy'. If idle production capacity is available, evaluation of a proposal to produce over and above the present level of production can be made through a simple comparison between the costs of making and buying. If there is no idle capacity, the decision to 'make' will also involve the notional cost of foregoing the contribution (known as the opportunity cost) of any other productive activity which could be carried out.

**Example**

Elite Plc manufactures integrated chips that are required in mobile handsets. The production capacity of Elite Plc is fully utilised.

Elite Plc has received an order for 500 new chips with improved features.

While evaluating whether to produce these 500 new chips in-house instead of producing old chips, the contribution foregone for not producing the old chips, should be considered.

(c) Balancing capacity / Limiting factor

Limiting factors are factors of production, i.e. resources that are scarce and therefore limit production. When there are limiting factors of production, they are given prime consideration while taking the 'make or buy' decision.

**Example**

Casco Plc is engaged in manufacturing two types of battery cells, A and B. It has idle machine capacity of 50,000 hours a year. However, labour time is a limiting factor and is currently fully utilised.

It has received an additional order for 2,000 cells of type A.

The labour hours required to produce a unit of Cell A is twice that of Cell B. (i.e. cell A = $\frac{1}{2}$ cell B). Since producing an additional unit of Cell A requires sacrificing the production $\frac{1}{2}$ unit of Cell B, accepting the proposal will be worthwhile only if the contribution earned per unit of Cell A is more than or equal to the contribution earned per two units of Cell B.

2. Qualitative factors

Even if these factors are not considered in a cost-benefit analysis, they definitely influence a decision **to make** or **to buy**.

(a) Technology

Technology is an important consideration for deciding whether to make or to buy. If a company has a lack of knowledge about the technology required for manufacturing a product, it will not be able to make the product, and will instead buy it from the market.

**Example**

Continuing the above example of Casco Plc, if it is not aware of the technology required for manufacturing Cell B, it cannot make it, and will have to purchase it from the market.

(b) Quality

Maintaining the quality of the product is of utmost importance. The quality of the product affects the reputation of the business. While choosing between 'make or buy', the company needs to ensure that the quality of the bought-in goods and services are of an acceptable standard. It is always better to produce in-house, if outsourcing runs a risk of adversely affecting the quality of the product.

(c) Response time

When meeting an early delivery schedule is the criterion, an organisation needs to weigh the options of either producing or buying the product to be delivered, in order to ascertain which has the shorter response time.

(d) Impact on core activities

While taking a 'make or buy' decision, a company needs to check that performing the activities in-house will not affect the core activities. Most of the time, an activity is outsourced in order to concentrate more on the core activities.

(e) Increase responsiveness

A situation may arise where an organisation does not have idle capacity, yet receives a special offer that, in order to increase its responsiveness, it does not want to forgo.

In such a situation, the organisation may decide to outsource the additional production to satisfy the demand.



Example

Secure You, a foundry unit, received a special order from a builder to supply 50 rolling shutters in a month's time. The existing production schedule of Secure You did not permit it to make and supply rolling shutters within two months. However, Secure You managed to supply the whole lot of 50 rolling shutters within the stipulated period, by getting the job done by an outside party.

(f) New entrant in a geographical area or in a new product segment

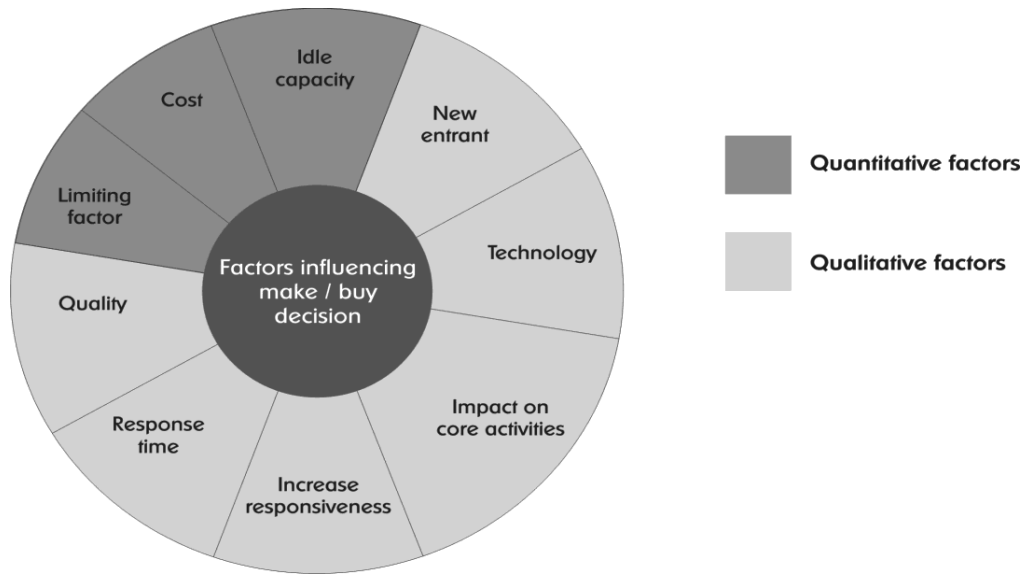
For a new entrant in a geographical area or a new product segment, it is always wise to outsource the production function until the sales volume reaches the level at which having its own production facility is worthwhile.



Example

Excellent Cars Plc, a car manufacturing company, is interested in launching a new car, Excel, in Asian countries for the first time. It has no production capacity in Asia. Excellent Cars Plc finds a local car company which has idle capacity. Excellent Cars may enter into a contract with this local company to manufacture Excel in Asia on its behalf. This contract will allow Excellent Cars Plc to sell Excel in the Asian market.

Diagram 1: Factors influencing 'make or buy' decisions



Test Yourself 1

Explain three quantitative and three qualitative factors that may have an impact on a 'make or buy' decision.

4. Calculate and compare make costs with buy in costs.

[Learning Outcome e]

In the above section, we have seen that cost is one of the most critical factors influencing the decision to **make** or to **buy**. The cost to produce in-house is compared with the cost of outsourcing. The alternative with the lower cost is chosen.

1. Calculation of cost of manufacture and cost of purchase

Cost of manufacturing (COM) / in-house cost

This is calculated as:

$$\text{Cost of manufacturing} = (\text{Number of units sold (n)} \times \text{Cost of manufacturing per unit}) + \text{Relevant fixed cost (F)}$$

Cost of Purchasing (COP)

This is calculated as:

$$\text{Cost of purchase (COP)} = \text{Number of units sold (n)} \times \text{Cost of purchase per unit (p)} + \text{Transportation cost (t)}$$

Transportation cost is an ingredient of cost of purchase. This cost may or may not be fixed.

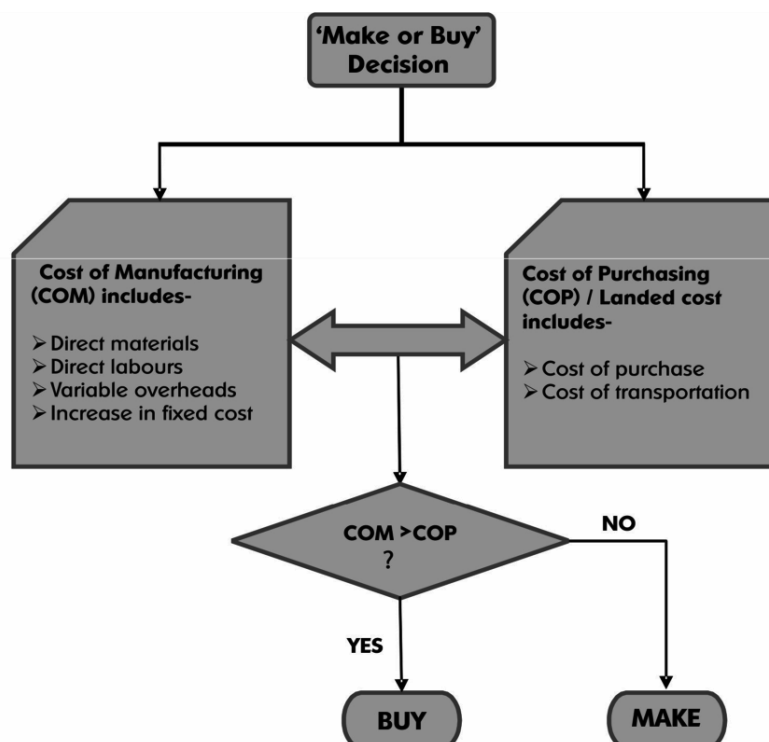
Wherever not specifically mentioned in this section, it is assumed that cost of purchasing is a landed cost and no other cost is to be incurred in relation to the purchases.

2. Comparison between cost of manufacture and cost of purchase

While taking a decision, the relevant **cost of manufacture** is compared with the **cost of purchase**. The alternative involving **less** cost is selected.

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Diagram 2: Process of 'Make or buy' decision



Example

Hollow Plc needs to produce 25,000 units of part no. 105. This part is currently manufactured in-house. The costs required to manufacture part no.105 include:

Particulars	TZS'000
Direct material (per unit)	5
Direct labour (per unit)	15
Variable overheads (absorption rate per unit)	7
Fixed overheads (absorption rate per unit)	12
Total per unit cost	39
Cost to buy from outside	32.5

Out of the fixed overheads, 40% are unavoidable.

If Hollow Plc decides to buy part no.105 from outside, the released facility would not be used in any other manufacturing activity and would remain idle.

The managing director of Hollow Plc found the offer reasonable, as the purchase price is less than the cost of manufacture.

Required:

As a cost accountant of Hollow Plc, help the managing director take this decision. In addition, state how other factors affect the decision.

Answer

Cost comparison	Manufacturing cost	Purchasing cost
	TZS'000	TZS'000
Direct material (TZS5,000 x 25,000)	125,000	
Direct labour (TZS15,000 x 25,000)	375,000	
Variable overheads (TZS7,000 x 25,000)	175,000	
Fixed overheads (relevant) (TZS7,200 x 25,000) (Note)	180,000	
Total purchase cost (TZS32,500 x 25,000)		812,500
Total	855,000	812,500

As far as cost is concerned, it is found that the cost of purchasing is less than the manufacturing cost; therefore it is better to purchase the part.

Continued on the next page

However, other factors, such as the use of idle capacity, quality of the product, reliability of the supplier etc. should also be taken into consideration while taking the decision whether to make or buy.

Note: 40% of the fixed overheads are unavoidable. This means that, even if the part is purchased from outside, 40% of the fixed overheads will continue to be incurred. Therefore, the unavoidable fixed costs are not relevant to the decision. The relevant fixed cost is TZS12,000 x 60% = TZS7,200.



Example

A firm of chartered accountants provides three different services: Audit, Taxation and Consultancy. The following is the cost structure:

	Audit (TZS'000)	Taxation (TZS'000)	Consultancy (TZS'000)
Variable cost	8,000	5,500	4,500
Fixed cost	300	200	200
Total cost	8,300	5,700	4,700

The firm can get the taxation work done by a tax consultant on a yearly basis at a cost of TZS5.9 million. The resources released by this can be utilised for audit work whose revenue is expected to be TZS0.3 million. Evaluate whether to outsource the taxation work.

Answer

	TZS'000
Relevant cost for in-house taxation services is a variable cost i.e.	5,500
The relevant cost of outsourcing is	5,900
Excess of outsourcing cost over the in-house cost	400
Less: Expected revenue earned from using the resources released by taxation services	300
Net excess, if the taxation job is outsourced	100

The table reveals that the cost of outsourcing is more than the in-house cost; therefore the company should not outsource taxation.



Test Yourself 2

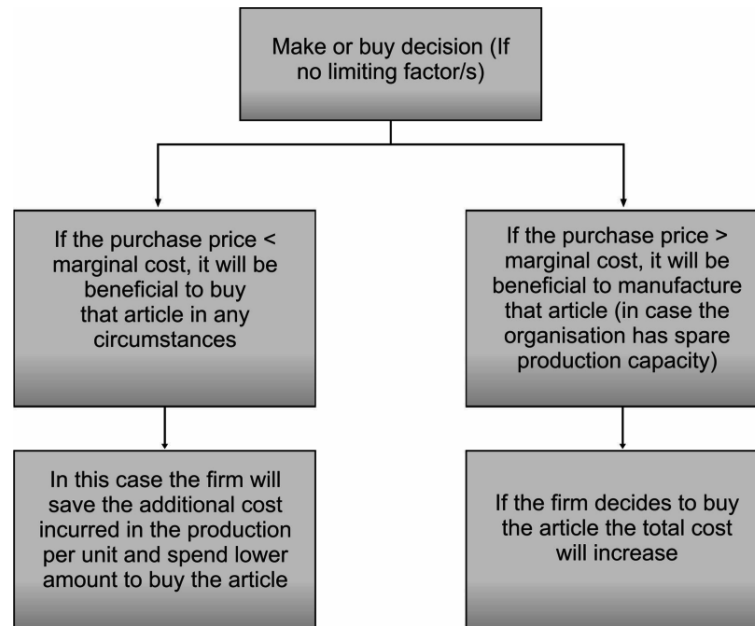
For making the 'make or buy' decision, two most important non-economic factors should also be considered:

1. whether the quality of the materials supplied by the supplier is equal to, better or poorer than the component the company is manufacturing in-house
2. whether the supplier is reliable in terms of providing the required quantities of the materials on a timely basis

A reduction in quality or reliability almost always rules out buying.

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Diagram 3: Make or buy decision



If there are one or more limiting factors, the decision variables to be considered are:

- purchase price of the item(s) under consideration
- marginal cost per unit of the limiting factor(s)

The purchase price or the marginal cost per unit, whichever is lower, will be determined and accordingly, the decision will be taken whether to buy or manufacture that article.



Example

Four types of tyres are currently being produced by Fast Motors Co using its own facilities. However, Fast Motors is working at full capacity and is considering buying one or more types of tyres from an outside supplier. The total fixed costs remain unaffected for the company as a whole irrespective of whether the tyres are made or bought from the market. The relevant data per unit of tyre is given below:

Tyres	I	II	III	IV
Man hours per tyre	0.40	0.50	0.50	0.30
Machine hours per tyre	0.10	0.20	0.40	0.50
Variable cost per tyre (TZS'000)	10	12	15	15
Allocated fixed costs per unit (TZS'000)	2	4	5	15
Total cost per unit (TZS'000)	12	16	20	30
Market price / purchase price (TZS'000)	9	17	22	24

Determine which tyre(s) is/are beneficial for Fast Motors to buy from the external market when:

- Man hours is the limiting factor
- Machine hours is the limiting factor

(TZS'000)

Tyres	I	II	III	IV
Purchase price per tyre	9	17	22	24
Variable cost per tyre	10	12	15	15
Net benefit if manufactured in-house	(1)	5	7	9
Contribution per man hour	(2.5)	10	14	30
Contribution per machine hour	(10)	25	17.5	18

Fixed costs are not considered as they do not change for the firm as a whole notwithstanding whether the tyres are 'made' or 'bought'.

Continued on the next page

A tyre which shows negative contribution should be bought under all circumstances (i.e. limited man hours and limited machine hours). Hence, tyre I should be bought.

In case a limitation on a resource still exists after buying tyre I, further tyres to be bought should be selected in the order of lower contribution per limiting factor.

When labour (man hours) is limiting factor	When machine hours is limiting factor
Tyre II	Tyre III
Tyre III	Tyre IV
Tyre IV	Tyre II

When there is no idle capacity and accordingly, making the component in the factory involves putting aside other work, the loss of contribution from the displaced work (this is the opportunity cost which is always a relevant cost) should also be considered along with the marginal cost of production.

In other words, it would be more beneficial to the manufacturer, if as long as:

Purchase price > Marginal cost of production + Traceable fixed costs + Loss of contribution

The loss of contribution is to be determined with reference to the limiting / key factor.



Example

A company produces two types of components - W and W-5, for a special product. W takes 13 hours to complete, at full capacity. The selling price of W is TZS100,000 and its marginal cost is TZS35,000.

Another component, W-5, can be produced on the same machine in 4 hours with a marginal cost is TZS12,000. Its purchase price is TZS27,000. Should the company produce or buy W-5? (Assume machine hours to be the limiting factor.)

Contribution per unit of W = TZS100,000 – TZS35,000 = TZS65,000

Contribution per machine hour = TZS65,000/13 hours=TZS5,000

If the company is going to manufacture W-5, then contribution of TZS20,000 (TZS5,000 per hour x 4 hours) from W will be lost.

Therefore total cost to produce W-5 = TZS12,000 + TZS20,000 = TZS32,000

The purchase price of W-5 is TZS27 and its manufacturing price is TZS32,000. So it is better to buy W-5.



Test Yourself 3

Gorgeous-look is a leading cosmetics company. Almost all its materials are purchased from other cosmetics companies, except 'lip gloss', which is prepared in its own division. The division then transfers it to other divisions.

The Fancy division of Gorgeous-look requires 6,000 bottles of lip gloss every month. It can also purchase this from the external market at TZS82,000 per bottle.

The lip gloss unit has a capacity of 5,000 bottles per month. It sells each bottle for TZS100,000 in the external market. The lip gloss unit's variable production cost per bottle is TZS66,000 and the selling cost per bottle is TZS5,000.

If Gorgeous-look manufactures 6,000 bottles, it will incur additional cost of TZS72 million as the production capacity is limited to 5,000 bottles only.

Required:

- Which is better - to manufacture in-house or to purchase from the external market?
- If Gorgeous-look were to have a production capacity of 10,000 bottles per month, what would be the better decision?

6. Prepare an analysis showing whether a special order should be accepted.**[Learning Outcome f]****Definition**

A special order is a one-time order that is not considered part of the company's normal on-going business.

When analysing a special order, only the incremental costs and benefits are relevant. Since the existing fixed manufacturing overhead costs would not be affected by the order, they are not relevant.

In most of the cases, **special orders should be accepted only if:**

- Incremental revenue exceeds incremental costs
- Current sales are unaffected
- The company has idle capacity to handle the order

**Example**

Space Ltd manufactures a single product whose normal selling price is \$30,000 per unit. An overseas distributor offers to purchase 3,000 units for \$15,000 per unit.

This is a one-time order that would not affect the company's regular business. Annual capacity is 10,000 units, but Space is currently producing and selling only 5,000 units. Space Ltd's current financial position is as follows:

Contribution income statement for Space Ltd

	TZS'000	TZS'000
Revenue (5,000 units x TZS30,000)		150,000
Less: Variable costs		
Direct materials (@TZS6,000) Direct	30,000	
labour (@TZS1,500) Production	7,500	
overheads(@TZS3,000) Sales costs	15,000	
(@TZS1,500)	7,500	(60,000)
Contribution		90,000
Less: Fixed costs		
Production overheads	42,000	
Sales costs	30,000	(72,000)
Net operating income		18,000

Total variable cost per unit is TZS12,000

Should Space Ltd accept the order?

Space Ltd should accept the order **only if the incremental revenue exceeds the incremental costs.**

Calculation of incremental revenue and profit (assuming that fixed costs remain unchanged and variable sales cost must be incurred)

	TZS'000
Incremental Revenue (3,000 units x TZS15,000)	45,000
Less: (Incremental) Variable costs (3,000 units x TZS12,000)	36,000
Increase in net operating income	9,000

The above calculation suggests that Space Ltd should accept the special order.

In the above example, the incremental revenue exceeds the incremental cost, which is profitable for the company if it accepts the special order.

The incremental cost represents the minimum price that the company should charge for the special order if it wishes to make neither profit nor loss.

As long as the customer pays that minimum price for the order, the company's profits will not be affected.



Test Yourself 6

Soak Decorations ordinarily sells towels for TZS30,000. The variable production cost is TZS8,000 per unit, the fixed production cost is TZS14,400 per unit, and the variable selling cost is TZS800 per unit.

A customer has requested a special order for 10,000 towels with cartoon prints for kids. This special order would not involve any selling costs, but Soak Decorations would have to purchase a printing machine for TZS40 million. There is sufficient spare capacity to fulfil the order and the printing machine has no further use after this order.

Determine the lowest / minimum price below which Soak Decorations should not agree to accept the order.

7. Apply relevant costing principles in situations involving shut-down and extra shifts.

[Learning Outcome g]

Apart from the 'make or buy' decision, there are several other decisions that an organisation needs to take in running its day-to-day business.

7.1 Application of relevant costing principles for shut-down (or continue) situation

The decision to shut-down may be a long-term or short-term decision. In the case of trade recession, management may be compelled to consider suspending production for a few days.

When a unit, department, product or any other activity is running at a loss, a decision may be taken to shut-down the plant permanently. This is a long-term shut down. However, apart from the cost considerations, several external and internal factors such as a change in consumer preference and taste, an unfavourable change in government policy or an industrial dispute may propel a decision to shut down.

1. Identifying costs relevant for shut-down

(a) Avoidable fixed costs

If the decision to shut-down is taken, a part of the fixed costs will no longer be incurred. On the other hand, as fixed costs represent constant expenditure incurred during a period, irrespective of the volume of production, it follows that even when production completely ceases, the expenditure will continue to be partially incurred. These unavoidable fixed costs are normally termed **shut-down costs**. The avoidable fixed costs are relevant for a shut-down decision. The avoidable costs are deducted from the total fixed cost to identify the **shut-down costs**.



Example

Engineering Plc wants to shut-down its production plant for a few months due to a trade recession. As production will start again after a few months, it is necessary to keep the manufacturing machinery used in the plant, in good condition. Therefore, in this case, the shut-down cost will be the maintenance cost of the machinery.

(b) Additional fixed costs

The decision to shut-down may give rise to additional fixed costs in the form of an additional maintenance cost to keep the plant in ready-to-use condition, an additional cost for increased janitorial services for the upkeep of the plant, etc. These additional fixed costs are also relevant costs for taking a shut-down decision.

When the shut-down decision is a long-term decision, the following costs also influence the shut-down decision:

- (i) Salvage value as a result of sale of non-current assets
- (ii) Costs towards retrenchment compensation given to the employees whose services would no longer be needed, cost of rehabilitating the retrenched employees or cost of providing them with alternative employment, etc.

However, in the further discussions regarding a shut-down decision, it is assumed that either:

The redundancy cost and the salvage value from the sale of non-current assets are matching and therefore, are not relevant to the shut-down decision; or
The redundancy cost and the salvage value of the non-current asset are so negligible that they do not affect the decision.

2. Identifying shut-down point

Shut-down point is the level of production indicative of a no profit or no loss situation in the event of shut down. The shut-down point can be calculated as follows:

$$\text{Shut down point} = \frac{\text{Shut down cost} + \text{Additional fixed costs}}{\text{Contribution per unit}}$$



Example

Bubbly Plc is a toy manufacturer. Due to a trade recession, the demand for the toys is falling and therefore management is of the opinion that the manufacturing activities should be shut down. The management accountant was asked to calculate the shut-down point. The following are the available details:

Particulars	Costs (TZS'000)
Total fixed costs	10,000
Avoidable fixed expenses	1,500
Shut-down expenses	2,000
Contribution per unit	2
Number of units produced	5,000 units

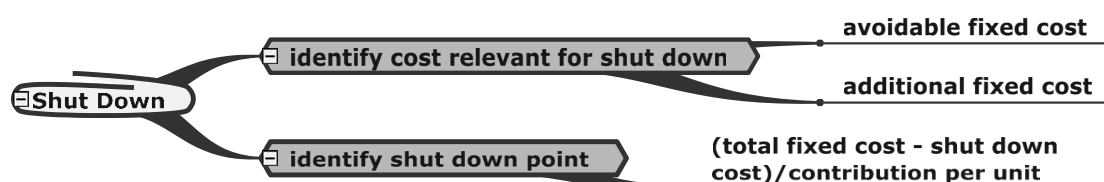
The management accountant derived the shut-down point in the following way:

$$\text{Shut down point} = \frac{\text{Shut down cost} + \text{Additional fixed costs}}{\text{Contribution per unit}}$$

$$= \frac{\text{TZS}2,000,000 + \text{TZS}(10,000,000 - 1,500,000)}{\text{TZS}2,000}$$

$$= 5,250 \text{ units}$$

SUMMARY



7.2 Application of relevant costing principles for extra shifts

Occasionally, businesses face hitches with regard to extra shift operations.

In making such type of short-term decisions, the following criteria are to be taken into consideration:

- Relevant revenue from the extra shift
- Relevant cost for the extra shift

If the relevant revenue exceeds the relevant cost, it is worthwhile to operate the extra shift.

However, both quantitative and qualitative matters should be given due consideration in decision making.



Example

King Ltd currently operates a single shift and the following financial information is available:

	TZS'000	TZS'000
Revenue (5,000 units x TZS40,000)		200,000
Less:		
Direct materials	62,500	
Direct labour	50,000	
Production overheads	10,000	122,500
Contribution		77,500
Less: Fixed overheads		(52,500)
Net operating income		25,000

Total variable cost per unit is TZS24,500

Suddenly, there is a demand for 2,500 units at the existing selling price of TZS40,000.

These units can be produced by King Ltd only if it operates an extra shift.

The total production capacity of King is 6,000 units. The proposed extra shift would increase capacity by 25% and consequently increase fixed costs by TZS22,500,000.

Calculation of incremental revenue and incremental cost

	TZS'000
Revenue (2,500 units x TZS40,000)	100,000
Less: Variable costs (2,500 units x TZS24,500)	61,250
Contribution	38,750
Less: Fixed costs	(22,500)
Net operating income	16,250

The above calculation suggests that King Ltd should operate the extra shift as the net operating income will increase by TZS16,250,000.



Test Yourself 7

First Choice is a retail shop for children. It has three departments –toys, clothes and general. The area occupied by all the three departments is equal.

The following is First Choice's profitability statement:

	Toys	Clothes	General
	TZS'000	TZS'000	TZS'000
Sales	653	452	324
Costs	520	404	333
Profit	133	48	(9)

Management is considering shutting down the general department so that the total profit will increase by TZS9,000.

The following is the cost structure of all three departments:

	Toys	Clothes	General
	TZS'000	TZS'000	TZS'000
Variable cost	410	291	230
Fixed cost (rent)	81	81	81
Fixed cost (other)	29	32	22
	520	404	333

Continued on the next page

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Out of other fixed costs, 50% are avoidable.

Required:

Advise management whether or not to close the general department.

Answers to Test Yourself

Answer to TY 1

The factors affecting a make or buy decision can be grouped into quantitative and qualitative factors. The following are some of the factors affecting the decision to make or buy.

Quantitative factors

(a) Cost

Cost is the main factor affecting the decision of whether or not to outsource. The decision-maker compares the relevant costs under the two alternatives and opts for the alternative with the least costs.

(b) Production capacity

If there is no spare capacity it would be expensive to decide to make the product because then the decision-maker will have to bear a huge fixed cost for the additional production capacity. Therefore, when there is no spare capacity, the decision generally taken is to purchase the product from outside.

(c) Limiting factor

A limiting factor is a resource required for production, which limits production due to its scarcity. In this case, the decision-maker will take into consideration the scarcity of that factor and accordingly choose an alternative which earns the highest contribution per unit of the limiting factor.

Qualitative factors

(a) Technology

If the decision-maker has limited knowledge of the technology required to produce a product he will not decide to produce the product in-house.

(b) Quality

The quality of the product also influences the 'make or buy' decision. Only if purchasing from a supplier does not affect the quality of the goods, can the decision to buy be taken into consideration.

(c) Response Time

Answer to TY 2

When meeting an early delivery schedule is the criterion, an organisation needs to weigh the options of either producing or buying the product to be delivered on the basis of response time.

Answer to TY 3

	If bottles are purchased from the external market TZS'000	If bottles are manufactured in-house TZS'000
Sales (6,000 bottles x TZS100,000)	600,000	600,000
Less: Variable costs	(492,000)	(426,000)
Contribution	108,000	174,000
Less: Additional fixed costs	-	(72,000)
Profit	108,000	102,000
Profit per bottle	18	17

Note: variable cost is taken as \$82,000 in situation 1 and \$71,000 in situation 2 because in situation 1, bottles are purchased from the external market and in situation 2, bottles are manufactured in-house.

Decision

It will be beneficial for Gorgeous-look to **purchase the lip gloss bottles** from the external market. It should go for the "buy" rather than the "make" option.

If the total production capacity were 10,000 bottles per month, additional fixed costs would have been avoided. This would result in higher contribution as shown below:

	If bottles are purchased from the external market TZS'000	If bottles are manufactured in-house TZS'000
Sales (6,000 bottles x TZS100,000)	600,000	600,000
Less: Variable costs	(492,000)	(426,000)
Contribution	108,000	174,000
Contribution per unit	18	29

Decision

It would be beneficial to **manufacture the lip gloss bottles** in house.

Answer to TY 4

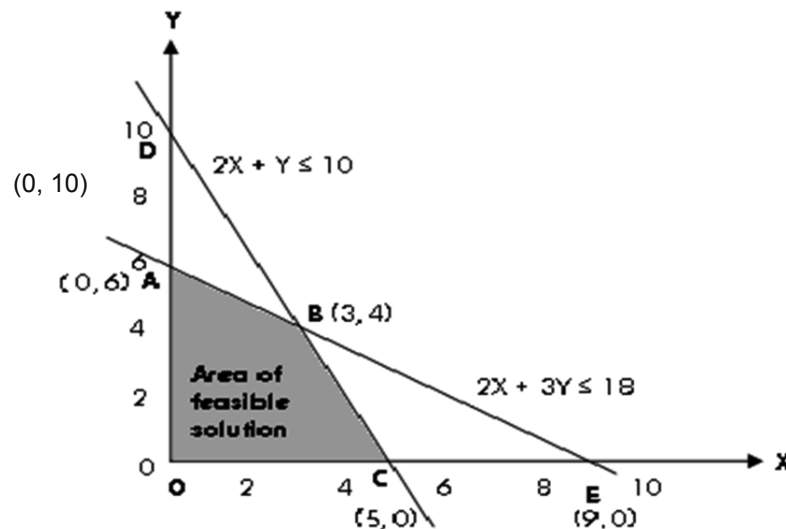
This LP problem has two variables, X and Y, and can therefore be solved by using a graph and trial-and-error approach. Two steps are followed. First, plot each constraint so that the area of feasible solutions can be identified. To plot a given constraint, change it from an inequality to an equality, then let $Y = 0$ and solve for X, and let $X = 0$ and solve for Y

For machine 1 constraint:

$$\text{When } Y = 0, \quad 2X + 3(0) = 18 \\ X = 9$$

$$\text{When } X = 0, \quad 2(0) + 3Y = 18 \\ Y = 6$$

Applying the same procedures to the Machine 2 constraint, $X = 5$ when $Y = 0$, and $Y = 10$ when $X = 0$. Plotting these constraints:



The second step is to find the optimal solution, **OABC** which is the corner points of the area of feasible solutions that maximises total contribution margin when objective function is $Z = 4,000X + 3,000Y$:

Co-ordinates of point B are calculated as follows

The $2X + 3Y = 18$ line intersected the $2X + Y = 10$ line. Therefore, by solving the equations, we get: $X = 3$ and $Y = 4$

Point	Corner	X	Y	Total Contribution Margin
C	(5,0)	5	0	$\text{TZS}4,000(5) + \text{TZS}3,000(0) = \text{TZS}20,000$
B	(3,4)	3	4	$\text{TZS}4,000(3) + \text{TZS}3,000(4) = \text{TZS}24,000$
A	(0,6)	0	6	$\text{TZS}4,000(0) + \text{TZS}3,000(6) = \text{TZS}18,000$
O	(0,0)	0	0	$\text{TZS}4,000(0) + \text{TZS}3,000(0) = \text{TZS}0$

Therefore, the maximum contribution margin is TZS24,000, which is at the corner point of (3, 4).

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The optimal solution can be obtained by changing the relevant constraints from inequalities to equalities and solving the resulting simultaneous equations:

$$2X + 3Y = 18 \text{ equation (i)}$$

$$2X + Y = 10 \text{ equation (ii)}$$

Subtracting the (ii) equation from the (i),

$$2Y = 8$$

$$Y = 4$$

By putting $Y = 4$ into the (i) equation,

$$2X + 3(4) = 18$$

$$2X = 6$$

$$X = 3$$

At this level of production, optimum profit will be:

$$(4,000X + 3,000Y) = (\text{TZS}4,000 \times 3 + \text{TZS}3,000 \times 4) = (\text{TZS}12,000 + \text{TZS}12,000) = \text{TZS}24,000$$

Answer to TY 6

The incremental cost represents the minimum price that the company should charge for the order.

Calculation of incremental costs

	TZS'000
Variable production costs (10,000 towels x TZS8,000)	80,000
Fixed costs (cost of the printing machine)	40,000
Total (incremental) costs	120,000
No. of towels	10,000
Incremental cost per unit	12

Hence, TZS12,000 per unit is the minimum price below which Soak Decorations should not accept the order.

Answer to TY 7

While taking a shutdown decision, the relevant costs are the variable cost and the avoidable fixed cost. Therefore the relevant cost is:

	TZS'000	
Variable cost	230	
Rent	0	(It is not avoidable as it is rent for the whole shop and cannot be avoided even if the general department is shutdown.)
Other fixed cost	11	(Being 50% avoidable)
Total relevant cost	241	
Sales	324	
Contribution	83	

The revenue generated by the general department is TZS324,000 and the relevant cost is TZS241,000. This signifies that the general department is contributing TZS83,000 towards recovering fixed costs. If the department is shut down, this will not increase the profit by TZS9,000, but instead will lead to a decrease in the total profit of TZS83,000.

Therefore, the general department should not be shut down.

Quick Quiz

1. Which of the following statements about linear programming is not true?
 - A Managers need to resort to linear programming in cases where the resources are available in abundance
 - B Managers need to resort to linear programming in cases where at least two of the resources are scarce
 - C The linear programming model contains an objective function, which is usually expressed as maximise profit or minimise cost
 - D The linear programming model contains one or more linear equations or inequalities representing constraints
2. Identify which of the following is not true about a limiting factor:
 - A It is a resource that is scarce
 - B It prevents production from reaching the desired level
 - C It is a short term phenomenon and can be overcome in the long run
 - D A factor of production e.g. land, labour, capital) cannot be a limiting factor
3. Identify which one of the following is not true about a graphical solution to a multiple scarce resource problem:
 - A A graphical solution is flexible only if the number of decision variables does not exceed two
 - B A graphical method of solving a linear programming problem can deal with any number of constraints but a large number of lines may make the graph difficult to read
 - C The optimal solution to a graphical problem lies at any of the corner points of the feasible region
 - D Even if the feasible region is bounded, a solution to a graphical problem can be obtained
4. Define relevant costing.
5. List any four factors affecting the decision to make or buy.
6. Fill in the blanks:
 - (a) For the purpose of a make or buy decision, relevant cost is _____ and _____.
 - (b) While taking a make or buy decision _____ is compared with the cost of purchase. The alternative involving _____ cost is selected.
7. State the formula to calculate the cost of manufacture.
8. State the cost relevant to the shut-down decision.
9. State the formula for calculating the shut-down point.

Answer to Quick Quiz

1. The correct option is **A**.
Managers need to resort to linear programming in cases where the resources are available in abundance.
2. The correct option is **D**.
A factor of production e.g. land, labour, capital) cannot be a limiting factor.
3. The correct option is **D**.
Only if the feasible region is bounded, a solution to a graphical problem can be obtained.
4. The **relevant costs** are the expected future costs that differ amongst the possible alternative courses of action.

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5. Factors affecting the make or buy decision are:

Cost
Production capacity
Quality
Technology / know-how
Timing

6. (a) Variable cost, avoidable fixed cost
(b) Cost of manufacture, less

7. $COM = FC + (VC \times N)$

Where,

FC= additional fixed cost required for manufacturing

VC= variable cost per unit

N = volume / number of units

8. Shut-down cost and avoidable fixed cost

Self-Examination Questions

Question 1

A company makes three products P_1 , P_2 , P_3 which go through three departments – assembly, packaging and storage. The hours of department time required by each of the products, the hours available in each of the departments and the profit contribution of each of the products are given in the following table.

Product	Time required per unit hours)			Contribution TZS'000 per unit)
	Assembly	Packaging	Storage	
P_1	6	5	9	3
P_2	3	2	7	5
P_3	5	5	10	10
Hours available	210	240	260	

The marketing department of the company indicates that the sales potential for products P_1 and P_2 is unlimited, but for P_3 it is not more than 25 units.

Required:

Formulate the linear programming problem.

Question 2

Solve the following problem by the **graphical method** and by the **simultaneous equation method**:

Minimise $C = 5,000A + 4,000B$

Subject to the constraints:

$$4A + B \leq 40$$

$$2A + 3B \leq 90$$

$$A \geq 0, B \geq 0$$

Question 3

The following is a profitability statement of Charles Plc for the first quarter of 20X8.

	A (TZS'000)	B (TZS'000)	Total (TZS'000)
Sales revenue	144,000	88,000	232,000
Manufacturing cost			
Fixed cost	25,000	19,000	44,000
Variable cost	60,000	52,000	112,000
	85,000	71,000	156,000
Administrative costs (fixed in nature) allocated in proportion to manufacturing costs	21,750	13,200	34,950
Selling costs allocated in proportion to revenue	4,030	4,580	8,610
Total Cost	110,780	88,780	199,560
Product profit / (loss)	33,220	(780)	32,440

Production volume for the first quarter of 20X8 is - A 1,200 units and B 800 units.

Charles Plc received an order for 200 units of product A from the export market at the rate of TZS61,000.

Management is of the opinion that Product B is making a loss and therefore it is to be terminated.

If product B is terminated, the released capacity can be given at a rent of TZS35 million. Moreover, the fixed manufacturing costs would not be incurred if product B were not manufactured.

Required:

Provide recommendations to management, supported by appropriate calculations, in response to the following questions:

- Should the special order be accepted? What minimum price would make acceptance of an order for an additional 200 units of product A worthwhile?
- Should production of product B be terminated?
- Other manufacturers are willing to supply both A and B at the levels required, at a unit cost of TZS125,000 and TZS95,000. If production ceases, Charles could offer the factory space for rent at TZS65 million. Administrative cost cutting will be 30%. Would this alternative be beneficial for the company?

Question 4

Elly Ltd is a multi-product company that currently manufactures 30,000 units of part MR24 each month for use in production. The facilities now being used to produce part MR24 have a fixed monthly cost of TZS150 million and a capacity to produce 84,000 units per month. If Elly was to buy part MR24 from an outside supplier, the facilities would be idle, but its fixed costs would continue at 40% of their present amount. The variable production costs of part MR24 are TZS11,000 per unit.

- Elly Ltd continues to use 30,000 units of part MR24 each month in its production. Calculate the price at which Elly would purchase MR24 from an outside supplier.
- Elly Ltd is able to obtain MR24 from an outside supplier at a unit purchase price of TZS12,875. Calculate the monthly usage at which there will be no difference in cost between buying and making MR24.

QUESTION 5

Where one of the production factors is the limiting factor: the following is the per unit cost structure of the three components used in a machine produced by Metal-Make Plc:

	A	B	C
	TZS'000	TZS'000	TZS'000
Direct material	26	24	45
Direct labour	8	22	44
Direct expenses	10	5	35
Fixed overheads	5	10	21
Production cost	49	61	145

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The direct expenses given above are related to the pressing machine that costs TZS5,000 per hour. These components can also be purchased from the available market at the following prices A -TZS49,000, B-TZS45,000, C-TZS145,000.

Production requirement (in units) A-3,700 B-1,600 C-1,900

Metal-Make Plc has a metal pressing capacity of 18,000 hours, which is not sufficient to produce all three components required in the machine. Therefore, management is considering the alternative of working in two shifts. Operating in two shifts would increase the wages by 30%. Fixed costs would increase by TZS1.8 million.

Required:

You have been asked to help management in taking the decision, by providing the calculations. Keeping in mind the limiting factor, advise management which components should be manufactured in-house, and which should be produced in the second shift and which should be bought from the market.

*QUESTION 6

NJAU Limited is a clothing manufacturer specializing in sustainable ladies fashion. The company has been in operation for ten years and during that time has built up a loyal and expanding customer base. NJAU Limited has three signature garments, a white blouse, a navy skirt and a grey dress, all produced from organically grown and dyed linen fabric. Successful marketing and sales of these garments has resulted in the company exceeding full capacity at its current manufacturing base in Limerick. Consequently the Directors are considering expanding production capacity over the next few years and are examining a number of possibilities.

However, for the current year the company has a total of 15,000 machine hours and 20,000 direct labour hours available for production at its Limerick manufacturing base. Production and sales details relating to the signature garments are shown below:

	Blouse	Skirt	Dress
Direct materials: Linen @ TZS 6 per metre	1.5 metres	1.25 metres	2.5 metres
Direct labour: @TZS 12 per hour	0.25 hours	0.25 hours	0.5 hours
Variable overhead: 150% of direct labour cost			
Machine hours required	0.3 hour	0.2 hour	0.25 hour
Sales demand for the year (units)	30,000	18,000	15,000
Selling price per unit	TZS 54	TZS 80	TZS 105

Budgeted fixed production overhead is estimated to be TZS. 95,200 per month and the company has also budgeted for selling and administration expenses of TZS 128,000 per quarter.

REQUIRED:

- Based on the information provided, state whether NJAU Limited has sufficient production capacity to satisfy sales demand for the coming year. You should provide calculations to support your answer.
- Calculate the optimal production plan for NJAU Limited for the current year, clearly showing total profit expected

*Question 7 (Limiting factor analysis)

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

Standard cost and selling prices per unit

Product	Day Scan (TZS)	Night Scan (TZS)	Omni Scan (TZS)
Materials	70	110	155
Manufacturing labour	40	55	70
Installation labour	24	32	44
Variable overheads	16	20	28
Selling price	250	320	460

Fixed costs for the period are TZS 450,000 and the installation labour, which is highly skilled, is available for 25,000 hours only in a period and is paid TZS 8 per hour.

Both manufacturing and installation labour are variable costs.

The maximum demand for the products

Day scan	Night scan	Omni scan
2000 units	3000 units	1800 units

Requirements:

- Calculate the shortfall (if any) in hours of installation labour
- Determine the best production plan, assuming that Triproduct Limited wishes to maximize profit.

- (c) Calculate the maximum profit that could be achieved from the plan in part (b) above
- (d) Having carried out an investigation of the availability of installation labour, the firm thinks that by offering TZS. 12 per hour, additional installation labour would become available and thus overcome the labour shortage.

Required

Based on the results obtained above, advise the firm whether or not to implement the proposal.

Question 8

ABC Ltd manufactures three prototype toy furniture products-chairs, benches and tables. The budgeted unit cost and resource requirement for each item are detailed below:

	Chair	Bench	Table
	TZS	TZS	TZS
Timber	5000	15000	10000
Direct labour cost	4000	10000	8000
Variable overhead cost	3000	7500	6000
Fixed overhead cost	4500	11250	9000
	16500	43750	33000
Budgeted Volume per annum	4000	2000	1500

The volumes are believed to equal the market demand for these products. The fixed overheads costs are attributed to the three products on the basis of direct labours. The labour rate is TZS 4,000 per hour. The cost of the timber is TZS 2,000 per square metre. The products are made from a special timber. A memo from the purchasing Manager advises you that because of a problem with a supplier, it is to be assumed that this special timber is limited in supply to 20,000 square metres per annum. The sales Manager has already accepted an order for 500 chairs, 100 benches and 150 tables which if not supplied would incur a financial penalty of TZS 2,000,000. These quantities are included in the market demand estimates above. The selling prices of the three products are:

Products	TZS
Chair	20,000
Bench	50,000
Table	40,000

Required:

- a) Determine the optimum production plan and state the net profit that should be yield per annum
- b) Calculate and explain the maximum prices which should be paid per square metre in order to obtain extra supplies of the timber.

***Question 9 CIMA (2012)**

WRX manufactures three products using different quantities of the same resources. Details of these products are as follows:

Product	W	R	X
	TZS/unit	TZS/unit	TZS/unit
Market selling price	90	126	150
Direct labour (TZS 7 per hour)	14	28	35
Material A (TZS 3 per Kg)	15	12	21
Material B (TZS 6 per litre)	24	36	30
Variable overhead (TZS4 per hour)	8	16	20
Fixed overhead	12	7	12
	73	99	118
Profit	17	27	32

The management of WRX has predicted the demand for these products for July as follows:

Product W 500 units
 Product R 800 units
 Product X 1,600 units

These demand estimates do NOT include an order from a major customer to supply 400 units per month of each of the three products, at a discount of TZS10 per unit from the market selling price.

During July the management of WRX anticipates that there will be a shortage of material B, and that only 17,500 kgs will be available.

It is not possible for WRX to hold inventory of any raw materials, work in progress or finished goods.

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Required:

- (a) **Prepare** calculations to show the optimum product mix to maximize WRX's profit for July, assuming that the order with the major customer is supplied in full

WRX has now realised that the contract with the major customer does not have to be met in full for any of the three products. The customers will accept whatever WRX is prepared to supply at the contracted prices but they will charge a financial penalty if WRX does not supply them in full in JULY.

- (b) **Calculate** the lowest value of the financial penalty that the major customer would need to insert in the contract to ensure that WRX meets its order in full in July.

- (c) Now that you have presented your answers to (a) and (b) above to the management team of WRX, the production manager has advised that, due to holidays, the number of direct labour hours available will be reduced to a total of 9,800 hours in July.

A decision has been made that WRX will fulfil its order with the major customer in full in July, and it has been agreed that a linear programming model will be used to determine the optimum usage of the resources that will be available after setting aside those required for the major customer's order.

Required:

- i) Identify the objective function and the constraints to be used in the linear programming model to determine the optimum usage of the remaining resources to maximise the company's profits for July.

- ii) The optimal solution has been determined as:

W	500 units
R	0 units
X	880 units

Explain which of the constraints you stated in (c) (i) are binding on the solution. (You are not required to draw a graph.)

*Question 10 CIMA (2010)

RT produces two products from different quantities of the same resources using a Just-in-time (JIT) production system. The selling price and resources requirement of each of the products are shown below:

Product	R	T
Unit selling price(TZS)	130	160
Resources per unit:		
Direct labour(TZS 8 per hour)	3 hours	5hours
Material A(TZS 3 per Kg)	5kgs	4kgs
Material B (TZS 7 per litre)	2 litres	1 litre
Machine hours(TZS10 per hour)	3 hours	4 hours

Market research shows that the maximum demand for products R and T during June 2010 is 500 units and 800 units respectively. This does not include an order that RT has agreed with a commercial customer for the supply of 250 units of R and 350 units of T at selling prices of TZS100 and TZS135 per unit respectively. Although the customer will accept part of the order, failure by RT to deliver the order in full by the end of June will cause RT to incur a TZS 10,000 financial penalty.

At a recent meeting of the purchasing and production managers to discuss the production plans of RT for June, the following resources restrictions for June were identified:

Direct labour	7,500 hours
Material A	8,500 kgs
Material B	3,000 litres
Machine hours	7,500 hours

Required:

- a) Assuming that RT completes the order with the commercial customer, prepare calculations to show, from a financial perspective, the optimum production plan for June 2010 and the contribution that would result from adopting this plan.
- b) Prepare calculations to show, from a financial perspective, whether RT should complete the order from the commercial customer.
You have now presented your optimum production plan to the purchasing and production managers of RT. During your presentation it became clear that the predicted resource restrictions were rather optimistic. In fact the managers agreed that the availability of all of the resources could be as much as 10% lower than their original predictions.
- c) Assuming that RT completes the order with the commercial customer, and using graphical linear programming, prepare a graph to show the optimum production plan for RT for June 2010 on the basis that the availability of all resources is 10% lower than originally predicted.

- d) Discuss how the graph in your solution to (c) above can be used to help to determine the optimum production plan for June 2010 if the actual resources availability lies somewhere between the managers optimistic and pessimistic predictions.

QUESTION 11

The Vipodozi Limited (VL) is a company producing a variety of cosmetic creams and lotions. The creams and lotions are sold to a variety of retailers at a price of TZS23,200 for each jar of face cream and TZS16,800 for each bottle of body lotion. Each of the products has a variety of ingredients, with the key ones being silk powder, silk amino acids and aloe vera.

Six months ago, silkworms were attacked by disease causing a huge reduction in the availability of silk powder and silk amino acids. The VL had to dramatically reduce production and make part of its workforce, which it had trained over a number of years redundant. The company now wants to increase production again by ensuring that it uses the limited ingredients available to maximize profits by selling the optimum mix of creams and lotions.

Due to the redundancies made earlier in the year, supply of skilled labour is now limited in the short-term to 160 hours (9,600 minutes) per week, although unskilled labour is unlimited. The purchasing manager is confident that they can obtain 5,000 grams of silk powder and 1,600 grams of silk amino acids per week. All other ingredients are unlimited.

The following information is available for the two products:

	Cream	Lotion
Materials required:		
Silk powder (at TZS2,200 per gram)	3 grams	2 grams
Silk amino acids (at TZS800 per gram)	1 gram	0.5 grams
Aloe vera (at TZS1,400 per gram)	4 grams	2 grams
Labour required:		
Skilled (at TZS12,000 per hour)	4 minutes	5 minutes
Unskilled (at TZS8,000 per hour)	3 minutes	1.5 minutes

Each jar of cream sold generates a contribution of TZS9,000 per unit, whilst each bottle of lotion generates a contribution of TZS8,000 per unit. The maximum demand for lotion is 2,000 bottles per week, although demand for creams is unlimited. Total fixed costs is TZS1,800,000 per week. The company does not keep inventory although if a product is partially complete at the end of one week, its production will be completed in the following week.

REQUIRED:

By rounding all working to two decimal places:

- (a) Use linear programming to:
- Calculate the optimum number of each product that the Vipodozi Ltd should make per week, to maximize contribution.
 - Calculate the total contribution per week for the new production plan.
- (b) Calculate the shadow price for silk powder and the slack for silk amino acids.

*Question 12

Higgins Company (HC) manufactures and sells pool cues and snooker cues. The cues both use the same type of good quality wood (ash) which can be difficult to source in sufficient quantity. The supply of ash is restricted to 5,400 kg per period. Ash costs TZS 40 per kg.

The cues are made by skilled craftsmen (highly skilled labour) who are well known for their workmanship. The skilled craftsmen take years to train and are difficult to recruit. HC's craftsmen are generally only able to work for 12,000 hours in a period. The craftsmen are paid TZS 18 per hour.

HC sells the cues to a large market. Demand for the cues is strong, and in any period, up to 15,000 pool cues and 12,000 snooker cues could be sold. The selling price for pool cues is TZS 41 and the selling price for snooker cues is TZS 69.

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Manufacturing details for the two products are as follows:

	Pool cues	Snooker cues
Craftsmen time per cue	0.5 hours	0.75 hours
Ash per cue	270 g	270g
Other variable costs per cue	TZS 1.20	TZS 4.70

HC does not keep inventory.

Required:

- Calculate the contribution earned from each cue.
- Determine the optimal production plan for a typical period assuming that HC is seeking to maximize the contribution earned. You should use a linear programming graph (using the graph paper provided), identify the feasible region and the optimal point and accurately calculate the maximum contribution that could be earned using whichever equations you need.

Some of the craftsmen have offered to work overtime, provided that they are paid double time for the extra hours over the contracted 12,000 hours. HC has estimated that up to 1,200 hours per period could be gained in this way.

Required:

- Explain the meaning of a shadow price (dual price) and calculate the shadow price of both the labour (craftsmen) and the materials (ash).
- Advise HC whether to accept the craftsmen's initial offer of working overtime, discussing the rate of pay requested, the quantity of hours and one other factor that HC should consider.

***Question 13**

- State when is a revenue or cost item relevant for a particular decision. **(3 marks)**
 - What are the potential problems to be avoided in relevant-cost analysis? **(2 marks)**
- A company has only 12,000 machine hours available for making three products A, B and C for the year 2013. The forecasted sales demand and budgeted data for its products are as follows:

	A	B	C
Projected Possible Sales Units	1,800	2,400	3,000
Per unit data:			
Selling price (TZS)	10,000	14,000	15,000
Variable costs (TZS)	4,000	8,000	9,000
Machine hours required per unit	4 hours	3 hours	2 hours

Budgeted Annual Fixed cost are TZS 15,000,000 for the year 2013.

REQUIRED:

- Prepare production plan that will maximize profits for the period and budgeted profit to be earned under this strategy. **(5 marks)**
- State the advantages of making products internally as opposed to buying from an external supplier. **(3 marks)**
- Assume an outside contractor had offered to manufacture any quantity required of the company's products at the following unit prices:
A TZS 8,000, **B** TZS 10,400 and **C** TZS 12,000.

REQUIRED:

- Advise on which products the company should buy from the outside contractor in order to make up the shortage in capacity. **(5 marks)**

Calculate the budgeted profit to be earned.

(2 marks)(Total = 20 marks)

***Question 14**

WZ is a manufacturing company with two factories. The company's West factory currently produces a number of product. Four of these products use differing quantities of the same resources. Details of these four products and their resource requirement are as follows:

	J	K	L	M
Product	TZS /unit	TZS /unit	TZS /unit	TZS /unit
Selling price	56	40	78	96
Direct labour (TZS 8 per hour)	20	16	24	20
Direct material A (TZS 3 per litre)	6	3	0	9
Direct material B (TZS 5 per kg)	10	0	15	20
Variable overhead (see note 1)				
Labour related	1.25	1	1.5	1.25
Machine related	1.25	2	0.75	1
Total variable cost	38.5	22	41.25	51.25
Other data				
Machine hours per unit	5	8	3	4
Maximum demand per week	1000	3500	2800	4500

Notes

1. An analyses of variable overhead shows that some of it is caused by the number of labour hours and the remainder is caused by the number of machine hours.
2. Currently WZ purchases a component P from an external supplier for TZS 35 per component. A single unit of this component is used in producing **N** the company's only other product. Product **N** is produced in WZ's other factory and does not use any of the resource identified above. Product **N** currently yield a positive contribution. WZ could manufacture the component in its West factory, but to do so would require: 1 hour of direct labour, 0.5 machine hours, and 2 kgs of direct material B. WZ purchases 500 components per week. WZ could not produce the components in its factory.
3. The purchasing director has recently advised you that the availability of direct material A and B is to be restricted to 21000 litres and 24000 kgs per week respectively. This restriction is unlikely to change for at least 10 weeks. No restriction are expected on any other resources.
4. WZ does not hold inventory of either finished goods or raw materials.
5. WZ has already signed a contract, which must be fulfilled, to deliver the following units of its product each week for 10 next weeks:

Product	Contract units
J	100
K	200
L	150
M	250

These quantities are in addition to the maximum demand identified above

Required:

- a) Calculate whether WZ should continue to purchase the component P or whether it should manufacture it internally during the next 10 weeks. (11 Marks)
- b) Prepare a statement to show the optimum weekly usage of the West factory's available resources.
Note: You are NOT required to use linear programming.
- c) (i) Assuming no other changes, calculate the purchase price of the component P at which your advice in part (A) above would change
(ii) Explain two non-financial factors that should be considered before deciding whether or not to manufacture the component internally
- d) if you were to solve part (b) above using linear programming state the following:
 - the objective function
 - the inequality for the material **A** constraint
 - the inequality for the material **B** constraint

***Question 15**

Mtaalamu Manufacturing Company manufactures agricultural equipment and currently is preparing its budget for the year 2002/3. An initial review clearly shows that the company will not able to manufacture all the requirements for components XA, XB, XC and XD because of limited pressing capacity of 20,000 hours

The production manager has advised the company management to choose between the alternative courses of action given below to obtain the components in excess of the normal production capacity

- (i) To buy entirely from outside suppliers
- (ii) To buy from outside suppliers and or use a partial second shift

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The data below are for the year 2002/2003

Standard production Cost per unit

Components	XA	XB	XC	XD
Variable costs	TZS	TZS	TZS	TZS
Direct Materials	740	540	500	880
Direct Labour	200	160	440	800
Direct Expenses	200	400	200	1,200
Fixed costs	100	80	220	400
Total production costs	<u>1,240</u>	<u>1,180</u>	<u>1,360</u>	<u>3,280</u>
Requirements in units	2,000	3,500	1,500	2,800

Direct expenses relate to the use of the mental presses, which cost TZS 200 per machine hour to operate. Fixed overhead is absorbed as a percentage of direct labour cost.

Quotation obtained by the purchasing department from outside suppliers indicate a willingness to manufacture all or any part of the total requirements at the following prices each delivered to the factory.

Component	TZS
XA	1,200
XB	1,180
XC	1,040
XD	3,360

Second shift operations would increase direct labour cost by 25% over the normal shift and fixed overhead for TZS 10,000 for each 1,000 units (or part thereof) for the second shift hours worked

As a Management Account, using the information given above with supporting calculations state

- Which components and in what quantities should be manufactured in the 20,000 hours of the press time available
- Whether it would be profitable to make any the balance of the components require on the second shift instead of buying them from outside suppliers

*Question 16

A divisional of manufacturing company is now producing product 'A' on single shift basis. The annual production is 150,000 units. The selling price is TZS 100 per unit. The cost data is as under:

Direct labour 50,000 hours at TZS 50 per hour	
Direct material	TZS 55 per unit
Other variable cost	TZS 975,000 per annum
Divisional fixed cost	TZS 3,500,000 per annum

The company is desirous of improving its profitability by increasing its production and sales to 250,000 units. The Company is confident of the sales potential of the increased production. However, the increase in production would involve working a full second-shift production. The labour efficiency in second shift is expected to be lower, and as such direct labour hours required in second shift for the increased production would be 42,000 hours. The direct labour cost per hour in second shift including O. T. Would be TZS 68. Additional fixed cost required would be TZS 800,000.

You are required to:

- Advise whether the second shift working should be taken up.
- Compare the profits before and after introduction of second shift.
- Offer your comments on the introduction of second shift from the business point of view rather than from profit angle.

*Question 17

APP Ltd is one of the most thriving manufacturing companies which have sprung up as a result of the trade liberalization policy in Tanzania. The Company produces a range of products and absorbs production overhead using a rate of 200% on direct wages. This rate was calculated from the following budgeted figures:-

Variable production costs	-	TZS 64,000,000
Fixed production costs	-	TZS 96,000,000
Direct labour costs	-	TZS 80,000,000

The normal selling price of product X which is one of APP Ltd's product lines is TZS 22,000, and with a production cost of 1 unit is as follows:-

Raw Material	-	TZS 8,000
Direct Labour	-	4,000
Production Overhead	-	<u>8,000</u>
		20,000

There is a possibility of supplying a special order of 2,000 units of product X at TZS 16,000 per unit. If the order is accepted, the normal budgeted sales would not be affected and the Company has the necessary capacity to produce the additional units.

You are further informed that the cost of making component Q, which forms part of product Y is stated below:-

		TZS
Raw Material	-	4,000
Direct Labour	-	8,000
Production Overhead	-	<u>16,000</u>
		<u>28,000</u>

Component Q could be bought from an outside supplier for TZS 20,000.

Required:

Assuming that fixed production cost will not change:-

- (a) State whether the Company should:-
- Accept the special order of 2,000 units of product X
 - Continue making component Q or buy it from outside.

Both your statements must be supported by detailed cost analysis.

Comment on the principle you have followed in your cost analysis to arrive at your answers to (i) and (ii) above.

***QUESTION 18**

The production manager of your organisation has approached you for some costing advice on project X, a one-off order from overseas that he intends to tender for. The costs associated with the project are as follows:

	£
Material A	4,000
Material B	8,000
Direct labour	6,000
Supervision	2,000
Overheads	12,000
	32,000

You ascertain the following:

- Material A is in stock and the above was the cost. There is now no other use for material A, other than the above project, within the factory and it would cost TZS 1750 to dispose of. Material B would have to be ordered at the cost shown above.
- Direct labour costs of TZS6000 relate to workers that will be transferred to this project from another project. Extra labour will need to be recruited to the other project at a cost of TZS7000.
- Supervision costs have been charged to the project on the basis of 33⅓% of labour costs and will be carried out by existing staff within their normal duties.
- Overheads have been charged to the project at the rate of 200% on direct labour.
- The company is currently operating at a point above break-even.
- The project will need the utilization of machinery that will have no other use to the company after the project has finished. The machinery will have to be purchased at a cost of TZS10,000 and then disposed of for TZS 5,250 at the end of the project.

The production manager tells you that the overseas customer is prepared to pay up to a maximum of TZS30,000 for the project and a competitor is prepared to accept the order at that price. He also informs you the minimum that he can charge is TZS40,000 as the above costs show TZS 32,000, and this does not take into consideration the cost of the machine and profit to be taken on the project.

Required:

- Cost the project for the production manager, clearly stating how you have arrived at your figures and giving reasons for the exclusion of other figures.
- Write a report to the production manager stating whether the organisation should go ahead with the tender for the project, the reasons why and the price, bearing in mind that the competitor is prepared to undertake the project for TZS 30,000.
- State four non-monetary factors that should be taken into account before tendering for this project
- What would be your advice if you were told that the organisation was operating below break-even point? Give reasons for your advice.

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*Question 19

UNIVERSE Ltd. Manufactures 20,000 units of X in a year at its normal production capacity. The unit cost as to variable costs and fixed costs at this level are TZS 13 and TZS 4 respectively. Due to trade depression, it is expected that only 2,000 units of X can be sold during the next year. The management plans to shut down the plant. The fixed cost for the next year then is expected to be reduced to TZS 33,000. Additional costs of plant shutdown are expected at TZS 12,000.

Required:

- Advise the management whether the plant should be shut down.
- Decide on the shut – down point.

*Question 20

The original budget for the K Department of Hilton Ltd for the forthcoming year was as follows;

Budgeted sales and production - 30,000 units

	Per unit of output (TZS)	Total for 30,000 units
Sales revenue	10	300,000
Manufacturing cost		
Material A (1 litre per unit)	2.0	60,000
Material B (1 Kg per unit)	1.5	45,000
Production labour	2.0	60,000
Variable overhead	1.0	30,000
Fixed manufacturing overhead	2.0	60,000
	8.5	255,000
Non manufacturing costs	1.0	30,000
Total costs	9.5	285,000
Budgeted net profit for the year	0.5	15,000

As part of Hilton Ltd's long term strategic plan the K department was due to be closed at the end of the forthcoming year. However, rumours of the closure have resulted in the majority of K's labour force leaving the firm and this has forced the abandonment of the original budget for the department.

The managing director has suggested that the department could be closed down immediately or, by employing contract labour, could be operated to produce 10,000 or 20,000 units in the year. With the exception of the foreman (see note (v)) the few remaining members of K's production labour force would then be redeployed within the firm. The following further information is available.

- Each hour of contract labour will cost TZS 3 and will produce one unit of the product. Contract labour would have to be trained at a fixed cost of TZS 20,000
- There are 30,000 litres of material A in stock. This material has no other use and any of it not used in department K will have to be disposed of. Costs of disposal will be TZS 2,000 plus TZS 0.5 per litre disposed of.
- There are 15,000 kgs of material B in stock. If the material is not used in department K then up to 10,000 kgs could be used in another department to substitute for an equivalent weight of a material which currently costs TZS 1.8 per kg. Material B originally costs TZS 1.5 per kg and its current market price (buying or selling) is TZS 2.0 per kg. Costs to H Ltd of selling any surplus material B will amount to TZS1.00 per kg sold.
- Variable overhead will be 30% higher per unit produced than originally budgeted.
- Included in fixed manufacturing overhead are
 - TZS 6,000 salary of departmental foremen
 - TZS 7,000 depreciation of the machine used in the department.

If the department is closed immediately, the foremen, who will otherwise retire at the end of the year, will be asked to retire early and paid TZS 2,000 compensation for agreeing to this.

The only machine used in the department originally cost TZS 70,000 and could currently be sold for TZS 43,000. This sale value will reduce to TZS 40,000 at the end of the year and, if used for any production during the year will decrease by a further TZS 500 per 1000 units produced.

- (vi) All other costs included in fixed manufacturing overhead and non manufacturing costs are apportionments of general overheads none of which will be altered by any decision governing the K Department
- (vii) The sales manager suggests that the sales volume of 10,000 units could be achieved if the unit sales price were TZS 9.00. A sales volume of 20,000 units would be achieved if the sales price per unit were reduces to TZS 8.00 and an advertising campaign costing TZS 15,000 were undertaken.

Required:

- (a) Advise H. Ltd if its best course of action regarding department K, presenting any data in tabular form
- (b) For each of the following separate circumstances, show how the advice given in (a) above is altered.
 - (i) Immediate closure of department K would enable its factory space to be rented out for one year at a rental of TZS 8,000.
 - (ii) The quoted level of efficiency of the contract labour is the average for production of the first 5,000 units and any additional production would reflect of the 90% learning curve which will be experienced. Show also that revised contract labour costs.
Ignore taxation and time value of money.

***Question 21**

A multi-product company has been producing an electronic component in its Department P. The budget of Department P for the next is as under:

Budgeted sales and production - 72,000 units

	TZS Per unit
Selling price	<u>200</u>
Direct Material	
Material X (1 litre per unit)	40
Material Y (1 Kg per unit)	30
Direct wages	40
Variable overhead	20
Fixed manufacturing overhead	60
Total	190
Budgeted net profit for the year	10

Subsequent to the preparation of the budget, the company offered that the the setting up of an electronic park in the region where the company is situated, has resulted in migration of the majority of the department's workforce and consequently the company is forced to take a decision on closure of the department and abandonment of the budget. The company was however, advised to produce either 24,000 or 48,000 components in the next year by employing contract labour. A few remaining workers will be absorbed by the company within the organization against vacancies. The relevant data are as under:

- a) The cost of contract labour is TZS 6 per hour and the standard contract labour time per unit is 10 hours. The Contract labour, however, will have to be trained at a fixed cost of TZS 40,000.
- b) The stock of material X is 72,000 kg. This material has no other use and any of it not used in department P will have to be disposed of. Costs of disposal will be TZS 4,000 plus TZS 1 per kg disposed of.
- c) The stock of material Y is 36,000 kg. If the material is not used in department P, a quantity up to 24,000 kg can be used in another department as substitute for an equivalent weight of a material which currently costs TZS 36 per kg. Material Y originally costs TZS 30 per kg and its current market price is TZS 40 per kg. If any surplus material Y is sold, it will fetch a realization of TZS 20.00 per kg sold.
- d) Variable overhead will be 30% higher per unit produced than originally budgeted.
- e) If the department is closed immediately, the foremen, who will otherwise retire at the end of the year, will be asked to retire earlier and he will be paid TZS 80,000 as compensation. His salary is TZS 6,000 per month
- f) The only machine used in the department P originally cost TZS 140,000 and it can be currently sold for TZS 86,000. This sale value will go down to TZS 80,000 at the end of the year and, if the machine is used for any production during the year will decrease by a further TZS 1,000 per 1000 units produced.
- g) The fixed manufacturing overhead are apportionments of general overheads and will not be altered by any decision concerning Department P.
- h) The sales manager state that the sales volume of 24,000 units could be achieved if the unit sales price were TZS 180. He further state that a sales volume of 20,000 units would be achieved if the sales price per unit were reduces to TZS 150.00 and an advertising expenditure costing TZS 30,000 were undertaken.

Required:

- i. Prepare a statement indicating the financial implications of the choice to be made between the following alternatives:
 - A. Close down department P immediately
 - B. Operate department P for a further year to produce 24,000 units of the component.
 - C. Operate department P for a further year to produce 48,000 units of the component.
- ii. Advise the management on the course of action to be taken.

Answers to Self-Examination Questions

Answer to SEQ 1

- (a) The objective is to maximise the total profit by selling units of P_1 , P_2 and P_3 which are produced under the given production time constraints and sales constraint.
- (b) Decision variables:
 Let p_1 be the number of units of product P_1 produced
 p_2 be the number of units of product P_2 produced
 p_3 be the number of units of product P_3 produced
- (c) Objective Function: Total profit to be maximised.
 Therefore, maximise $Z = 3,000p_1 + 5,000p_2 + 10,000p_3$
- (d) Constraints
- (i) Assembly department constraint: Total time required for assembly i.e. $6p_1 + 3p_2 + 5p_3$ must be less than or equal to the time available i.e. 210 Hours
 Therefore, $6p_1 + 3p_2 + 5p_3 \leq 210$
- (ii) In a similar manner, packaging department constraint:
 $5p_1 + 2p_2 + 5p_3 \leq 240$
- (iii) Similarly, store department constraint:
 $9p_1 + 7p_2 + 10p_3 \leq 260$
- (iv) Sales Constraint for product P_3 : the sale is not likely to exceed 25 units. Hence,
 $p_3 \leq 25$
- (d) The LPP formulation will be:

Objective function: Maximise profit, $Z = 3,000p_1 + 5,000p_2 + 10,000p_3$

Subject to

Assembly constraint: $6p_1 + 3p_2 + 5p_3 \leq 210$
 Packaging constraint: $5p_1 + 2p_2 + 5p_3 \leq 240$
 Storage constraint: $9p_1 + 7p_2 + 10p_3 \leq 260$
 Sales constraint: $p_3 \leq 25$
 Non-negativity condition: $p_1, p_2, p_3 \geq 0$

Answer to SEQ 2

Solving the linear programming problem by graphical method

Step 1

- (a) Find out the points of intersection of the equation $4A + B = 40$ with the axes. First this inequality is converted into the equation $4A + B = 40$
 So as to obtain the points of intersection with the axes

Put $A = 0$,

$$4A + B = 40$$

$$4 \times (0) + B = 40$$

$$B = 40$$

Again,

Put $B = 0$,

$$4A + B = 40$$

$$4A + 0 = 40$$

$$A = 10$$

Alternatively, by expressing the equation $4A + B = 40$ into intercept form, we get, $\frac{A}{10} + \frac{B}{40} = 1$

Accordingly, we can directly infer that the straight line intersects the horizontal axis at (10,0) and the vertical axis at (0,40) points.

(b) Find out the points of intersection of the equation $2A + 3B = 90$ with the axes

First this inequality is converted into the equation $2A + 3B = 90$

So as to obtain the points of intersection with the axes,

Put $A = 0$,

$$2A + 3B = 90$$

$$2 \times (0) + 3B = 90$$

$$B = 30$$

Again,

Put $B = 0$,

$$2A + 3 \times (0) = 90$$

$$2A + 0 = 90$$

$$A = 45$$

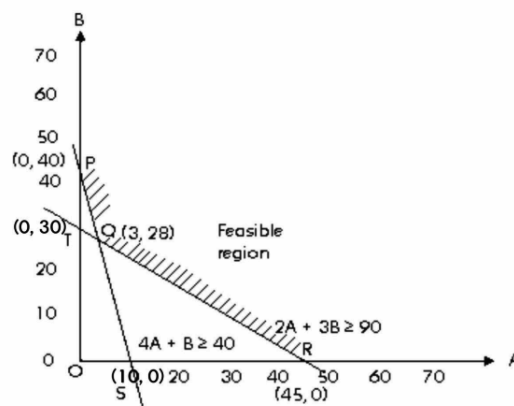
$$\frac{A}{45} + \frac{B}{30} = 1$$

Alternatively, by expressing the equation $2A + 3B = 90$ into intercept form, we get, $\frac{A}{45} + \frac{B}{30} = 1$

Accordingly, we can directly know that the straight line intersects the horizontal axis at (45, 0) and the vertical axis at (0,30) points.

Step 2

Graphical presentation of Linear Programming problem



Step 3

Find out co-ordinate corner points of the feasible region

(a) Co-ordinate of point Q

At the point Q, the $4A + B = 40$ equation line intersected the $2A + 3B = 90$ equation line. Therefore, calculating the co-ordinates of point Q by solving these two equations under the simultaneous equation method, we get

$$4A + B = 40 \text{ equation (i)}$$

$$2A + 3B = 90 \text{ equation (ii) multiplied by 2}$$

$$4A + 6B = 180 \text{ equation (iii)}$$

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$$4A + 6B = 180 \text{ equation (iii)}$$

$$(-) 4A + B = 40 \text{ equation (i)}$$

$$5B = 140 \text{ Equation (iii) – (i)}$$

$$B = 28$$

By putting the value of B in equation (i), calculate the value of A

$$4A + B = 40$$

$$4A = 12$$

$$A = 3$$

Co-ordinates of corner points of the PQR feasible region

Point	(A, B)
P	(0, 40)
Q	(3, 28)
R	(45, 0)

Step 4

Find out the optimum minimum) cost by putting the value of the co-ordinates of the corner points of the feasible region into the objective function $C = 5,000A + 4,000B$

Corner point	Co-ordinates of corner points	Objective function $C = 5A + 4B$	Value (TZS)
P	(0, 40)	$C(P) = 5,000 \times (0) + 4,000 \times (40)$	160,000
Q	(3, 28)	$C(Q) = 5,000 \times (3) + 4,000 \times (28)$	127,000
R	(45, 0)	$C(R) = 5,000 \times (45) + 4,000 \times (0)$	225,000

Out of the three alternatives, the second one i.e. for point (Q), gives the minimum value of \$127,000 indicating that the optimum value of the objective function is 127,000.

Solving the linear programming problem by simultaneous equation method

For solving the problem under the simultaneous equation method, the constraints are converted into the following equations:

$$4A + B = 40 \text{ (i)}$$

$$2A + 3B = 90 \text{ (ii)}$$

By multiplying both the sides of the equation (ii) by 2,

We get,

$$4A + 6B = 180 \text{ (iii)}$$

Deducting equation (i) from this, we will get,

$$5B = 180 - 40$$

$$\text{Or, } 5B = 140$$

$$\text{Or, } B = 28$$

By substituting the value of B in equation (i), we get

$$4A + 28 = 40$$

$$\text{Or, } 4A = 12$$

$$\text{Or, } A = 3$$

Therefore, the optimum value of the objective function would be $5,000 \times (3) + 4,000 \times (28) = 127,000$

Answer to SEQ 3

- (i) The variable cost per unit of product A is TZS50,000 and the export offer price is TZS61,000, therefore acceptance of the offer will give a per unit contribution of TZS(61,000 – 50,000) = TZS11,000.

Total contribution from the offer = TZS11,000 x 200 = TZS2,200,000

Therefore it is profitable to accept the offer.

A price sufficient to cover the variable cost is the minimum price for a special order, as accepting any price below this would signify an increase in loss. Any price beyond this level would earn contribution to the company to recover its fixed costs.

When the special offer price is sufficient to cover the variable cost, management should think of accepting the offer in order to increase its responsiveness and to introduce its product in the export market.

Therefore, the minimum price for accepting the offer is equal to the variable cost per unit i.e. TZS50,000.

- (ii) The relevant costs for making a decision to terminate a product line are the avoidable fixed costs and the variable costs.

Management is of the opinion that production of product B should be stopped as it is making a loss. The following calculations identify whether or not it is beneficial to cease the production of product B:

Costs relevant of Product B	TZS'000	TZS'000
Variable cost per unit (TZS65,000 x 800 units)		52,000
Avoidable fixed cost		
Set up expenses	19,000	
Selling expense	4,580	
		23,580
Total relevant costs		75,580
Sales revenue		88,000
Total contribution from product B		12,420
If Product B is terminated the income from renting the idle capacity is		35,000

Conclusion

As the contribution from product B is not more than the income from rent, production may be terminated.

- (iii) If both A and B are purchased instead of continuing to manufacture:

	TZS'000	TZS'000
If products A & B are purchased		
Sales revenue		
A. 1,200 x TZS120,000	144,000	
B. 800 x TZS110,000	88,000	232,000
Costs:		
A 1,200 x TZS125,000	150,000	
B 800 x TZS95,000	76,000	226,000
Contribution		6,000
Administration cost (70% of total cost)		24,465
Selling cost		8,610
Loss on purchasing products A and B		(27,075)
Rent received		65,000
Profit		37,925

Administration cost of 70% is unavoidable.

Manufacturing of both A and B in-house gives profit of TZS32,440,000 whereas profit on purchasing of both A and B gives profit of TZS37,925,000. Purchase for resale would give a higher return than sales of the manufactured product. However, while finalising the decision to purchase, the company should consider other factors influencing the decision such as ability to rent, closure cost, and continuity of supply and purchase price.

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Answer to SEQ 4

(a) Calculation of price

Step 1

Calculate the total relevant costs of making part MR24

	TZS million
Variable costs (30,000 units x TZS11,000)	330
Avoidable fixed costs (TZS150 million x 60%)	90
Total relevant costs	420

Step 2 Divide the total relevant costs of making the part by the number of units produced

$$= \text{TZS}420 \text{ million} / 30,000 \text{ units} = \text{TZS}14,000$$

If the unit price is less than TZS14,000; Elly Ltd will purchase part MR24 from the market.

(b) The point of indifference (point where there is no profit no loss) between making the part and buying it from the market, is the number of units (monthly usage in this case) for which the total relevant costs of these two alternatives is equal.

Let us assume X is the monthly usage for which it is indifferent to make or to buy

Relevant cost of making is $\text{TZS}11,000X + (\text{TZS}150 \text{ million} \times 60\%)$

Relevant cost of buying is $\text{TZS}12,875X$

At the point of indifference,

$$\text{TZS}11,000X + \text{TZS}150 \text{ million} \times 60\% = \text{TZS}12,875X$$

$$\text{Or, TZS}90 \text{ million} = \text{TZS}1,875X$$

$$X = 48,000 \text{ units.}$$

At 48,000 units, the cost of manufacturing and the cost of purchase would be the same.

Answer to SEQ 5

(a) As the pressing machine hour is the limiting factor, we will calculate the contribution per machine hour and accordingly decide which components are more profitable to produce in-house.

(i) Cost of manufacture (per unit)

	A	B	C
	TZS'000	TZS'000	TZS'000
Direct material	26	24	45
Direct labour	8	22	44
Direct expenses	10	5	35
Variable cost per unit to manufacture	44	51	124
Purchasing price	49	45	145
Excess of variable cost per hour over purchase price	5	(6)	21
No of hours required per unit (Note 1)	2	1	7
Excess of variable cost per hour	2.5	(6)	3

Here, in the case of component B, the purchase cost is less than the variable cost. Therefore, it is better to purchase component B from the market.

For the remaining components, considering the limiting factor, component C has the maximum contribution. Therefore, Component C should be produced first, if machine hours are available, component A should be produced.

In 18,000 hours, the following quantities can be produced:

	Hours required	Available hours
Component C (1,900 x 7)	13,300	18,000
Balance hours		4,700

For component A $(3,700 \times 2) = 7,400$ hours are required but only 4,700 are available therefore the number of units produced will be $4,700/2 = 2,350$ units.

The remainder $(3,700 - 2,350) = 1,350$ units should be purchased from outside.

Second shift consideration

As the variable cost is more than the purchase cost for component B, there is no question of manufacturing it. For the remaining units of component A, we will compare the cost of producing 1,350 units in the second shift.

	TZS'000
Variable cost $TZS(26,000 + 8,000 + 10,000)$	44.0
Add: 30% of direct labour $(TZS8,000 \times 30\%)$	2.4
Variable cost per unit in second shift	46.4

For 1,350 units, total manufacturing cost will be:

	TZS'000
Variable cost $(1,350 \text{ units} \times TZS46,400)$	62,640
Add: Fixed cost	1,800
Manufacturing costs	64,440

Purchase cost 1,350 units x TZS49,000 = TZS66,150,000

The purchase cost (TZS66,150,000) is more than the manufacturing cost (TZS64,440,000). Therefore, operating in two shifts is recommended.

Note 1: Number of hours required per component

	A	B	C
Direct expenses (TZS'000)	10	5	35
Machine cost (TZS'000)	5	5	5
Number of hours required	2	1	7

Purchase cost = $TZS 49,000 \times 1350 = TZS 66,150,000$

Produce 1350 units extra shift

Cost of second shift

Material: $26,000 \times 1350 \text{ unit} =$	35,100,000
Labour: $TZS 8,000 \times 1.3 \times 1350 =$	10,800,000
Direct expenses $10,000 \times 1350 =$	13,500,000
Fixed cost =	<u>1,800,000</u>
Total cost =	<u>61,200,000</u>

Conclusion:

Metal Make plc to produce internally C = 1900 units and A = 2350 units in the first shift

Buy from external market B = 1600 units

Produce internally A = 1350 units in the second shift.

Answer to SEQ 8

(a) Require capacity = $(4,000 \times 2.5) = (2000 \times 7.5) + (1500 \times 5)$
= 32,500 sq meters

Available capacity = 20,000

Shortage = 12,500 sq. meters

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Square meters: Chair = $5,000/2,000 = 2.5$
 Bench = $15,000/2,000 = 7.5$
 Table = $10,000/2,000 = 5$

	Chair	Bench	Table
SP/U	20,000	50,000	40,000
VC/U	<u>12,000</u>	<u>32,500</u>	<u>24,000</u>
CM/U	8,000	17,500	16,000
Sq meter/unit	2.5	7.5	5
Cm/sq. meter	3,200	2,333.33	3,200
Rank	1	3	2

Order of Product Plan	Sq. meters	Contribution
Chair – 4,000 units x 2.5 =	10,000 x 3,200 =	32m
Tables – 1,500 units x 5 =	7,500 x 3,200 =	24m
Benches – 333 units x 7.5 =	2,500 x 333.33 =	<u>5,833,328</u>
Available	20,000 Cm	61,833,328
	Less fixed costs	54,000,000
	Net profit	<u>7,833,328</u>

- (b) Note: Demand for chairs and tables is satisfied but any additional timber would be utilized to manufacture benches.

Therefore, the maximum price = TZS 2333 + TZS 2,000 = TZS 4,333/=

i.e. Each sq. meter used on a bench contributes TZS 2,333 after charging the present cost of timber (TZS2,000 per sq.)

Answer SEQ 11

- (a)
 Optimum production plan define the variables;
 Let x = no. of jars of face cream to be produced
 Let y = no. of bottles of body lotion to be produced
 Let C = contribution

The objective is to maximise contribution, C

$$C = 9,000x + 8,000y$$

State the constraints

$$\text{Silk powder } 3x + 2y \leq 5,000$$

$$\text{Silk amino acids } 1x + 0.5y \leq 1,600$$

$$\text{Skilled labour } 4x + 5y \leq 9,600$$

$$\text{Non-negativity constraints: } x, y \geq 0$$

$$\text{Sales constraint: } y \leq 2,000$$

Draw the graph

$$\text{Silk powder } 3x + 2y = 5,000$$

$$\text{[if } x = 0, \text{ then } 2y = 5,000, \text{ therefore } y = 2,500$$

$$\text{[if } y = 0, \text{ then } 3x = 5,000, \text{ therefore } x = 1,666.7$$

$$\text{Silk amino acids } 1x + 0.5y = 1,600$$

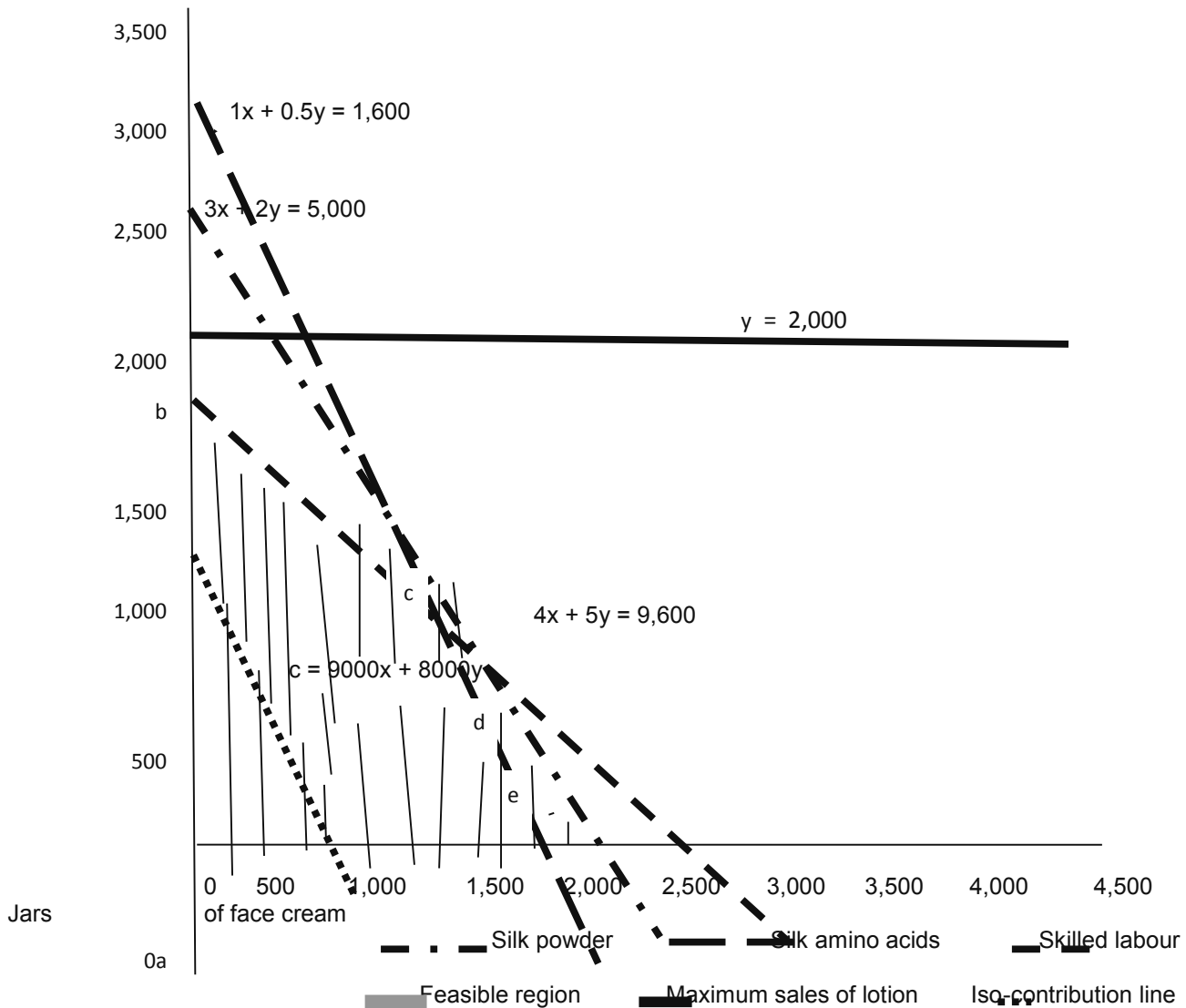
$$\text{[if } x = 0, \text{ then } 0.5y = 1,600, \text{ therefore } y = 3,200$$

$$\text{[if } y = 0, \text{ then } x = 1,600 \text{ Skilled labour } 4x + 5y = 9,600$$

$$\text{[if } x = 0, \text{ then } 5y = 9,600, \text{ therefore } y = 1,920$$

$$\text{[if } y = 0, \text{ then } 4x = 9,600, \text{ therefore } x = 2,400$$

Solve using iso-contribution line if $y = 800$ and $x = 0$, then if $= (8 \times 800) = 6,400$. Therefore, if $y = 0$, $9x = 6,400$
Therefore $x = 711.11$



Using the iso-contribution line, the furthest vertex from the origin is point c, the intersection of the constraints for skilled labour and silk powder. Solving the simultaneous equations for these constraints:

$$\begin{aligned} 4x + 5y &= 9,600 \times 3 \\ 3x + 2y &= 5,000 \times 4 \end{aligned}$$

$$\begin{aligned} 12x + 15y &= 28,800 \\ 12x + 8y &= 20,000 \end{aligned}$$

Subtract the second equation from the first equation

$$7y = 8,800, \text{ therefore } y = 1,257.14$$

$$\text{If } y = 1,257.14 \text{ and: } 4x + 5y = 9,600$$

$$\text{Then } 5 \times 1,257.14 + 4x = 9,600$$

$$\text{Therefore } x = 828.58$$

$$\text{If } C = 9000 \times 828.58 + 8000 \times 1257.14 = 17,514,340$$

$$C = 17,514,170$$

Alternatively, Candidate can solve using Equation method as follows:

Optimum Production Plan

Let x be no of bar

Let y be no of lotion

Let c be contribution

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Objective function;

$$\text{Max } c = 9000x + 8000y$$

Subject to:

$$3x + 2y \leq 5000 \text{ silk powder constraint}$$

$$x + 0.5y \leq 1600 \text{ silk amino constraint}$$

$$4x + 5y \leq 9000 \text{ Labour skilled constraint}$$

$$y \leq 2000 \text{ sales constraint}$$

$$x, y \geq 0 \text{ Non-negativity constraint}$$

Solving by simultaneous equation:

$$\begin{aligned} &\begin{cases} 3x + 2y = 5,000 \\ 3x + 2y = 5,000 \end{cases} \\ &-3 \begin{cases} 3x + 2y = 5,000 \\ 3x + 2y = 5,000 \end{cases} \\ &3x + 2y = 5,000 \\ &-3x - 1.5y = -4,800 \\ &0.5y = 200 \\ &y = \frac{200}{0.5} = 400 \end{aligned}$$

$$\begin{aligned} \therefore 3x + 2 \times 400 &= 5000 \\ 3x + 800 &= 5000 \\ x &= \frac{5000 - 800}{3} \end{aligned}$$

$$\begin{aligned} x &= 1,400 \\ (1,400, 400) \end{aligned}$$

$$\begin{aligned} 4(x + 0.5y) &= 1600 \\ -(4x + 5y) &= 9600 \end{aligned}$$

$$\begin{aligned} 4x + 2y &= 6400 \\ -4x - 5y &= -9600 \end{aligned}$$

$$\begin{aligned} -3y &= \frac{-3200}{3} \\ y &= 1066.67 \end{aligned}$$

$$x + 533.34 = 1600$$

$$\begin{aligned} x &= 1600 - 533.34 \\ &= 1066.67 \end{aligned}$$

$$\begin{aligned} 5. \quad &(1066.67, 1066.67) \\ &x + 0.5y = 1600 \\ &y = 2000 \end{aligned}$$

$$\begin{aligned} x + 0.5 \times 2000 &= 1600 \\ x &= 1600 - 1000 \\ x &= 600 \end{aligned}$$

$$(600, 2000)$$

$$\begin{aligned} 4x + 5y &= 9600 \\ y &= 2000 \end{aligned}$$

$$\begin{aligned} 4x + 5 \times 2000 &= 9600 \\ 4x &= 9600 - 10000 \\ 4x &= -400 \text{ not feasible} \end{aligned}$$

Optimum output

- (i) Cream = 828.57 unit
Lotion = 1257.13

- (ii) Total contribution.

$$C = 9000 \times 828.57 + 8000 \times 1259.13$$

$$C = \text{TZS } 17,514,170$$

- (b) Shadow prices and slack

The shadow price for silk powder can be found by solving the two simultaneous equations intersecting at point c, whilst adding one more hour to the equation for silk powder.

$$4x + 5y = 9,600 \times 3$$

$$3x + 2y = 5,001 \times 4$$

$$12x + 15y = 28,800$$

$$12x + 8y = 20,004$$

Subtract the second one from the first one $7y = 8,796$, therefore $y = 1,256.57$

$$3x + (2 \times 1,256.57) = 5,001. \text{ Therefore } x = 829.29$$

$$C = (9 \times 829.29) + (8 \times 1,256.57) = \text{TZS } 17,516.17$$

Original contribution = TZS 17,514.34 Therefore shadow price for silk powder is TZS 1.83 per gram.

The slack for amino acid can be calculated as follows: $(828.58 \times 1) + (0.5 \times 1,257.14) = 1,457.15$ grams used. Available = 1,600 grams. Therefore slack = 142.85 grams.

SECTION B5: PRICING DECISION

Get Through Intro

In olden times, people used to depend on a barter system to exchange goods in the course of trading. No specific exchange value of a product was available. However, with the advent of society and its economic system, the determination of the exchange value of a product has become a matter of utmost importance for any goods and service trading. The exchange value of a product, i.e. its price, is a function of several factors such as its cost, overall demand, competitors' product price etc.

In order to settle an optimum price, an organisation needs to have access to information, both internal and external. In addition, knowledge about pricing strategies is of prime importance.

This section deals with different pricing strategies, derives the demand equation as well as the total cost function and also discusses the situation where profit can be maximised. Knowledge of these topics will enhance students' managerial skills. Moreover, a question, or part of a question, on this topic is expected in the exam.

Learning Outcomes

- a) Evaluate the factors that influence the pricing of a product or service.
- b) Illustrate the pricing policy, pricing objectives, and pricing strategies.
- c) Evaluate the different cost-plus pricing methods for deriving selling prices.
- d) Calculate the selling price using cost-plus pricing methods.
- e) Evaluate the limitations of cost-plus pricing.
- f) Illustrate the role that target costing plays in the pricing decision.
- g) Illustrate the price elasticity of demand.
- h) Formulate the demand function.
- i) Evaluate how the optimum output and selling price is determined using the economic theory.
- j) Calculate the optimum selling price and output for an organisation using calculus.

1. Evaluate the factors that influence the pricing of a product or service. Illustrate the pricing policy, pricing objectives, and pricing strategies.

[Learning Outcomes a and b]

Price is an essential component of a marketing mix, also known as the "four Ps" of marketing. The price is an important element in achieving marketing objectives such as customer acquisition and retention for particular target markets. The pricing decision is very complex because it is influenced by numerous, interacting factors and has no simplistic solution.

1.1 Factors influencing pricing

The following are factors that explicitly or implicitly influence a pricing decision:

1. The objectives and strategies of the firm

The objective of a firm may be profit maximisation. The strategy of the firm may accordingly be either to maximise profit from the existing products, to gain a target market share, to launch a new product in the market or to utilise spare capacity, etc. In order to pursue the policy, the firm may decide on the pricing of a product or service.

2. The market condition in which the firm operates

Market conditions (i.e. perfect or imperfect competition, oligopoly or monopoly) influence pricing decisions. In a perfectly competitive market, the alternative products of competitors can affect demand and force a firm to lower its prices. The extent and nature of the competition are the determining factors for pricing a product. On the other hand, in a monopoly, the business has the power to determine the price of its products or services. In other words, a firm which doesn't have any competition can set a higher price.

3. The customers of the firm

The price of a product or service is dependent on the demand and supply for it. The customers cause a change in the demand for a product or service. Firms often take pricing decisions by considering the price from the customers' viewpoint. Too high a price may cause customers to reject a company's product and choose a competing product.

4. The costs of the product or service

Costs affect the supply of the product or service. A firm will be willing to increase production if the gap between the price charged and costs incurred is widened. A lower cost of production allows the product price to be set so that the product becomes attractive to the customers, while maximising the operating income of the firm. While calculating the relevant costs for a pricing decision, the manager must consider relevant costs in all value-chain business functions from research and development to after sales service.

5. The other factors that influence the price of a product or service

Other influencing factors include:

- the demand for the firm's product
- the elasticity of demand for the product
- the stages of the product life cycle
- whether the firm can dominate the market and act as a price maker or not (if it is a price taker, accept the market price)
- the level of capacity utilisation by the firm
- whether the prices are administered by the government or not
- whether the product has distinctive features or not (i.e. are there close substitutes?), etc.

All these issues are not explicitly considered in every pricing decision.

1.2 Pricing policy

Pricing policy is commonly referred to as the policy based on which a company determines the wholesale and retail prices for its products or services. A company may adopt any of the following pricing policies depending upon factors such as its nature of business, type of product, target market, etc.

1. **Flexible pricing policy:** it offers the same product to various customers at different negotiated prices.



Example

In the car market, people usually buy cars at negotiated contracts due to customisations. If one customer buys a customised green car and another buys the readily available white car, the first one might have to pay TZS1 million more.

2. **Uniform pricing policy:** under this policy, all customers are charged the same price for all the goods and services offered for sale.



Example

Anything that you can buy at a store that is fixed, or can only be bought at one uniform price, like a 500 ml bottle of cold drink.

3. **Prestige pricing:** this method is used to raise a higher margin.



Example

Some fashion accessories in big malls are sold for high prices, but the same designs and quality are available at cheaper rates in the street markets. A customer will pay a higher price when buying from malls, assuming higher quality or for social prestige.

4. **Odd-Even pricing:** this method is used by the businesses to make their customers think they are getting a bargain.



Example

Some businesses price their products at odd figures like TZS99,999 or TZS199,995 instead of TZS100,000 or TZS200,000. This makes the customers psychologically think they are paying a lower price and they get motivated to buy the product.

1.3 Pricing objectives

The objectives of pricing give a sense of direction to the whole pricing process. The following are some of the most common pricing objectives:

1. **Maximise profit:** this objective attempts to maximise current profit by considering revenue and costs. However, it might not be a very suitable objective if short-term profit maximisation results in lower long-term profits.
2. **Maximise revenue:** this objective attempts to maximise current sales revenue with no regard to profit margins. The fundamental objective often is to maximise long-term profits by increasing market share and minimising costs.
3. **Maximise sales volume:** this objective aims for maximising the number of units sold. This can be achieved by competitive pricing and better product quality.
4. **Stability:** an organisation may seek stability in price with a view to avoiding price clashes and maintaining stability in profits.
5. **Survival:** this is the most important objective of any organisation - to survive in tough situations like a declining market. An organisation may have to lower its prices in order to sustain in the market. However, when survival takes precedence over profits, this objective proves to be momentary.

1.4 Pricing strategies

Pricing strategies always correspond to pricing objectives. Different pricing methods can be used to achieve different objectives as listed in the above paragraph.

1. Price skimming

Price skimming refers to the strategy of **selling a product or a service at a high price to gain a high profit**, while sacrificing high growth in sales. A high price can be charged when an organisation has substantial competitive advantage. However, the advantage is not sustainable. The high price tends to attract new competitors into the market, and the price inevitably falls due to increased supply.



Example

Consumer durables manufacturers use a skimming approach when a model (with new features) arrives into the market. Once other manufacturers launch products with similar features the price of the products is lowered due to a higher level of supply.

The **objective** of a price skimming strategy is **to grab the consumer surplus** (i.e. the difference between the price the consumers are willing to pay and the actual price of a product or service). If this is done successfully, then theoretically the organisation will be able to charge an amount not less than the maximum amount customers' are willing to pay. In practice, however, it is impossible for a firm to grab this entire surplus. Price skimming is effective only if the demand of the product or service is inelastic.

2. Penetration pricing

The price charged for products and services is **set artificially low in order to gain market share**. An organisation with huge production capacity may initially adopt a penetration pricing policy to gain a greater market share. After securing greater demand for the commodity, the organisation may increase production and, accordingly, secure economies of scale resulting in a reduction in unit costs. As a result, the organisation can secure a greater market share and profitability despite initial losses.

Penetration pricing is suitable in the following cases:

- Product demand is highly price elastic.
- Substantial economies of scale are available.
- The product faces stiff competition soon after its introduction.
- In industries where standardisation is important. The product that achieves high market penetration often becomes the industry standard (as witnessed in the case of the computer operating system, Microsoft Windows). Other similar products, even if they are superior in quality, become marginalised.

3. Complementary product

Products are said to be complementary if they are connected to each other in some manner and when the sales of one product increase, it is reasonable to assume that demand for the other product will also increase. Examples of some complementary products are: computer and software, pen and ink, car and gasoline, etc.

The pricing of complementary products may be affected by price changes made to the primary product since customers may compare the price for complementary products with the primary product price.

4. Product-line

Companies usually develop product-lines (i.e. a series of products) instead of trading on a single product. Each successive product in the line offers more features, and, for each of them, the organisation needs to decide on price, keeping in mind the price of the preceding product in the line and the new features added to it. Price is decided taking into account the **cost differences between the products, customer evaluations of their features and benefits and competitors' prices**. If the price difference between two successive products is negligible, buyers will usually be tempted to buy the more advanced product. This will increase the organisation's profits, if the cost difference between the two products is less than the price difference.

5. Volume discounting

This pricing strategy is employed to **induce buyers to purchase in higher volume** so as to receive a discount (on list prices). The vendor passes cost savings, due to economies of buying in bulk, on to the buyer.

6. Discrimination

With price discrimination, a firm **sells a single identical product in different segments of the market at different prices**. For price discrimination to work successfully, the different market segments must be kept separate. Different geographical areas, different times in a day and customers of different age groups may be considered to be different market segments.



Test Yourself 1

List the factors that influence the pricing decision.

2. Evaluate the different cost-plus pricing methods for deriving selling prices.
Calculate the selling price using cost-plus pricing methods.
Evaluate the limitations of cost-plus pricing.

[Learning Outcomes c, d and e]

Pricing is an important strategic issue because it is related to product positioning. Having set the pricing objectives and goals, the next step is to determine how these may be achieved. While there is no single recipe to determine pricing, the following are the different pricing strategies adopted by businesses in different situations:

2.1 Cost-plus pricing

1. Total cost-plus pricing

Total cost-plus pricing is the simplest pricing method. The organisation calculates the cost of producing the product and adds on a percentage (profit) to that price to identify the selling price. Unfortunately, because of fixed costs, the full cost per unit of a product is dependent on the number of units sold. However, sales quantity is dependent on the price charged for the product, and moves in the opposite direction to the movement of price, and so the argument is circular. This method of pricing, although simple, has two flaws: it takes no account of demand and there is no way of determining if the potential customers will purchase the product at the calculated price.

If everything goes according to plan (so that direct costs, overheads and the basis of charging overheads, e.g. machine hours, prove to be as expected), then selling the products at their total cost will cause the business to break-even exactly. Therefore, if an element of profit is not charged over and above the total cost in order to ascertain the price, in reality the business will not be able to make a profit.

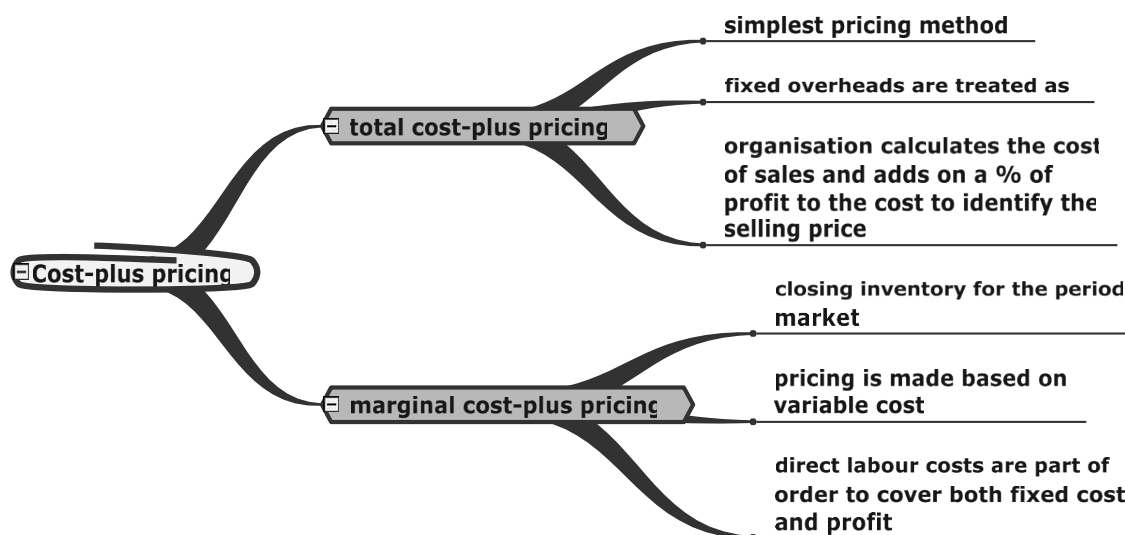
Where a price is quoted by a jobbing company (an organisation that makes products to order) for a specific quantity of a product made to the customer's specification, total cost-plus pricing is an acceptable pricing method. However, for the majority of other kinds of organisations this pricing method is not acceptable.

2. Marginal cost-plus pricing

Under this method, pricing is made based on the variable cost of the item to be sold, a large mark-up percentage is added in order to cover both fixed costs and profit. This method of pricing is preferred over full cost-plus pricing during times of recession. This is because knowledge of marginal cost allows the possibility of pricing below total cost in order to maximise capacity utilisation. This method of pricing is found to be particularly suitable to price-specific contracts, since it can be used to recognise relevant costs and opportunity costs as well as sunk costs.

The main drawback of this system of pricing is that, in a dull market, competing organisations may start to lower their respective prices, even below the total cost, in order to gain market share (since the demand will be price elastic). In this process, the weaker organisations will ultimately go out of business and the remaining organisations will face strong customer resistance if they try to increase the price substantially.

SUMMARY



1. Full cost plus pricing

The selling price of a product can be determined under this method in the following steps:

Step 1

Calculate total budgeted production cost

$$\text{Total budgeted production cost} = \text{Total budgeted production cost} + \text{Total production overheads}$$

Step 2

Calculate total budgeted cost

$$\text{Total budgeted costs} = \text{Total budgeted production cost} + \text{Total budgeted non-production overheads}$$

It may be noted that 'non-production overheads' include administration overheads and selling and distribution overheads.

Step 3

Calculate the price

$$\text{Selling price} = \frac{\text{Total budgeted cost} + \text{Profit mark up}}{\text{Budgeted sales unit}}$$

It may be noted that the profit margin may be calculated either as a percentage of full cost or as a percentage of the sales price or, alternatively, a lump-sum amount as decided by the management.



Example

The following are extracts from the budget of Pinpoint Ltd. The company has a policy to add a mark-up of 40% on the total cost per unit to derive a selling price.

Production	10,000 units
Variable product costs	TZS20,000 per unit
Fixed overheads	TZS100 million
Sales	10,000 units

Continued on the next page

Hence,

$$\begin{aligned}\text{Selling price} &= \frac{\text{Total budgeted cost} + \text{Profit mark up}}{\text{Budgeted production unit}} \\ &= \frac{[(10,000 \times \text{TZS}20,000) + \text{TZS}100 \text{ million}] + 40\% \text{ of total cost}}{10,000 \text{ units}} \\ &= \text{TZS}42,000\end{aligned}$$

2. Marginal cost plus pricing

This is the method of pricing based on variable unit or marginal cost. The steps of calculating marginal cost-plus pricing are as follows:

Step 1

Calculate budgeted variable production cost per unit

$$\text{Budgeted variable production cost per unit} = \text{Budgeted material cost per unit} + \text{Budgeted labour cost per unit} + \text{Budgeted direct expenses (if any) per unit} + \text{Budgeted variable production overheads}$$

Step 2

Calculate budgeted variable non-production overheads

$$\text{Budgeted variable non-production overheads} = \text{Budgeted variable administration overhead per unit} + \text{Budgeted variable selling and distribution overhead per unit}$$

Step 3

Calculate the price

$$\text{Selling price} = \text{Budgeted variable production cost per unit} + \text{Budgeted variable non-production cost per unit} + \text{Profit mark up per unit}$$



Example

Trigger Ltd provides the following cost information for its product:

	TZS'000 per unit
Direct materials	15.00
Direct labour	10.00
Direct expenses	7.50
	TZS million
Administration overheads (60% fixed)	800
Selling and distribution overheads (40% fixed)	1,200
	Units
Budgeted production and sales	50,000

Trigger has a policy to add a mark-up of 50% on the total marginal cost per unit to derive a selling price.

Hence, selling price would be calculated as follows:

$$\begin{aligned}\text{Selling price} &= \text{Budgeted variable production cost per unit} + \text{Budgeted variable non-production cost per unit} + \text{Profit mark up per unit} \\ &= \text{TZS}32,500 + [(\text{TZS}320 \text{ million}/50,000) + (\text{TZS}720 \text{ million}/50,000)] + \text{Profit mark up per unit} \\ &= [\text{TZS}32,500 + \text{TZS}6,400 + \text{TZS}14,400] + \text{Profit mark up per unit} \\ &= \text{TZS}53,300 + (\text{TZS}53,300 \times 50\%) \\ &= \text{TZS}53,300 + \text{TZS}26,650 \\ &= \text{TZS}79,950\end{aligned}$$



Test Yourself 2

A manufacturer wants to launch a new product.

The non-current assets needed for production will cost TZS8,000 million, and working capital requirements are estimated at TZS1,600 million.

The estimated annual sales volume is 80,000 units.

Variable production costs are TZS60,000 per unit.

Fixed production costs will be TZS900 million each year, and annual fixed non-production costs will be TZS300 million.

Required:

- (a) Calculate selling price using
 - (i) Full cost plus 20%
 - (ii) Marginal cost plus 40%
 - (iii) Pricing based on a target return on an investment of 10% per year.
- (b) If actual sales are only 40,000 units and the selling price is set at full cost plus 20%, what will the profit be for the year?

3. Relevant cost based pricing

In order to calculate a price based on the relevant cost of a product (or service), the following steps need to be followed:

Step 1

Calculate the marginal cost of producing and selling the product. Often, the marginal cost of producing and selling a product is relevant.

Step 2

If any scarce resource is needed for production and sale of the product, the relevant cost should include the opportunity cost of using the resource.

Accordingly, the relevant cost will be the marginal cost plus the opportunity cost per unit.

Step 3

The price may be calculated by adding a margin to the relevant cost:

$\text{Selling price} = \text{Relevant cost per unit} + \text{Profit margin per unit}$



Example

South-port is a shipbuilding company. It uses two types of material, steel and fibreglass. It needs to complete a shipping order using 1,250 tonnes of steel and 2,500 tonnes of fibreglass. The work force will have to work 5,000 hours on making the boat: 3,000 hours will be utilised in the assembly process. The remaining hours will be spent finishing (painting the boat and other finishing tasks). South-port will quote a price of relevant cost plus 50%.

South-port has 500 tonnes of steel held in inventory. This originally cost TZS25,000 per tonne. The current price is now TZS30,000, and can be sold for TZS20,000 per tonne. South-port no longer produces steel boats and has no other use for the steel. However it produces fibreglass boats on a regular basis.

There are 1,000 tonnes of fibreglass held in inventory. This originally cost TZS50,000 per tonne. It currently has a purchase price of TZS55,000 per tonne and a selling price of TZS38,000 per tonne. (Selling price and net realisable value can be assumed to be the same figure).

All labour is paid TZS10,000 per hour. To complete the contract on time, labour for the finishing process will have to be transferred from other work which produces contribution at a rate of TZS7,500 per hour (after labour costs). There is currently surplus capacity for assembly labour amounting to 2,500 hours. Labour will have to be hired on a temporary basis at a rate of TZS10,000 per hour for completing the assembly job.

Continued on the next page

Required:

Calculate the price South-port will quote on the contract.

Answer**Calculation of the price that South-port will quote**

	TZS'000
Steel (W1) Fibreglass	32,500
(W2) Finishing labour	137,500
(W3) Assembly labour	35,000
(W4) Relevant cost	5,000
Add: Mark-up (50%)	210,000
Quoted price	105,000
	315,000

Even though 1,000 tonnes of fiberglass were in inventory, it is calculated at a purchase price of TZS55,000. This is because it is assumed that fiberglass may have another use.

		TZS'000
W1	Net realisable value of the steel held in inventory = 500tonnes x TZS20,000	10,000
	Purchases of steel = 750tonnes x TZS30,000	22,500
W2	Fibreglass = 2,500tonnes x TZS55,000	137,500
W3	Finishing labour = 2,000hrs x TZS10,000	20,000
	Contribution lost in other work = 2,000hrs x TZS7,500	15,000
W4	Cost towards hiring Assembly labour = 500hrs x TZS10,000	5,000

Limitations of cost plus pricing

Though the cost plus pricing method is widely used, it possesses the following listed limitations:

1. Impact of sales volume on per unit cost

As we know, sales volume plays a significant role in determining cost per unit. The lower the sales volume, the higher the per unit price a company must charge to meet its desired ROI. This happens because fixed costs are spread over fewer units and therefore the fixed cost per unit increases.

The increase or decrease in sales volume again is dependent on price. Hence, it is a sequence of interdependent causes – cost plus mark-up is the price based on sales volume and sales volume is based on price.

**Example**

Zara Ltd's fixed costs are TZS500 million, sales volume is 5,000 units and per unit fixed cost is TZS100,000. The company has a policy to add 30% mark-up on fixed cost per unit. Hence, selling price per unit would be TZS130,000.

If the sales volume is reduced to 2,500 units, per unit fixed costs will be increased to TZS200,000. In such circumstances, the company would have to increase the selling price to TZS260,000.

However, if the company increases its selling price per unit, the sales volume would get affected.

2. Ignorance of competition

One of the important factors – i.e. competition - is not included in cost-based pricing methods. Competition should affect how you price your product.

The idea of simply adding a profit level or percentage to a product price will only work in industries with limited competition.

In a competitive market, cost based pricing may encourage competitors to enter the market with a lower price.



Example

In the above example of Zara Ltd, selling price is increased from TZS130,000 to TZS260,000. Practically, none of the competitive businesses can drastically increase the selling price. To survive in the market and to retain the customers, prices have to be competitive i.e. in line with the competitors' prices.

3. Consideration of customer demand

The cost based pricing model does not give due concern to the customer demand side. It does not consider the aspect that the customers actually pay the derived price. If the customer believes a product may be in short supply, due to heavy demand, they may be willing to pay more. On the other hand, if demand is very low, the customer will look for a discount on the price.



Example

Even if a bottle of perfume only costs TZS10,000 to make, the consumer will be ready to pay TZS100,000 for it if a famous celebrity's name is attached to it.

Cost plus pricing misses this key factor in pricing and profits.

4. No motivation to enhance cost efficiency

The basic premise of this method is that if costs of production decrease, pricing should decrease and vice-versa. When pricing decreases, the company misses an opportunity to make profits.

On the other hand, in the case of increasing production costs, this method doesn't encourage efficiency.

If customers are paying production costs, a company would not be motivated to lower costs or find faster, cheaper and more effective ways of production. The company, hence, effortlessly becomes satisfied. Meanwhile, competitors would move towards producing a better product faster and in a more efficient way, which would allow them to grab market share.

3. Illustrate the role that target costing plays in the pricing decision.

[Learning Outcome f]

In the earlier Learning Outcome 2, we studied different pricing methods. Cost plus pricing is one of the most popular methods. While the cost-plus method uses cost to determine price, target costing works in an opposite way, starting from the targeted selling price.

3.1 Target costing and pricing

Target costing uses price to determine cost. In target costing, businesses determine how much they want to charge for a product. Then the desired profit is deducted from that target selling price to arrive at the maximum cost it can afford to pay to produce that product.



Example

Foot Pleasure Ltd makes shoes, and it wants to introduce a new range of ladies footwear. Foot Pleasure's assessment of the market revealed that it shouldn't charge more than TZS60,000 per pair.

If it desires a mark-up of 25 percent over cost, then Foot Pleasure must be able to produce each pair for TZS48,000 or less.

If the estimated standard cost is higher than TZS48,000, the difference is regarded as a target cost gap. To reduce the cost gap, cost reduction is important.

Target costing improves a company's ability to strive in the global market place. It identifies the most suitable competitive market price for the product, defines the desired profit margin and computes the allowable cost for the product.

Target costing provides management the ability to control the costs of a new product at the planning stage itself. After deriving the target cost, it is then given to the engineers and product designers. It becomes their responsibility to use it as a maximum cost to be incurred for materials and other resources required to design and manufacture the product.

Sometimes, when the desired cost cannot be met, the organisation should try to modify the product's design and the production methodology. If that is not possible, they should invest in new machinery and techniques.

3.2 Methods of establishing target selling price

Target costing promotes cost consciousness and focuses on profit margins. It establishes a price acceptable to customers, which is capable of withstanding competition. The implications of using target costing on pricing can be understood if we consider the following three commonly adopted methods of establishing the price:

1. The existing price of the product plus the market value of new features added.



Example

If a new model of a laptop has the 'blue tooth' feature, we might take the price of the previous model and add the value of the blue tooth component to determine the new price.

2. The projected market price that will provide a target market share.



Example

A mobile handset manufacturer may set a price that will give him a 30% market share. This price will ensure that the sales volume of the manufacturer is equal to 30% of the entire market sale of mobiles.

3. The existing price plus the value of added physical attributes.

This is typically used for products in which the customer's desired performance is captured by some physical characteristic of the product.



Example

A customer's performance requirement of how fast and close a lawn mower cuts the grass is closely related to the engine horsepower. Therefore, a lawn mower with a two horsepower motor that sells for TZS100,000 might be sold at TZS150,000 for a three horsepower motor, if we can establish that the market pays TZS50,000 per horsepower.

4. Illustrate the price elasticity of demand.

[Learning Outcome g]

4.1 Concept of price elasticity of demand

An important consideration for a seller is the reaction of buyers to changes in price. The responsiveness of demand for a product due to a change in price is measured by the 'price elasticity of demand'.



Example

If Donald's Pizza, a fast food chain raises its prices by ten per cent, what will happen to its revenue? The answer depends on how the consumers' respond. Will they cut back on purchases a little or a lot?

In economics, the price elasticity of demand is an elasticity that measures the nature and degree of the relationship between changes in the quantity demanded of a commodity and changes in its price. There is an inverse relationship between price and demand. If price of a product / service is increased, demand for the product / service decreases and vice versa.



Definition

Price elasticity of demand ('e') is measured as the percentage change in quantity demanded, divided by the percentage change in the price of the goods.



Example

If, in response to a 5% fall in the price of a product (or service), the quantity demanded increases by 10%, the price elasticity of demand would be $10\% / 5\% = -2$.

In general, a fall in the price of goods is expected to increase the quantity demanded, so the price elasticity of demand is negative as above. However, in economics, the minus sign is often omitted and the elasticity is given as absolute value.

Goods are considered inelastic when the quantity demanded does not change much with the price. Necessities have highly inelastic demand.

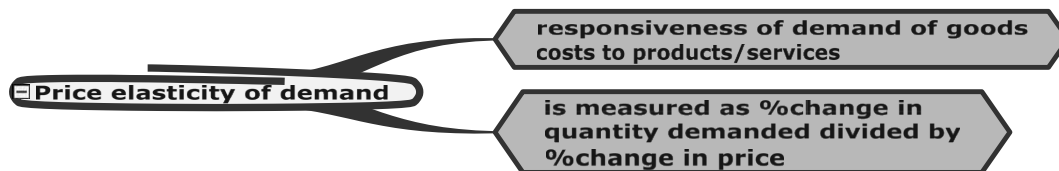


Example

Antibiotics may cure a person who would otherwise die. The sick person is likely to pay any amount for the necessary medication in order to live.

In contrast, elastic goods face large changes in the quantity demanded with relatively small changes in price. Elastic goods have demand curves that approach horizontal lines. Elastic goods are usually those with very similar substitutes.

SUMMARY



4.2 Different measures of price elasticity of demand

- (a) If the price elasticity of demand is **greater than one**, the goods are price **elastic**. Demand is reasonably responsive to a change in price.



Example

Demand for luxury goods and services (e.g. 3G mobile phones, luxury holidays) are more elastic. If the price of designer watch is increased by 15%, its demand may fall by 25%. This suggests the price elasticity of demand for the watch will be 1.67 (25%/15%).

- (b) If the price elasticity of demand is **less than one**, the goods are price **inelastic**. Demand is not very responsive to a change in the price.



Example

If the price of gasoline increases by 5%, the quantity demanded will fall by 1%. Therefore, the elasticity for gasoline will be 0.20 (1%/5%).

- (c) If the price elasticity of demand is **equal to one**, the goods have **unit elasticity**. The percentage change in the quantity demanded is equal to the percentage change in price. Demand changes in proportion to the price change.



Example

If the price of Pepsi rises by 10%, one may purchase Coke, 7-Up etc. The demand for Pepsi may accordingly decrease by the same percentage. Therefore, its elasticity will be 1.

- (d) If the price elasticity of demand is **equal to zero**, the goods are **perfectly inelastic**. A change in price will not have any influence on the quantity demanded.



Example

Necessities tend to have a more inelastic demand. A 5% increase in the price of food, grains, milk or medicines will not affect the quantity demanded. This means that a change in the price will have zero impact on the demand. Therefore, the elasticity for this will be 0.

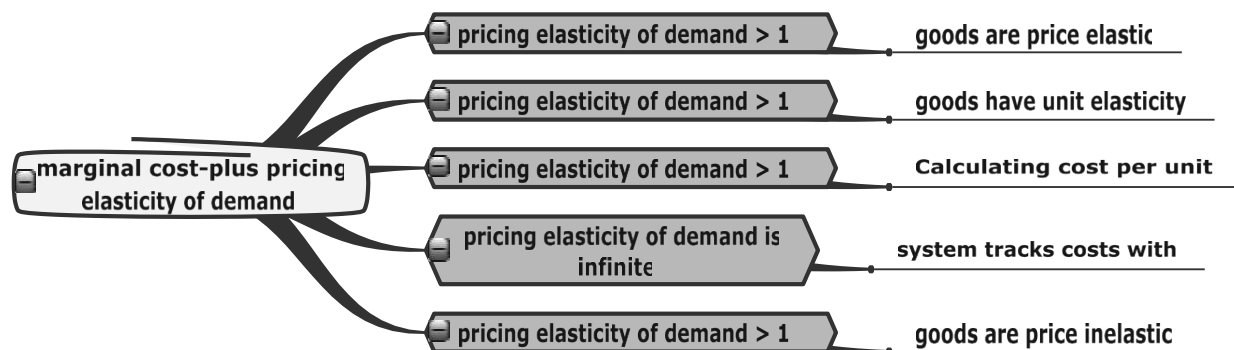
- (e) If the price elasticity of demand is **infinity**, the goods are **perfectly elastic**. Any change in price will see the quantity demanded fall to zero. This demand curve is associated with firms operating in perfectly competitive markets.



Example

If there is a significant decrease in the price of diamonds, their demand will increase drastically.

SUMMARY



Test Yourself 3

The price of a commodity is TZS3,000 per unit and annual demand is 500,000 units. Market research indicates that, if the price of the commodity is increased by TZS250 per unit, it will result in a fall in the annual demand of 48,000 units.

Required:

What is the price elasticity of demand?

5. Formulate the demand function.

[Learning Outcome h]

5.1 Derive and manipulate a straight line demand equation

1. The demand equation

The simplest form of demand equation signifies a linear (i.e. straight line) demand.

The equation can be written in the following form:

$$Q = a + bP$$

Where Q = quantity, P = price

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The parameters 'a' and 'b' are called the intercept and slope, respectively. The value of 'a' indicates the value of Q when P is equal to zero. The value of 'b' indicates the amount of change in Q that will occur due to a unit change in P. The value of b will always be negative, meaning that P and Q move in opposite directions, because the law of demand tells us that when the price goes up, the quantity demanded goes down.

Q is on the left-hand side because it is usually thought that quantities demanded are dependent on price. So, Q is the dependent variable, i.e. Q is a function of P.

Therefore, the demand equation written above may also be written as $Q(P) = a + bP$, which emphasises the dependence of Q on P.



Example

The current price of a product is TZS12,000. At this price, the company sells 60 items a month. One month the company decides to raise the price to TZS14,000, but only 45 items are sold at this price. Determine the demand equation.

Answer

The equation is $Q = a + bP$; where Q denotes quantity and P denotes price. Accordingly, by putting the values of Q and its corresponding values of P, we get,

$$60 = a + b12,000 \dots\dots\dots (i)$$

$$45 = a + b14,000 \dots\dots\dots (ii)$$

To solve this equation we'll subtract (i) – (ii) then

$$15 = -b2,000$$

$$15/2,000 = -b$$

$$\mathbf{-0.0075 = b}$$

Putting the value of b in equation (i), we get,

$$60 = a + (-0.0075) \times 12,000$$

$$60 = a - 90$$

$$60 + 90 = a$$

$$\mathbf{150 = a}$$

Therefore, the demand equation will be $Q = 150 - 0.0075p$



Example

The current price of a product is TZS30,000 and the producers sell 100 items a week at this price. One week the price is dropped by TZS3,000 because of a special offer, and the producers sell 150 items.

Required:

Find an expression for the demand curve.

Answer

$$Q = a + bP$$

When price is \$30,000, demand is 100 units.

Hence,

$$100 = a + 30,000b$$

$$a = 100 - 30,000b \dots\dots\dots (1)$$

When price falls by 10% i.e. \$27,000, demand becomes higher by 50% i.e. 150 units

Hence,

$$150 = a + 27,000b$$

$$a = 150 - 27,000b \dots\dots\dots (2)$$

Comparing equation (1) and (2)

$$100 - 30,000b = 150 - 27,000b$$

$$-50 = 3,000b$$

$$b = -0.1667$$

Continued on the next page

By putting the value of 'b' in the first equation

$$a = 100 - 30,000b$$

$$a = 100 - 30,000(0.1667)$$

$$= 100 + 500$$

$$= 600$$

Even if we put the value of 'b' in equation 2, we will get the same answer for 'a' i.e. 600

Now,

$$\text{Demand curve: } Q = a + bP$$

Hence,

$$Q = 600 + (-0.1667)P$$

$$Q = 600 - 0.1667P$$

2. The inverse demand equation

According to tradition, when economists draw a demand curve in a two dimensional diagram, they put the price on the vertical axis, and the quantity on the horizontal axis.

Mathematical tradition dictates that the dependent variable be drawn on the vertical axis, and the independent variable be drawn on the horizontal axis. Therefore, one must also be able to think of P as a function of Q. The function P (Q) which is also linear is called the inverse of the function Q (P).

The corresponding inverse demand equation is written like this:

$$P = c + dQ$$

If one starts with the demand equation, $Q = a + bP$, and if a little algebra is done to isolate P on the left-hand side, the equation would become:

Hence,

$$bP = Q - a$$

$$\frac{Q - a}{b}$$

$$P = \frac{Q - a}{b}$$

$$P = Q/b - a/b$$

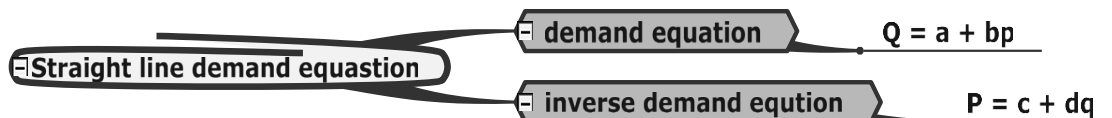
$$P = -a/b + (1/b)Q$$

$$P = c + dQ$$

Since, the sign of 'a' is positive and the sign of 'b' is negative, these equalities show that 'c' must be positive and 'd' must be negative.

Typically, the price goes down as the product becomes more and more available. So, if one thinks of Q as the input and P as the output, a straight line with negative slope could be used to model the dependence of P upon demand Q.

SUMMARY



Test Yourself 4

Market research conducted by GER has revealed that the maximum demand for product A is 60,000 units each year, and that demand will decrease by 50 units for every TZS1,500 increase in the selling price. Based on this information GER has calculated that the profit-maximising level of sales for product A for the coming year is 45,000 units.

Required:

Determine the demand equation and the price at which these units will be sold.

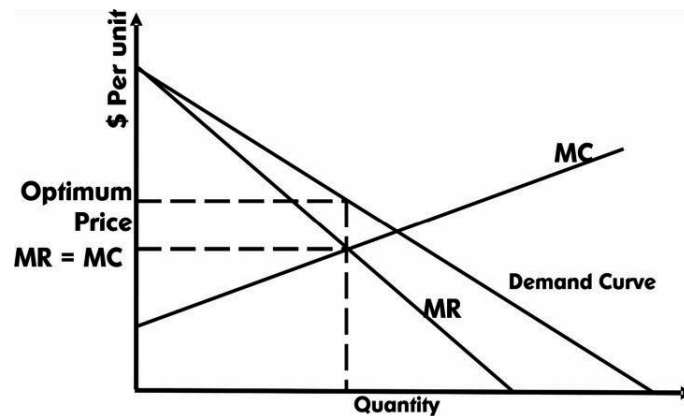
6. Evaluate how the optimum output and selling price is determined using the economic theory.

[Learning Outcome i]

According to **microeconomic theory**, profits are maximised when **Marginal revenue (MR) = Marginal cost (MC)**. In other words, the combination of the two concepts cost and revenue are being used to determine the **optimal levels of production**.

With an increase in production and sales volume, extra cost will be incurred and extra revenue will be earned. An increase in production as well as sales is profitable until the point where marginal cost (i.e. the additional cost of producing one more unit) does not surpass the marginal revenue (i.e. the additional revenue earned if one additional unit is sold).

The situation (that profit maximises at $MR = MC$) can be best explained by means of a graph:



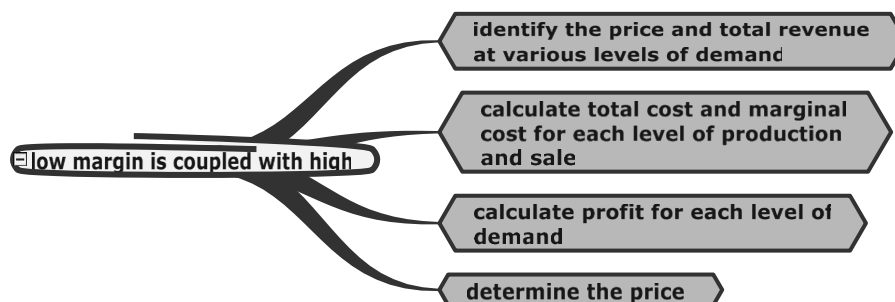
Therefore, profit maximisation can take place up to the point of production and sales where, Marginal cost (MC) = Marginal revenue (MR). Marginal cost (MC) is derivative of total cost (TC). Marginal revenue (MR) is derivative of total revenue (TR).

The steps to **profit maximisation** are as follows:

- Identify the price and the total revenue for various levels of demand.
- Calculate the total cost and the marginal cost for each level of production and sales.
- Finally, calculate profit for each level of demand and accordingly determine the price and level of demand for which profit is maximised.

The price at which profit can be maximised can also be identified by equating the marginal cost and marginal revenue equations and solving them for quantity produced and sold.

SUMMARY





Example

When the selling price per unit was TZS15,000, the number of units sold was 100. With a TZS10,000 increase in price, the demand falls by 20%. What will be the revenue maximisation selling price?

Let's derive the demand equation

$$Q = 100 \text{ when } P = 15,000$$

$$Q = 80 \text{ when } P = 25,000$$

$$Q = a + bP$$

$$100 = a + b15,000 \text{ and } 80 = a + b25,000$$

$$\text{From the above two demand equations; } a = 100 - 15,000b \text{ and } a = 80 - 25,000b$$

$$\text{Hence; } 100 - 15,000b = 80 - 25,000b$$

$$-10,000b = 20$$

$$b = -0.002$$

$$\text{And hence, } a = 130$$

Demand equation: $Q = a + bP$

$$Q = 130 + (-0.002)P$$

$$Q = 130 - 0.002P$$

$$P = \frac{130}{0.002} - \frac{Q}{0.002}$$

$$P = 65,000 - \frac{1,000Q}{2}$$

Total revenue = Quantity sold x Selling price per unit

$$TR = Q \times P$$

$$TR = Q \times 65,000 - \frac{1,000Q^2}{2}$$

$$TR = 65,000Q - 1,000Q^2/2$$

Marginal revenue is a derivative of total revenue

$$MR = 65,000 - 2,000Q/2$$

$$= 65,000 - 1,000Q$$

For revenue maximisation, $MR = 0$

Hence,

$$65,000 - 1,000Q = 0$$

In accordance with the calculus theory, for revenue maximisation, MR is always equal to zero.

$$Q = 65 \text{ units Optimum quantity}$$

By putting value of 'Q' in the equation of 'P'

$$P = 65,000 - 65,000/2$$

$$P = \text{TZS}32,500 \text{ Optimum selling price}$$



Test Yourself 5

The management of X Ltd is trying to decide the selling price of a new product. Market research has indicated that demand for the product, which has a marginal cost of TZS12,000 per unit, would be 8,000 units p.a. at a price of TZS20,000. However the demand would fall by 400 units for each additional TZS500 increase in the price.

Required:

Set the price in order to maximise profits.

7. Calculate the optimum selling price and output for an organisation using calculus. [Learning Outcome j]

7.1 Introduction to calculus

Calculus is a branch of mathematics in which the derivative is a measure of how a function changes as its input changes. A derivative is how much one quantity varies in response to variations in some other quantity. The process of finding a derivative is called differentiation and the reverse process is called anti-differentiation or integration.

In the context of marginal analysis, in the fields of economics and commerce, **differential calculus** helps in solving problems related to finding the maximum profit or minimum cost etc. **Integral calculus** is used to find the cost function when the marginal cost is given; and to find the total revenue when marginal revenue is given.

7.2 Application of calculus to calculate optimum selling price and output

1. Revenue and cost functions



Tip

The following functions are used to calculate **optimum selling price and output** using calculus:

Total cost function:

$$C(x) = F + V(x)$$

Where, F = fixed costs and $V(x)$ = Variable cost per unit x No. of units

Demand function:

$$x = f(p)$$

Where, x = number of units demanded and p = selling price per unit

Revenue function:

$$R(x) = x.p$$

Where, x = number of units sold and p = selling price per unit

Profit function:

$$P(x) = R(x) - C(x)$$

Break-even point:

$$R(x) = C(x) \text{ OR } P(x) = 0$$

The following example would help in understanding the functions and application of calculus in deriving the optimal selling price and output.



Example

Shiny Co's daily cost of producing x number of items of a product is linearly established by $C(x) = 420,000x + 14,000,000$

- (i) If each item is sold for TZS700,000, the minimum number that must be produced and sold daily to ensure no loss will be calculated as follows:

Here, $R(X) = 700,000X$ and $C(X) = 420,000X + 14,000,000$

$$P(X) = 700,000X - (420,000X + 14,000,000)$$

$$P(X) = 280,000X - 14,000,000$$

For no profit no loss $P(X) = 0$

$$0 = 280,000X - 14,000,000$$

$$280,000X = 14,000,000$$

$$X = 50 \text{ units}$$

Hence, to ensure no loss, the company must produce and sell at least 50 items daily.

Continued on the next page

(ii) If the selling price is increased by 10%, the revised break-even point would be derived as follows:

When selling price is increased by TZS70,000 per unit, $R(X) = \text{TZS}770,000X$ and $P(X) = 350,000X - 14,000,000$

$$\text{BEP: } 350,000X = \text{TZS}14,000,000$$

Hence, $X = 40$ units

(iii) If each item is sold for TZS600,000, the minimum number that must be produced and sold daily to ensure a profit of TZS4,000,000 will be calculated as follows:

Here, $R(X) = 600,000X$ and $C(X) = 420,000X + \text{TZS}14,000,000$

$$P(X) = 600,000X - (420,000X + \text{TZS}14,000,000)$$

$$\text{TZS}4,000,000 = 180,000X - \text{TZS}14,000,000$$

$$180,000X = 18,000,000$$

$$X = 100 \text{ units}$$

2. Average and Marginal Functions

When two variables x and y are related as $y = f(x)$, the average function may be simply defined as $\frac{f(x)}{x}$.

The marginal function is the immediate rate of change of y with respect to x . i.e. $\frac{dy}{dx}$ or $\frac{d}{dx}(f(x))$

(a) Average and marginal costs

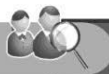
(i) Let $C = C(x)$ be the total cost of producing and selling x units of a product, then the average cost (AC) is

$$\text{defined as: } AC = \frac{C(x)}{x}$$

Hence, the **average cost represents per unit cost**.

(ii) **Marginal cost (MC)** is interpreted as the approximate cost of one additional unit of output. Let $C = C(x)$ be the total cost of producing x units of a product, then the marginal cost (MC), is defined to be the rate of change of $C(x)$ with respect to x

$$MC = \frac{dc}{dx} \text{ or } \frac{d}{dx}(C(x))$$



Example

Continuing the previous example of Shiny,

$$C(X) = 420,000X + \text{TZS}14,000,000$$

$$\text{Average cost} = \frac{C(x)}{x} = \frac{420,000x + \text{TZS}14,000,000}{x}$$

$$\frac{dc}{dx}$$

$$\text{Marginal cost} = \frac{dc}{dx} = 420,000$$

(b) Average and marginal revenue:

(i) Let $R = R(x)$ be the total revenue from selling X units of a product, then the average revenue (AR) is defined

$$\text{as: } AR = \frac{R(x)}{x}$$

Hence, the **average revenue represents per unit selling price**.

(ii) The **marginal revenue (MR)** is defined as the rate of change of total revenue with respect to the quantity demanded. MR is interpreted as the approximate revenue received from producing and selling one additional unit of the product.

$$MR = \frac{dR}{dx} \text{ or } \frac{d}{dx}(R(x))$$



Example

Continuing the previous example of Shiny,

$$R(X) = 700,000X$$

$$\text{Average revenue} = \frac{R(x)}{x} = \frac{700,000x}{x} = 700,000$$

$$\text{Marginal revenue} = \frac{dR}{dx} = 700,000$$

3. Relationship between marginal cost and marginal revenue

If marginal revenue is greater than marginal cost, as is the case for small quantities of output, then the firm can increase profit by increasing production. Extra production adds more to revenue than to cost, so profit increases.

If marginal revenue is less than marginal cost, as is the case for large quantities of output, then the firm can increase profit by decreasing production. Reducing production reduces revenue less than it reduces cost, so profit increases.

If marginal revenue is equal to marginal cost, then the firm cannot increase profit by producing either more or less output. Profit is maximised.

For each unit sold, marginal profit equals marginal revenue minus marginal cost. Then,

if marginal revenue is greater than marginal cost, marginal profit is positive

if marginal revenue is less than marginal cost, marginal profit is negative

when marginal revenue equals marginal cost, marginal profit is zero

Since total profit increases when marginal profit is positive and total profit decreases when marginal profit is negative, it must reach a maximum where marginal profit is zero - or where marginal cost equals marginal revenue. This is because the producer has collected positive profit up until the intersection of MR and MC (where zero profit is collected and any further production will result in negative marginal profit, because MC will be larger than MR).

4. Minimisation of average cost or total cost and maximisation of total revenue, the total profit

(a) Fundamentally, profit maximisation is achieved when $dc/dx = dR/dx$ (or when $MC = MR$).

(b) Average cost is minimum where, $\frac{d}{dx}(AC) = 0$ and $\frac{d^2}{dx^2}(AC) > 0$

(i.e. first derivation equals to zero and second derivation is greater than zero)

(c) Average revenue is maximum where, $\frac{d}{dx}(R) = 0$ and $\frac{d^2}{dx^2}(R) < 0$

(i.e. first derivation equals to zero and second derivation is smaller than zero)



Example

Rainbow Ltd operates in an entirely different industry. However, it produces to order and carries no inventory. Its demand function can be established as $P = 100,000 - 2,000X$ (where P is the selling price per unit and X is the demanded units in thousands). Total cost function is $C(X) = 1,000X^2 + 10,000X + 500,000$. (where C indicates costs in TZS'000)

Profit maximisation and sales maximisation is computed as shown below:

- (i) Calculation of the total output that will **maximise total profits** and corresponding profit, selling price per profit and total sales revenue

Revenue function: $R(X) = XP$

$$R(X) = X(100,000 - 2,000X)$$

$$R(X) = 100,000X - 2,000X^2$$

Marginal revenue

$$MR = \frac{dR}{dx} = 100,000 - 4,000X$$

Total cost function: $C(X) = 1,000X^2 + 10,000X + 500,000$

Marginal cost

$$MC = \frac{dc}{dx} = 2,000X + 10,000$$

Optimum output level

$$MR = MC$$

$$100,000 - 4,000X = 2,000X + 10,000$$

$$90,000 = 6,000X$$

$$X = 15 \text{ units (in thousands) i.e. 15,000 units}$$

Selling price per unit at optimum output of 15,000 units

$$P = 100,000 - 2,000X = 100,000 - (2,000 \times 15) = \text{TZS}70,000 \text{ per unit}$$

Profit at optimum output of 15,000 units

$$\text{Profit} = TR - TC$$

$$= R(X) - C(X)$$

$$= [100,000X - 2,000X^2] - [1,000X^2 + 10,000X + 500,000]$$

$$= -3,000X^2 + 90,000X - 500,000$$

$$= -3,000(15)^2 + 90,000(15) - 500,000$$

$$= -675,000 + 1,350,000 - 500,000$$

$$= \text{TZS}175,000 \text{ (in thousands) i.e. TZS}175,000,000$$

- (ii) Calculation of the total output that will **maximise total revenue** and corresponding profit (or loss), selling price per profit and total sales revenue



Tip

Profit maximisation sales revenue maximisation; total revenue will be maximised when MR i.e. $\frac{d}{dx}(R) = 0$ and

$$\frac{d^2}{dx^2}(R) < 0$$

Continued on the next page

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$$MR = \frac{dR}{dx} = 100,000 - 4,000X = 0 \text{ (first derivative)}$$

Hence, $X = 25$ (i.e. 25,000 units)

Second derivative is -4,000 i.e. smaller than zero

Selling price per unit at optimum output of 25,000 units

$$P = 100,000 - 2,000X = 100,000 - (2,000 \times 25) = \text{TZS}50,000 \text{ per unit}$$

Profit (or loss) at optimum output of 25,000 units

$$\begin{aligned} \text{Profit} &= TR - TC \\ &= R(X) - C(X) \\ &= [100,000X - 2,000X^2] - [1,000X^2 + 10,000X + 500,000] \\ &= -3,000X^2 + 90,000X - 500,000 \\ &= -3,000(25)^2 + 90,000(25) - 500,000 \\ &= -1,875,000 + 2,250,000 - 500,000 \\ &= -125,000 \text{ (in thousands) i.e. Loss of TZS125,000,000} \end{aligned}$$



Test Yourself 6

Silver Co manufactures a single product whose variable cost per unit and selling price per unit is TZS150,000 and TZS200,000 respectively. It has incurred TZS100 million as fixed costs.

- (a) Establish the functions and compute break-even point.
- (b) Determine the profit at the sales volume of 2,500 units.

Answers to Test Yourself

Answer to TY 1

The following are the factors that explicitly or implicitly influence the pricing decision:

- (a) The objectives and strategies of the firm
- (b) The market condition in which the firm operates
- (c) The customers of the firm
- (d) The costs of the product or service
- (e) The other factors that influence the price of the product or service
- (f) The demand of the firm's product
- (g) The elasticity of demand for the product
- (h) The stages of the product life cycle
- (i) Whether or not the firm can dominate the market and act as a price maker (if it is a price taker)
- (j) Level of capacity utilisation by the firm
- (k) Whether or not the prices are administered by the government
- (l) Whether or not the product has distinctive features (i.e. are there close substitutes?) etc.
- (m) All these issues are not explicitly considered in every pricing decision.

Answer to TY 2**(a) Calculation of selling price****(i) Full cost plus 20%****Step 1**

	TZS million
Fixed cost	900
Annual non-production cost	300
Total fixed cost	1,200
Per unit fixed cost (TZS1,200 million/80,000units)	0.015

Step 2

Calculate total budgeted cost per unit	TZS'000
Variable cost	60
Fixed costs (Step 1)	15
Full cost	75

Step 3

Full cost plus 20%	TZS'000
Total full cost	75
Mark-up: 20% on cost	15
Selling price	90

(ii) Marginal cost plus 40%

Marginal cost plus 40%	TZS'000
variable cost	60
Mark-up: 40% on variable cost	24
Selling price	84

(iii) Pricing based on a target return on an investment of 10% per year**Step 1**

Target ROI pricing	TZS million
Non-current assets	8,000
Working capital	1,600
Capital employed	9,600
Profit required (TZS9,600 million x 10%)	960
Profit required per unit (80,000 units)	0.012

Step 2

	TZS'000
Variable cost	60
Fixed costs (see above)	15
Full cost	75
Profit	12
Selling price	87

(b) Profit for the year

	TZS million
Sales (40,000 units x TZS90,000)	3,600
Variable cost (40,000 units x TZS60,000)	(2,400)
Contribution	1,200
Fixed costs	(1,200)
Net Profit	0

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Answer to TY 3

Annual demand is 500,000 units at \$3,000 per unit. When the commodity price increases to \$3,250 per unit, annual demand for the commodity will be 452,000 (500,000 – 48,000) units.

Price elasticity of demand $\frac{\% \text{ change in demand}}{\% \text{ change in price}}$

$\% \text{ change in demand} = (48,000/500,000) \times 100 = 9.60\%$

$\% \text{ change in price} = (250/3000) \times 100 = 8.33\%$

Price elasticity of demand $\frac{\% \text{ change in demand}}{\% \text{ change in price}} = \frac{9.6\%}{8.33\%} = 1.152$

Answer to TY 4

Step 1

Find the price at which demand would be nil.

Assuming the demand is linear, each increase of TZS1,500 in the price would result in a fall in demand of 50 units. For demand to be nil, the price needs to rise from its current level by as many times as there are 50 units in 60,000 units (60,000/50 = 1,200).

Step 2

When price = 0, demand, Q = 60,000 i.e. $0 = a - 60,000b$ (i)

When price = 1,500, demand, Q = 59,950 i.e. $1,500 = a - 59,950b$ (ii)

By solving equation (i) – (ii)
 $-1,500 = -50b$

Therefore $b = 30$ and

Substitute in (i) $a = (60,000 \times 30) = 1,800,000$

Step3

Demand equation for product A is $p = 1,800,000 - 30Q$

When $Q = 45,000$ units, $p = 1,800,000 - (30 \times 45,000) = \text{TZS}450,000$

Answer to TY 5

The demand for the product, at a price of TZS20,000 is 8,000 units.

If demand falls at the rate of 400 units per TZS500 increase in price, the demand would be zero at the price of
 $= \text{TZS}20,000 + (8000/400) \times \text{TZS}500 = \text{TZS}30,000$

Hence, the demand function is:

$P = 30,000 - (500 \times Q/400)$ or, $p = 30,000 - 1.25Q$ (i)

Now, total revenue $R = P \times Q = Q (30,000 - 1.25Q)$,

$R = 30,000Q - 1.25 Q^2$

As MR is derivative of TR,

Marginal revenue = $MR = d(Q (30,000 - 1.25Q)) = 30,000 - 2.50Q$

Profit will be maximised when $MR = MC$

$30,000 - 2.50Q = 12,000$

Therefore $Q = 7,200$ units

Again $P = 30,000 - 1.25 \times 7,200 = \text{TZS}30,000 - \text{TZS}9,000 = \text{TZS}21,000$

Therefore, profit is maximised at a price of TZS21,000 when 7,200 units are sold.

Answer to TY 6

Let (X) be the number of units sold.

Hence,

Cost function: $C(X) = F + V(X) = \text{TZS}100,000,000 + \text{TZS}150,000X$

Revenue function: $R(X) = X.p = \text{TZS}200,000X$

Profit function: $P(X) = R(X) - C(X) = \text{TZS}200,000X - (\text{TZS}100,000,000 + \text{TZS}150,000X)$

Break-even point: $R(X) = C(X)$

Hence,

$\text{TZS}200,000X = \text{TZS}100,000,000 + \text{TZS}150,000X$

$\text{TZS}50,000X = \text{TZS}100,000,000$

$X = 2,000$ units

Sales volume beyond 2,000 units will generate profits

Profit function: $P(X)$

$= R(X) - C(X)$

$= \text{TZS}200,000X - (\text{TZS}100,000,000 + \text{TZS}150,000X)$

$= (\text{TZS}200,000 \times 2,500 \text{ units}) - [\text{TZS}100,000,000 + (\text{TZS}150,000 \times 2,500 \text{ units})]$

$= \text{TZS}500,000,000 - \text{TZS}475,000,000$

$= \text{TZS}25,000,000$

Quick Quiz**1. State true or false.**

- i. Goods are considered elastic when the quantity demanded does not significantly change with the price.
- ii. If price elasticity of demand = 1 then goods are price inelastic.
- iii. In price discrimination, a firm sells a single identical product in different segments of the market at the same price.

2. Fill in the blanks

- i. The price elasticity of demand is measured as % change in _____ divided by % change in _____ of the goods.
- ii. A volume-based discount is allowed in order to increase _____ during a _____ period without dropping the price permanently.
- iii. _____ refers to the strategy of selling a product or service at a high price, to gain high profit while sacrificing high growth in sales.

Answers to Quick Quiz**1. True or false**

- i. False
- ii. False
- iii. False

2. Fill in the blanks

- i. quantity demanded, price
- ii. sales volume, poor sales
- iii. price skimming

Self Examination Questions

Question 1

SIL Co is considering the pricing of one of its products. It has already carried out some market research with the following results:

The quantity demanded at a price of TZS200,000 will be 2,000 units.

The quantity demanded will increase / decrease by 200 units for every TZS100,000 decrease / increase in the selling price.

The marginal cost of each unit is TZS70,000.

Note if selling price (p) = $a - bx$ then marginal revenue = $a - 2bx$

Required:

Calculate the selling price that maximises company profit.

Question 2

GIL, a manufacturer wants to produce a new domestic product.

The non-current assets needed for production will cost TZS5,000 million, and working capital requirements are estimated at TZS1,300 million.

The estimated annual sales volume is 50,000 units.

Variable production costs are TZS50,000 per unit.

Fixed production costs will be TZS600 million each year and annual fixed non-production costs will be TZS200 million.

Required:

- (a) Calculate selling price using:
 - (i) Full cost plus 30%
 - (ii) Marginal cost plus 50%
 - (iii) Pricing based on a target return on investment of 15% per year.
- (b) If actual sales are only 30,000 units and the selling price is set at full cost plus 25%, what will the profit be for the year?

Question 3

Infinity is a furniture manufacturing company which supplies custom-made furniture items to Eternity Ltd, who provides office furniture to small companies as per specification. It uses two materials: steel and wood.

It needs to complete Eternity's order using 1,000 tonnes of steel and 2,000 tonnes of wood.

The workforce of Infinity will have to work 4,000 hours on making the boat: 2,400 hours will be in the assembly process and the remainder will be in the finishing (painting the desks, tables, cupboards, etc. and other finishing tasks).

Infinity will quote a price of relevant cost plus 60%.

Infinity has 400 tonnes of steel held in inventory. This originally cost TZS20,000 per tonne. It now has a current price of TZS24,000 and could be sold for TZS16,000 per tonne. Eternity no longer produces steel furniture and has no other use for the steel. It only produces wooden furniture on a regular basis.

There are 800 tonnes of wood held in inventory. This originally cost TZS40,000 per tonne. It currently has a purchase price of TZS44,000 per tonne and a selling price of TZS30,000 per tonne. (Selling price and net realisable value can be assumed to be the same figure).

All labour is paid TZS8,000 per hour. To complete the contract on time, labour for the finishing process will have to be transferred from other work which produces contribution at a rate of TZS6,000 per hour (after labour costs). There is currently a surplus capacity for assembly labour amounting to 2,000 hours which will have to be hired on a temporary basis at a rate of TZS8,000 per hour.

Required:

- (a) Calculate the price Infinity will quote on the contract.
- (b) State any TWO limitations of cost-based pricing.

Question 4

Wince Co produces branded watches. Based on their study of production costs and demand curve, it has determined the following demand and cost functions:

$$P = 80,000 - 3,000X \text{ (demand units are in thousands)}$$

$$C = 1,000X^2 + 20,000X + 100,000 \text{ (cost figures are in thousands)}$$

Required:

- Determine the level that maximises sales revenue.
- Determine the level that maximises profit.
- Determine the optimal price to maximise profits.

Question 5

Vinyago Craftworks Ltd (VCL) is a newly established maker and distributor of unique mninga sculptures. VCL management are inexperienced in making and selling process of their mninga sculptures and are yet to decide the selling price which will maximize both sales revenue and profit of the company. VCL management have heard of marginalist theory, a neo – classical theory of the firm which is based on two rules: $MC = MR$, the theory which is likely to help them establish selling price for their sculptures.

You have been identified as a management consultant who could help VCL management, and you have been provided with the following information:

- The cost of making the first sample of a sculpture included

Direct material 2 pieces of mninga@TZS 20,000	40,000
Sculpturing labour 50 hours @TZS 1,000	50,000
Variable overhead (50% of Sculpturing labour)	25,000
	115,000

- Budgeted fixed cost per annum include:
Rental charges TZS 50,000,000
Administration expense TZS 80,000,000
- VCL management expects the Sculpturing time to gradually improve with experience and has estimated 80% learning curve for the first 16 Sculptures, after which a steady state production time will apply with labour time per Sculpture being equal to the 16th Sculpture.
- It has been established that, the current price of similar mninga Sculptures in the market is TZS 120,000 and at this price 100,000 units are demanded. Experience in this market indicate if price of similar Sculptures increase or decrease by TZS 10,000, quantity demand will increase or decrease by 25,000 units.
- Currently, 20 units of mninga Sculptures have been ordered by a newly established resort.

Note: The learning curve formula is $Y = ax^b$. At the learning rate of 0.8 (80%), the learning factor (b) is equal to -0.322. All figures should be rounded off to one decimal place.

REQUIRED:

- Determining sales maximizing selling price and the maximum sales revenue at this sales point **(4 marks)**
- Determining profit maximizing selling price and the maximum profit at this sales point **(8 marks)**
- Explain what is meant by a penetration pricing strategy and a market skimming strategy and discuss the cases that would make VCL to use such pricing strategies when launching their mninga sculptures **(8 marks)**

***Question 6- ACCA (2015)**

ALG is launching a new, innovative product onto the market and is trying to decide on the right launch price for the product. The product's expected life is three years. Given the high level of costs which have been incurred in developing the product, ALG Co wants to ensure that it sets its price at the right level and has therefore consulted a market research company to help it do this. The research, which relates to similar but not identical products launched by other companies, has revealed that at a price of TZS60, annual demand would be expected to be 250,000 units.

However, for every TZS2 increase in selling price, demand would be expected to fall by 2,000 units and for every TZS2 decrease in selling price, demand would be expected to increase by 2,000 units. A forecast of the annual production costs which would be incurred by ALG Co in relation to the new product are as follows:

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Annual production (units)	200,000	250,000	300,000	350,000
	TZS	TZS	TZS	TZS
Direct material	2,400,000	3,000,000	3,600,000	4,200,000
Direct labour	1,200,000	1,500,000	1,800,000	2,100,000
overheads	1,400,000	1,550,000	1,700,000	1,850,000

Required:

- Calculate the total variable cost per unit and total fixed overheads
- Calculate the optimum selling price for the new product AND calculate the resulting profit for the period.
- The sales director is unconvinced that the sales price calculated in (b) above is the right one to charge on the initial launch of the product. He believes that a high price should be charged at launch so that those customer prepared to pay a higher price for the product can be 'skimmed off first'.

Required:

Discuss the conditions which would make market skimming a more suitable pricing strategy for ALG, and recommend whether ALG should adopt this approach instead

Question 7

Magari Co. specializes in the production of a range of motor vehicles. It is about to launch a new product, the 'Kantinka', a unique motor vehicle which is capable of providing unprecedented levels of speed using a minimal amount of fuel. The technology used in the Kantinka is unique, so Magari Co. has patented it so that no competitors can enter the market within two years. The company's development costs have been high and it is expected that the product will only have a five-year life cycle.

Magari Co. is now trying to ascertain the best pricing policy that they should adopt for the Kantinka's launch onto the market. Demand is very responsive to price changes and research has established that, for every TZS1,500,000 increase in price, demand would be expected to fall by 1,000 units. If the company set the price at TZS73,500,000, only 1,000 units would be demanded.

The cost of producing each motor vehicle is as follows:

	TZS	
Direct materials	4,200,000	
Labour	1,200,000	(15 hours at TZS80,000 per hour. See note A below)
Fixed overheads	<u>600,000</u>	(based on producing 50,000 units per annum)
Total cost	<u>6,000,000</u>	

Note A

The first motor vehicle took 15 hours to make and labour costs TZS80,000 per hour. A 95% learning curve exists, in relation to production of the unit, although the learning curve is expected to finish after making 100 units. Magari Co's management have said that any pricing decisions about the Kantinka should be based on the time it takes to make the 100th unit of the product. You have been told that the learning coefficient, $b = -0.0740005$.

All other costs are expected to remain the same up to the maximum demand levels.

Required

- Establish the demand function (equation) for motor vehicle units.
 - Calculate the marginal cost for each motor vehicle unit after adjusting the labour cost as required by note (a) above
 - Calculate the optimum price and quantity.
 - Explain what is meant by a 'penetration pricing' strategy and a 'market skimming' strategy and discuss whether either strategy might be suitable for Magari Co. when launching the 'Kantinka'.
- (8 marks)**

*Question 8

AB plc. Makes two products, Alpha and Beta. The company made a TZS 500,000 profit last year and proposes an identical plan for the coming year. The relevant data for last year are summarized in Table 1.

Table 1: Actuals for last year

	Product Alpha	Product Beta
Actual production and sales (units)	20,000	40,000
Total cost per unit	TZS 20	TZS 40
Selling prices per unit (25% on cost)	TZS 25	TZS 50
Machining time per unit - hours	2	1
Potential demand at above selling price -units	30,000	50,000

Fixed costs were TZS 480,000 for the year, absorbed on machining hours which were fully utilized for the production achieved.

A new managing Director has been appointed and he is somewhat skeptical about the plan being proposed. Furthermore, he thinks that additional machining capacity should be installed to remove any production bottlenecks and wonders whether a more flexible pricing policy should be adopted.

Table 2 summarizes the changes in costs involved for the extra capacity and gives price/demand data, supplied by the marketing department, applicable to the conditions expected in the next period.

Table 2: Costs

Extra machining capacity would increase fixed costs by 10 per cent in total. Variable costs and machining times per unit would remain unchanged.

	Product Alpha	Product Beta
Price/demand data		
Price range (per unit)	20-30	45-55
Expected demand	45,000-15,000	70,000-30,000

You are required to

- Calculate the plan to maximize profits for the coming year based on the data and selling prices in Table 1
- Comment on the pricing system for the existing plan used in table 1;
- Calculate the best selling prices and production plan based on the data in table 2;
- Comment on the methods you have used in part (c) to find the optimum prices and production levels.

Any assumptions made must be clearly stated.

***Question 9**

ABC Electronics makes audio player model 'AB 100'. It has 80 components. ABC sells 10,000 units each month at TZS 3,000 per unit. The cost of manufacturing is TZS 2,000 per unit or TZS 20,000,000 per month for the production of 10,000 units. Monthly manufacturing costs incurred are as follows:

	TZS
Direct material costs	10,000,000
Direct manufacturing labour costs	2,000,000
Machining costs	2,000,000
Testing costs	2,500,000
Rework costs	1,500,000
Ordering costs	20,000
Engineering costs	1,980,000
Total costs	20,000,000

Labour is paid on piece rate basis. Therefore ABC considers direct manufacturing labour costs as variable cost.

The following additional information is available for 'AB 100'

- Testing and inspection time per unit is 2 hours.
- 10 per cent of AB 100' manufactured are reworked.
- It currently takes 1 hour to manufacture each unit of 'AB 100'.
- ABC places two orders per month for each component. A different supplier supplies each component.

ABC has identified activity cost pools and cost drivers for each activity. The cost per unit of the cost driver for each activity cost pool is as follows:

Manufacturing activity	Description of activity	Cost driver	Cost per unit of cost driver
Machining costs	Machining components	Machine hours of capacity	TZS 200
Testing costs	Testing components and finished products (Each unit of 'AB 100' is tested individually)	Testing hours	TZS 125
Rework costs	Correcting and fixing errors and defects	Units of 'AB 100' reworked	TZS 1,500 per unit
Ordering costs	Ordering of components	Number of orders	TZS 125 per order
Engineering costs	Designing and managing of products and processes	Engineering hours	TZS 1,980 per engineering hour

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Over a long-run horizon, each of the overhead costs described above vary with chosen cost drivers.

In response to competitive pressure ABC must reduce the price of its product to TZS 2,600 and to reduce the cost by at least TZS 400 per unit. ABC does not anticipate increase in sales due to price reduction. However, if it does not reduce price it will not be able to maintain the current sales level.

Cost reduction on the existing model is almost impossible. Therefore, ABC has decided to replace 'AB 100' by a new 'AB 200', which is a modified version of 'AB 100'. The expected effect of design modifications are as follows:

- i. The number of components will be reduced to 50.
- ii. Direct material costs to be lower by TZS 200 per unit.
- iii. Direct manufacturing labour costs to be lower by TZS 20 per unit.
- iv. Machining time required to be lower by 20 per cent
- v. Testing time required to be lower by 20 per cent.
- vi. Rework to decline to 5 per cent
- vii. Machining capacity and engineering hours capacity to remain the same, ABC currently outsources the rework on defective units.

Required:

- a) Compare the manufacturing cost per unit of 'AB 100' and 'AB 200'.
- b) Determine the immediate effect of design change and pricing decision on the operating income of ABC.

*Question 10

HS manufactures components for use in computers. The business operates in a highly competitive market where there are a large number of manufacturers of similar components. HS is considering its pricing strategy for the next 12 weeks for one of its components. The Managing Director seeks your advice to determine the selling price that will maximise the profit to be made during this period.

You have been given the following data:

Market demand

The current selling price of the component is \$1,350 and at this price the average weekly demand over the last four weeks has been 8,000 components. An analysis of the market shows that, for every \$50 increase in selling price, the demand reduces by 1000 components per week. Equally, for every \$50 reduction in selling price, the demand increases by 1,000 components per week. Equally, for every \$50 reduction in selling price, the demand increases by 1,000 components per week.

Costs

The direct material cost of each component is \$270. This price is part of a fixed price contract with the material suppliers and the contract does not expire for another year. Production labour and conversion costs, together with other overhead costs and the corresponding output volumes, have been collected for the last four weeks and they are as follows:

Week	Output volume (units)	\$000
1	9,400	7,000
2	7,600	5,688
3	8,500	6,334
4	7,300	5,446

No significant changes in cost behaviour are expected over the next 12 weeks.

Required:

- (a) Calculate the optimum (**profit-maximising**) selling price of the component for the period.
- (b) Identify and explain three reasons why it may be inappropriate for HS to use this theoretical pricing model in practice.

*Question 11

Product 'M' is currently being tested by MKL and is to be launched in ten weeks' time. The 'M' is an innovative product which the company believes will change the entire market. The company has decided to use a market skimming approach to pricing this product during its introduction stage.

MKL continually reviews its product range and enhances its existing product by developing new models to satisfy the demands of its customers. The company intends to always have presence in the market.

MKL is currently reviewing its two existing flagship products, Product K and Product L. You have been given the following information:

- Product K was introduced to the market some time ago and is now about to enter the maturity stage of its life cycle. The maturity stage is expected to last for ten weeks. Each unit has a variable cost of \$38 and takes 1 standard hour to produce. The managing Director is unsure which of four possible prices the company should charge during the next ten weeks. The following table shows the results of some market research into the level of weekly demand at alternative prices:

Selling price per unit	\$100	\$85	\$80	\$75
Weekly demand (units)	600	800	1,200	1,400

- Product L was introduced to the market two months ago using a penetration pricing policy and is now about to enter its growth stage. This stage is expected to last for 20 weeks. Each unit has a variable cost of \$45 and takes 1.25 standard hours to produce. Market research has indicated that there is a linear relationship between its selling price and the number of units demanded, of the form $P = a - bx$. At a selling price of \$100 per unit demand is expected to be 1,000 units per week. For every \$10 increase in selling price the weekly demand will reduce by 200 units and for every \$10 decrease in selling price the weekly demand will increase by 200 units.

The company currently has a production facility which has a capacity of 2,000 standard hours per week. The facility is being expanded but the extra capacity will not be available for ten weeks.

Required:

- Calculate which of the four selling prices should be charged for product K, in order to maximise its contribution during its maturity stage;
- Following on from your answer above in (a), calculate the selling price of product L during its growth stage.

Compare and contrast penetration and skimming pricing strategies during the introduction stage, using product M to illustrate your answer.

Answers to Self Examination Questions

Answer to SEQ 1

Marginal cost of each unit = TZS70,000

Marginal revenue = $a - 2,000bx$

Profit will be maximised if $MC = MR$

$$\text{i.e. } 70,000 = a - 2,000bx \text{ or } a - 2,000bx = 70,000 \dots (i)$$

Given that, Price (P) = $a - bx$, where x is quantity demanded, a and b are the constants,
When price is 200,000, quantity demanded is 2,000 units,

$$\text{Therefore, } 200,000 = a - 2000b \dots (ii)$$

If, demand increases by 200 units for every TZS100,000 decrease in selling price

$$\text{i.e. } 200,000 - 100,000 = a - b(2,000 + 200)$$

$$100,000 = a - 2,200b \dots (iii)$$

By solving equation (ii) and (iii) we get

$$100,000 = 200b$$

Therefore, $b = 500$

Substituting $b = 500$ in equation (ii)

$$200,000 = a - 2,000(500)$$

Therefore $a = 1,200,000$

Now, substituting a and b value in equation (i)

$$70,000 = 1,200,000 - 2(500)x$$

$$1,130,000 = 1,000x$$

$$x = 1,130$$

Profit will be maximised Price (P) = $a - bx$

$$P = 1,200,000 - 500(1,130)$$

$$P = 1,200,000 - 565,000$$

$$P = 635,000$$

Answer to SEQ 2

(a) Calculation of selling price

(i) Full cost plus 30%

Step 1	TZS million
Fixed cost	600
Annual non-production cost	200
Total fixed cost	800
Per unit fixed cost (TZS800 million/50,000)	0.016

Step 2	TZS'000
Calculate total budgeted cost per unit	per unit
Variable cost	50
Fixed costs	16
Full cost	66

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Step 3	TZS'000
Full cost plus 30%	per unit
Total full cost	66.0
Mark-up: 30% on cost	19.8
Selling price	85.8

(ii) Marginal cost plus 50%

	TZS'000
variable cost	50
Mark-up: 50% on variable cost	25
Selling price	75

(iii) Based on ROI of 15%

Step 1

Target ROI pricing	TZS million
Non-current assets	5,000
Working capital	1,300
Capital employed	6,300
Profit required (TZS6,300 million x 15%)	945
Profit required per unit (50,000 units)	0.19

Step 2

	TZS'000
Variable cost	50
Fixed costs	16
Full cost	66
Profit	19
Selling price	85

Selling price is calculated as full cost TZS66,000 + profit margin 25% i.e. TZS16,500 = TZS82,500 per unit

(b) Profit for the year

	TZS million
Sales (30,000 units x TZS82,500)	2,475
Variable cost (30,000 units x TZS50,000)	(1,500)
Fixed costs	(800)
Net Profit	175

Answer to SEQ 3

(a) Calculation of the price that Infinity will quote

	TZS'000
Steel (W1)	20,800
Wood (W2)	88,000
Finishing labour (W3)	22,400
Assembly labour (W4)	3,200
Relevant cost	134,400
Add: Mark-up (60%)	80,640
Quoted price	215,040

Workings

		TZS'000
W1		
Net realisable value of the steel held in inventory	= 400 tonnes x TZS16,000	6,400
Purchases of steel	= 600 tonnes x TZS24,000	14,400
W2		
Wood	= 2,000 tonnes x TZS44,000	88,000
W3		
Finishing labour	= 1,600 hours x TZS8,000	12,800
Contribution lost in other work	= 1,600 hours x TZS6,000	9,600
W4		
Cost towards hiring Assembly labour	= 400 hours x TZS8,000	3,200

Notes

- (i) The company has 400 tonnes of steel held in inventory which has no other use. The steel can be sold in the market at TZS16,000 per tonne. Therefore, it will be considered relevant cost. The balance of 600 tonnes (1,000 – 400 tonnes) will be bought from the market at the current price of TZS24,000 per tonne.
- (ii) The company also held 800 tonnes of wood which can be used for the production of wooden furniture. Therefore, it cannot be used in completing the Eternity's order. Hence, the company has to purchase it from market at a price of TZS44,000 per tonne.
- (iii) Out of the total workforce of 4,000 hours, 1,600 hours (4,000 – 2,400 hours) are in the finishing process. If the labour of the finishing process is transferred to complete the order, it will have the effect of forgoing the contribution of TZS6,000 per hour. Therefore, this will be considered relevant cost. The balance of 400 labour hours (2,000 – 1,600 hours) will be hired from the assembly process at a rate of TZS8,000 per hour.

(b) Limitations of cost-based pricing

- (i) Cost-based approaches to pricing all ignore external market factors such as the price that customers are prepared to pay and what the competitors are charging for the rival products or services.
- (ii) Cost-based pricing does not ensure a profit, because the sales volume must be sufficient to cover all fixed costs, and not even full cost plus pricing can ensure that sufficient sales volumes will be achieved to cover all the fixed costs.

Answer to SEQ 4**Optimisation of revenue function**

$$\begin{aligned}
 R(X) &= X.p \\
 &= X(80,000 - 3,000X) \\
 &= 80,000X - 3,000X^2
 \end{aligned}$$

Total revenue will be maximised when MR i.e. $\frac{d}{dx}(R) = 0$ and $\frac{d^2}{dx^2}(R) < 0$

Marginal revenue (MR) = 0

$$80,000 - 6,000X = 0$$

$$X = 13.33 = 13,334 \text{ watches (approx.)}$$

Determination of second derivative to decide whether $X = 13,334$ corresponds to optimum value of R

$$\frac{d^2}{dx^2}(R) = -6 < 0$$

Since, it is negative, **X = 13,334 watches** corresponds to maximum value of R.

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Optimisation of profit function

$$P(X) = R(X) - C(X)$$

$$P(X) = [80,000X - 3,000X^2] - [1,000X^2 + 20,000X + 100,000]$$

$$P(X) = -4,000X^2 + 60,000X - 100,000$$

Total profit will be maximised when MP i.e. $\frac{d}{dx}(P) = 0$ and $\frac{d^2}{dx^2}(P) < 0$

$$MP = -8,000X + 60,000$$

$$0 = -8,000X + 60,000$$

$$X = 60,000/8,000$$

$$X = 7.5 \text{ (i.e. 7,500 watches)}$$

Determination of second derivative to decide whether $X = 7,500$ corresponds to optimum value of R

$$\frac{d^2}{dx^2}(P) = -8 < 0$$

Since, it is negative, **$X = 7,500$ watches** corresponds to maximum value of R.

Optimal price for profit maximisation

$$P = 80,000 - 3,000X$$

$$= 80,000 - 3,000(7.5)$$

$$= \text{TZS}57,500$$

Total revenue at this point will be: $7,500 \text{ units} \times \text{TZS}57,500 = \text{TZS}431,250,000$

Total profit at this point will be:

$$= -4,000X^2 + 60,000X - 100,000$$

$$= -4,000(56.25) + 60,000(7.5) - 100,000$$

$$= -225,000 + 450,000 - 100,000$$

$$= 125,000 \text{ (i.e. TZS}125,000,000\text{)}$$

Answer to SEQ 5

ALTERNATIVE 1

(a) Sales Maximizing selling Price is determine when $MR = 0$

$$MR = a - 2bq$$

$$a - \text{Current price} + \left(\frac{\text{Current Qty}}{\text{Change in Qty}} \right) \times \text{change in price}$$

$$a = \text{TZS } 120,000 + \left(\frac{100,000}{25,000} \right) \times 10,000$$

$$a = 160,000$$

$$b = \frac{\text{Change in price}}{\text{Change in Qty}} = \frac{10,000}{25,000} = \frac{2}{5} = 0.4$$

Marginal Revenue function after having obtained a and b

$$MR = a - 2bq$$

$$MR = 160,000 - (2)(0.4)Q$$

$$MR = 160,000 - 0.8Q$$

Since sales is maximized when

$$MR = 0$$

$$\text{Then } 0 = 160,000 - 0.8Q$$

$$\frac{0.8Q}{0.8} = \frac{160,000}{0.8}$$

$$Q = 200,000 \text{ Units}$$

ALTERNATIVE 2

$$P = a - bq$$

$$b = \frac{\text{Change in price}}{\text{Change in Qty}} = \frac{10,000}{25,000} = \frac{2}{5} = 0.4$$

$$\text{From } P = a - bq$$

$$120,000 = a - 0.4 (100,000)$$

$$a = 120,000 + 40,000$$

$$a = 160,000$$

MR

$$P = 160,000 - 0.4Q$$

$$TR = P \times Q$$

$$TR = (160,000 - 0.4Q)Q$$

$$TR = 160,000q - 0.4Q^2$$

$$MR = \frac{d(TR)}{d_Q} = 160,000 - 8Q$$

Sales maximizing selling price:

$$MR = 0$$

$$Q = \frac{160,000}{0.8}$$

$$Q = 200,000 \text{ units}$$

$$\text{From } P = a - bq$$

$$= 160,000 - 0.4 (200,000)$$

$$P = \text{TZS } 80,000$$

Sales maximizing selling price = TZS 80,000/unit

Maximum sales revenue

$$TR = P \times Q$$

$$= 80,000 \times 200,000$$

$$= \text{TZS } 16,000,000$$

(b) Profit maximizing selling price and max profit:

MC = MR – marginalist theory.

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$$MC = VC/\text{Unit}$$

Total VC	Total	per Unit (Based on 20 Units)
D. Material (W_2)	800,000	40,000
D. Labour (4_1) 380x3x1000 hrs	386,000	19,300
HD	<u>193,000</u>	<u>9,600</u>
	1,379,000	68,950

$$VC/\text{unit} = \frac{1,379,000}{20 \text{ units}} = 68,950$$

Labour hours per unit if learning is assumed to exist
Total hours needed = 20 hours

W_1 Hours for the 16th sculptures:

Cumm Sculptures	$y = 50 (x - 0.322)$ average hours	Total hours
16	20.5	328.0
15	20.9	<u>313.5</u>
Incremental time		14.5 hrs

Total hours	Average hours	Total hours
Sculpture		
16	20.5	328
04	14.5	<u>58</u>
		386

$$W_2 \text{ Total DM} = 2 \times 20,000 \times 20 = 800,000 \text{ (TZS)}$$

$$MC = VC = 68,950$$

Profit maximizing quantity and selling prize:

$$MR = MC$$

$$160,000 - 0.8q = 68,950$$

$$160,000 - 68,950 = 0.8q$$

$$Q = \frac{91,050}{0.8}$$

$$Q = 113,813$$

Since $P = a - bq$

$$P = 160,000 - (0.4)113,813$$

$$P = 160,000 - 45,525.2$$

$$P = 114,474.8$$

$\therefore$ Profit maximizing price = TZS 114,475
Profit maximizing quantity = 113,813 units

$$\text{Maximum profit} = 114,475 \times 113,813$$

$$= \text{TZS } 13,028,743,175$$

- (c) **Penetration pricing** is a policy of low prices when a product is first launched in order to obtain sufficient penetration into the market.

It is suitable in the following cases:

- Product demand is highly elastic
- Substantial economies of scale are available
- The product faces stiff competition soon after its introduction
- In industries where standardisation is important
- Firm wishes to discourage new entrants into the market
- Firm wishes to shorten the initial period of the products' life cycle murder to enter growth
- The product enters maturity stage as quickly as possible.

Price skimming/Market Skimming

Involves charging high prices when a product is first launched in order to maximize short-term profitability. Initially there is heavy spending on advertising and sales promotion to obtain sales. As the product moves into the later stages of its life cycle (growth, maturity and decline) progressively lower prices are charged. The profitable 'cream' is thus skimmed off in stages until sales can only be sustained at lower prices.

Answer to SEQ 7

- (a) From $P = a - bQ$

$$b = \text{change in price/change in quantity} = \text{TZS } 1,500,000/1,000 = 1500$$

Given, $P = \text{TZS} 73,500,000$, $Q = 1,000$ units.

$$\text{Then } 73,500,000 = a - 1500Q$$

Therefore $a = \text{TZS } 75,000,000$.

Demand function is therefore $P = 75,000,000 - 1500Q$

- (b) Establish marginal cost

First, determine the labour cost of the first 100 units:

$$\text{From } y = ax^b$$

Given $a = 15$, $x = 100$ and $b = -0.0740005$,

$$\text{Then } y = 15 \times 100^{-0.0740005} = 10.668178$$

Therefore labour cost per unit = $10.668178 \times \text{TZS } 80,000 = \text{TZS} 853,450$ (approx.)

Total labour cost for 100 units = $853,450 \times 100 = \text{TZS } 85,345,000$

Second, determine the labor cost for the first 99 units

Given $x = 99$, $y = 15 \times 99^{-0.0740005} = 10.676115$

Labour cost per unit = $10.676115 \times 80,000 = \text{TZS } 854,080$

Total labour cost for 99 units = $\text{TZS } 84,555,000$

Third, determine the marginal cost;

Marginal cost = Cost of producing 100th unit

Labour cost of 100th unit – $\text{TZS } 85,345,000 - \text{TZS } 84,555,000 = \text{TZS} 790,000$.

Total marginal cost, $MC = \text{TZS} 4,200,000 + \text{TZS} 790,000 = \text{TZS} 4,990,000$

- (c) Optimal price and quantity

From $MR = a - 2bQ$

$$MR = 75,000,000 - 3,000Q$$

Equate MC and MR

$$4,990,000 = 75,000,000 - 3,000Q$$

$$3,000Q = 70,010,000$$

$$Q = 23,337$$

Find optimum price

$$P = 75,000,000 - (1,500 \times 23,337) = \text{TZS} 39,995,000$$

- (d) With penetration pricing, **a low price would initially be charged** for the Kantinka.

The idea behind this is that the price will make the product accessible to a larger number of buyers and therefore the high sales volumes will compensate for the lower prices being charged. A large market share would be gained and possibly, the Kantinka might become accepted as the only motor vehicle worth buying.

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The circumstances that would favour a penetration pricing policy are:

- Highly elastic demand for the Kantinka i.e. the lower the price, the higher the demand. The preliminary research does suggest that demand is elastic.
- If significant economies of scale could be achieved by Magari Co, then higher sales volumes would result in sizeable reductions in costs. This is not the case here, since learning ceases at 100 units.
- If Magari Co was actively trying to discourage new entrants into the market. In this case, new entrants cannot enter the market anyway, because of the patent.
- If Magari Co wished to shorten the initial period of the Kantinka's life cycle so as to enter the growth and maturity stages quickly. We have no evidence that this is the case for Magari Co, although it could be.

From the above, it can be seen that this could be a suitable strategy in some respects but it is not necessarily the best one.

With market skimming, **high prices would initially be charged** for the Kantinka rather than low prices. This would enable Magari Co to take advantage of the unique nature of the product, thus maximizing sales from those customers who like to have the latest technology as early as possible.

The most suitable conditions for this strategy are:

- The product is new and different. This is indeed the case with the Kantinka.
- The product has a short life cycle and high development costs that need to be recovered quickly. The life cycle is fairly short and high development costs have been incurred.
- Since high prices attract competitors, there needs to be barriers to entry in order to deter competitors. In Magari Co's case, there is a barrier, since it has obtained a patent for the Kantinka.
- The strength and sensitivity of demand are unknown. Again, this is not the case here.

Once again, the Kantinka meets only some of the conditions which would suggest that although this strategy may be suitable the answer is not clear cut. The fact that high development costs have been incurred and the life cycle is fairly short are fairly good reasons to adopt this strategy. Whilst we have demand curve data, we do not really know just how reliable this data really is, in which case a skimming strategy may be a safer option.

SECTION B6: DECISION MAKING UNDER ENVIRONMENT OF UNCERTAINTY AND RISK

Get Through Intro

Decision-making is part and parcel of life. A decision process is said to be under conditions of uncertainty when states of nature are unknown and no objective information is available about their chances of occurrence. Widely-accepted techniques for decision-making under uncertainty are 'maximax', 'maximin' and 'minimax regret' criteria.

While taking decisions subject to risk, the decision-maker is supposed to have believable, evidence, knowledge, experience or judgement to enable him to assign probability values to the likelihood of the occurrence of each state of nature. In a situation involving risks, the most accepted criterion is obtaining the expected value of the future outcomes.

This section will acquaint you with various decision-making techniques applied under the conditions of uncertainty and risk. The knowledge presented in this section will not only help you to answer the related questions in the examination but will also enable you, in your future career as a management accountant, to advise your employer on how to deal with risk and uncertainty in decision-making.

Learning Outcomes

- a) Evaluate risk with probability distributions.
- b) Evaluate the impact of uncertainty and risk on decision models.
- c) Apply the techniques of maximax, maximin, and minimax regret to decision-making problems including the production of profit tables.
- d) Analyse risk and uncertainty by calculating expected values and standard deviations together with probability tables.
- e) Calculate the expected values and ascertain the value of information.
- f) Prepare decision trees and use it to solve a multi-stage decision problem.

1. Evaluate risk with probability distributions.
Evaluate the impact of uncertainty and risk on decision models.

[Learning Outcomes a and b]

Uncertainty and problems arise when the **actual state of affairs differs from the desired**. Problems may also give rise to favourable opportunities. Decision making involves bridging the gap between the situation as it stands and the desired situation through problem solving and creating opportunities.



Definition

Risk is basically defined as the final outcome of a decision may differ from that which was expected when the decision was taken.

There are number of risk which organisations faces. Examples include market risk, credit risk, liquidity risk, operational risk, legal and regulatory risk, strategic risk, business risk, reputation risk etc. Risk usually has negative implications, with regards to potential loss. However, the potential for better than expected returns also habitually exists.

Risk comprises two elements.

1. The first is the **probability** (or likelihood) of occurrence of a negative event during the lifetime of operation of a facility;
2. The second is the **consequence of a negative event** which has taken place.

Risk assessment is part of strategic planning and the decision-making exercise and includes assessment of risks with respect to legal, political, social, economic, environmental and engineering considerations.



Definition

Uncertainty, on the other hand, is closely related to risk. The term “uncertainty” emphasises that the decision must be made on the basis of incomplete knowledge about projects that do not yet physically exist.

Uncertainties arise from the randomness of events, along with three sources of errors, namely:

- data errors (uncertainties about past events)
- forecasting errors (uncertainties about future events)
- residual errors (i.e., the differences between observed and expected values)



Definition

The term ‘probability’ refers to the likelihood or chance that a certain event will occur, with potential values ranging from 0 (the event will not occur) to 1 (the event will definitely occur).

For example, the probability of a head or tail occurring when tossing a coin is $\frac{1}{2}$ (i.e. 0.5). Similarly, when rolling a dice, the probability that it will show a ‘four’ is $\frac{1}{6}$ (0.166).



Definition

A **probability distribution** is a graph, table, or formula that gives the probability for each value of the random variable.

If x is a random variable, then $P(x)$ is the probability that x occurs.



Tip

In any case, it is certain that $0 \leq P(x) \leq 1$ for each value of x and $P(x) = 1$ (the sum of all the probabilities is 1.)



Example

The return on investment is expected as shown below:

Project A		Project B	
ROI	Probability of return	ROI	Probability of return
10%	0.40	6%	0.30
12%	0.35	8%	0.30
14%	0.25	10%	0.40

Expected value is derived as follows:

Project A: $(10\% \times 0.40) + (12\% \times 0.35) + (14\% \times 0.25) = 4\% + 4.2\% + 3.5\% = 11.7\%$

Project B: $(6\% \times 0.30) + (8\% \times 0.30) + (10\% \times 0.40) = 1.8\% + 2.4\% + 4\% = 8.2\%$

Hence, we can say that probabilistic results demonstrate not only what could happen, but also how likely each outcome is.

Risk and uncertainty are briefly explained in the earlier paragraphs. Despite the clear distinction between risk and uncertainty, while making decisions, managers tend to ignore this distinction and usually treat both risk and uncertainty as one.

Risk and uncertainty have a significant impact on managerial decision models, depending on the risk appetite of the decision maker. Risk appetite refers to the amount of risk that an individual / entity / body is willing to accept in order to fulfil its strategy (i.e. the attitude towards risk). Risk attitude is the liking or disliking of uncertainty and hence the magnitude of possible gains or losses.

Attitudes toward risk are generally grouped into THREE different categories according to organisational preference:

1. Risk averse

These organisations are the most cautious while accepting any kind of risk. They avoid risk wherever possible, but are willing to accept some risks. Such an attitude towards risk makes organisations **miss out on profit opportunities** by resisting or slowly adapting to innovative products or practices.

2. Risk neutral

These organisations prefer a balanced approach to risk and **try to minimise risk while pursuing profit opportunities**. They recognise that there is some level of risk in almost every situation and understand the need to accept some level of risk.

3. Risk loving or risk seeking

These organisations enjoy taking risks and challenges. They often opt out of 'expensive' mitigation strategies. Typically these organisations take up projects where the residual risk is quite high and hence cannot be managed. They **pursue profit opportunities** that risky ventures present because they want to benefit from the risk-return trade-offs.

A state of uncertainty suggests that there is indefiniteness about the occurrence of an event or outcome. A decision process is said to be under a condition of uncertainty when the states of nature are unknown and no objective information is available about their chances of occurrence. In such cases, no historical data or relative frequency are available that could indicate the probability of the occurrence of a particular state of nature. This situation may arise when a new product is introduced into the market or a plant is set up.



Example

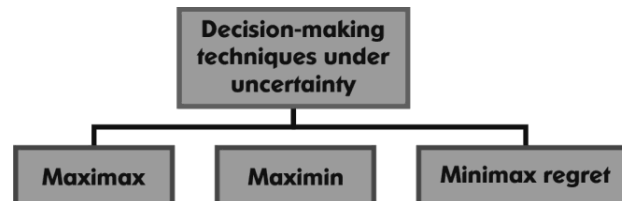
Adventure Ltd is considering a new ship-building project. Deciding whether or not to take up the project is really difficult in the absence of any historical data about the project.

2. Apply the techniques of maximax, maximin, and minimax regret to decision-making problems including the production of profit tables.

[Learning Outcome c]

Maximax, maximin and minimax regret are decision-making techniques adopted in situations of uncertainty. They are suitable techniques to be used under uncertainty due to unavailability of historical data, lack of experience, etc.

Diagram 1: Decision-making techniques under uncertainty



2.1 Maximax

This is an optimistic approach to decision-making. Leonid Hurwitz suggested this decision criterion. Under this approach, the alternative that maximises the maximum outcome for every alternative strategy is selected.

The steps followed in this approach:

Find out the maximum payoff for each of the strategies.

Select the maximum out of the maximum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the maximum payoffs i.e., **maximax**.

Identify the strategy corresponding to the maximax payoff.



Example

Pretty, a cosmetics dealer wants to decide on the amount of advertising necessary for her products. The following is the profit table corresponding to the advertisement expenditure:

Demand	Low advertisement	Average advertisement	High advertisement
High	155	165	185
Average	140	150	160
Low	130	120	125

Which strategy should Pretty adopt under the maximax approach?

Answer

The payoff table

Strategies → States of nature ↓	Low advertisement	Average advertisement	High advertisement
High demand	155	165	185
Average demand	140	150	160
Low demand	130	120	125

Steps explaining calculation of maximax strategy:

Step 1: Find out the maximum payoff for each strategy:

Low advertisement	155
Average advertisement	165
High advertisement	185

Step 2: Select the maximum out of the maximum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the maximum payoffs i.e., the **maximax** payoff is 185.

Step 3: The corresponding strategy is to go for high advertisement. Therefore, the maximax approach suggests that the advertisement level should be high.

2.2 Maximin

This is a pessimistic approach to decision-making. Under this approach, the alternative that maximises the minimum most value of the outcomes for every alternative strategy is selected.

Steps followed in this approach:

- Find out the minimum payoff for each of the strategies.
- Select the maximum out of the minimum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the minimum payoffs i.e. **maximin**.
- Identify the strategy corresponding to the maximin payoff.



Example

Continuing the above example of Pretty to understand how the decision can vary under the maximin approach.

Strategies → States of nature ↓	Low advertisement	Average advertisement	High advertisement
High demand	155	165	185
Average demand	140	150	160
Low demand	130	120	125

Steps explaining calculation of the maximin strategy:

Step 1: Find out the minimum payoff for each strategy:

Low advertisement	130
Average advertisement	120
High advertisement	125

Step 2: Select the maximum out of the minimum payoffs for each strategy as identified in the preceding step.

The payoff thereby selected is the maximum out of the minimum payoffs i.e. the **maximin** payoff is 130.

Step 3: Corresponding strategy is to go for low advertisement

Therefore the maximin approach suggests that the advertisement level should be low.

2.3 Minimax regret

This is a strategy that tries to minimise maximum possible regret (i.e. opportunity loss) by adopting a strategy. In this approach the following steps are to be adopted:

- For each of the states of nature find out the regret.
- Regret = Maximum payoff for a state of nature – Payoff for the strategy
- This will give a regret table.
- From the regret table, find out the maximum regret for each strategy.
- Select the minimum from the maximum regret selected above – minimax.
- Select the strategy corresponding to the minimax regret.



Example

Continuing the above example of Pretty under the minimax regret approach:

Step 1: Find out the highest payoff for each state of nature:

Strategy → States of nature ↓ Demand	Low advertisement	Average advertisement	High advertisement	Highest payoff for the states of nature
High	155	165	185	185
Average	140	150	160	160
Low	130	120	125	130

(continued on the next page)

Step 2: Calculate regret table

Strategy → States of nature ↓ Demand	Low advertisement	Average advertisement	High advertisement
High	$(185 - 155) = 30$	$(185 - 165) = 20$	$(185 - 185) = 0$
Average	$(160 - 140) = 20$	$(160 - 150) = 10$	$(160 - 160) = 0$
Low	$(130 - 130) = 0$	$(130 - 120) = 10$	$(130 - 125) = 5$

Step 3: Maximum regret for each strategy:

Low advertisement	30
Average advertisement	20
High advertisement	5

Step 4: Minimum regret from these payoffs 5

Step 5: Corresponding strategy is high advertisement.

Therefore the minimax regret approach suggests that the advertisement level should be high.



Test Yourself 1

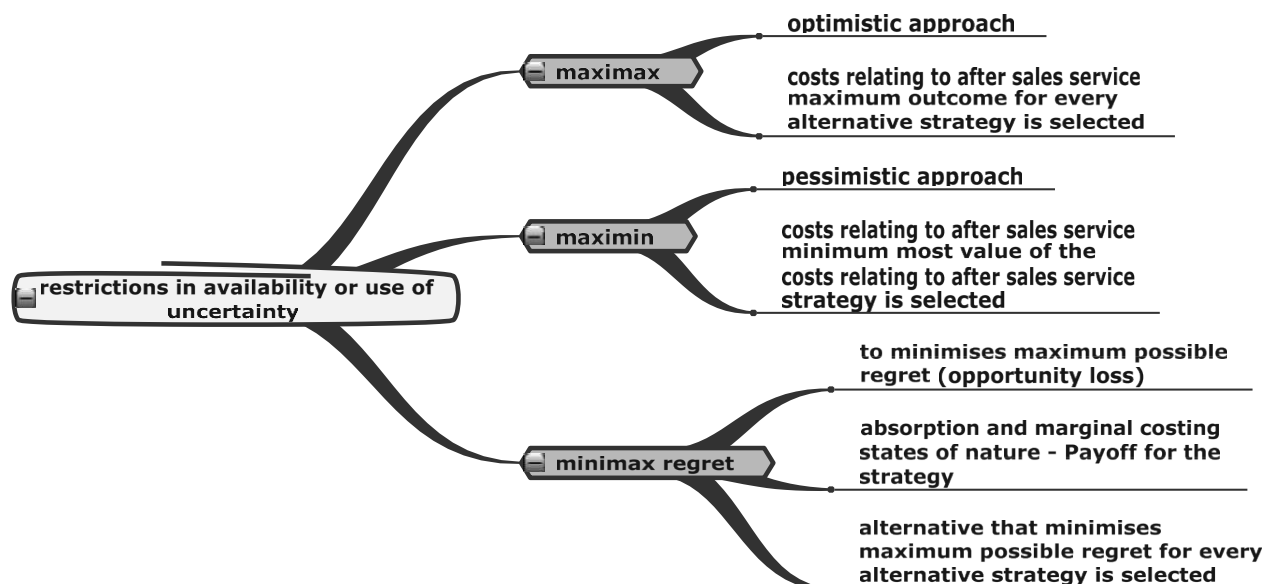
Sweetie, a confectionery shop owner likes to buy 110 kg of either chocolate-flavoured pastry or strawberry-flavoured pastry from the producer at the beginning of the week. The chocolate-flavoured pastry costs her TZS6,000 per kg, which she sells at TZS8,000 per kg. Similarly, the strawberry-flavoured pastry costs her TZS4,000 per kg which she sells at TZS7,000 per kg. The potential demands per week for these pastries are expected to be 90, 100 or 110 kg. Any pastries remaining unsold at the end of the week are repurchased by the producer for TZS3,000 per kg.

Required:

Identify which of the pastries Sweetie should buy, using:

- (a) Maxmin criterion
- (b) Maxmax criterion
- (c) Minmax regret criterion

SUMMARY



3. Analyse risk and uncertainty by calculating expected values and standard deviations together with probability tables.

[Learning Outcome d]

Expected value is the weighted average of the alternative payoffs estimated for different states of nature i.e. the events. The weighted average of the payoffs is made with reference to the related probabilities for the possible states of nature.

Expected value is the sum of the probability of each possible outcome of the strategy multiplied by its payoff.



Example

Harry wants to catch a flight. The strategies before him are either to go to the airport by bus or to go by cab. Either he catches the flight or he misses it. These are the events.

If he goes by bus, the probability of catching the flight is 0.90 but if he goes by cab, the probability of catching the flight is 0.99. The bus will cost him TZS2,000 and a cab, TZS5,000. If he catches the flight, he will finalise a business deal that will fetch him a profit of TZS150,000.

He will calculate the expected cost of going by bus as well as the cost of going by cab and will choose the option that will give him the greater gain in the given situation.

While calculating expected value, it is necessary to consider all the possible events related to the strategies.

1. Important terms

Some important terms related to the **expected value**:

(a) Events

Events are the occurrences beyond the control of the decision-maker. The events are often called outcomes or states of nature.



Example

Continuing the above example of Harry

Catching the flight or missing it, are the events.

(b) Payoff

Payoff is a conditional value of a strategy employed by a decision-maker. It indicates a net gain or net loss for the decision-maker as a result of the strategy adopted by him against a state of nature.

When the strategies and the events are arranged in a tabular format, the outcome of each strategy as against each event is written in the cell where the rows (usually signifying the events) intersect with the columns (usually signifying the strategies).



Example

Continuing the above example of Harry

Payoff can be calculated as follows: if he catches the flight, the gain will be (TZS150,000 - TZS2,000) for the bus and (TZS150,000 - TZS5,000) for the cab, if he misses the flight, the loss will be TZS2,000 for the bus and TZS5,000 for the cab.

State of nature	Strategies	
	Going by Bus	Going by Cab
Catches the flight	TZS148,000	TZS145,000
Misses the flight	TZS(2,000)	TZS(5,000)

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Every action has as many payoffs as the events i.e. if there are 3 events related to a strategy; the number of payoffs will be $1 \times 3 = 3$. If the strategies are 3 and the numbers of possible events are 3, the number of payoffs will be $3 \times 3 = 9$.

(c) Strategy

Strategy is a course of action to be chosen by a decision-maker.



Example

Continuing the above example of Harry

Strategies before Harry are either to go to the airport by bus or to go by cab.

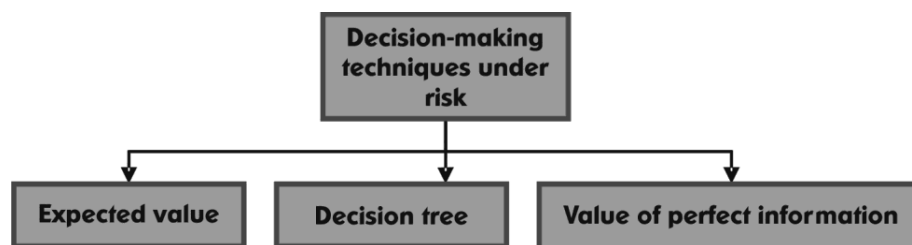
2. Application of expected value

Expected value is widely-used in situations involving risk, in order to evaluate the alternatives. While taking a decision under risk, the decision-maker, on the basis of knowledge, experience or judgement, assigns probabilities to the likelihood of an occurrence of a state of nature.

Steps to apply expected value technique in solving decision-making problem:

1. Identify strategies and states of nature
2. Calculate payoffs
3. Calculate EMV for each strategy
4. Choose the strategy with the maximum expected value

Diagram 2: Decision-making techniques under risk



In the expected value technique, different alternatives are evaluated in order to choose the one that presents the maximum gain. Expected value is normally expressed in a tabular format, where the events (states of nature) are arranged in the far left column, and the acts (strategies) in the topmost row.

The form of a payoff table is produced below:

State of nature	Probabilities	Strategies			
		S ₁	S ₂	S ₃	S ₄
N ₁		Payoffs			
N ₂					
N ₃					
N ₄					

3. Calculation of expected value

$$\text{Expected value } [E(s)] = p_1x_{11} + p_2x_{12} + \dots + p_{n-1}x_{1n-1} + p_nx_{1n}$$

$$= \sum_{j=1}^n p_j x_{ij}$$

Where,

's' denotes a particular strategy

'x_{ij}' denotes payoffs at the juncture of strategy j and state of nature i

'n' denotes number of possible events for a particular strategy

The probabilities of the possible events are denoted by p₁, p₂, p_{n-1}, p_n.

4. Application of the expected values technique in solving decision-making problems



Example

Praise, a tomato seller, provides the following information about the grades of tomato he trades -

Daily demand for grade in (tonnes)	1	2	3	4
Probability of demand	0.2	0.3	0.4	0.1

If any amount of tomatoes supplied is not sold will be donated free to public schools.

The cost of tomato per tonne is TZS12,500,000 and its selling price is TZS15,000,000.

Required:

Calculating the expected value, advice the company on how many tonnes of tomatoes should be purchase daily.

Step 1: Identify strategies and states of nature

Here, the strategies would be:

- S₁ Buy 1 tonne of tomato
- S₂ Buy 2 tonne of tomato
- S₃ Buy 3 tonne of tomato
- S₄ Buy 4 tonne of tomato

The states of nature are the demand for the tomato.

Step 2: Calculate payoffs

Accordingly we will calculate the payoff for each strategy corresponding to the states of nature. Payoff will be calculated as: Payoff = Selling price of a tonne of tomato – (Cost of the tonne of tomato x No. of tonnes of tomato)

Payoff table in (TZS million)

States of nature	Probabilities	Strategies			
		S ₁	S ₂	S ₃	S ₄
N ₁	0.2	2.5	-10(W1)	-22.5	-35
N ₂	0.3	2.5	5	-7.5	-20
N ₃	0.4	2.5	5	7.5	-5
N ₄	0.1	2.5	5	7.5	10

Step 3: Calculate EMV for each strategy

We will calculate the EMV for each strategy

$$S_1 = 0.2(2.5) + 0.3(2.5) + 0.4(2.5) + 0.1(2.5) = 2.5$$

$$S_2 = 0.2(-10) + 0.3(5) + 0.4(5) + 0.1(5) = 2$$

$$S_3 = 0.2(-22.5) + 0.3(-7.5) + 0.4(7.5) + 0.1(7.5) = -3$$

$$S_4 = 0.2(-35) + 0.3(-20) + 0.4(-5) + 0.1(10) = -14$$

Step 4: Choose the strategy with the maximum expected value

Here, the maximum expected value is for strategy S₁. Therefore, Praise should be advised to buy 1 tonne of tomato a day.

Workings

W1 Calculation of payoff

If strategy 2 i.e. buy 2 tonnes of tomato is adopted in states of nature N1 where the demand is for only one tonne of tomato, the payoff will be:

$$\begin{aligned} \text{Payoff} &= (\text{TZS}15,000,000 \times 1 \text{ tonne of tomato}) - (\text{TZS}12,500,000 \times 2 \text{ tonnes of tomato}) \\ &= \text{TZS}(10,000,000) \end{aligned}$$

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As the cost incurred for buying tomatoes is more than the sales revenue, a loss of TZS10,000,000 will be incurred. The payoff for other strategies corresponding to each state of nature can be calculated in the same manner.

Expected value is normally denoted as $E(X)$. It is also called the **mean of the probability distribution**. It indicates average value of the outcomes if the risky decision were to be repeated a large number of times. Expected value does not give actual value of the random outcomes. However, variance is a measure of absolute risk.

Variance measures **dispersion of outcomes** about the expected outcome. It is normally denoted as $V(X)$. The higher the variance, the greater the risk associated with a probability distribution.

Standard deviation is the square root of variance. The higher the standard deviation, the greater is the risk. Standard deviation is a number which describes the **spread of the distribution**. Low standard deviation indicates that the data points tend to be very close to the mean; high standard deviation indicates that the data points are spread out over a large range of values.

It is normally denoted as σ . Standard deviation is computed by **subtracting the expected value from each of the potential outcomes**, then **squaring the result** and **multiplying it by the probability**.



Example

Continuing the previous example of Praise, standard deviation for strategy 2 is calculated as follows:

Payoff table is given below and the expected value for strategy S_1 is 2.5, S_2 is 2, S_3 is -3 and S_4 is -14

Probabilities	Strategies			
	S_1	S_2	S_3	S_4
0.2	2.5	-10(W1)	-22.5	-35
0.3	2.5	5	-7.5	-20
0.4	2.5	5	7.5	-5
0.1	2.5	5	7.5	10

For Strategy 2

Returns (X)	Expected returns ($E(x)$)	$X - E(X)$	$[X - E(X)]^2$	Probability ($P(X)$)	$P(X) \times [X - E(X)]^2$
-10	2	-12	144	0.2	28.8
5	2	3	9	0.3	2.7
5	2	3	9	0.4	3.6
5	2	3	9	0.1	0.9
					36.0

Variance = 36

Hence, standard deviation = $\sqrt{36} = 6$

Advantages of measuring standard deviation

There are several advantages to measuring the standard deviation of possible outcomes.

It provides a numerical value to the spread of possible results around the average or expected value.

It recognises risk in a decision, and quantifies that risk.

By assuming the probability distribution as a normal distribution, it can be used for statistical analysis.

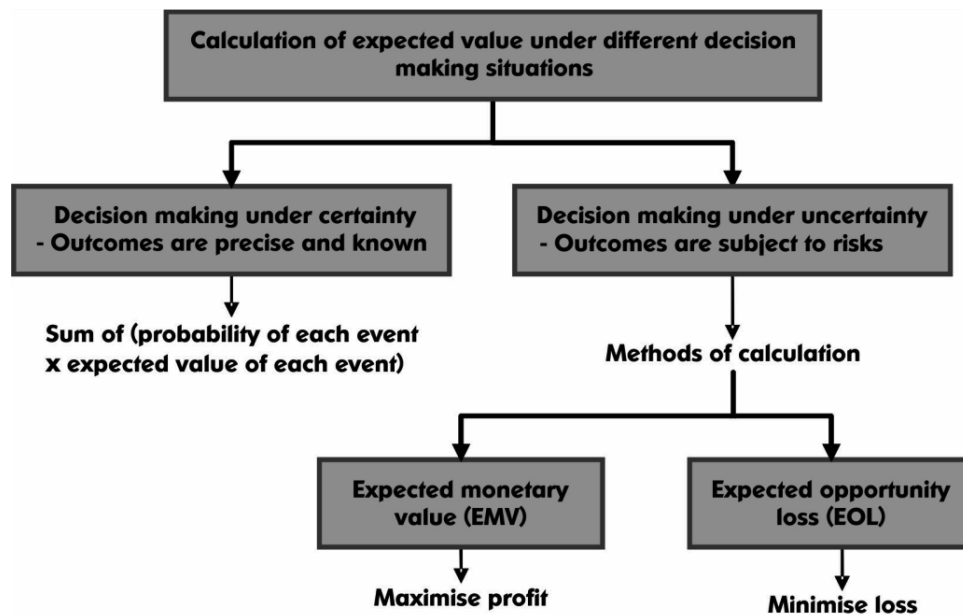
Disadvantages of measuring standard deviation

When the probability distribution is not a normal distribution, the significance of a standard deviation is restricted.

4. Calculate the expected values and ascertain the value of information.**[Learning Outcome e]**

Expected values aid decision making, but unless we know how to use them effectively as tools in this process, they are of no use. When there is only one alternative the outcome is certain and predictable. This is decision making under certainty. However in most cases the decisions are subject to **uncertainty**. The major difficulty in such cases is the choice of the best from amongst many. The outcomes of alternatives are subject to many possible events (or states of nature).

Expected values can be used in various simple decision making problems in the given manner using either EMV or EOL approach.

Diagram 3: Methods of calculation of expected value**Example**

BSR Plc manufactures bikes. It wants to launch a new model in the quarter before Christmas as the demand is high during this time. The company has three models lined up for launch; Legend, Invader and Street Hawk. BSR Plc naturally wants to launch the most profitable bike in the season. The demand conditions as forecasted by the company are:

Demand condition	Legend	Invader	Street hawk
High	200 units	150 units	80 units
Moderate	150 units	90 units	60 units
Low	100 units	70 units	10 units

The profits associated with each bike are Legend TZS20,000, Invader TZS35,000 and Street Hawk TZS50,000. The three demand conditions given above form the 'events'. The acts in this case constitute the launch of any of the three bikes, Legend, Invader or Street Hawk. As the demand conditions and profits are different for all bikes the outcomes will differ for each condition. The payoff table will be as follows:

Amount in TZS'000			
Acts → Events ↓	Launch Legend (Profit 20)	Launch Invader (Profit 35)	Launch Street Hawk (Profit 50)
High demand	200 units x 20 = 4,000	150 units x 35 = 5,250	80units x 50 = 4,000
Moderate demand	150 units x 20 = 3,000	90 units x 35 = 3,150	60 units x 50 = 3,000
Low demand	100 units x 20 = 2,000	70 units x 35 = 2,450	10 units x 50 = 500

Continued on the next page

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This forms our payoff table arranged in a matrix structure. By assigning probabilities to the demands we can formulate an expected value table and ascertain the best option. The probabilities of the demand forecast of high, moderate and low are 0.1, 0.7 and 0.2 respectively as provided by the finance manager, based on market research.

Continuing the same format as the table above, we multiply the probability with each payoff and sum up the products for each act. The expected value is normally measured in monetary units and hence also called '**Expected Monetary Value**' (**EMV**). When we multiply the respective pay offs with their probabilities, we attain an expected value for each pay off.

Computation of EMV of various acts

		Amount in TZS'000		
Acts → Events ↓	Probability	Launch Legend	Launch Invader	Launch Street Hawk
High demand	0.1	$4,000 \times 0.1 = 400$	$5,250 \times 0.1 = 525$	$4,000 \times 0.1 = 400$
Moderate demand	0.7	$3,000 \times 0.7 = 2,100$	$3,150 \times 0.7 = 2,205$	$3,000 \times 0.7 = 2,100$
Low demand	0.2	$2,000 \times 0.2 = 400$	$2,450 \times 0.2 = 490$	$500 \times 0.2 = 100$
EMV		2,900	3,220	2,600

The product of the payoffs and probabilities gives us conditional values hence the table is also called a '**conditional value table**'. The sum of the pay offs for each act gives us the EMV of the chosen act. Since we want to maximise profit we choose to launch Invader as it has the **maximum EMV**.

Converting the above given payoff table to a regret table we get:

		Amount in TZS'000		
Acts → Events ↓		Launch Legend (Profit 20)	Launch Invader (Profit 35)	Launch Street Hawk (Profit 50)
High demand		$5,250 - 4,000 = 1,250$	$5,250 - 5,250 = 0$	$5,250 - 4,000 = 1,250$
Moderate demand		$3,150 - 3,000 = 150$	$3,150 - 3,150 = 0$	$3,150 - 3,000 = 150$
Low demand		$2,450 - 2,000 = 450$	$2,450 - 2,450 = 0$	$2,450 - 500 = 1,950$

To ascertain the EOL we assign probabilities to each regret or loss value obtained:

		Amount in TZS'000		
Acts → Events ↓	Probability	Launch Legend	Launch Invader	Launch Street Hawk
High demand	0.1	$1,250 \times 0.1 = 125$	$0 \times 0.1 = 0$	$1,250 \times 0.1 = 125$
Moderate demand	0.7	$150 \times 0.7 = 105$	$0 \times 0.7 = 0$	$150 \times 0.7 = 105$
Low demand	0.2	$450 \times 0.2 = 90$	$0 \times 0.2 = 0$	$1,950 \times 0.2 = 390$
EOL		320	0	620

The aim here is to minimise the regret or the EOL. Hence we choose the act with the minimum EOL which is to launch Invader.

Though the EMV and the EOL criteria are conceptually different, in practice both the criteria will lead to choosing the **same strategy**. Hence the strategy with the **maximum EMV** is also the strategy with the **minimum EOL**.

4.1 Perfect information

If perfect information about the future were available, it would be very easy to make a decision as the uncertainty and the risk associated with it would be non-existent. Thus, management would like to know the cost of obtaining the perfect information about future events. This is technically known as "expected value of perfect information (EVPI)". It is the price that one would be willing to pay in order to gain access to perfect information of an uncertain outcome in decision theory.

Arithmetically, EVPI can be defined as the difference between the payoff under certainty and the payoff under risk.

$EVPI = \text{Expected value under certainty} - \text{Maximum Expected Monetary Value (EMV)}$

Where,

Expected value under certainty = (Best outcome or consequence for 1st state of nature) x (Probability of 1st state of nature) + (Best outcome for 2nd state of nature) x (Probability of 2nd state of nature) + (Best outcome for last state of nature) x (Probability of last state of nature).....

Expected value under certainty is also known as expected value with perfect information (i.e. EVwPI)



Example

Strong Base Constructions is popular for its fancy construction designs. The following data relates to the estimated net profit in both favourable and unfavourable market conditions which are considered to have equal chance of outcome.

	Favourable market	Unfavourable market
To build a large facility	TZS200 million	(TZS110 million)
To build a small facility	TZS175 million	(TZS55 million)
Not to build any facility	-	-

Required:

Calculate expected profit with perfect information and the value of perfect information

Expected profit/monetary value(EMV):

- **For a large facility**
 $EMV = TZS\ 200(0.5) + -100(0.5)$
 $= TZS\ 45\ \text{million}$
- **For a small facility**
 $EMV = TZS\ 175(0.5) + -55(0.5)$
 $= TZS\ 60\ \text{million}$
- Not to build any facility
 $EMV = 0$

The maximum EMV = TZS 60 million

With perfect information

The best outcome for "favourable market conditions"

Large facility = 200 million (0.5)

Best outcome for "favourable market conditions" on No facility

= 0 million(0.5)

Expected profit with perfect information

= $200(0.5) + 0(0.5) = TZS\ 100\ \text{million}$

The value of perfect information will be be:

= TZS 100 million – TZS 60 million

= TZS 40 million

1. Expected Opportunity Loss (EOL)

Before we understand what EOL is, let us first look at the meaning of opportunity loss.

(a) Opportunity Loss

Opportunity loss or "regret" is the loss that arises because the exact state of nature is not known at the time a decision is made.

The opportunity loss is computed by calculating the difference between the optimal decision for each state of nature and the other decision alternatives.

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EOL is the probabilistic value criterion used to arrive at a selection of the most economically feasible option out of several alternatives available. For any alternative, EOL is the expected value of regret associated with that action.

(b) Calculation of EOL

Let A_i be the i th decision alternative.

Let $P(S_j)$ be the probability of the j th state of nature.

Let $R(A_i, S_j)$ be the value of the regret for the combination of decision alternative A_i and state of nature S_j .

Let $EOL(A_i)$ be the expected opportunity loss for the decision alternative A_i .

$$EOL(A_i) = \sum P(S_j)R(A_i, S_j)$$



Example

A food vendor has two options - whether to sell soft drinks or hot dogs in cool or warm weather. The following table shows pay-off (expected profit) of selling soft drinks and hot dogs under cool and warm weather.

		Course of action(A_i)	
		Sell soft drinks	Sell hot dogs
Events (E_i)	Probability		
Cool weather	0.5	TZS100,000	TZS200,000
Warm weather	0.5	TZS400,000	TZS250,000

Expected opportunity loss for selling soft drinks in a cool weather = Highest possible profit for an event E_i – Actual profit obtained for an action A_j
 = Highest profit for selling hot dogs in a cool weather – Actual profit obtained from selling soft drinks
 = (TZS200,000 x 0.50) - (TZS100,000 x 0.50)
 = TZS50,000



Tip

The lowest EOL is always equal to the EVPI



Example

Continuing the previous example of food vendor

Expected Monetary Value

Selling soft drinks: (TZS100,000 x 0.50) + (TZS400,000 x 0.50) = TZS250,000

Selling hot dogs: (TZS200,000 x 0.50) + (TZS250,000 x 0.50) = TZS225,000

Highest **EMV** for selling soft drinks = TZS250,000

EVwPI = Hot dog sales in cool weather + Soft drinks sales in warm weather
 = (TZS200,000 x 0.50) + (TZS400,000 x 0.50) = TZS300,000

EVPI = EVwPI – EMV
 = TZS300,000 - TZS250,000
 = TZS50,000
 = EOL



Example

k: 307

Bags Co manufactures two types of travelling bags. However, at one point, the management of the company is faced with choosing one of the two types for manufacturing. The probability matrix after market research for the two types of bags was as follows:

Courses of action	States of nature		
	Good	Fair	Poor
Type A	75%	15%	10%
Type B	60%	30%	10%

Expected profits at different levels of market conditions are as below:

Courses of action	States of nature		
	Good	Fair	Poor
Type A	TZS35,000,000	TZS15,000,000	TZS5,000,000
Type B	TZS50,000,000	TZS20,000,000	(TZS3,000,000)

Required:

Calculate the expected value, expected opportunity loss and expected value with perfect information of the alternatives and advise the management of Bags Co.

Answer

Decision matrix can be set up as follows:

Courses of action	States of nature			Expected monetary value (EMV)
	Good	Fair	Poor	
Type A	75% TZS35,000,000	15% TZS15,000,000	10% TZS5,000,000	= TZS26,250,000 + TZS2,250,000 + TZS500,000 = TZS29,000,000
Type B	60% TZS50,000,000	30% TZS20,000,000	10% (TZS3,000,000)	= TZS30,000,000 + TZS6,000,000 - TZS300,000 = TZS35,700,000

On the basis of EMV, management is advised to manufacture type B.

Expected value with perfect information

Courses of action	States of nature		
	Good	Fair	Poor
Type A	75% TZS35,000,000	15% TZS15,000,000	10% TZS5,000,000
Type B	60% TZS50,000,000	30% TZS20,000,000	10% (TZS3,000,000)

$$\begin{aligned}
 EV_{wPI} &= \text{Type B in good nature} + \text{Type B in fair nature} + \text{Type A in poor nature} \\
 &= TZS30,000,000 + 6,000,000 + TZS500,000 \\
 &= TZS36,500,000
 \end{aligned}$$

$$\begin{aligned}
 EVPI &= EV_{wPI} - EMV \\
 &= TZS36,500,000 - TZS35,700,000 \\
 &= \mathbf{TZS800,000}
 \end{aligned}$$

EOL

Courses of action	States of nature		
	Good	Fair	Poor
Type A	75% TZS50,000,000 - TZS35,000,000 = TZS15,000,000	15% TZS20,000,000 - TZS15,000,000 = TZS5,000,000	10% TZS5,000,000 - TZS5,000,000 = TZS0
Type B	60% TZS50,000,000 - TZS50,000,000 = TZS0	30% TZS20,000,000 - TZS20,000,000 = TZS0	10% TZS5,000,000 - (TZS3,000,000) = TZS8,000,000

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EOL

Product A = $(TZS15,000,000 \times 0.15 + TZS5,000,000 \times 0.15) = \textbf{TZS3,000,000}$

Product B = $(TZS8,000,000 \times 0.10) = \textbf{TZS800,000}$

On the basis of EOL, management is advised to manufacture type B.



Test Yourself 2

Based on market research, following estimates have been established by a vendor of flowers. The cost of purchasing one flower is TZS1,000 and the selling price per flower is TZS1,400. Hence profit on units sold = TZS400.

Daily demand	0	100	200	300
Probability	0.20	0.30	0.30	0.20

How many flowers can be stocked each day?

Note: assume that inventory at the end of the day cannot be sold on any other

day. Derive the expected value with the perfect information.

4.2 Imperfect information

Imperfect information refers to the information that reduces uncertainties, but, unlike perfect information does not eliminate the uncertainties.

The prime difference between perfect and imperfect information lies in the fact that the later can lead to untrue predictions. Such information is ascertained in addition to perfect information as a result of further enquiry / research.

The analysis of imperfect information is similar to that of perfect information. The expected value of such information has to be analysed before obtaining the same (in order to ascertain its worth). This is technically known as "expected value of imperfect information (EVII). It is also sometimes referred to as expected value of sample information (EVSI).

Three types of probabilities can be analysed to determine EVII:

Prior probabilities: these probabilities are established before the additional information is acquired

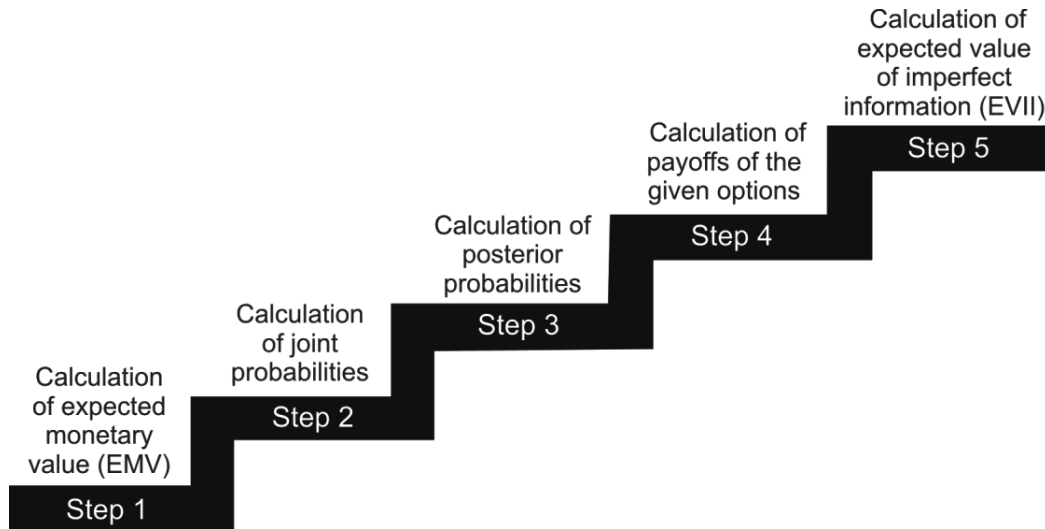
Conditional probabilities: refers to the probability of occurrence of an event as a result of occurrence of some other event. These are acquired in the process of acquiring the additional information.

Posterior probabilities: the prior probabilities need to be 'conditioned' using the conditional probabilities in order to incorporate the additional information into them. The conditioned probabilities are referred to as posterior probabilities

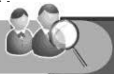
Steps to calculate EVII

The following diagram shows the steps involved calculating EVII

Diagram 4: Steps to calculate EVII



The process of calculating EVII is illustrated with the help of the following example



Example

Kitchen Magic produces and sells small kitchen appliances. The marketing department of the company is considering the following options:

Running an end of season sales promotion

(B₁)

Not running any sales promotions

(B₂)

The following table shows the probabilities associated with three possible demand outcomes and the profit (loss) earned by the company under various options.

Possible demand situation	Probability	Alternative options	
		B ₁ (TZS'000)	B ₂ (TZS'00)
Highly favourable (D ₁)	0.70	500,000	0
Favourable (D ₂)	0.10	200,000	0
Unfavourable (D ₃)	0.20	(300,000)	0

The marketing department of Kitchen Magic obtains additional information through a research that if it undertakes surveys, its sales can be increased. The following further options are being considered:

Option 1: Conduct survey in Northern Europe (O₁), which may help in increasing the sales by 20%

Option 2: Conduct survey in Southern Europe (O₂), which may help in increasing the sales by 15%

Option 3: Do not conduct survey at all (O₃). This will not lead to any increase in sales of the company.

Conditional probabilities associated with the survey results are given as under

Demand situation	O ₁	O ₂	O ₃
D ₁	0.60	0.30	0.10
D ₂	0.30	0.60	0.10
D ₃	0.10	0.10	0.80

Calculate the maximum amount that can be paid for the research.

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Step 1: Calculation of expected monetary value (EMV)

Possible demand situation	Probability	Alternative options	
		B ₁ (TZS'000)	B ₂ (TZS'000)
Highly favourable (D ₁)	0.70	500,000	0
Favourable (D ₂)	0.10	200,000	0
Unfavourable (D ₃)	0.20	(300,000)	0

$$\text{EMV (B}_1\text{)} = (0.7 \times 500,000,000) + (0.1 \times 200,000,000) + (0.2 \times (300,000,000)) = \text{TZS}310,000,000$$

$$\text{EMV (B}_2\text{)} = 0$$

Therefore, the maximum EMV = TZS310,000,000

Step 2: Calculation of joint probabilities

The next step involves calculation of joint probabilities by multiplying the prior probabilities with the respective conditional probabilities.

Demand situation	Prior probabilities	O ₁	Joint probabilities	O ₂	Joint probabilities	O ₃	Joint probabilities
D ₁	0.7	0.60	0.42	0.30	0.21	0.10	0.07
D ₂	0.1	0.30	0.03	0.60	0.06	0.10	0.01
D ₃	0.2	0.10	0.02	0.10	0.02	0.80	0.16
Cumulative			0.47		0.29		0.24

In column four, the joint probabilities of demand situations and option1 have been computed in the following manner:

$$P(D_1 \text{ and } O_1) = 0.7 \times 0.60 = 0.42$$

$$P(D_2 \text{ and } O_1) = 0.1 \times 0.30 = 0.03$$

$$P(D_3 \text{ and } O_1) = 0.2 \times 0.10 = 0.02$$

Similarly, the joint probabilities of demand situations and options 2 and 3 have been computed in columns six and eight respectively.

Step 3: Calculation of posterior probabilities

The prior probabilities need to be revised.

Demand situation	Posterior probability (O ₁)	Posterior probability (O ₂)	Posterior probability (O ₃)
D ₁	0.894	0.724	0.292
D ₂	0.064	0.207	0.042
D ₃	0.042	0.069	0.667

The posterior probabilities can be computed with the help of the data contained in the table of step 2. For example the posterior probabilities in column two have been computed in the following manner:

$$P(D_1 / O_1) = P(D_1 \text{ and } O_1) / P(O_1) = 0.42 / 0.47 = 0.894$$

$$P(D_2 / O_1) = P(D_2 \text{ and } O_1) / P(O_1) = 0.03 / 0.47 = 0.064$$

$$P(D_3 / O_1) = P(D_3 \text{ and } O_1) / P(O_1) = 0.02 / 0.47 = 0.042$$

The posterior probabilities in columns three and four can be computed in a similar way.

Step 4: Calculation of payoffs of the three options

$$\text{Option 1 (Conduct survey in Northern Europe): } (500,000,000 \times 0.894) + (200,000,000 \times 0.064) + ((300,000,000 \times 0.042) = \text{TZS}447,200,000$$

$$\text{Option 2 (Conduct survey in Southern Europe): } (500,000,000 \times 0.724) + (200,000,000 \times 0.207) + ((300,000,000 \times 0.069) = \text{TZS}382,700,000$$

Option 3 (Do not conduct survey at all): Nil

Step 5: Calculation of expected value of imperfect information (EVII)

$EVII = EMV (\text{with survey}) - \text{Maximum EMV}$

Where,

EMV (with survey) = the sum of (payoffs calculated for each option (in step 4) x cumulative posterior probability of each option)

$$= (TZS447,200,000 \times 0.47) + (TZS382,700,000 \times 0.29) + (TZS0 \times 0.24) = 210,184,000 + 110,983,000 + 0$$

$$= TZS321,167,000$$

Therefore, **EVII** = TZS321,167,000 - TZS310,000,000 = **TZS11,167,000**

TZS11,167,000 represents the amount that Kitchen Magic would be willing to pay for the survey. However, even after spending TZS11,167,000, the uncertainty regarding the demand and sales would not be totally eliminated.

5. Prepare decision trees and use it to solve a multi-stage decision problem.

[Learning Outcome f]

In the earlier sections, we have seen that the process of decision making involves selecting an alternative that is the best fit for the organisation under the circumstances. Most complex decisions are made under risk and uncertainty. Risk is the probability of not achieving the desired objective. Uncertainty is the lack of complete knowledge about the future event, which is required for the purpose of making a decision.

A decision maker is faced with a challenge of making a decision under the circumstances of risk and uncertainty. The risk is usually measured in terms of probability or frequency and the impact or consequence. The decision maker estimates probabilities of various outcomes, based on the past information and the available knowledge about the future. The sum of all probabilities would be 1.0, so that the set of outcomes in a decision problem should be mutually exclusive and collectively exhaustive.

Decision tree is a useful **analytical tool** for classifying the range of alternative courses of action and their possible outcomes. It is a diagram showing several possible courses of action and possible events (i.e. states of nature) and the potential outcomes for each course of action. It depicts in a systematic manner all possible sequences of decisions and consequences. Decision trees are designed to illustrate the full range of alternatives and events that can occur under all predicted conditions. It brings out logical analysis of a problem and enables a complete strategy to be drawn to cover all eventualities before an organisation becomes committed to a decided course of action.

In the decision tree, various act-event combinations and resulting pay-offs of the problems are considered based on the risks. Decision trees give a clear, concise and meaningful overview of outcomes of various alternatives.

Decision trees provide an effective method of decision making because they:

- clearly lay out the problem so that all options can be challenged;
- allow us to fully analyse the possible consequences of a decision;
- provide a framework within which to quantify the values of outcomes and the probabilities of achieving them;
- and
- help us to make the best decisions on the basis of existing information and best guesses.

Following criteria are used for decision making under conditions of risks and uncertainty:

- Expected Monetary Value (EMV)
- Expected Opportunity Loss (EOL)
- Expected Value of Perfect Information (EVPI)



Example

D Risk Limited is currently working on a process which, after paying for direct expenses, would bring a profit of TZS12 million. The following alternatives are available to the organisation:

- It can conduct research (R1) which is expected to cost TZS10 million with 90% chances of success. If it proves to be successful, it can earn a gross income of TZS25 million.
- It can conduct research (R2) which is expected to cost TZS8 million with a chance of 60% success; the expected gross income will be TZS25 million.
- It can pay royalty of TZS6 million for a new process which will bring a gross income of TZS20 million.
- It can continue with the current process.

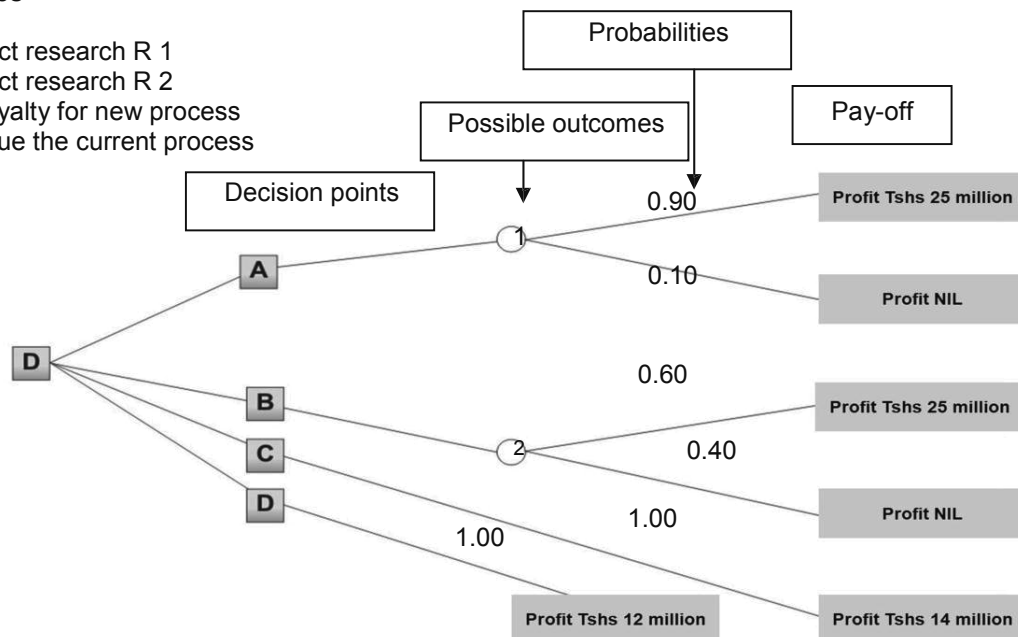
Due to limitation of resources it can conduct only one of the two types of research at a time.

Use of decision tree analysis to determine the optimal strategy for the organisation:

The various activity–event combinations and the resulting pay offs of the problem are given in the following decision tree diagram. The net expected monetary value (EMV) of each event / decision points are also indicated below:

Alternatives

- A Conduct research R 1
- B Conduct research R 2
- C Pay royalty for new process
- D Continue the current process



In the given decision tree, there are three types of nodes represented, namely decision nodes, chance nodes and terminal nodes.

**Tip**

Decision nodes: represent points at which the company has to make a choice of one alternative from a number of possible alternatives (e.g. points A, B, C, D mentioned above).

Chance nodes: represent points at which chance, or probability, plays a dominant role and reflect alternatives over which the company has (effectively) no control (e.g. points 1 and 2 mentioned above).

Terminal nodes: represent the ends of paths from left to right through the decision tree (e.g. pay-off).

Decision analysis at point D

Decision	Event	Probability	Gross Income(TZS million)	Expected Income (TZS million)
1. Conduct Research (R1)	Successful	0.9	25	22.5
	Unsuccessful	0.1	0	0
			Total	22.5
			Cost	(10.0)
			Net EMV	12.5
2. Conduct Research (R2)	Successful	0.6	25	15
	Unsuccessful	0.4	0	0
			Total	15
			Cost	(8)
			Net EMV	7
3. Pay royalty for new process	Certain	1	20	20
			Total	20
			Cost	(6)
			Net EMV	14
4. Continue the current process	Certain	1	12	

As the net EMV is the highest for the alternative “**Pay royalty for the new process**”, the optimal decision would be to introduce the new process on royalty basis.

Advantages of the decision tree method

Decision trees are able to generate understandable rules.

Decision trees perform classification without requiring much computation.

Decision trees are able to handle both continuous and categorical variables.

Decision trees provide a clear indication of which fields are most important for prediction or classification.

Disadvantages of the decision tree method

Decision trees are less appropriate for estimation tasks where the goal is to predict the value of a continuous attribute.

Decision trees are prone to errors in classification problems with many classes and relatively small number of training examples.

The process of developing a decision tree is expensive. At each node, each candidate splitting field must be sorted before its best split can be found. In some algorithms, combinations of fields are used and a search must be made for optimal combining weights. Pruning algorithms can also be expensive since many candidate sub-trees must be formed and compared.

Decision trees are not very effective in the case of non-rectangular regions. Most decision-tree algorithms only examine a single field at a time. This leads to rectangular classification boxes that may not correspond well with the actual distribution of records in the decision space.

Answers to Test Yourself

Answer to TY 1

In the given problem, the alternative strategies are:

S_1 – to buy the chocolate flavoured pastry

S_2 – to buy the strawberry flavoured pastry

The states of nature are:

N_1 – demand for 90 kg,

N_2 – demand for 100 kg,

N_3 – demand for 110 kg

Payoff (profit) can be calculated as follows:

$$\text{Payoff} = (\text{Quantity sold} \times \text{Profit per kg}) - (\text{Quantity unsold} \times \text{Loss per kg})$$

Here, profit per kg of the chocolate flavoured pastry sold = Selling price – Cost

$$= \text{TZS}8,000 - \text{TZS}6,000 = \text{TZS}2,000$$

Loss per kg of the chocolate flavoured pastry, if unsold = Cost – Resale price

$$= \text{TZS}6,000 - \text{TZS}3,000 = \text{TZS}3,000$$

Similarly, profit per kg of the strawberry flavoured pastry sold = $\text{TZS}7,000 - \text{TZS}4,000 = \text{TZS}3,000$

Loss per kg of the strawberry flavoured pastry, if unsold = $\text{TZS}4,000 - \text{TZS}3,000 = \text{TZS}1,000$

Hence for the chocolate flavoured pastry (i.e. strategy S_1), as the quantity purchased is 110 kg,

Profit if the demand is 90 kg	$(90 \text{ kg} \times \text{TZS}2,000) - (20 \text{ kg} \times \text{TZS}3,000) = \text{TZS}120,000$
Profit if the demand is 100 kg	$(100 \text{ kg} \times \text{TZS}2,000) - (10 \text{ kg} \times \text{TZS}3,000) = \text{TZS}170,000$
Profit if the demand is 110 kg	$(110 \text{ kg} \times \text{TZS}2,000) - 0 = \text{TZS}220,000$

For the strawberry-flavoured pastry, (i.e. strategy S_2), as the quantity purchased is 110 kg,

Profit if the demand is 90 kg	$(90 \text{ kg} \times \text{TZS}3,000) - (20 \text{ kg} \times \text{TZS}1,000) = \text{TZS}250,000$
Profit if the demand is 100 kg	$(100 \text{ kg} \times \text{TZS}3,000) - (10 \text{ kg} \times \text{TZS}1,000) = \text{TZS}290,000$
Profit if the demand is 110 kg	$(110 \text{ kg} \times \text{TZS}3,000) - 0 = \text{TZS}330,000$

Payoff table

Strategies	States of nature			Minimum profit	Maximum profit
	N_1	N_2	N_3		
S_1	TZS120,000	TZS170,000	TZS220,000	TZS120,000	TZS220,000
S_2	TZS250,000	TZS290,000	TZS330,000	TZS250,000	TZS330,000

(a) Maximin criterion

Steps followed in this approach:

Find out a minimum payoff for each of the strategies:

Strategy	Minimum profit
S_1	TZS120,000
S_2	TZS250,000

Select the maximum out of the minimum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the minimum payoffs i.e. the **maximin** payoff is TZS250,000.

Identify a strategy corresponding to the maximin payoff.

S_2 belongs to the strategy of buying the strawberry flavoured pastry, hence, it is the optimal strategy, therefore Sweetie should buy it.

(b) Maximax criterion

Steps followed in this approach:

Find out a maximum payoff for each of the strategies:

Strategy	Maximum profit
S ₁	TZS220,000
S ₂	TZS330,000

Select the maximum out of the maximum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the maximum payoffs i.e. the **maximax** payoff is TZS330,000.

Identify a strategy corresponding to the maximax payoff.

S₂ belongs to the strategy of buying the strawberry flavoured pastry, hence, it is the optimal strategy, and therefore Sweetie should buy it.

(c) Minimax regret criterion

Steps followed in this approach:

For each of the states of nature find out the regret

Regret = Largest payoff for a state of nature – Payoff for the strategy

We find out the regrets for each strategy, corresponding to each state of nature as:

Regret = Largest payoff for a state of nature – Payoff for the strategy

The following regret table is constructed to present the regrets for the strategies under the different states of nature.

Regret table

Strategy	N ₁	N ₂	N ₃	Maximum regret
S ₁	TZS130,000	TZS120,000	TZS110,000	TZS130,000
S ₂	0	0	0	0 (Minimax)

From the regret table, find out the maximum regret for each strategy.

Strategy	Maximum regret
S ₁	TZS130,000
S ₂	TZS0

Select the minimum from the maximum regrets selected above – i.e. the minimax regret strategy S₂ with regret of TZS0 is selected, according to the minimax regret criteria.

Select the strategy corresponding to the minimax regret.

S₂ (i.e. the strategy of buying the strawberry flavoured pastry) is the optimal strategy and Sweetie should buy the strawberry-flavoured pastry.

Answer to TY 2**Calculation of expected value**

Amount in TZS'000

Stock (Events)	Probability	Demand / Event of nature				EMV
		0	100	200	300	
0	0.20	0	0	0	0	0
100	0.30	(100)	40	40	40	6
200	0.30	(200)	(60)	80	80	(30)
300	0.20	(300)	(160)	(20)	120	(72)

Highest amount is TZS6,000, hence EMV = TZS6,000

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Note: EMV column is calculated as follows:

For third row of inventory and second column of demand:

Inventory is 200 and demand is 100. Hence, total cost will be $200 \times \text{TZS}1,000 = \text{TZS}200,000$ and selling price = $100 \times \text{TZS}1,400 = \text{TZS}140,000$

$$\begin{aligned}\text{Profit} &= \text{Sales} - \text{Cost} \\ &= \text{TZS}140,000 - \text{TZS}200,000 \\ &= \text{TZS}60,000 \text{ Loss}\end{aligned}$$

The rest of the calculations are done in a similar way. The optimal inventory action is the one with the highest EMV, i.e. inventory of 100 flowers.

Expected value with perfect information = Maximum pay-off for each event $\times$ Probability

$$\begin{aligned}\text{EVwPI} &= (0 \times 0.20) + (40,000 \times 0.30) + (80,000 \times 0.30) + (120,000 \times 0.20) \\ &= 0 + 12,000 + 24,000 + 24,000 \\ &= 60,000\end{aligned}$$

With the existing information, the best decision that can be made is to hold an inventory of 100 flowers and earn TZS6,000. With perfect information (forecast), the decision maker could make as much as TZS60,000.

Hence, the expected value of perfect information is $\text{TZS}60,000 - \text{TZS}6,000 = \text{TZS}54,000$. This is the maximum price the decision maker would be willing to pay for additional information.

Quick Quiz

- _____ is a conditional value of a strategy in juncture of a particular event.
- Which approach is followed by a pessimistic decision-maker?
- State the formula for calculating Expected Value.
- State the steps to be followed for arriving at a decision under maximax criteria.

Answers to Quick Quiz

- Payoff
- Maximin approach is followed by a pessimistic decision-maker.
- Expected value $[E(s)] = p_1x_{11} + p_2x_{12} + \dots + p_{n-1}x_{1n-1} + p_nx_{1n}$**
$$= \sum_{j=1}^n p_j x_{ij}$$

Where,

's' denotes a particular strategy

' x_{ij} ' denotes payoffs at the juncture of strategy j and state of nature i

'n' denotes number of possible events for a particular strategy

The probabilities of the possible events are denoted by $p_1, p_2, \dots, p_{n-1}, p_n$.

- Steps followed in the maximax approach

Find out the maximum payoff for each of the strategies.

Select the maximum out of the maximum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the maximum payoffs i.e. **maximax**.

Identify the strategy corresponding to the maximax payoff.

Self Examination Questions

Question 1

Volvo Travel agency keeps 5, 10 or 20 Volvo cars depending on the demand in the market. The firm knows the profit or loss which these varying demand situations give it every day. The firm also has probability distribution of the various states of demand on the basis of the past experience. The payoffs table and the probability distribution are given below:

PAYOFF MATRIX (TZS'000)			
Strategy			
Demand	5 Volvos	10 Volvos	20 Volvos
Low	200	-100	-300
Moderate	250	300	-500
High	300	500	600

Probability Distribution			
Demand	Low	Moderate	High
Prior Probability	0.20	0.30	0.50

If the firm wishes to maximise its expected profit, what will be its optimal decision?

Question 2

Pearl, a cosmetics company, is considering the introduction of a new product to replace an existing product. The strategies for the decision are:

A new product with new packaging at a much higher price; or

A moderate change in the composition of the existing product with new packaging at a moderate increase in the price; or

No change in the composition of the existing product with no change in packaging except the addition of the word 'new' and a negligible increase in price

The three possible states of nature or events are:

- (i) High increase in sales
- (ii) No change in sales
- (iii) Decrease in sales

The following payoff is worked out in terms of annual net profits for each of the strategies of the three events.

States of nature →	Payoffs in (TZS million)		
Strategies ↓	S ₁	S ₂	S ₃
A ₁	550	250	50
A ₂	310	350	0
A ₃	250	225	150

Required:

Which strategy should the concerned executive choose on the basis of?

- (a) Maximin criterion
- (b) Maximax criterion
- (c) Minimax regret criterion

Question 3

Boost Plc wants to make a public issue of TZS1,000 million (0.1 million shares of TZS10,000 each) for its expansion programme. If the issue were made now it would be fully taken up at a price of TZS15,000 per share. However, the company is facing two crucial situations, both of which may influence the share price in the near future, namely:

- (i) A Bill has been proposed in Parliament which, if passed, will adversely affect the company's share price.
- (ii) The possibility of a major acquisition of a refinery company, which is expected to lead to an increase in Boot's share price.

Management has determined the following prices in the given situations:

- (i) The Bill is passed and the refinery company acquired – share price rises to TZS17,000
- (ii) The Bill is passed but the refinery company not acquired – share price stays at TZS15,000
- (iii) The Bill is not passed but the refinery company acquired – share price hovers around TZS16,000
- (iv) The Bill is not passed and refinery company is not acquired – share price drops to TZS8,000

Management has also identified three possible strategies that the company could adopt, namely:

- Issue all the shares now
- Issue all the shares after both the events occur
- Issue 50% now and 50% after both the events occur

Required:

- (a) Draw up a payoff table for the company and determine the minimax regret solution.
- (b) Determine the optimum policy for the company using the criterion of maximising expected payoffs, given the estimate that the probability of the bill being passed is 55%, and the chance of acquiring the refinery company is 65%, these probabilities being independent.

Question 4

Flora, a florist, sells flowers at TZS5,500 per bouquet. The direct cost of a bouquet is TZS3,500. Overheads attributable to the bouquet are TZS750.

Unsold bouquets are sold at the end of the day at TZS4,000.

Flora has estimated the following demand for a day with the corresponding probabilities:

Demand (in bunch)	0	1	2	3	4	5
Probability	0.01	0.07	0.08	0.3	0.5	0.04

Find out the optimal production of flowers.

(Assume that all unsold bouquets will be sold)

Question 5

Tabat Ltd is a shoe manufacturer. In the last two years, the company has not introduced a new variety of shoes. It has TZS100 million surplus cash for which management is exploring introducing three new product lines, each with different levels of price, profitability and sales volumes. Market research has been conducted to estimate customer demand for each type of shoe. Each type of shoe requires an initial investment of TZS50 million, so the directors are faced with a decision to choose two out of three options.

The three new shoe products have been named TAA, BAA and DAA. TAA has been estimated as having a 90 per cent take-up from customers as it is a variation of an existing model which has been very successful. BAA has a take-up estimate of 85 per cent; however, DAA has been estimated at only 55 per cent as it is a new design that has been targeted as a diversion away from market trends, as a signature item. Taba Ltd's marketing department has given the unit sales estimations along with the sales price set for each new product. The finance department has provided the cost estimates of each new shoe to complete the unit profit analysis.

A summary of the data is as follows:

Product	Take Up (%)	No. of Units	Sales Value (TZS million)	Cost (TZS million)	Profit (TZS million)
TAA	90%	10,000	395	158	237
BAA	85%	10,000	445	190	255
DAA	55%	7,500	59	190	405

In case the company decides not to introduce any new product, management can park the surplus cash in a liquid financial instrument and wait for alternative investment opportunities.

Management is also worried that the brand of the company may lose popularity due to lack of innovativeness in introduction of new products in the market.

Required:

Construct a decision tree showing various options for enabling management to arrive at a decision.

***Question 6 - Drury**

Shifters Haulage (SH) is considering changing some of the vans it uses to transport crates for customers. The new vans come in three sizes; small, medium and large. SH is unsure about which type to buy. The capacity is 100 crates for the small van, 150 for the medium van and 200 for the large van.

Demand for crates varies and can be either 120 or 190 crates per period, with the probability of the higher demand figure being 0.6.

The sale price per crate is TZS 10 and the variable cost TZS 4 per crate for all van sizes subject to the fact that if the capacity of the van is greater than the demand for crates in a period then the variable cost will be lower by 10% to allow for the fact that the vans will be partly empty when transporting crates.

SH is concerned that if the demand for crates exceeds the capacity of the vans then customers will have to be turned away, SH estimates that in this case goodwill of TZS 100 would be charged against profits per period to allow for lost future sales regardless of the number of customers that are turned away.

Depreciation charged would be TZS 200 per period for the small, TZS 300 for the medium and TZS 400 for the large van.

SH has in the past been very aggressive in its decision-making, pressing ahead with rapid growth strategies. However, its managers have recently grown more cautious as the business has become more competitive.

Required:

- Explain the principles behind the maximax, maximin and expected value criteria that are sometimes used to make decisions in uncertain situations.
- Prepare a profits table showing the SIX possible profit figures per period.
- Using your profit table from (b) above discuss which type of van SH should buy taking into consideration the possible risk attitudes of the managers.
- Describe **THREE** methods other than those mentioned in (a) above, which businesses can use to analyze and assess the risk that exists in its decision making.

***Question 7**

RY Limited a transatlantic airline company has recently launched a low-cost airline company providing flights within Europe. The market is highly competitive and two other low-cost airlines, B Limited and G Limited, together hold 98% of the market.

RY Limited commissioned some market research to help with the pricing decision for one route, London to Paris, which it is thinking of offering. The research identified three possible market states and the likely number of passengers that would be attracted at three price levels on this route.

TicketPrice Market	Probability	TZS 80 Passenger seats	TZS 90 Passenger seats	TZS 100 Passenger seats
Pessimistic	0.2	80	60	30
Most likely	0.6	100	90	80
Optimistic	0.2	150	150	120

Airport charges are incurred for each customer and these are expected to be either TZS 5 or TZS 6 per customer depending on the negotiations with the airports involved. The probabilities for the airport charges are 0.6 for an airport charge of TZS 5 per passenger and 0.4 for an airport charge of TZS 6 per customer.

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The fixed costs of a flight from London to Paris are TZS 4,422.

Required:

- (d) Draw a decision tree to illustrate the pricing decision faced by RY Limited
- (e) Using the decision tree or otherwise, establish the optimum price that RY Limited should charge in order to maximize profit.
- (f) If RY Limited knew that there would be a pessimistic market, which price should it charge in order to maximize profit?
- (g) Discuss the limitations of basing this decision on expected value calculations

*Question 8 ACCA (2013)

Gym Bunnies (GB) is health club. It currently has 6,000 members, with each member paying a subscription fee of sh. 720 per annum. The club is comprised of a gym, a swimming pool and a small exercise studio.

A competitor company is opening a new gym GB's local area, and this expected to cause a fall of GB's membership numbers unless GB can improve its own facilities. Consequently, GB is considering whether or not to expand its exercise studio in hope to improve its membership numbers. Any improvements are expected to last for three years.

Option 1

No expansion. In this case, membership numbers would be expected to fall to 5,250 per annum for the next three years. Operational cost would stay at their current level of TZS 80 per member per annum.

Option 2

Expand exercise studio. The capital cost of this would be TZS 360,000. The expected effect on membership numbers for the next three years is as follows.

Probability effect on membership numbers

- 0.4 Remain at their current level of 6,000 members per annum.
- 0.6 Increase to 6,500 members per annum.

The effect on operational costs for the next three years is expected to be:

Probability effect on operational cost

- 0.5 Increase to TZS 120 per annum.
- 0.5 Increase to TZS 180 per annum.

Required:

- a) Using the criterion of expected value, prepare and fully label a decision tree that shows the two options available to GB. Recommend the decision that GB should make.
- b) Calculate the maximum price that GB should pay for perfect information about expansion's exact effect on MEMBERSHIP NUMBERS.
- c) Briefly discuss the problems of using expected values for decision of this nature

*Question 9 ACCA (2011)

Cement Co is a company specializing in the manufacture of cement, a product used in the building industry. The company has found that when weather conditions are good, the demand for cement increases since more building work is able to take place. Last year, the weather was so good, and the demand for cement was so great, that Cement Co was unable to meet demand. Cement Co is now trying to work out the level of cement production for the coming year in order to maximize profits. The company doesn't want to miss out on the opportunity to earn large profits by running out of cement again. However, it doesn't want to be left with large quantities of the product unsold at the end of the year, since it deteriorates quickly and then has to be disposed of. The company has received the following estimates about the probable weather conditions and corresponding demand levels for the coming year:

Weather	Probability	Demand
Good	25%	350,000 bags
Average	45%	280,000 bags
Poor	30%	200,000 bags

Each bag of cement sells for TZS 9 and costs TZS 4 to make. If cement is unsold at the end of the year, it has to be disposed of at a cost of TZS 0.50 per bag.

Cement Co has decided to produce at one of the three levels of production to match forecast demand. It now has to decide which level of cement production to select.

REQUIRED:

- (a) Construct a payoff table to show all the possible profit outcomes.
- (b) Decide the level of cement production the company should choose, based on the following decision rules:
 - (i) Maximin
 - (ii) Maximax
 - (iii) Expected value

You must justify your decision under each rule, showing all necessary calculations.

- (c) Describe the 'maximin' and 'expected value' decision rules, explaining when they might be used and the attitudes of the decision makers who might use them.

***Question 10 ACCA (2014)**

Gam Co sells electronic equipment and is about to launch a new product onto the market. It needs to prepare its budget for the coming year and is trying to decide whether to launch the product at a price of TZS 30 or TZS 35 per unit. The following information has been obtained from market research:

Price per unit TZS 30		Price per unit TZS 35	
Probability	Sales volume	Probability	Sales volume
0.4	120,000	0.3	108,000
0.5	110,000	0.3	100,000
0.1	140,000	0.4	94,000

Notes

1. Variable production costs would be TZS 12 per unit for production volumes up to and including 100,000 units each year. However, if production exceeds 100,000 units each year, the variable production cost per unit would fall to TZS 11 for all units produced.
2. Advertising costs would be TZS 900,000 per annum at a selling price of TZS 30 and TZS 970,000 per annum at a price of TZS 35.
3. Fixed production costs would be TZS 450,000 per annum.

Required:

- a) Calculate each of the six possible profit outcomes which could arise for Gam Co in the coming year.
- b) Calculate the expected value of profit for each of the two price options and recommend, on this basis, which option Gam Co would choose.
- c) Briefly explain the maximin decision rule and identify which price should be chosen by management if they use this rule to decide which price should be charged.
- d) Discuss the factors which may give rise to uncertainty when setting budgets.

Answers to Self-Examination Questions**Answer to SEQ 1**

The payoff table would be as follows:

Demand	Prior Prob.	Expected payoff (TZS'000)		
		5 Volvos	10 Volvos	20 Volvos
Low	0.20	$0.2 \times 200 = 40$	$0.2 \times -100 = -20$	$0.2 \times -300 = -60$
Moderate	0.30	$0.3 \times 250 = 75$	$0.3 \times 300 = 90$	$0.3 \times -500 = -150$
High	0.50	$0.5 \times 300 = 150$	$0.5 \times 500 = 250$	$0.5 \times 600 = 300$
	1.00	265	320	90

Since, for the option of 10 Volvos, the EMV is the highest i.e. TZS320,000, the optimal solution for the firm would be to maintain 10 Volvo buses.

Answer to SEQ 2

States of nature →	Payoffs in (TZS million)		
Strategies ↓	S ₁	S ₂	S ₃
A ₁	550	250	50
A ₂	310	350	0
A ₃	250	225	150

Maximin criterion

Steps followed in this approach:

Find out the minimum payoff for each strategy:

Strategies	Minimum Payoff
A ₁	50
A ₂	0
A ₃	150

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Select the maximum out of the minimum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the minimum payoffs i.e. **maximin** payoff is TZS150 million. Identify the strategy corresponding to the maximin payoff.

TZS150 million payoff belongs to strategy A3 i.e. no change in the composition of the existing product with no change in the packaging except the addition of the word 'new' and a negligible increase in price.

Therefore, this strategy is to be selected under the maximin approach.

Maximax criterion

Method followed in this approach:

Find out the maximum payoff for each strategy

Strategies	Maximum Payoff (TZS million)
A ₁	550
A ₂	350
A ₃	250

Select the maximum out of the maximum payoffs for each strategy as identified in the preceding step. The payoff thereby selected is the maximum out of the maximum payoffs i.e. **maximax** payoff is TZS550 million.

Identify the strategy corresponding to the maximax payoff.

TZS550 million pay-offs belongs to strategy A1 i.e. a new product with new packaging at a much higher price. Therefore, this strategy is to be selected under the maximax approach.

Minimax regret criterion

This is a regret strategy. In this approach, the following method is adopted:

For each of the states of nature find out the regret

Regret = Largest payoff for a state of nature – Payoff for the strategy

This will give a regret table.

From the regret table, find out the maximum regret for each strategy.

Select minimum from the maximum regret selected above – minimax.

Select the strategy corresponding to the minimax regret.

Strategy	States of Nature		
	S ₁ (TZS million)	S ₂ (TZS million)	S ₃ (TZS million)
A ₁	0 (550 - 550)	100 (350 - 250)	100 (150 - 50)
A ₂	240 (550 - 310)	0 (350 - 350)	150 (150 - 0)
A ₃	300 (550 - 250)	125 (350 - 225)	0 (150 - 150)

Strategy	Maximum opportunity loss (TZS million)
A1	100
A2	240
A3	300

The executive should choose strategy A₁ as this strategy minimises the maximum of the opportunity losses.

Answer to SEQ 3

(a) In a minimax regret approach, the following steps are adopted –

Step 1: Identify strategies and events

Strategies are:	Events are:
S1-Issue all the shares now S2-Issue all the shares after both the events occur S3-Issue 50% now and 50% after both the events occur	E1-Bill is passed and refinery company acquired E2-Bill is passed but refinery company not acquired E3-Bill is not passed but refinery company acquired E4-Bill is not passed and refinery company not acquired

Payoff tables (TZS million)			
Events	S ₁	S ₂	S ₃
E ₁	1,500	1,700	$(1,500 \times 0.5) + (1,700 \times 0.5) = 1,600$
E ₂	1,500	1,500	$(1,500 \times 0.5) + (1,500 \times 0.5) = 1,500$
E ₃	1,500	1,600	$(1,500 \times 0.5) + (1,600 \times 0.5) = 1,550$
E ₄	1,500	800	$(1,500 \times 0.5) + (800 \times 0.5) = 1,150$

For each of the states of nature find out the regret

Regret = Largest payoff for a state of nature – Payoff for the strategy

This will give a regret table.

Regret table (TZS million)			
	Alternative strategy		
Events	S ₁	S ₂	S ₃
E ₁	0.20	0	0.10
E ₂	0	0	0
E ₃	0.10	0	0.05
E ₄	0	0.70	0.35

From the regret table, find out the maximum regret for each strategy

	S ₁	S ₂	S ₃
Max. regret	0.20	0.70	0.35

Select the minimum from the maximum regret selected above – (i.e. minimax regret)

It is 0.2.

Select the strategy corresponding to the minimax regret.

Minimax regret is related to strategy S₁ i.e. issue all the shares now.

(b) Calculation of expected value

Calculations for expected payoff of various acts									
Event				Expected payoff (TZS million)					
	Probability			S ₁		S ₂		S ₃	
	Bill passing	Acquisition of refinery	Product	Pay off	Payoff x Probability	Pay off	Payoff x Probability	Pay off	Payoff x Probability
E ₁	0.55	0.65	0.3575	1500	536.25	1700	607.75	1,600.00	572.00
E ₂	0.55	0.35	0.1925	1500	288.75	1500	288.75	1,500.00	288.75
E ₃	0.45	0.65	0.2925	1500	438.75	1600	468.00	1,550.00	453.38
E ₄	0.45	0.35	0.1575	1500	236.25	800	126.00	1,150.00	181.13
Expected value					1,500.00		1,490.50		1,495.25

Since S₁ has the highest expected payoff of 1,500 million, the company should adopt strategy S₁.

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Answer to SEQ 4

Step 1: Identify strategies and states of nature

Strategies will be producing 0, 1, 2, 3, 4, 5 bouquets of flowers.

State of nature is demand for bouquets of flowers.

Step 2: Calculate payoffs

Payoff = profit / loss on sale of bouquets of flowers.

Cost of a bouquet = Direct costs + Overheads
 = TZS3,500 + TZS750
 = TZS4,250

Profit (when bouquets are sold) = TZS5,000 - TZS4,250 = TZS1,250

Loss (when bouquets are unsold) = TZS4,000 - TZS4,250 = (TZS250)

Payoff will be calculated as:

(Profit x Number of bouquets of flowers sold) + (Loss x Number of bouquets of flowers unsold)

Therefore the **conditional payoff table** will be –

Demand for bouquets	Probability of demand	Strategies- Number of bouquets					
		0	1	2	3	4	5
0	0.01	0	(250)	(500)	(750)	(1,000)	(1,250)
1	0.07	0	1,250	1,000	750	500	250
2	0.08	0	1,250	2,500	2,250	2,000	1,750
3	0.30	0	1,250	2,500	3,750	3,500	3,250
4	0.50	0	1,250	2,500	3,750	5,000	4,750
5	0.04	0	1,250	2,500	3,750	5,000	6,250

Step 3: From payoff tables calculate EMV (i.e. payoff x corresponding probability) for each strategy

Payoff table

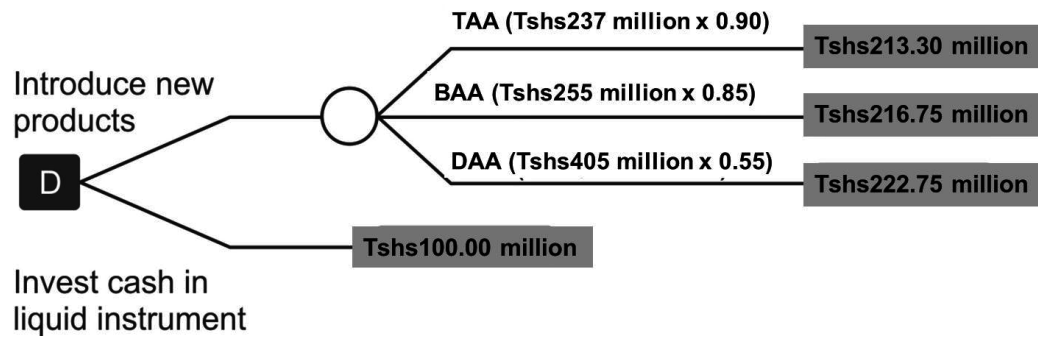
Demand for bouquets	Probability of demand	Strategies- Number of bouquets					
		0	1	2	3	4	5
0	0.01	0	(2.50)	(5.00)	(7.50)	(10.00)	(12.50)
1	0.07	0	87.50	70.00	52.50	35.00	17.50
2	0.08	0	100.00	20.00	180.00	160.00	140.00
3	0.30	0	375.00	750.00	1,125.00	1,050.00	975.00
4	0.50	0	625.00	1,250.00	1,875.00	2,500.00	2,375.00
5	0.04	0	50.00	100.00	150.00	200.00	250.00
EMV		0	1,235.00	2,365.00	3,375.00	3,935.00	3,745.00

Step 4: Find out the strategy with the maximum profit payoff

As the EMV for Strategy 4 is the highest, the daily production and sale of 4 bouquets of flowers is the most profitable strategy.

Answer to SEQ 5

Decision tree (TABA Ltd)



Analysis and conclusion

The output from the decision tree indicates that DAA is the most profitable product per unit, and is estimated to have sufficient take-up to match the overall contribution from TAA and BAA. The financial analysis indicates that the working capital of TZS100 million available should then be allocated to investing in DAA and BAA, since the company can introduce two products.

SECTION C1: OBJECTIVES OF BUDGETS

■ Get Through Intro

A budget is a planning and controlling tool for an organisation. It is not only a cost monitoring mechanism but also an integral part of an organisation's planning and control activities. It aims at achieving organisational objectives and motivating the personnel concerned.

The ideal budgeting system is one that encourages goal congruence (i.e. a situation where the personal goals of the employees match the organisational goals). Greater participation of the supervisory level in the management process can ensure goal congruence.

Knowledge obtained from this section will help you as a management accountant in devising budgeting systems so as to ensure goal congruence in your organisation in the future. Understanding this section will also enable you to answer the examination questions on this topic.

■ Learning Outcomes

- a) Illustrate how corporate and divisional objectives may differ and can be reconciled.
- b) Identify and resolve conflicting objectives and explain its implications.

1. Illustrate how corporate and divisional objectives may differ and can be reconciled. [Learning outcome a]

Every organisation prepares budgets for the various activities / functions of the organisation. Budgets are also used to coordinate all these functional activities and make a detailed common plan. Budgetary control is used as a tool of planning and control.

1.1 Meaning and definitions



Definition

A budget is a quantitative statement, for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget provides a focus for the organisation, it aids the co-ordination of activities and facilitates control. Planning is achieved by means of a fixed master budget, whereas control is generally exercised through the comparison of the actual costs with a flexible budget.



Definition

A budgetary control system is a means of monitoring revenue and costs, and thereby exercising control in an entity by devising budgets and comparing budgeted figures with the actual results, to find discrepancies, if any, and to take corrective actions.

The success of an organisation is the outcome of the collective efforts of all the departments. All departments should aim to achieve the higher objectives of the organisation. Objectives are rarely clearly defined. Moreover, an organisation may have multi-dimensional objectives, some of which may conflict. The difference between the objectives may be between the organisation as a whole and a department or between several departments.

1.2 Conflict between organisation as a whole and individual department

The idea behind a well co-ordinated budget is that, individual departments in co-operation with each other should produce a combined effect, greater than the sum of their separate effects (known as synergy). Co-ordinated work helps an organisation to achieve its overall objectives. But, in industry, it is very common to observe that different managers decide their objectives differently due to departmental rivalries and to maximise their contribution. They ignore the organisational objectives. This affects the target of achieving goal congruence.

Goal congruence is the agreement between corporate objectives and the actions of various departments and managers.

The following may contribute to conflicting objectives between an organisation and its departments:

1. Reward system

Generally, the reward system of an organisation is linked to the performance evaluated on the basis of the budget prepared for various departments. Due to this, individual managers set their targets in isolation, ignoring the impact on the organisational objectives. This is one of the major causes of conflict between the individual objectives and the organisational objectives.

2. Objectives are not clearly defined

When the organisation's objectives are not clearly defined before the individual budgets are prepared, it may result in conflicting objectives.

If the organisation's objectives are well defined in advance, the individual preparing the departmental budgets will know the limits within which he will have to act.

3. Imperfect information

When there is no proper communication between the top and middle or lower level management, perfect information may not be available, resulting in conflicting objectives.

4. Departmental rivalry

Every manager tries to perform better than the other managers. In this race, a manager may prepare a budget that will conflict with the organisation's objectives. To avoid this conflict, functional budgets are reviewed and then modified (if necessary) by top management.

1.3 Inter-departmental conflicts

In the course of preparing the budgets for individual departments, the departmental objectives should not conflict with each other as well as with the organisational objectives. Instead, they should be synchronised in order to reach synergy.

The budgets of individual departments are linked with each other.



Example

The purchase budget is based on the production budget i.e. depends on the material required for production. The production budget is based on the sales budget i.e. the target number of units to be sold.

In such a case, when one budget is linked with another, there is the possibility that the objective of one department will conflict with that of another department.



Example

The purchase department has planned the quantity and timing of raw material procurement in such a way that it does not allow for the smooth flow of production, causing conflict with the production department.

In order to avoid this, the budget should be co-ordinated and agreed upon by the functional heads before being finalised.

1.4 Reconciliation of the budgets

For a budgetary control system to be successful, the objectives of the individual departmental budgets need to be reconciled with the objectives of the organisation as a whole. This also helps to facilitate goal congruence. Reconciliation of budgets involves:

1. Participation of all levels of management

All levels of management should be involved in the budget process. Lower level management should make their suggestions and highlight any grass root level problems noticed by them. Top level management should give guidelines on the preparation of the budgets. The budgetary targets should be set in line with the strategic objectives, as set by top management. As all levels of management agree on the targets, it helps to avoid inter-departmental conflicts as well as conflicts between the organisation and an individual department.



Example

Ambition Ltd has an objective for the year to capture 65% of the market share. However, according to the production manager, the desired level of production cannot be produced due to the non-availability of skilled labour. In order to achieve this objective, the senior manager may decide to hire more workers or arrange shift-work, overtime-work etc.

In this case, if the senior management sets the budget targets without consulting the functional managers (including the production manager), the production manager may have to accept a budget which is, in fact, unachievable.

On the other hand, if the production manager prepares the budgets without consulting the other functional heads (e.g. finance manager) and senior management, he may set a target which will not be in line with the corporate objectives and hence will not achieve goal congruence.

2. Co-ordination of budgets

Co-ordination of individual budgets with others, and then approval by top management will resolve the matter of conflicting objectives of the organisation, and that of the departments as well as amongst the departments.



Example

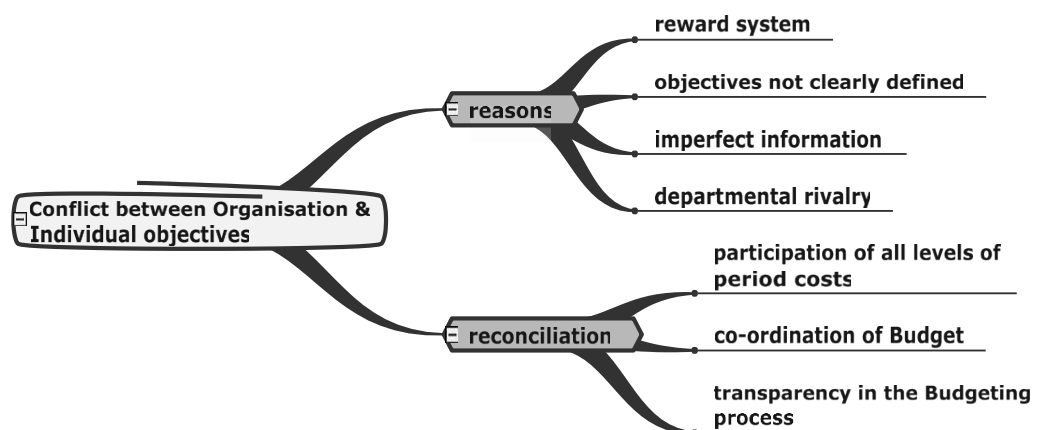
A production manager proposes a budget in which production is 10% higher than the previous year. In order to achieve this, he will require extra hours of production. The finance manager is not willing to pay an extra amount in the form of overtime premium due to lack of sufficient working capital. Obviously, the production manager will need to modify his budget proposal to bring it in line with the cash budget.

3. Transparency in the budgeting process

While preparing budgets there should be free communication horizontally as well as vertically. This will create a sense of belonging within the organisation and will motivate everyone to work hard.

In addition, as a result of inter-departmental conflicts, it may become necessary to amend the budget to accommodate the departmental targets. In such cases, modifications should be made considering the views of the departmental heads; otherwise they will be discouraged and may not actively participate in the operational process.

SUMMARY



Test Yourself 1

What is goal congruence? How does an organisation achieve it?

2. Identify and resolve conflicting objectives and explain its implications.

[Learning outcome b]

2.1 Objectives of budget

A budget is prepared with multiple objectives, as mentioned below:

(i) Planning

A budget is a basis for planning. The budget motivates managers to prepare a plan. In a budget, the targets are already decided. In order to meet the budget, it is necessary to decide the plan of action that leads them to achieve the target.

(ii) Controlling

A budgetary control system identifies any variances, investigates the reasons for these variances and accordingly leads to corrective action being taken. Any extravagant expenses are identified and steps are taken to avoid their recurrence. Therefore, a budget acts as a tool for controlling.

(iii) Communication

In a budgetary control system, top management communicates its expectations to the lower level management. Lower level management communicates its problems in fulfilling the set targets.

(iv) Co-ordination

A budget aims to co-ordinate the activities of an organisation. The organisation should try to achieve goal congruence. The individual objectives and actions are combined to achieve the organisational objectives.

(v) Motivation

Often, a reward system is connected to the success of the budget. In such cases, a budget motivates managers to give their best work.

(vi) Performance evaluation

A budget provides a basis for evaluation of the performance of a division or a manager. Actual results are compared with budgeted figures and any difference is analysed to correct in the future.

(vii) To increase profitability

In a budget, extravagant expenses are identified. These can then be avoided in the future by decreasing costs, and thereby increasing profitability.

(viii) To ensure optimal utilisation of the resources

In a budget, limiting factors / constraints are identified, and are allocated in such a manner that they can be utilised optimally.

(ix) To identify the areas of inefficiency

By identifying the variances, a budgetary control system helps in identifying the areas of inefficiency.

Sometimes these objectives may conflict with each other. Below are some examples of conflicting objectives:

2.2 Examples of conflicting objectives of budgetary control systems

Planning, controlling, motivating, performance evaluation, co-ordination etc. are the objectives of a budget. Some of them may conflict with each other such as:

1. Planning objective with motivation

In order to motivate the personnel of the organisation, budgets are usually set high. However, such budgets may not be suitable for planning, as planning requires that the target set should be achievable.

**Example**

Ahead Ltd has planned a sales target 20% higher than last year, which is unlikely to be achieved although it may create motivation. However, such an unachievable target cannot form a base for planning.

2. Planning objective with performance evaluation

Budgets are prepared in advance of the budget period. For planning, it is essential, but for performance evaluation, the preparation of budgets ahead of the budget period may not be suitable. The circumstances and environment at the time when the budgets are set may differ drastically from those at the time of actual performance.

Therefore, performance should be measured by comparing the actual performance with the adjusted budgeted performance, in order to avoid / resolve the conflicts.

**Example**

At the time of preparing the budget for a transport company, the price of fuel (e.g. petrol) was predicted to be TZS1,650 per litre. In reality, due to an unprecedented rise in the price of petrol internationally, the company had to buy petrol at around TZS2,000 per litre, causing a major shortfall in achieving the profit target. If the budget is not revised in this case, considering the reality of the petrol price, the performance evaluation will be misleading.

3. Motivation objective with performance evaluation

In order to motivate the personnel in an organisation, goals are usually set high. This practice sometimes acts as undue pressure on the personnel, and instead of motivating, de-motivates them. This ultimately affects their performance and consequently the objective to motivate fails.

2.3 Implications of the conflicting objectives

From the above conflicts it is clear that the main reasons for conflict between objectives are:

1. Unachievable targets may result in failure of the budgetary system.
2. Budgets are prepared in advance, not taking into account that circumstances can change. If circumstances changed the budget targets will not be achieved.

In both circumstances, the success of the budgetary system will be doubtful.

If the targets set are high, it will de-motivate the budget holders i.e. those responsible for implementing the budget and as a result the targets may not be achieved. They will become unhappy because their performance will be measured on the basis of these high targets. If the internal and external environment undergoes significant changes, which are not taken care of, the targets set may lose their relevance.

In order to avoid this, proper care should be taken while setting the targets. They should not be very high / unachievable or very easy to achieve.

Also, when substantial change takes place in the environment, the changes should be identified and wherever required, budgets should be revised accordingly.

2.4 Techniques to resolve the conflicts between objectives

These conflicts between objectives of the budget can be resolved by various management techniques. The following are examples of such management techniques.

1. Rolling budgets

Organisations operating in a frequently changing environment resort to rolling budgets. Unexpected and sudden changes make fixed budgets irrelevant. Rolling budgets are alternatively called continuous budgets. Rolling budgets cover a defined period of time e.g. one year, but are prepared more frequently causing regular updates in budget estimates by adding a further period and deducting the earliest period.



Example

An annual rolling budget is prepared on the last day of the previous year i.e. 31st December. Preparation of rolling budgets (updated every two months) is as follows:

Date of budget preparation	Period covered by budget
December 20X7	January 20X8 – December 20X8
February 20X8	March 20X8 - February 20X9
April 20X8	May 20X8 – April 20X9
June 20X8	July 20X8 – June 20X9
August 20X8	September 20X8 – August 20X9
October 20X8	November 20X8 – October 20X9
December 20X8	January 20X9 – December 20X9

Rolling budgets are prepared by taking into consideration recent experiences, therefore, when budgeted results are compared to actual results, variance due to changes in the environment is minimum.

2. Contingency planning

Budgets for a period are prepared well in advance. There is the possibility that a significant change may take place in the environment which will make meeting the objectives set in the original budget impossible. Conflicts caused by these changes can be avoided by contingency planning for a future course of action.



Example

A particular raw material may be in short supply during the budget period. To tackle this problem, a contingency plan may be devised to identify and procure a substitute material at short notice, if needed.

3. Updating through revised forecasts

As a budget is devised based on forecast, it is necessary to keep the organisation updated with recent events. This will help in planning as well as in performance evaluation. In addition, it will give the budget holder confidence that the budget is realistic and achievable.

4. Performance evaluation on the basis of revised budgets

There are certain circumstances / factors when it becomes necessary to revise the original budgets. When such a revision is made and approved, the revised budget, not the original budget, should be used to evaluate the performance of the person responsible for implementing the budget.

5. Judgement of the general manager

The role of top management is very important in resolving the conflicts between the objectives of the budget. Management should try to resolve the conflicts by getting involved in the process in the early stages. It should try to identify the changes in the environment and should identify the corresponding changes required in the budgets.

The judgement of the general manager is final and everyone abides by his verdict. Therefore, he is the person who can help in resolving conflicts.

6. Tight ship policy

This means that the organisational management procedures should be followed very closely. When an organisation is run like a tight ship, few allowances are permitted for unorthodox procedures.

7. An approach combining bottom-up approach and top-down approach

In the bottom-up approach, those who are directly responsible for meeting the budget set the targets. The next level of management then reviews these targets and suggests changes accordingly, in order to achieve goal congruence. This is one of the ways to avoid the conflict between planning and motivation because the planning carried out by lower level management will keep them motivated.

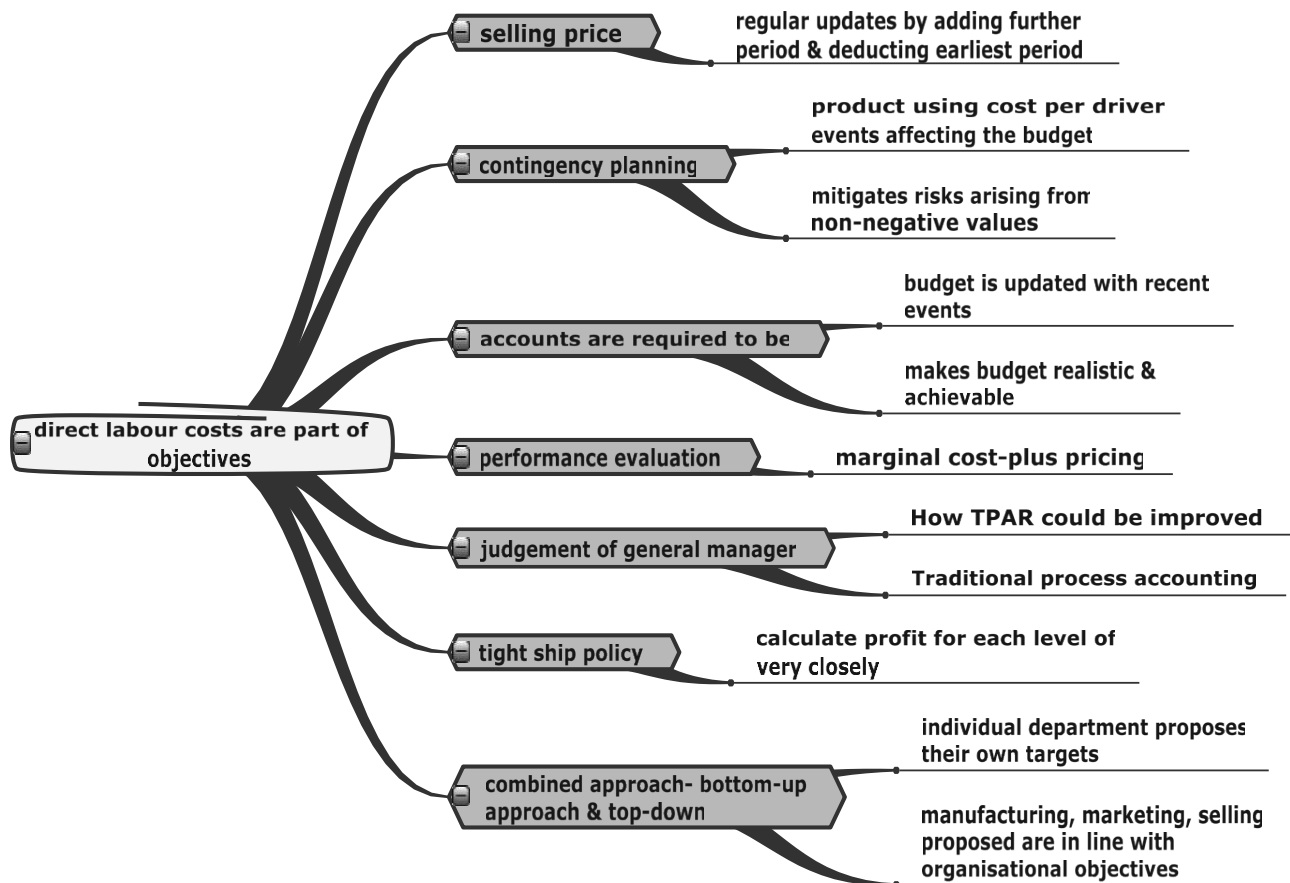
The bottom-up approach may cause conflicts between the divisional objectives, as each individual proposes his own target without communicating with the other departments. However these conflicts can be avoided if the superior level managers in the hierarchy check whether the objectives proposed are in line with the organisational objectives and not in conflict with other departments. It suggests that the budget should go through successive levels of review before reaching the final stage.



Example

An overambitious sales budget may be curtailed by top management so as to make the sales target feasible, keeping in mind the constraints of production capacity, working capital shortages and the supply of raw material. This alleviates the reasons for inter-departmental conflict and thereby achieves goal congruence.

SUMMARY



Test Yourself 2

Budgets are prepared with multiple objectives. However, these objectives may conflict with each other. Give examples of conflicting objectives. State the causes of conflicting objectives and how they can be avoided.

Answers to Test Yourself

Answer to TY 1

Goal congruence

Goal congruence means resemblance between the objectives of an individual / department and those of the organisation as a whole. In the case of goal congruence, meeting organisational goals ensures achieving individual / departmental goals.

The individual objectives should lead to achieving the organisational objectives and should not conflict with the organisational objectives. But, in most organisations, there is conflict between the organisational objectives and inter-departmental objectives. This is because the managers aim to achieve the best for their department and do not consider the overall objectives of the organisation.

As a budget is used as a basis for performance evaluation, individuals try to maximise their contribution and ignore the impact on the organisation as a whole or on the other departments.

As a result, it becomes difficult for an organisation to achieve its goals and thus, co-ordination and resolving conflict becomes the main job for management.

This conflict in inter-departmental objectives, between organisational objectives and individual objectives can be resolved by the following:

(a) Participation of all levels of management

If all levels of management are actively participating in the preparation of the budget, they can communicate to each other their expectations, problems etc. and arrive at a target that is acceptable to the top level of management as well as to those who are responsible for its implementation.

If the individual targets are set in line with the organisational strategy, there will be no conflict between the organisational objectives and the individual objectives. If top management is involved in the budget process, their decision will be final and this may resolve the conflict between various departments.

(b) Co-ordination of budgets

A top level manager should review departmental budgets to identify the conflicts (if any,) with the other departments. Such conflicts should be resolved by getting those responsible for preparing the budget involved in the process of negotiation / co-ordination. The targets which bring out the best from the maximum divisions / managers should be accepted, so that the budget is in the best interests of the organisation.

(c) Transparency in the budgeting process

Top management should communicate difficulties, if any, to the lower level management who are responsible for implementing the budgets, so that they feel motivated to perform and to co-operate in removing any organisational bottlenecks.

Answer to TY 2

Although a budget can serve many purposes, sometimes it fails to resolve the conflicts in goals. Generally the conflict is between planning, motivation and performance evaluation.

- (a) Planning with motivation:** in order to get the best from employees, budget targets are set high. This will serve the purpose of motivation, however such budgets are not suitable for planning, as planning requires the goals to be realistic and achievable.
- (b) Planning with performance evaluation:** budgets are made in advance. During the budget period, the environment may change so significantly that if budget figures are compared to the actual results it will reflect a distorted picture of the performance of a manager / department.
- (c) Motivation with performance evaluation:** if the budget targets are set high, it is better for motivation, but not for performance evaluation, as unachievable targets may de-motivate the employees.

The following are two reasons for conflicting objectives:

High targets are set

Changes in the external and internal environment, after the budget has been prepared, can cause an adverse / favourable impact on performance.

If high targets are set, they will motivate those responsible for the budget, but high estimations' cannot form a basis of planning. Also, as the budget is prepared in advance, it cannot be a good basis on which to evaluate performance as circumstances may change.

This conflict between the objectives can be overcome by the following techniques:

(a) Rolling budget

A rolling budget takes into account any developments in technology, economy, regulations, market movements etc. i.e. all the factors affecting the performance of an organisation. By adopting a rolling budget, an updated budget can be prepared which will provide realistic targets and objectives so that motivation, planning and performance evaluation will not conflict.

(b) Contingency planning

If an organisation plans for contingencies, significant changes in the environment can be taken care of automatically and hence will not affect the performance.

(c) General manager's judgement

The general manager's verdict is the final decision. Top management should interfere with the budget process when objectives are conflicting, in order to avoid further problems.

(d) Updating the revised forecasts

Keeping abreast with the latest information about the environment and any changing factors which influence the operations are essential to resolve the conflicts resulting from them. This helps in performance evaluation by providing the reasons for deviation from the original budgets.

(e) Performance evaluation on the basis of revised budget

If performance is evaluated on the basis of revised budgets, the evaluation becomes more realistic. If budgets are revised from time to time, and planning is devised on the basis of these revised budgets, the plan will be achievable and will be relevant in the environment in which the organisation operates.

(f) Tight ship policy

The tight ship policy does not leave room for any unorthodox or unplanned steps to be incorporated into the budgeting process. By strict adherence to the policies of the organisation, it does not provide any scope for conflict between the different levels of management.

(g) Participation of all levels of management

If all levels of management participate in the process of budget preparation, any conflicting issues will be discussed at the time the budget is prepared, and any reasons for further conflict will not arise.

Quick Quiz

1. Define a budget.
2. How does a budgetary control system monitor an organisation?
3. List any three objectives of a budget.
4. List any three reasons for not achieving goal congruence and having a difference in objectives.
5. How can participation by all levels of management avoid the conflict between the organisational objectives and individual objectives?
6. How does the motivation objective of the budget conflict with the performance evaluation objective?

Answers to Quick Quiz

1. A budget is a quantitative statement, for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget provides a focus for an organisation aids the co-ordination of activities and facilitates control. Planning is achieved by means of a fixed master budget, whereas control is generally exercised through the comparison of the actual costs with a flexible budget.
2. Once the budget is prepared, the actual performance is compared with the budgeted. If any significant deviation is revealed, it is investigated and corrective action is taken.
A budget also acts as a measure for evaluating the performance of the particular department and the person responsible for the budget.
3. Planning, Co-ordination, Communication, Motivation, Performance Evaluation.
4. Reward system, Unclear corporate objectives, Departmental rivalry
5. Participation by all the levels of management in preparation of the budget can reduce the conflicts between the objectives of the organisation as a whole and the objectives of individual departments. This is because top management provides guidelines for framing the budgets which they then communicate to their subordinates. If the subordinates have any problems with the targets set, they discuss their problems with management and accordingly come to the final decision on the targets, which should be accepted by both.
6. Top management generally sets high targets, as they motivate those responsible to meet the budgets. This is true to some extent, but when the targets are too high to achieve, the subordinates may get de-motivated and won't give their best. Also, as performance is measured on the basis of the budgets, setting objectives too high will affect performance.

Self-Examination Questions

Question 1

Explain how an organisational objective can be achieved through a budget.

Question 2

Enumerate the reasons for conflicts between the objectives of the organisation and of the individual departments, and state how these can be overcome.

Answers to Self-Examination Questions

Answer to SEQ 1

Corporate objectives can be achieved by properly planning for them. Once the corporate objectives are determined, it is necessary to prepare long-term plans and then split them into a number of short-term plans. Short-term financial plans are called a budget.

A budget is prepared to serve multiple objectives such as planning, motivation, co-ordination, controlling and performance evaluation.

A budget is a basis for planning. Once a budget has been prepared, it means that targets have been decided and the means of achieving the targets can now be devised.

While preparing a budget, limiting factors are identified and the budget is prepared so that all resources can be used optimally.

Once all the functional budgets have been prepared, they should be coordinated, so that the individual budgets are in line with the corporate objectives, and do not conflict with other departmental objectives.

A budget gives a target to those responsible for implementing budgets, so that they can put in their best efforts to meet the targets set in the budget. Often, rewards are linked to performance. This motivates them to meet the targets.

In the budgetary process, actual results for the budget period are regularly compared with the budgeted results. This is a feedback activity to measure the success of the budget. It gives an idea about where the organisation is and what kind of corrective action needs to be taken to meet the organisational objectives.

Answer to SEQ 2

Even if one of the objectives of the budget is co-ordination among the departments, which should lead to achieving the organisational objectives, there are certain practical issues which contribute to the conflicts between the organisational objectives and the objectives of the individual departments. These issues are:

(a) Reward system

In many cases, the reward system is linked to performance. This motivates a person to do his best to achieve the budget targets. But this also leads managers to make their own targets, ignoring the targets of the other departments and the organisation as a whole. This mentality is one of the major reasons for conflict between individual objectives and those of the organisation.

(b) Organisational objectives are not clearly defined

Often organisational objectives are not clear. As they are not clear to the lower level of management, there remains scope for conflict between the departmental objectives and the overall organisational objectives.

(c) Imperfect information

When there is a communication gap, be it vertically or horizontally, co-ordination between all levels of management is affected. This ultimately results in individuals having objectives which are not in line with the organisational objectives. In the case of imperfect information, the policies and guidelines from top management may not get properly communicated to the lower level management. Information about problems or suggestions from individual departments cannot reach top management.

(d) Departmental rivalry

As performance is evaluated on the basis of the budget, and also in comparison with the other departments, it may lead to rivalry between different departments. Each departmental head tries to maximise his contribution in the success of the organisation and due to this they set objectives which are not in line with other departments or with the organisation as a whole.

These conflicts between the organisational and departmental objectives can be resolved by the following:

Participation by all levels of management

If all levels of management are involved in the process of budget preparation, all possible conflicts and problems can be discussed at an early stage, and can be resolved.

Co-ordination of budgets

Once the functional budgets have been prepared, they need to be reviewed and approved by the superiors. The superiors will see whether the budgets are in line with the corporate objectives, and whether they are prepared by following the guidelines issued by top management. Also, they will see whether the budgets have been prepared to achieve goal congruence. This review process, which may lead to modifications being made, ensures that goal congruence is achieved.

Transparency in the budgeting process

There should be transparency in the process of preparing a budget as well as while modifying the budget. If those responsible for preparing the budgets are made aware of the overall organisational target, it will be easy for them to strike a balance between the corporate and departmental objectives.

SECTION C2: BUDGETARY CONTROL SYSTEM

Get Through Intro

A budget is a planning and controlling tool for an organisation. This tool can work effectively only when it is used with due care. For the success of a budgetary system, gathering the essential information and choosing an appropriate budgetary system etc. are necessary.

Information required for budget preparation includes internal as well as external information. There are various sources from where the relevant information can be obtained. Mainly, various records kept in the organisation and the forms filled in on the basis of these records are the sources for internal information. External information includes information about the customers, competitors, market, relevant enactments, government policies and regulatory authorities.

This section will explain how to decide which system is appropriate for your organisation, what kind of information is required for devising a budget along with the sources from which to gather this information and how to tackle situations of uncertainty when you act as a management accountant in an organisation. This knowledge will also enable you to answer the related questions in the exam.

Learning Outcomes

- a) Evaluate the nature of a budgetary control system.
- b) Illustrate the functions of a budgetary control system.
- c) Evaluate the objectives of a budgetary control system.
- d) Illustrate how budgetary control systems fit within the performance hierarchy.
- e) Select and explain appropriate budgetary systems for an organization, including top-down, bottom-up, rolling, zero-base, activity-base, incremental and feed-forward control.
- f) Evaluate the information used in budgetary systems and the sources of the information needed.
- g) Illustrate how budgetary systems can deal with uncertainty in the environment.

1. Evaluate the nature of a budgetary control system.
2. Illustrate the functions of a budgetary control system.

[Learning Outcomes a and b]

1.1 Defining a budget



Definition

A budget is a quantitative statement for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget provides a focus for an organisation aids the co-ordination of activities and facilitates control. Planning is achieved by means of a fixed master budget, whereas control is generally exercised through the comparison of actual costs with a flexible budget.

CIMA official terminology, 2005

A budget is different from a forecast. A forecast only aims to predict what will happen in the future. On the other hand, a budget helps an organisation to plan its objectives for the future and the methodology to achieve these objectives.

Analysis of the definition reveals the following:

1. A budget is prepared and approved before the start of the accounting period (known as the budget period).



Example

The budget for the year 20X8 needs to be prepared before the start of 20X8 i.e. by the end of the year 20X7.

2. It is all about **planning** for the **future period** and **controlling** the **activities** (and in turn the costs) of an organisation by pursuing management policies. The objective of this overall organisational plan is achieved by means of a master budget. A **master budget** is a statement showing estimation of revenue, costs and **profit / (loss)** for the organisation as a whole.
3. It is a **quantitative / financial** statement with an **action plan**. In other words, it is a business plan, normally expressed in monetary terms.
4. A budget includes statements showing income, expenditure, cash flow and the capital to be employed.
5. A budget may either be in the form of a fixed master budget or in the form of a flexible budget. A **fixed budget** is devised based on the assumption of a particular capacity level e.g. selling a certain quantity of goods. On the other hand, a **flexible budget** is designed to adjust the cost levels according to changes in the actual level of activity. Flexible budgets are mainly used to exercise control over business activities. This will be discussed further in section C4.



Example

A manufacturing company is required to plan the future production in order to estimate the labour and raw material requirements. This information can be obtained from the sales budget.

The territory-wise sales budgets for the year 20X9 based on the estimates of the sales division managers were as follows:

South zone	Sales of 20,000 units at a price of TZS10,000
North zone	Sales of 12,500 units at a price of TZS9,000
East zone	Sales of 10,000 units at a price of TZS9,000
West zone	Sales of 8,000 units at a price of TZS9,000

Total budgeted sales were 50,500 units for the whole organisation.
Hence, the sales budget will look as follows:

Continued on the next page

	South zone	North zone	East zone	West zone	Total
Budgeted units	20,000	12,500	10,000	8,000	50,500
Budgeted selling price	TZS10,000	TZS9,000	TZS9,000	TZS9,000	
Total sales (TZS)	200,000,000	112,500,000	90,000,000	72,000,000	474,500,000

With the help of this sales budget, the production department can prepare its budget for material and labour requirements.

1.2 Budget period

The budget period is an important factor in developing a budget. The budget period can be short term (short range budgets) or long term (long range budgets).

Short range budgets are prepared for a period of less than a year. For example, short range plans are usually used by the wholesale or retail firms, manufacturing units etc.

Long range plans are prepared for a period of more than a year. For example, long range plans usually cover extensive research and development programmes, capital expenditures, financial profit forecasts etc.

Budget period has been explained furthering more detail, later in this section.

1.3 The various functions of budgets

The various functions of a budget highlight its usefulness to the organisation and elaborate on the reason we prepare budgets.

1. Planning and achieving objectives

As we have already discussed, budgets are primarily statements showing the operational planning of an organisation. The process of budgeting is an integral part of planning for future operations, in order to achieve organisational objectives.

The plan of an organisation is expressed in the form of a master budget that is a summary statement of all the functional budgets. The master budget provides management with ideas about how all the functional budgets can be co-ordinated so as to achieve the organisational objectives.

In planning future operations, the management is required to consider potential changes in the external as well as the internal environment and the steps needed to respond to these changes. This helps management to anticipate future problems before they arise.



Example

It is thought that present demand for television sets is 10,000,000 units globally. Glob Ltd is a T.V. manufacturing company in Japan. Until the year 20X8, Glob Ltd produces and sells 1,000,000 T.V. sets per annum.

However, keeping in mind the wide market available to Glob Ltd, the company has decided to increase its sales and production budget for the year 20X9 from 1,000,000 to 2,500,000 T.V. sets per annum.

This target will enable the production managers to plan and negotiate labour and material contracts at favourable rates.

2. Coordinating

Coordinating involves synchronising all the business activities to achieve the organisational objectives.

To devise the master budget, there should be **synchronisation between all functional budgets**. The budgeting process necessitates inter-departmental dialogue, which ensures that individual departmental budgets fit in with the common organisational goal.

However, coordination is difficult to achieve at times. This is because each functional unit would have its own departmental plans and these inter departmental budgets might not be fully integrated to fit into the master plan to achieve the organisational objectives.



Example

The sales department and the production department prepare their respective functional budgets.

The sales department of 'Just do It' Ltd, has prepared its sales budget for 100,000 units.

Just do It Ltd has introduced a company policy for the year 20X9 to maintain an inventory of 6,000 units. This policy is adopted to ensure that the company is not out of stock at any point of time. The opening inventory of the company for 20X9 is estimated at 5,000 units.

The production budget needs to be prepared after coordinating with the sales budget and the company policy. Hence, the production department would budget for 101,000 units. The basis for the production budget would be the sales budget i.e. 100,000 units and an additional 1,000 units as the inventory level needs to be increased to 6,000 from 5,000.

3. Motivation

A budget motivates managers to perform in line with the organisational goals / objectives.

Transparency in the budgeting process ensures involvement of the lower and middle management. One of the reasons for involving lower and middle management in the budgeting process is that greater participation creates a team spirit amongst the employees and in turn motivates them to meet that budget.

In order to remain motivated, the targets set in the budget need to be achievable. Linking the target with rewards or providing feedback to employees for deviating from the budget can help the employees to be motivated further.



Example

The marketing department of P&M Plc received an urgent order of 1,000 units for sale in addition to their budgeted sales. As a result, the sales and the production budget for the month of June 20X9 will have to be revised. This will result in an additional workload on the workers in the production department.

Management should speak to the staff in advance and explain the situation to the workers in the production department. This will give them the feeling that they are involved in the management process of planning and budgeting. This feeling will motivate them to achieve the new target.

Management could also declare that the workers who produce extra units would get a bonus of TZS2,000 per unit of goods sold. Because of the reward system, the workers would be further motivated to achieve their target.

4. Control

Control is the action necessary to ensure that objectives and plans are attained in reality. The budget is a widely used tool for controlling the operational activities of a business.

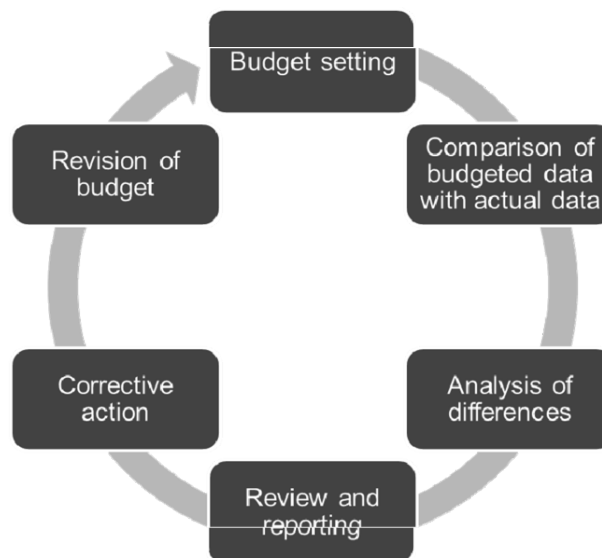
Budgets are more useful if actual performances are compared with those budgeted and the difference, or variance, is examined. This process of comparing and highlighting the variance / difference and then taking corrective measures is called budgetary control.



Definition

A **budgetary control system** is a means of monitoring revenue and costs and thereby exercising control in an entity by developing budgets and comparing budgeted figures with actual results. This system highlights any discrepancies and allows corrective action to be taken.

The procedure of budget monitoring can be seen as a periodic cycle, which is also termed as budgetary control cycle. It is illustrated in the below diagram:

Diagram 1: Budgetary control cycle

Budgetary control helps management to take timely corrective action in cases where actual performance is not in line with the budget.



Example

Skytel Ltd is a manufacturing company. Skytel's budget period is one year. However, in order to achieve better control, the company splits its budget period into twelve monthly budgets and at the end of each month actual figures are compared with the corresponding budgeted figures.

In the months of January and February, management observed that the actual cost of raw materials exceeded the standard cost. This comparison of budget and actual figures is budgetary control. With further detailed study, management discovered that the poorly managed inventory system had led to emergency purchases at short notice and this had resulted in an increase in the cost of raw materials.

Accordingly, as a corrective action, a perpetual inventory control system was introduced to ensure the timely purchase of the right quality and quantity of raw materials at the right price. Thus, the examination of the variance helped the company to take timely corrective action.

5. Performance evaluation and responsibility accounting

Budgetary planning helps to allocate the responsibility of the attainment of the budgeted targets and the operations to the area manager.

Very often, managers' performance is evaluated on the basis of whether their department achieved the budget. In some organisations, incentives in the form of monetary benefits or promotions are given to managers based on their performance (meeting the budget).

Also, comparison of actual figures with budgeted figures gives the managers an opportunity for introspection, and ultimately helps to improve their performance.



Example

Thomas is a sales manager in Shoes Unlimited Co. His target for the year 20X8 was 25,000 units. However, he managed to sell 26,000 units.

By comparing the actual figures with budgeted figures and analysing the market conditions, management concluded that Thomas had achieved his targets without much effort. So, in the subsequent budget for the year 20X9, management might plan to set a higher target for Thomas.

Similarly, by comparing the actual figures with the budgeted targets, Thomas can evaluate his own performance which will motivate him to achieve higher targets.

6. Communicating

All levels of management normally get involved in the budgeting process. Essential ingredients of the budgeting process are:

- Communication from top to bottom about the plans to be implemented
- A flow of feedback (about difficulties in implementing the plans, if any) from the supervisory level (at the bottom of the management hierarchy) to the top management

Again, in order to coordinate the budgeting process of different departments, horizontal communication amongst the departments is also vital.

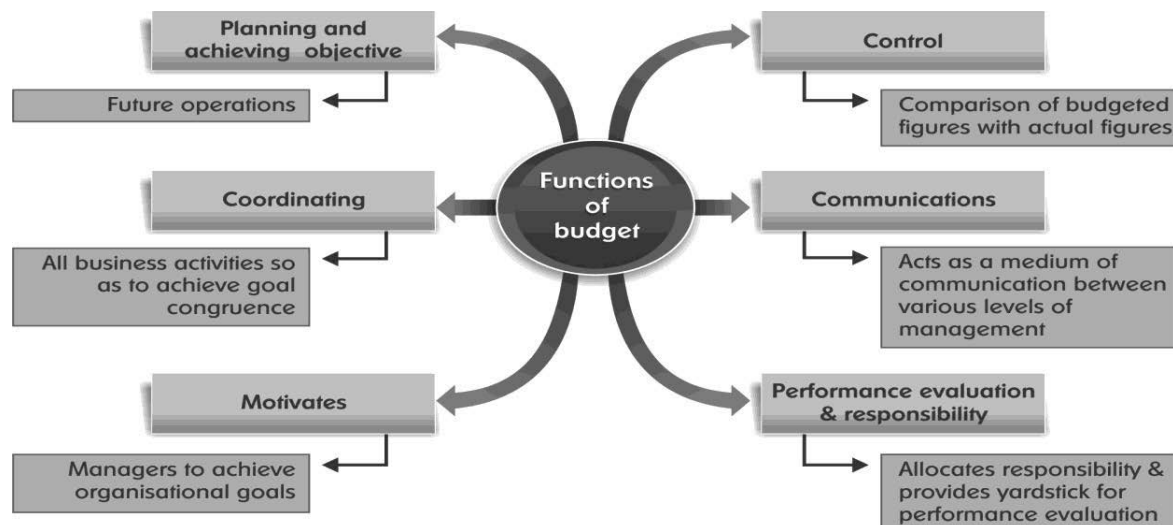
Moreover, once the budget is finalised, it needs to be communicated to all levels of management for its implementation. Furthermore, each person affected by the budget should know his targets. In addition to this, there should be proper communication amongst all the functional departments so as to ensure successful achievement of the target.

Tip

In short, we can say that organisations prepare budgets for – PCMCPC

- P** Planning
- C** Coordinating
- M** Motivation
- C** Control
- P** Performance evaluation
- C** Communicating

Diagram 2: Functions of budget



3. Evaluate the objectives of a budgetary control system.

[Learning objective c]

Every organisation prepares budgets for the various activities / functions of the organisation. Budgets are also used to coordinate all these functional activities and make a detailed common plan. Budgetary control is used as a tool of planning and control.

2.1 Objectives of a budgetary control system

1. To plan the various activities of the organisation

A budget is a formal expression of the future plan. It helps in determining the individual goal of each activity or department and planning their actions to achieve this goal. Budgets provide premises for detailed operational plans to be followed during the budget period.



Example

The sales department of Select Ltd decides to sell 10% more than last year. The production department has to plan to complete the production of the required quantity within the specified date. Also, the sales department has to plan how the target can be achieved. The sales manager discusses this with the sales representatives. He plans to introduce incentives on the basis of the sales representatives' performances, in order to motivate them. Thus Select Ltd prepares a budget incorporating all these targets.

Also, as stated in the definition of the budget, a fixed master budget is used as a basis for the overall planning of an organisation.

2. To co-ordinate the activities of the organisation

Every department may prepare their individual plan believing that they are doing the best for the organisation, but this may result in a conflict with the objectives of the other departments. The budgetary control system helps to resolve conflicts between departments and therefore helps the organisation to progress as a whole.

A master budget is a consolidation of all the other functional budgets. While preparing a master budget, all the budget targets are reviewed and any conflict between them is resolved. This system converts the budget into a common plan.



Example

Suppose the production department of an organisation targets to achieve 10% higher production in the following year, and thereby to achieve a higher profit. However, the sales department is concerned that it will not be able to sell all the units produced because demand for the product is not sufficient to absorb the additional units of production. As a result, the extra production would result in excessive inventory resulting in higher costs of investment and holding the inventory.

Accordingly, the budgetary control system will reconcile the individual budgets of the sales department and the production department and allow preparation of the functional budgets in line with the other budgets.

3. To evaluate the performance of the executives

The budget sets targets for implementation. Such targets are compared with actual performances at regular intervals. The performance of the executives is also evaluated.



Example

Jim, a production manager, budgeted to increase the sales by 15% during the year. This target of increasing the sales will be considered as a benchmark and used for evaluating Jim's performance.

4. To identify the areas of efficiency and inefficiency

The budget provides a yardstick for measuring performance and identifying deviations. Such deviations are then analysed to determine the efficiency of the personnel as well as the machines. Once any inefficiencies have been identified, corrective action is taken to overcome these inefficiencies.

After the budgets have been prepared, feedback on performance is given at a regular interval and any variances are investigated. This helps in achieving the organisational objectives.



Example

Johnny has planned to cut the selling expenses by 10% compared to the previous year. Accordingly he has met the target, by cutting down spending on advertisements. In this case, although Johnny has achieved the target it does not show his efficiency because what he has achieved is at the cost of long-term performance. In the short-term, this is rewarded as it will lead to profit maximisation. However, in the long-term, this may adversely affect demand for the product.

Therefore management should be careful while assessing the performance, and ensure that the performance assessed is not at the cost of any other department or the organisation's long-term objectives. If management notices such incidences it should immediately give feedback to the concerned person or department to avoid such situations.

5. To provide a basis for the control system

Budgeting is a management tool. Its emphasis is on managing costs and revenues. By doing so, it ultimately manages the activities. It provides a good guideline of what the allowable limit of cost should be.

Again, a budget provides a good measure of performance. Accordingly, top management can resort to selective control to concentrate more on areas of weakness. This approach is called management by exception.

It also aids lower level management to evaluate their own performance by comparing it with that budgeted.



Example

Continuing the previous example of Jim, if he cannot meet the target, the reasons for such deviations are then investigated and corrective action is taken, in order to improve the efficiency of his department.

6. To motivate managers

Budgets provide challenges as well as incentives for better performance. A budget is used as a tool to measure the performance of managers; it motivates managers to work effectively and efficiently to meet the target. Sometimes, monetary rewards and promotions are given if the targets set in a budget are met. This motivates managers to improve their performance. If achieving higher productivity is linked with incentives, managers will be encouraged to achieve it.



Example

Tim, the production manager of Sigma, budgeted to increase the production efficiency by 15% during the year. At the end of the year, it was seen that the efficiency had actually increased by 22%. According to the incentive policy of Sigma, Tim receives a bonus, which motivates him to further improve his performance.

7. To increase profitability

While reviewing the budgets before they are finalised, if overestimation of expenditure is identified, senior managers will curtail the excess provision for expenditure. Also, by comparing the budgeted expenditure with the actual expenditure, managers can pinpoint any extravagant expenses and can avoid them in the future. By avoiding these extravagant expenditures, profitability can be increased.



Example

The products of Lumina were well established in the market. The budget set for advertising expenses was TZS10 million, whereas the actual expenditure amounted to TZS25 million. Therefore, the budget helped to identify the variation of expense, TZS15 million. If the expenses are controlled, the overall profitability of the company will improve.

8. To ensure best use of available resources

Men, material, machinery and money are referred to as the four M's and are the factors of production. These factors are vital for production and thus should be optimally utilised. At the time of devising budgets, management identifies current and future limiting factors and manages them in such a way that they will not become hindrances in the future.



Example

In Pineapple Ltd, the production capacity is fully utilised. The sales department has set a sales target higher than the production capacity. In such a situation, production capacity becomes the limiting factor. It is not a wise decision to stop selling beyond the production capacity. This problem can be resolved by procuring additional units by outsourcing production, or increasing the in house production capacity.



Example

Pineapple Ltd produces two products, A and B. The company's budget reveals that skilled labour is available to the extent of 5,000 hours. Product A can be produced in 2 hours. Product B requires 1 hour. Management has to carefully determine the contribution per hour for each product. The product that gives the maximum contribution per hour is prioritised for production in order to maximise the profit of the organisation.

9. To provide a means of communication

Budget targets are the expectations. If the individual functional managers prepare the budget, they communicate the functional objectives through the budget. In the same way, top level management sets the target to be achieved during the budget year. Therefore, the budget acts as a medium of communication (horizontally as well as vertically) between all the levels of management within the organisation.



Example

A sales manager will communicate his sales targets to all concerned through the sales budget.

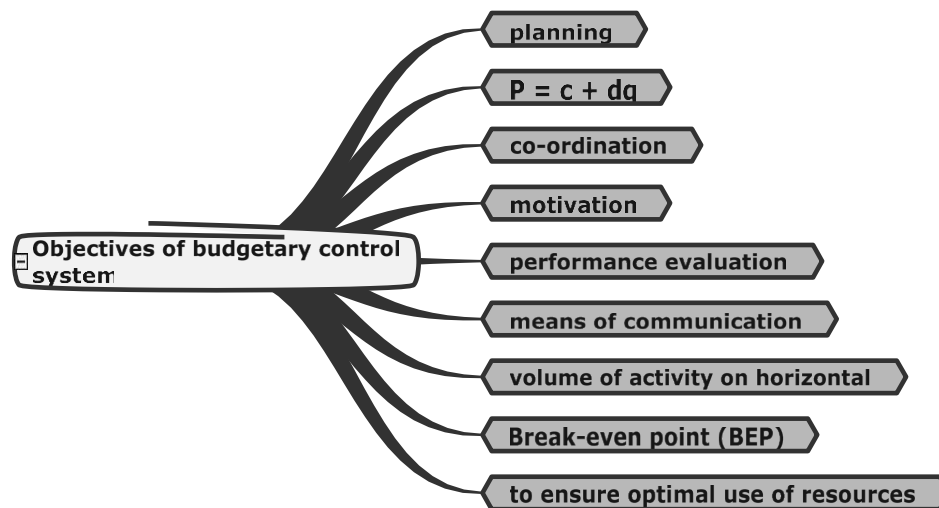
All levels of management are involved in preparing the budget. They communicate with each other regarding the targets, the actions required to achieve the organisational objectives, problems in implementing the budgets etc.



Example

The sales manager of Comfort Ltd has prepared a budget and given a particular target to each of the salesmen. He communicates the sales targets to them through the budget. While negotiating the budget, the salesmen will discuss various issues such as how to achieve the target, what the difficulties will be in achieving the target etc. In this way, the budget facilitates communication between the different levels of management.

SUMMARY



Test Yourself 1

Define a budgetary control system and its objectives.

4. Illustrate how budgetary control systems fit within the performance hierarchy.**[Learning Outcome d]**

As you know, budgets are prepared with multiple objectives. One of these objectives is to provide a yardstick for evaluating performances. In most organisations, rewards are linked with performance which is evaluated with reference to the budgets. Therefore, a budget encourages the employees in an organisation to maximise their contribution towards achieving the goals set in the budget.

Budgets are the techniques for devising operational plans. Accordingly, a budget is considered to be devised for the operational level only. However, top management also participates in the budgeting process to ensure that the operational plan is drawn up within the scope of the organisation's strategic planning and overall objective.

In performance hierarchy models, the mission statement tops the performance hierarchy followed by strategic planning, operational planning and operational activities.

Diagram 3: Performance hierarchy

The performance hierarchy is linked to the hierarchical levels of an organisation. The lower level of management (i.e. the supervisory level) is responsible for operational activities, the middle level of management (such as functional managers) is responsible for operational planning and the top level of management is responsible for strategic planning. The shareholders and the top management decide on the mission statement i.e. the broad objectives of the business.

According to the performance hierarchy model, performance should be evaluated at all the levels i.e. the strategic, tactical and operational levels. In a budgetary system, the lower and middle levels of management are assigned targets that are then evaluated by the top level. In the hierarchy model, the budget fits into the operational planning and operational activities level. The budget acts as a management tool for setting operational plans. Also, the budgetary system becomes instrumental in converting the strategic plans into action. In the performance hierarchy model, the budget plays a significant role.

Again, a budgetary system aims at explaining the relationship between performance goals and the costs for achieving the targeted levels. This is about evaluating the efficacy of the whole system.

**Example**

Perfect Ltd prepares a budget, targeting to increase sales revenue by 20%. The additional costs for achieving this target are provided for in the budget. The comparison between actual revenue and budgeted revenue indicates the level of efficiency of the market promotion department.

The evaluation of a budget is made by top management suggesting that all levels of management have a role in the budgeting exercise. It is too simplistic a view to suggest that budgetary exercises are confined to the operational level only.

5. Select and explain appropriate budgetary systems for an organisation, including top-down, bottom-up, rolling, zero-base, activity-base, incremental and feed-forward control.
[Learning Outcome e]

To ensure the efficient performance of a budgetary system, the selection of an appropriate budgetary system is vital. Budgetary systems include top-down, bottom-up, zero-base, activity based, incremental and feed-forward control. All budgetary systems are not suitable to all kinds of organisation. The various budgetary systems and their suitability to an organisation are discussed as below.

4.1 Top-down approach

1. Meaning

Under the top-down approach, budgets are prepared in line with the strategic objectives of an organisation. Top management specifies their expectations and objectives and, accordingly, the overall organisational budget and the divisional budgets are prepared. The divisional budgets are therefore components of the overall budget.

This approach enables communication between the top level of management and the other levels. Top management may set high targets in order to motivate the employees to chase these targets.

As top management makes the guidelines, it will support this approach. Also, the objectives / targets set by the individual departments are more likely to be co-ordinated as the superiors review the work of the subordinates.

In small organisations where top management is aware of all the situations and all the aspects of the business, the top-down approach is highly suitable.

The lower level of management may not like this approach, as they are not involved in the budget process.

2. Appropriateness of the top-down approach

In the top-down approach, the overall budget is first prepared on the basis of the strategic objectives and then, in line with the overall budget, the budgets of the individual departments are prepared. By adopting this approach, it is therefore possible **to achieve synergy in the working of an organisation. This approach is most suitable to small organisations where superiors have overall knowledge of the working of the organisation.** It is also suitable in situations where the organisation cannot allow much time or cost for planning.

4.2 Bottom-up approach

1. Meaning of bottom-up approach



Definition

The bottom-up approach is where all budget holders are given the opportunity to participate in setting their own budgets.

The opposite of the top-down approach, the bottom-up approach starts with the targets set by lower level management, which are then rolled over to successive stages for review. Once all divisional budgets have been collected, an overall budget for the organisation is prepared. This achieves the co-ordination that is essential for the success of a budgetary system.

This approach to devising a budget allows greater involvement of those responsible for the implementation of the budget and is therefore favoured by them.

2. Appropriateness of the bottom-up approach

The bottom-up approach makes it possible to involve all levels of management in the budgeting process. Since, under this approach, the targets are set by the lower level of management (who are aware of the actual working conditions), the budget is more realistic than one which is prepared by top management (who are not aware of problems at grassroots level). **Conflicts between the objectives of the budget can be avoided by adopting the bottom-up approach.**

This approach is generally adopted in large and established organisations where the involvement of lower level of management is necessary because of the complexity of the budget-setting process.

As individual managers prepare the budget, there remains the risk of not achieving goal congruence. Goal congruence requires negotiation at various levels, if detailed planning and co-ordination do not exist. Also, this is a time-consuming process and therefore rarely adopted.

4.3 Rolling budgets

1. Meaning of rolling budget

A rolling budget is a budget that needs to be continuously updated by deducting the earliest period and taking into consideration the future period. This approach to budgeting helps in eliminating the adverse impact of environmental uncertainties in setting goals by updating the budget in quick succession. This budget encourages a forward-looking attitude.



Example

Belur Ltd prepares rolling budget for one year (January to December) and reviews it at the end of each quarter. The review at the end of the first quarter is undertaken by comparing the achievements of the period against the targets. The outcome of the review is then used by Belur Ltd to update the rest of the budget period and a further three months are added to the budget period to have a one year budget.

2. Appropriateness of the rolling budgets

As rolling budgets are prepared on the basis of the current experience (taking into consideration the current period), they are updated with the current changes. Rolling budgets are continuously updated with the current information. This helps in minimising the operational variances.

Rolling budgets are the **most suitable form of budget for organisations working in an uncertain environment**, where future costs and/or activities cannot be foreseen reliably.

4.4 Zero-base budget (ZBB)

1. Meaning of zero-base budget

Unlike a conventional budgetary system, where the budget is prepared by adding up to or deducting from the budget of the preceding period, a zero-base budget involves an elaborate practice of having a manager justify activities from scratch, as if they are being launched for the first time.



Definition

A **zero-base budget** is a method of budgeting which needs each cost element to be specifically justified, as though the activities to which the budget relates were being undertaken for the first time. Without approval, the budget allowance is zero.

ZBB is a cost-benefit approach to budgeting in which each cost element should be evaluated to be included in the budget. Each year when the budget is prepared, all the cost elements have to be evaluated as if the budget is being undertaken for the first time and will be authorised only if these are justified. The justification of any cost should be in relation to the way it helps to meet objectives and how the expenditure benefits the organisation. ZBB takes away the implied right of existing activities to continue to receive resources, unless it can be shown that this is the best use of those resources.



Example

Shan, a marketing manager for Choice Plc, has included advertisement expenditure of TZS5,500,000 in the budget just because last year it was TZS5,000,000 and this year he expects a 10% increase. With effect from the current budget period the company has introduced zero-base budgeting. The general manager does not agree with Shan and will not allot any amount for advertisement expenses unless justification for incurring such expenditure is given. Shan should explain how this amount will contribute to increasing the sales of Choice Plc in order to get his budget proposal accepted.

2. Appropriateness of zero-base budget

As a zero-base budget aims to curtail unnecessary costs, it is suitable for both profit-seeking as well as not-for-profit organisations.

It is **best suited to the service industries and to not-for-profit organisations** where, for each activity, alternative courses of action are possible. In such organisations ZBB helps in deciding the most suitable way of performing the activity.

ZBB can also be successfully applied to the **discretionary costs and support activities**. It may be noted that the discretionary costs are the fixed costs (usually) that arise from periodic budget approximation decisions taken according to organisational policy.



Example

For research and development expenditure, zero-base budgets are mostly suitable since in a zero-base budget any expenditure is evaluated and is authorised only if it is justified. These expenditures are not provided for on the basis of a previous budget and hence can be avoided if unnecessary.

However, ZBB is less suitable for estimating the direct materials cost, labour cost etc. as these costs are not of discretionary nature.

For an activity where there is no clear relationship between the input and output, zero-base budgets can be used. Where there is clear input-output relationship, it is not possible to reduce the requirement of the input.



Example

The raw material allocation depends upon the number of units planned for production. A budget manager cannot alter raw material requirements. In this case, a zero-base budget cannot bring in any improvement in estimating expenditures.

But for training costs, it is not necessary that they should be allowed only because they were approved last year. Here, zero-base budgets are more effective.

4.5 Activity-based budget (ABB)

1. Meaning

ABB is an approach to budgeting in which, instead of evaluating the cost elements, **activities causing costs are evaluated** in order to ascertain whether they are essential for the budgeted production and sales volume. The endeavour of an activity-based budget is to ensure the supply of only those resources that are needed to perform activities required to meet the budgeted production and sales.



Definition

An activity-based budget is a method of budgeting based on an activity framework and utilising cost driver data in the budget-setting and variance feedback processes.

In this approach, the budget is based on the activities that drive the costs. Like all other approaches to budgeting it is also a feedback activity. ABB allows supply of only those resources that are needed to carry out the activities required to meet the budgets.



Example

Activities such as machine operation drive cost. To carry out this activity, resources in the form of power, fuel, labour etc. are needed. In activity-based budgeting, the costs towards these resources would be authorised.

Activity-based costing assigns resource costs to activities and then uses activity cost drivers to assign activity costs to cost objects (such as products, services or customers), but an activity-based budget follows the reverse process. Cost objects are the starting point. Their budgeted output determines the necessary activities which are then used to estimate the resources that are required for the budget period.



Example

The production department of Cyntex Plc has three major activities, namely, material handling, production runs and quality tests. On the basis of the activity levels of the next period, the following budget has been drawn for the production department of Cyntex Plc.

Activities	Material handling	Production runs	Quality tests	Total cost
Cost drivers	No. of movements of material	No. of production runs	No. of quality tests	TZS million
Driver volume	300	220	200	
Cost	TZS million	TZS million	TZS million	
Management salaries	10	20	20	50
Salaries of supervisory staff	10	10	10	30
Salaries of workers	20	30	10	60
Salaries of office staff	5	10	5	20
Factory overheads (electricity, fuel, water, rent, etc.)	15	40	25	80
	60	110	70	240
Cost per activity (TZS million)	200	500	350	

2. Appropriateness of activity-based budget

An activity based budget is one of the most appropriate forms of budget as it identifies the cause and effect relationship between the activity and the cost as well as between the activity and the product.

ABBs are suitable to only those organisations where the activity-based costing system is adopted. This is because, in such organisations, activity centres are identified.

The ABC system calculates the costs of individual activities and assigns the activity costs to products or services (i.e. the cost objects) on the basis of the activities needed to produce a product or a service. Without having such information it is not possible to evaluate the activities. Therefore, ABB cannot be used in an organisation where the ABC system is not adopted.

4.6 Incremental Budgets

1. Meaning

An incremental budget is a budget prepared on the basis of the previous year's budget with some additions and deletions for the forthcoming budget period.



Example

In Fortune Ltd, an incremental budgetary system is followed for preparation of budget. The sales target for the previous year was 50,000 units and for the current year it is set at 55,000 units (i.e. there has been a 10% increase). While preparing the budget for market promotion expenditure, Robert, the sales manager would like to increase the expenditure by 10% i.e. from TZS5,000,000 to TZS5,500,000. In this approach, Robert would not consider whether the budget of TZS5,500,000 for market promotion expenditure is really needed or not. If the previous year is the first year for launching the product, in the second year the same amount of expenditure may not be required, but all these factors are ignored in an incremental budget.

2. Appropriateness of the incremental budget

Incremental budgets are suitable for all kinds of organisations. But they are criticised for not justifying the cost elements for inclusion in the budgets. Nevertheless they are widely used by organisations since they are easy to prepare.

4.7 Feed forward control

1. Meaning

An organisation may have two kinds of control mechanisms: **feedback control** that scans past performances to detect and correct disturbances to the plan and **feed forward control** that responds to immediate or forthcoming dangers by making adjustments to the system in advance in order to cope with the problem.

Feed forward control may be described as a control mechanism where the factors affecting the system are predicted and corrective actions are taken in advance (i.e. before they occur and affect the system). In this process, the future is predicted and then the budget is evaluated in the light of the forecast to determine whether the actual result would be better or worse than the budgeted and corrective action is taken to achieve at least the budgeted figures.



Example

- (i) A petroleum refinery may enter into an agreement with a crude oil producing company to supply crude oil at a fixed price for six months, if it anticipates an upward surge in the international crude oil prices in the next six months caused by major political disturbance in an oil-producing country.
- (ii) A manufacturing company may like to explore an outsourcing option in anticipation of closure of one of its production plants because of a prolonged labour agitation.



Example

Raw material report, January 2011

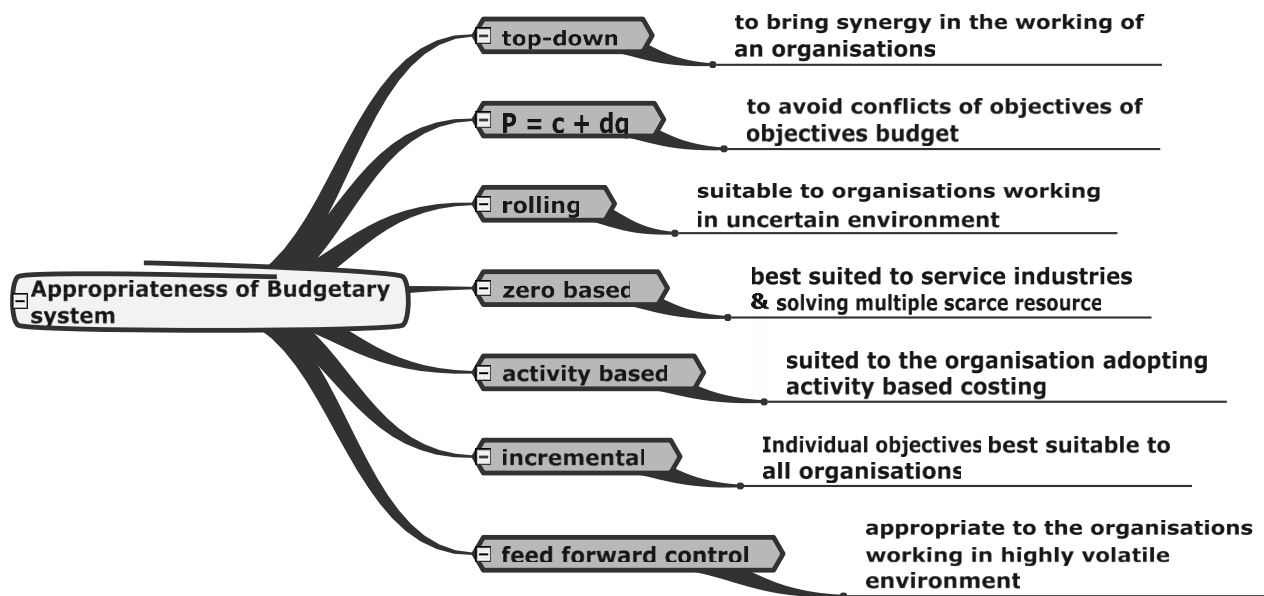
Material	Budget (TZS'000)	Annual forecast (based on current information) (TZS'000)	Variance expected (TZS'000)
Material 1	150,000	135,000	15,000 (F)
Material 2	200,000	230,000	30,000 (A)
Total	350,000	365,000	15,000 (A)

Based on the above report, the materials manager can take appropriate measures to avoid the expected adverse variance of TZS15,000,000.

2. Appropriateness of feed forward control

Feed forward control is most **suited to those organisations working in a highly volatile environment**. This control predicts future bottlenecks and takes action to restrain those bottlenecks from affecting production and thereby allow the organisation to chase its objectives. The ability to sense impending problems and to take prior corrective actions, which are the essence of feed forward control, is the hallmark of successful organisations.

SUMMARY



Test Yourself 2

What is a zero-base budget and when it is appropriate to adopt zero-base budgets?

6. Evaluate the information used in budgetary systems and the sources of the information needed.

[Learning outcome f]

6.1 Information used in budgetary system

The information used in a budgetary system can be mainly divided into two groups:

Internal information

External information

1. Internal information

Internal information useful for the preparation of budget includes inter-departmental information because the budget of one department may be linked to those of the other departments.



Example

Information about the inventory level, production capacity etc. will be useful for the sales department to prepare the sales budget. This will give the department an idea of the maximum volume that may be available for sale.

Other important internal information includes critical factors influencing grassroots level operations such as a pay rise for employees, change in working conditions, change in method of production, major breakdown of machinery, etc. All these factors individually or collectively may influence the objective set in a budget and are therefore considered to be pertinent internal information.

2. External information

External information includes information about the following:

(a) Customers

This includes information about the class of the customers, any change in the customers' taste, their preferences etc. This helps in estimating the potential demand for the product in the market. Estimating demand for the product is crucial to deciding the sales target. Often, it acts as a limiting factor for preparation of the budget. It determines the production target and thereby assesses the requirements for the other factors of production.

(b) Competitors

It is necessary to gather information about the competitors, their strategies, their market share, price charged by them, etc. This information helps in determining the strategy of an organisation.

(c) Legal framework

An organisation has to work within the legal framework applicable to it. For example, an organisation must have information on the requirements for safety measures, working conditions, etc. so that it can comply with these requirements.

(d) Suppliers and availability of other resources

The information regarding availability of resources such as the availability of suitable manpower, the availability of the required quantity and quality of raw materials, the availability of substitutes, the availability of plant or machinery on hire, etc. are essential for determining the production target.

(e) Political and regulatory framework

Decisions of the regulatory authorities may affect the operation of organisations. Therefore one needs to be aware of the policies of the regulating authorities and the government before devising budgets. In addition, the political environment of a country may influence the government's policy towards an industry.



Example

Autofast Plc, a car manufacturer, exports 90% of the cars manufactured by it.

The export duty on cars has increased by more than double as compared to the last year, in the finance budget for the current year.

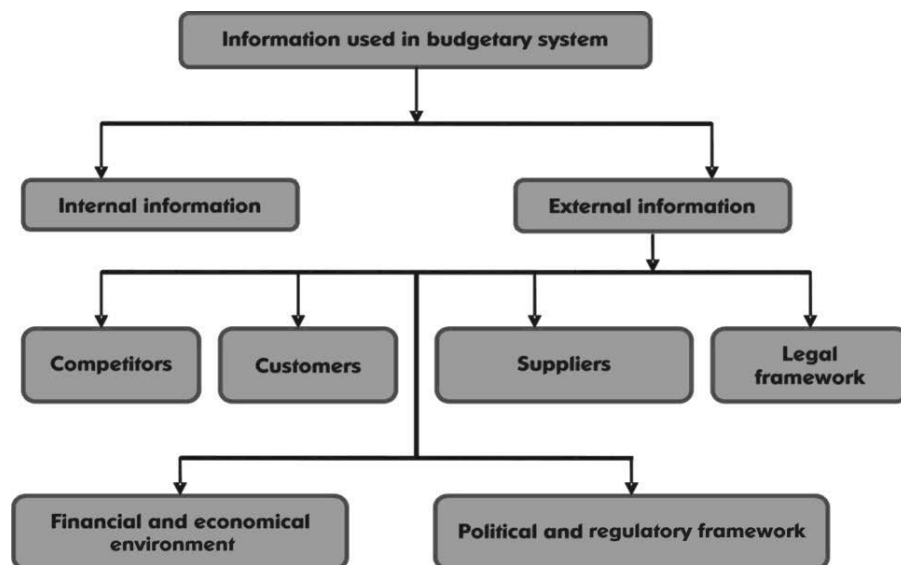
This may cause a decrease in demand in the foreign market for the cars of Autofast Plc.

The information on the rise in export duty will be important while preparing the sales budget of Autofast.

(f) Financial and economic environment

The decisions of organisations are generally influenced by information about inflation rates, interest rates, foreign exchange rates, and so on.

Diagram 4: Sources of information influencing budget



6.2 Sources of information used in budgetary system

1. Internal forms and records

Basic information is available from various records maintained in an organisation and the forms filled in by the various departments.



Example

While preparing a cash budget, the finance manager may require information about the inflow and outflow of cash during the last budget period. Accordingly, he may refer to the cash book, the general ledger and the cash budget of the previous year.

2. Market research and focus group

These techniques are widely-used techniques for gathering information about the potential demand for a product.

3. Newspapers and other news media

Newspapers, magazines, and electronic media also act as sources of useful information about the various factors affecting the budget of an organisation. In recent times, the internet has become the most vital source of information.

4. Information from regulatory authorities

There are certain industries whose affairs are controlled by regulatory authorities e.g. the banking industry in any country is regulated by the respective central banks; insurance businesses in different countries are also regulated by the respective authorities etc. These regulators may frame certain rules and regulations that may have an impact on the budget of an organisation. Moreover, the regulator may sometimes provide vital information about the industry.

5. Suppliers' price lists and brochures

These will provide important information about the pricing strategy, product launching etc. of the suppliers.

6. Government reports and statistics

Government reports may include general reports on any sector of the economy or on the economy as a whole. Also, the government may occasionally publish a specific report on a particular sector. The government publishes reports on certain statistics such as economic indicators, industrial output, consumer spending, inflation rates etc.



Test Yourself 3

When devising a budget, certain external as well as internal information is required. State which kind of information is useful for budget preparation and where it can be obtained.

7. Illustrate how budgetary systems can deal with uncertainty in the environment.

[Learning outcome g]

Uncertainty lies in a situation where there may be more than one possible outcome to a course of action and the probability of occurrence of an outcome is not known.

Uncertainty affecting the budget includes uncertainty over demand for the product, inflation, technological changes, changes in government / regulatory authority's policies, climatic uncertainty, competition etc.

These uncertainties can be dealt with by the budget system with the help of the following:

1. Rolling budget

As a rolling budget is continuously updated with recent changes, it takes into account the changing environment and its effect on the budget of an organisation.

2. Feed forward control

As we have seen, feed forward control takes into consideration the factors which have an adverse effect on operations and suppresses them before they occur in order to protect the system / operation from being affected. Therefore, by adopting this method, uncertainty can be reduced.

3. Market research and Focus Group

These are techniques for gathering external information. An organisation can use these techniques to estimate the demand for the product and accordingly prepare its budgets. By using these techniques, uncertainty about estimating the potential demand for the product can be reduced.

4. Contingency planning

As we studied earlier, contingency planning is about planning for contingent events affecting the budget target i.e. having stand-by arrangements for various activities. It is a good way of mitigating the risks arising from a changing environment.



Example

Perfect Ltd has a contract with Ideal Ltd to procure the raw materials required for production. Perfect Ltd also has an alternative arrangement to buy raw material from Model Ltd in case Ideal Ltd fails to honour the contract for any reason. This is a contingency plan for dealing with the uncertainty regarding the supply of raw materials.

5. Prediction about the changing economic parameters

Economic parameters such as trade cycle, inflation rate, interest rate etc. have an impact on the working of an organisation.

There are certain government and non-government agencies which give an indication of changes in economic parameters through various reports generated by them. These reports give important information about the direction of the economy of any particular country or area.



Example

Moody, Standard and Poor are international credit rating agencies which give credit ratings to a country seeking credit from the international market or seeking foreign investments. These agencies also give an explanation of why they have given such a rating and discuss the economic condition of that particular country. These reports may form an important source of information about the economy of any country and a business entity may take business decisions accordingly.

6. Shorter budget periods

Normally, most organisations have a budget period of one year, but organisations which operate in an uncertain environment may prefer to prepare budgets for a period of less than a year, for which the outcome of future events can be better predicted.

7. Other forecasting techniques

Forecasting is about predicting future events. It is an essential technique for preparing a budget. Forecasting techniques help an organisation to acquire information about future changes in order to plan appropriate courses of action.

The Delphi method and the S-curve method are the qualitative forecasting techniques, which help in forecasting.



Example

The Delphi method is an example of a forecasting technique where a panel of experts predict the future by answering the relevant questionnaire related to the organisation. As the prediction is made by a number of experts instead of a single person, it yields a better result. This helps in reducing the uncertainty.

8. Application of probability theory

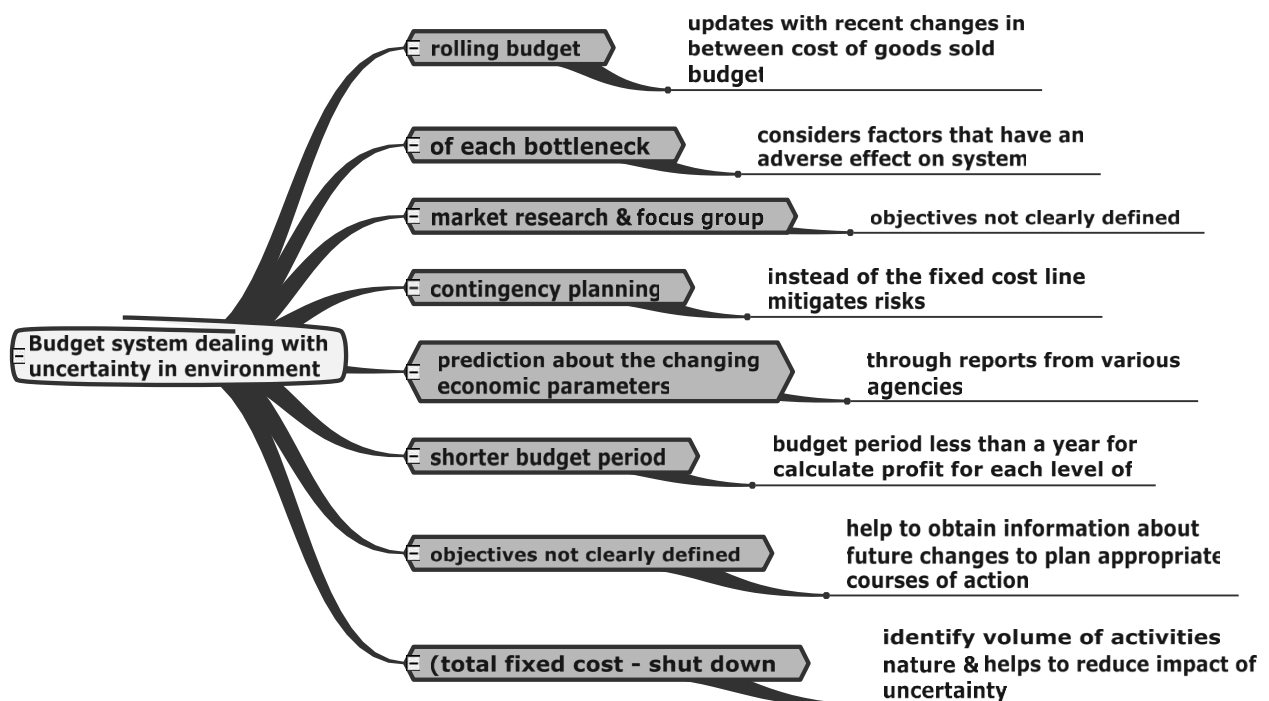
With the benefit of past experience, it is sometimes possible to assign probabilities to the states of nature according to their likelihood of occurrence. The application of the probability theory, in the budgetary system helps to reduce the impact of uncertainty on the budget.



Example

Assigning probabilities to all the possible prices that a product may fetch in the market and then calculating the expected price would provide a good estimation of the representative future price that should be considered for budget preparation.

SUMMARY





Test Yourself 4

The following are the approximate sales and profits for the last few years of Better Ltd:

Particulars	TZS'000
Sales	1,200,000
Variable costs	(280,000)
Contribution	920,000
Fixed cost	(750,000)
Profit	170,000

Better Ltd is planning to introduce a new product next year. Expected annual sales for the new product are TZS300 million with variable costs 40% of sales and fixed costs of TZS4.5 million per month. The new product may be introduced either at the beginning of the third month or at the beginning of the eleventh month.

It is expected that variable cost may go up by 7.5% on account of an increase in the wage rate.

Required:

Identify the optimistic and pessimistic situations, and prepare the budget of Better Ltd for the next year.

Answers to Test Yourself

Answer to TY 1

Budgetary control system

A budgetary control system is a means of monitoring revenue and costs and thereby exercising control in an entity by devising budgets and comparing budgeted figures with actual results to find out discrepancies, if any, and thereby take corrective action.

Objectives of the budgetary control system

(i) Planning

A budget is a basis for planning. The budget motivates managers to prepare a plan. In a budget, the targets are already decided. In order to meet the budget, it is necessary to decide the plan of action that leads them to achieve the target.

(ii) Controlling

A budgetary control system identifies any variances, investigates the reasons for these variances and accordingly leads to corrective action being taken. Any extravagant expenses are identified and steps are taken to avoid their recurrence. Therefore, a budget acts as a tool for controlling.

(iii) Communication

In a budgetary control system, top management communicates its expectations to the lower level management. Lower level management communicates its problems in fulfilling the set targets.

(iv) Co-ordination

A budget aims to co-ordinate the activities of an organisation. The organisation should try to achieve goal congruence. The individual objectives and actions are combined to achieve the organisational objectives.

(v) Motivation

Often, a reward system is connected to the success of the budget. In such cases, a budget motivates managers to give their best work.

360: Budgetary Planning and Control

(vi) Performance evaluation

A budget provides a basis for evaluation of the performance of a division or a manager. Actual results are compared with budgeted figures and any difference is analysed to correct in the future.

(vii) To increase profitability

In a budget, extravagant expenses are identified. These can then be avoided in the future by decreasing costs, and thereby increasing profitability.

(viii) To ensure optimal utilisation of the resources

In a budget, limiting factors / constraints are identified, and are allocated in such a manner that they can be utilised optimally.

(ix) To identify the areas of inefficiency

By identifying the variances, a budgetary control system helps in identifying the areas of inefficiency.

Answer to TY 2

CIMA Official Terminology defines a zero-base budget as a method of budgeting which requires each cost element to be specifically justified, as though the activities to which the budget relates were being undertaken for the first time. Without approval, the budget allowance is zero.

ZBB involves a cost benefit analysis in which each cost element included in the budget will need to be justified.

ZBB aims to curtail extravagant costs. In budgeting for direct cost elements where there is a relationship between input and output, this system is not useful because, in this case, the input requirement depends upon the output.

For example, if an organisation has to produce 2,000 bikes, it would definitely require 2,000 engines.

Therefore a zero-base budget is appropriate for support activities such as advertisement, after sales service, research and development expenditures etc. where there is no correlation between these costs and the volume of sales or volume of production.

This approach can be used in profit-making as well as non-profit-making organisations. ZBB is also appropriate for service organisations where there are more chances of saving costs by planning, without affecting the quality of service.

Answer to TY 3

The kind of information required in budgeting is about the consumers, competitors, market, government, regulatory bodies etc. Information about the following is necessary:

(a) Customers

Information about customers is vital for projecting the sales of any product. This includes information about their expectations, changes in taste, preferences for any brand, price they would agree to pay for a product etc. This information can be used in estimating the demand for the product while preparing the sales budget.

(b) Competitors

This includes information about the pricing and other strategies of the competitors, their market share etc. This information may help in deciding the strategies of the organisation.

(c) Legal

This is information regarding the laws and regulations applicable to an organisation. An organisation should have knowledge about the applicable laws and regulations in order to make sure that it complies with them.

(d) Government and regulatory authorities

Decisions of the regulatory authorities may affect the operation of an organisation. Therefore one needs to be aware of the policies of the regulating authorities and the government before devising a budget. Also, the political environment of a country may influence the government's policy towards an industry.

(e) Suppliers and availability of other resources and infrastructure

An organisation should have a proper database with information on suppliers and the availability of raw materials of the desired quantity and quality. These may act as limiting factors. Therefore, an organisation should have information about this in advance.

Also, some internal information is relevant for the preparation of the budget. When the budget of one department is linked to the budget of any other department(s), information about the other department is necessary for the preparation of the budget.

Sources of information**(a) Internal forms**

Internal information can be gathered from the records maintained in an organisation and other internal forms filled in by the various departments.

(b) Market research and focus group

In market research, researchers interview certain people to gather specific information. In a focus group a group of a few people (a target group) is asked certain questions so as to know their views on different matters. These techniques help in gathering qualitative information about the expectations of the customers.

(c) Newspapers and other media of communication

Newspapers, magazines, and electronic media also act as sources of useful information about the various factors affecting the budget of an organisation. Nowadays, the internet has become the most vital source of information.

(d) Information from regulatory authorities

There are certain industries whose affairs are controlled by regulatory authorities e.g. the banking industry in any country is regulated by the respective central banks; insurance businesses in various countries are also regulated by the respective authorities etc. These regulators may frame certain rules and regulations that may have an impact on the budget of an organisation. Moreover, the regulator may sometimes provide vital information about the industry.

(e) Suppliers' price lists and brochures

This will provide important information about the pricing strategy, product launching etc. of the suppliers.

Answer to TY 4

The uncertainties in the given problem are: launch of the new product at the beginning of either the third month or the eleventh month, change in variable cost of the current product etc. We can expect the following in the optimistic and pessimistic situations:

Optimistic	Pessimistic
New product after 2 months	New product after 10 months
No changes in costs	Variable cost up by 7.5%

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	Optimistic		Pessimistic	
	TZS'000	TZS'000	TZS'000	TZS'000
Revenue from current product	1,200,000	920,000	1,200,000	899,000
Variable cost	(280,000)		(301,000)	
Contribution				
New product sales (W1)	250,000	150,000	50,000	30,000
Variable cost (W2)	(100,000)		(20,000)	
Contribution				
Total contribution		1,070,000		929,000
Fixed cost				
New product (W3)	45,000		9,000	
Others	750,000		750,000	
		(795,000)		(759,000)
Profit		275,000		170,000

Workings

W1 New product sales

For optimistic situation: TZS300 million x 10 months/12 months = TZS250 million

For pessimistic situation: TZS300 million x 2 months/12 months = TZS50 million

W2 Variable cost of new product

For optimistic situation: TZS250 million x 40% = TZS100 million

For pessimistic situation: TZS50 million x 40% = TZS20 million

W3 Fixed cost

For optimistic situation: TZS4.5 million x 10 months = TZS45 million

For pessimistic situation: TZS4.5 million x 2 months = TZS9 million

Quick Quiz

1. Feed forward control is suitable for which kind of organisations?
2. Define an activity-based budget.
3. Define the bottom-up approach.
4. What kind of information about the customers is useful for an organisation for budgeting?
5. List any three sources of information used in budgetary systems.
6. _____ is one of the major difficulties an organisation has to face when changing a budgetary system.
7. What is contingency planning?

Answers to Quick Quiz

1. Feed forward control is suitable to those organisations working in highly volatile environment.
2. According to CIMA Official Terminology, an activity-based budget is a method of budgeting based on an activity framework and utilising cost driver data in the budget-setting and variance feedback processes.
3. According to CIMA Official Terminology, the bottom-up approach is a budgeting system in which all budget holders are given the opportunity to participate in setting their own budgets.

4. Needs of the customer, any change in the taste of the customers, price which they are ready to pay or can be acceptable to them, expected demand for the product etc. This information about the customer would be helpful while preparing the budget.
5.
 - a) Market research and focus group
 - b) Magazines and other media of communication
 - c) Government report and statistics
6. Resistance to change by personnel in the organisation.
7. Contingency planning is a standby arrangement for various activities. It is a plan for mitigating the probable risks.

Self Examination Questions

Question 1

What are activity-based budgets and rolling budgets? For which organisations are they appropriate?

Question 2

- (a) Discuss the key features of zero-base budgeting and explain how it may be applied to a not-for-profit organisation.
- (b) Briefly discuss how activity-based budgeting might be introduced into a manufacturing organisation and the advantages that might arise from the use of activity-based budgeting in such an organisation.

Question 3

Avila Engineers Plc manufactures and sells components used by car manufacturers. The company operates a budgetary control system.

The management accountant of the company expected that 5,300 kg of direct material will be required in 20Y0. However, contingency for a reduction of 5% has been estimated and approved due to an improvement in the production process.

The price of the direct material was budgeted on the basis of previous year's material cost i.e. TZS260,000 per kg. However, it is estimated that the price will be significantly affected by the supply of the material in the market.

The following estimates have been made for 20Y0.

Supply in the market	Increase in the price	Probability
Good	Nil	60%
Normal	10%	20%
Scarce	20%	20%

Additionally, inflation of 5% on direct material cost is forecasted for 20X9 and 20Y0.

Question 4

State any five techniques for dealing with uncertainty in the budget environment.

Answers to Self-Examination Questions

Answer to SEQ 1

(a) Activity-based budget

CIMA Official Terminology defines **an activity-based budget** as a method of budgeting based on an activity framework and utilising cost driver data in the budget-setting and variance feedback processes.

Under this system, activities causing costs for value addition are evaluated and only those activities that can be justified are allowed.

Suitability

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For better results, it is necessary to have activity-based budgets in organisations where activity-based costing systems are adopted.

As this system identifies the cause and effect relationship between the activity and the cost and also between the activity and the product, it is a most appropriate system. However, for its implementation, a detailed analysis is needed in the organisations that have already adopted an activity-based budget.

(b) Rolling Budgets

Rolling budgets cover a defined period of time e.g. one year, but are prepared more frequently causing regular updates in the budget estimate by adding a further period and deducting the earliest period.

Rolling budgets take into consideration the recent changes in the environment and therefore, minimise the operational variances.

Suitability

As it takes care of latest developments, it is most suitable to the organisations working in a volatile environment.

Answer to SEQ 2

(a) Under a zero-base budget system, as part of the budget process, all the cost elements need to be re-evaluated for the value addition. Economic resources should be consumed only for the purpose of value addition. Functional managers need to justify the inclusion of each cost element in the proposed budget. Only when the need is justified, are the costs elements allowed in the budget.

Under this system, the functional managers need to develop different activities aiming at achieving the organisational activities and then rank such activities.

Once the activities are ranked on the basis of their efficiency and effectiveness in fulfilling the organisational objectives, the budget committee may review the activities. The activities are selected, resources are then allocated to the activities and included in the budget. Such budgets are then reviewed by the senior managers, controllers or the budget department for their appropriateness and to see whether they aim at achieving goal congruence.

As a result of this, the reviewers may ask the functional managers to modify the budgets.

On the other hand, under an incremental budget system, certain adjustments are made to the budget of the previous year considering the changes in the coming budgetary period.

As the previous year's budget is taken as a base for the current year, there are chances that the inefficiencies of the previous year may be carried forward into the current year. Also, a budget slack is sometimes added to the budgets. These disadvantages can be overcome by adopting a zero-base budget system.

ZBB aims at achieving value for money which is of utmost importance to not-for-profit organisations as those who donated money to the charity are keen to know whether their money is being used effectively. Unlike profit-making organisations, there is no input-output relationship in the case of not-for profit organisations. ZBB is more suitable to these kinds of operations.

When ZBB is used in not-for-profit organisations, each activity is analysed to decide whether it adds value to the organisation and aims at achieving the objectives of the organisation.

ZBB can be effectively used in the service industry and not-for-profit organisations.

(b) Under activity-based budgeting (ABB), only the resources that are necessary for the activities essential to achieve the targets are allowed. To prepare an activity-based budget, a detailed analysis of costs and cost drivers is needed. This analysis helps in determining the cost drivers and cost pools that are used in activity-based costing.

Under the activity-based costing system of overhead apportionment, costs are identified with the activities pooling the costs. This determines an activity-based recovery rate.

After the required activity level is determined through conventional methods, the requirement of the resource-consuming activities is assessed from an organisational perspective. Only the necessary activities are then identified. Then the resources needed for these activities are assessed.

Once the activity levels are determined, e.g. production of 50,000 units, ABB then requires determination of the

quantity of activity cost drivers, e.g. the number of set-ups needed to support the planned sales and production. Standard cost data needs to be collected and studied to determine the details of the activity cost drivers required to produce a product.

The resources needed to support the budgeted number of activity cost drivers are identified (e.g. the number of maintenance hours needed to complete the machine set-ups). These resource requirements are then matched against the available capacity (i.e. the number of purchase clerks to process purchase orders) to determine whether any change in the capacity needs to be incorporated.

In ABB, as costs and activities are analysed in detail, resources are allocated more efficiently. It also avoids the drawbacks of the incremental budget such as inefficiencies in the previous year's budget and budget slacks because resources are allowed only on the basis of the desired level of activity and in accordance with the desired cost drivers.

Answer to SEQ 3

Due to uncertainty regarding the expenses on direct material, the contingency of a reduction of 5% has been agreed. Therefore, the direct material cost budget should be prepared for 5,035 kg (5,300 kg - 5% of 5,300 kg).

The cost of the material is also affected by its supply in the market. This could result in extra cost in the material budget. Therefore, the following adjustment is required to be made to the budget:

$$[(\text{Nil} \times 60\%) + (10\% \times 20\%) + (20\% \times 20\%)] = 6\%$$

An adjustment of 6% increase in the price of the material is required to be made to the material budget.

Therefore, the budgeted amount of direct material for 20Y0:

$$5,035 \text{ kg} \times \text{TZS}260,000 \text{ per kg} \times 106\% \times 105\% = \text{TZS}1,457,028,000$$

Remember to adjust the direct material cost budget for 5% inflation.

Therefore, the direct material cost of TZS1,457,028,000 is expected to be incurred in 20Y0.

Answer to SEQ 4

A budget is prepared in advance, for the period for which it is prepared. It is based on estimates and is therefore affected by uncertainties in the environment.

The following techniques can be used to deal with uncertainties in the budget environment:

(a) Rolling budget

As a rolling budget is continuously updated with recent changes, it takes account of the changing environment and its effect on the budget of an organisation.

(b) Contingency planning

This is planning for unforeseen events so as to tackle the uncertainty arising as a result of these unforeseen events. Having standby arrangements is a good way of dealing with uncertainty.

(c) Feed forward controls

Feed forward controls anticipate the factors that adversely affect the operations of an organisation and restrain them before their occurrence. These factors are considered while preparing budgets. In this way uncertainties are dealt with before their occurrence and their impact can be reduced.

(d) Market research and focus groups

These are the techniques used for gathering information. Perfect information helps in anticipating the outcomes of a particular strategy and thereby helps in taking better decisions.

(e) Prediction about the changing economic parameters

Inflation rate, interest rates etc. are the economic parameters that have an impact on the success of an organisation. If these factors are predicted in advance and if strategies are defined after taking into consideration their impact on the organisation, the organisation would not be affected much as a result of change in the economic parameters.

(f) Shorter budget periods

Normally the budget period is of one year, but organisations that operate in an uncertain environment, may prefer to have a budget period of less than a year for which the outcome of the future events can be better predicted.

(g) Other forecasting techniques

The Delphi method and the S-curve method are the qualitative forecasting techniques, which help in forecasting. Under these methods, experts' opinions are taken into consideration to forecast the future.

SECTION C3: TYPES OF BUDGET

Get Through Intro

Budgets may be of different types to suit the different practices followed by different organisations. An organisation using a conventional system of budgeting may sometimes need to switch over to another system to suit its requirements. The nature of the business, the business's strategic plans, the availability of all the relevant information and the nature of the existing record-keeping system etc. are the factors which influence the decision on the most suitable budgeting practice for an organisation.

Changing a budgetary system is not a simple task. An organisation has to face certain difficulties in the form of resistance to change by the personnel of the organisation, changes required in the existing support systems, changes required in the cost recording system, etc. in order to change its budgetary system.

This SECTION will take you through the usefulness and problems with different budget types and the difficulties of changing the type of budget used. This will allow you, in your future role as a management accountant, to evaluate different budgets and decide which one is most appropriate for your organisation. This knowledge will also help you to solve the relevant questions in your examination.

Learning Outcomes

- a) Identify the usefulness and problems with different types of budgets (functional, master, flexible, zero-base, activity-based and incremental)
- b) Prepare functional budgets, master budgets.
- c) Evaluate the difficulties of changing the type of budget used.

1. Identify the usefulness and problems with different types of budgets (functional, master, flexible, zero-base, activity-based and incremental).

[Learning Outcome a]

In Section C2, we have discussed the different types of budgets. In this Section, we will discuss the usefulness of these budgets and the problems associated with their use.

1.1 Flexible budget

As discussed in the previous paragraphs, budgets are generally prepared for a fixed level of activity, and actual results are compared to evaluate the performance. However, when the actual activity level is different from the budgeted, comparison becomes difficult. Also, in the uncertain real life environment, the chances of attaining the predicted activity level are remote.

In order to tackle this, a budget is prepared for various expected levels of activities, which is called a flexible budget.



Example

If production capacity is 50,000 units, and demand for the product cannot be estimated exactly but, from past experience, may be estimated to vary from 30,000 units to 50,000 units, a flexible budget may be prepared for 30,000 units, 35,000 units, 40,000 units, 45,000 units and 50,000 units.

A flexible budget is a budget that takes into account changes in sales volume and other cost driver activities. The budget incorporates the effects on each cost and revenue as a result of change in activity. It determines the variability of the cost along with the level of activity, which will be then used as a control tool. The aim of this budget is to control the cost.

During the preparation of a flexible budget, costs are analysed as fixed costs, variable costs and semi-variable costs. Semi-variable costs are then further segregated into their fixed and variable components.

1. Usefulness

- Flexible budgets are mainly prepared for control purposes. If the actual results are compared with the static budget (a budget which is not a flexible budget and prepared for only one level of activity) the performance evaluation may give misleading results, as a change in the level of activity has not been considered. On the other hand, a flexible budget is prepared for various levels of activities and, according to the actual level of activity achieved, a comparison is made.
- A flexible budget is suitable for organisations where it is difficult to forecast the demand for the products.
- Organisations which operate in an uncertain environment can adopt a flexible budget. It is simple, and saves time and cost as compared to contingency planning and rolling budgets.
- This budget is also a good option for organisations which have limiting factors and whose targets may change according to the availability of the limiting factors.

2. Problems

- Determining the level of activity itself is a big problem. It is also difficult to ascertain the range of activity one should consider for preparing a flexible budget. Therefore, in most cases, only the behaviour of the cost is determined instead of the level of activity.
- Analysing the cost behaviour, i.e. its variability, is a time-consuming affair and managers are normally reluctant to do this.



Example

Tende Limited makes metal casings for lawn mowers in one standard size. In February 2018 the company's budget for sales and related costs is as follows:

	TZS'000
Sales: 800 units x TZS 35,000	28,000
Costs	
Direct materials: 800 Units x (2kg x TZS 6,000)	(9,600)
Direct labour: 800 units x (1 hour x TZS 7,500)	(6,000)
Production overheads	<u>(4,000)</u>
	8,400
Selling and administrative overheads	<u>(2,300)</u>
Net Profit	<u>6,100</u>

The actual figures for February 2018 are as follows:

Sales: 900 Units @ TZS 36,000	32,400
Costs	
Direct materials: 900 Units x (1.9kg x TZS 5,500)	(9,405)
Direct labour: 900 units x (1.2 hours x TZS 7,000)	(7,506)
Production overheads	<u>(4,400)</u>
	11,089
Selling and administrative overheads	<u>(2,450)</u>
Net profit	<u>8,639</u>

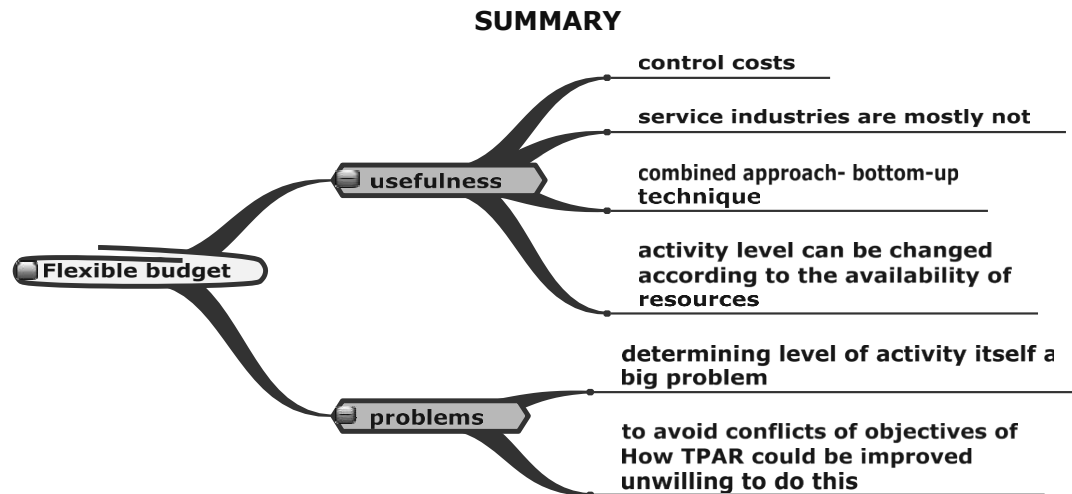
REQUIRED:

- i) Calculate unit cost for direct material, direct labour and sales price to be applied for the purpose of preparing flexed budget
- ii) Prepare a flexed budget for 900 units for February 2018 and calculate the variances

Solution Tende:

	Fixed Budget	Actual	Unit	budgeted cost
Sales	28000	32400	35	31500
Cost				
Direct material	9600	9405	12	10800
Direct labour	6000	7506	7.5	6750
Production overheads	4000	4400		4000
	8400	11089		9950
Selling and Admin expe	2300	2450		2300
Net profit	6100	8639		7650

	Flexed budget	Actual	variance	
Sales	31500	32400	-900	F
Cost				
Direct material	10800	9405	1395	F
Direct labour	6750	7506	-756	U
Production overheads	4000	4400	-400	U
	9950	11089	-1139	U
Selling and Admin expenses	2300	2450	-150	U
Net profit	7650	8639	-989	U



1.2 Zero-based budget (ZBB)

The definition of a zero-base budget is given in SECTION C2. In a zero-base budget, the financial planning starts from scratch. This is unlike the budgeting practice for incremental budgeting where an organisation's historical costs are the basis for budget planning. In a zero-base budget, each of the budget proposals needs to be justified in order to be considered.

1. Usefulness

- (a) Goals are more accurately established and alternative means are explicitly considered.
- (b) Managers are more involved in a well-structured budget process that encourages communication and consensus.
- (c) Priorities amongst activities are better pinpointed.
- (d) It focuses attention on value for money and makes explicit the relationship between the input of resources and the output of benefits.
- (e) A ZBB results in a more efficient allocation of resources to activities and departments.



Example

In a ZBB, the production department may need to justify the labour-hours it needs to utilise to perform a given volume of production. Accordingly, the department may need to produce a greater volume than before with less man-power.

- (f) A ZBB is a systematic way of challenging the existing situation and compels the organisation to examine alternative activities and existing cost behaviour patterns and expenditure levels.

2. Problems

- (a) The time and cost of preparing the budget are much higher than for an incremental budget. The paperwork also increases substantially.
- (b) Managers may dislike having to justify each minor component of their proposals. This will cause them to oppose a zero-base budget.
- (c) The determination of performance measures is difficult.
- (d) Budget-holders may try to curtail short-term expenditures which will prove expensive in the long run.

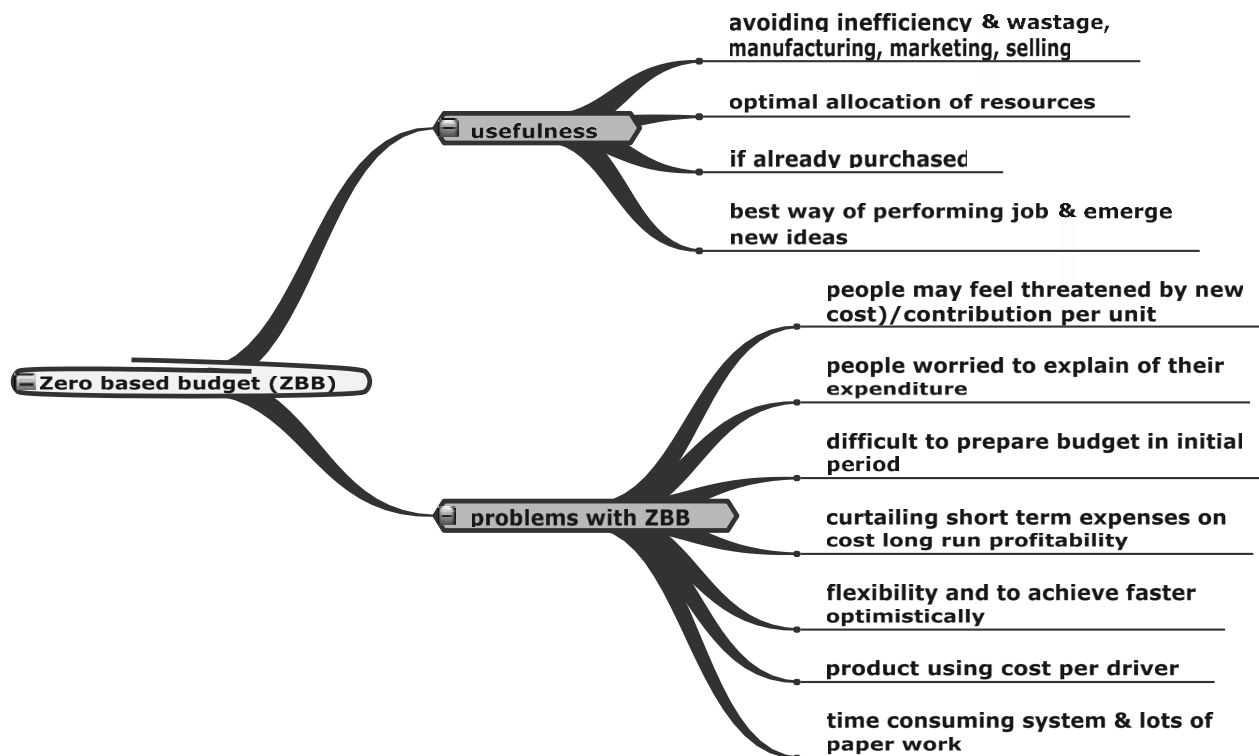


Example

Curtailling the maintenance cost of machinery may result in the breakdown of machinery and stoppage of production.

- (e) It is more likely that the budgets prepared will be optimistic so as to get approval easily even if it is not realistic or achievable.
- (f) As allowing cost and allocating resources are a matter of judgement by the person passing the budget, this may result in inter-departmental conflict.
- (g) If the ZBB is used for years, there is a possibility that managers will repeat the same arguments to justify the cost elements. In this case, the ZBB would become a mechanical exercise and the benefits of ZBB would be lost.

SUMMARY



1.3 Activity-based budget (ABB)

The definition of an activity-based budget is given in SECTION C2. In this type of budget, the targets are determined first, then the activities necessary to meet these targets are identified and only those resources that are necessary to perform these activities are allotted.

Those who are responsible for meeting a particular budget target, i.e. the budget-holders, should have control over the events that affect the performance under their jurisdiction.

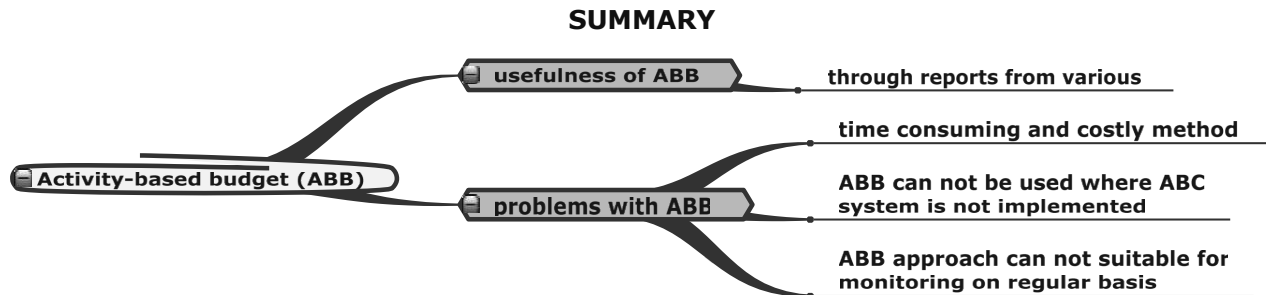
1. Usefulness

- (a) An activity-based budget aims to allocate resources optimally. Only those resources that are critical for an activity are allocated.
- (b) An activity-based budget facilitates continuous improvement.
- (c) The process of preparing an ABB highlights opportunities for cost reduction and elimination of wasteful activities.
- (d) ABB reduces the workload to the minimum level necessary to achieve the organisational objectives.
- (e) A traditional budget does not look beyond the organisation and treats the activities of its suppliers or customers as a given condition. In contrast, a successful ABB requires co-ordinating closely with suppliers and meeting the needs of customers and therefore it becomes more effective.

2. Problems

- (a) Its implementation is a long-term process. Moreover, it is an expensive method of preparing a budget.
- (b) Being a new concept, an activity-based budget is expected to produce initial errors. In addition, the organisation's personnel are likely to be reluctant to implement a new system which is unfamiliar to them. To avoid this, an orientation programme and the involvement of top management are necessary to motivate the personnel.
- (c) The ABC system calculates the costs of individual activities and assigns activity costs to the products or services (i.e. the cost objects) on the basis of the activities needed to produce each product or service. Without this information it is not possible to evaluate the activities. Therefore, an ABB cannot be used in an organisation where the ABC system has not yet been adopted.

- (d) An activity-based approach may not always be suitable for month-to-month monitoring of actual performance because of short-term fluctuations. However, if the increase in activity lasts for a long period, it is likely that the organisation will need more staff, will have to pay an overtime premium and so on. The inevitable variability in the cost per activity warrants attention to whether resources are being used effectively or not and what levels may be required in the future.



1.4 Incremental budget

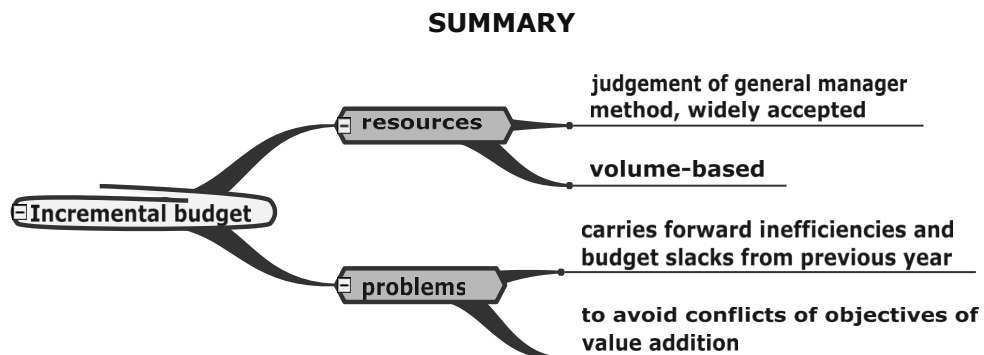
Under an incremental budget, the budget of the previous year is taken as a base. This base is then adjusted for changes expected in the budget period for which the budget is prepared.

1. Usefulness

- (a) It is a simple, cost and time-saving method of budgeting and therefore widely accepted by the organisations.
- (b) An organisation's personnel usually prefer this system, as they are given a ready-made base on which to prepare a budget rather than preparing the budget from scratch.

2. Problems

- (a) The main disadvantage of this method is that the majority of the previous year's expenditures remain unchanged in the new budget. As a result, the inefficiencies and wastages of the base period are carried forward.
- (b) There is also more chance of budget slack in the case of an incremental budget; as the cost elements are not evaluated for value addition.



1.5 Master Budget

A master budget is a consolidation of the various operational and financial budgets. It is a projected financial plan. Budgeted financial statements are prepared on the basis of the master budget.

1. Usefulness

- (a) The prime advantage of the master budget is that it helps to co-ordinate all the other budgets and to devise the short-term objectives of an organisation. Any conflict between departments is resolved by the master budget as it is a consolidation of all the functional budgets.



Example

The master budget ensures synchronisation in the objectives of the sales department and the production department. The production department agrees to produce only that quantity which the sales department can sell by putting in all its efforts.

- (b) It is a good medium of communication between the various departments as it consolidates the functional budgets.
- (c) It enables an overall plan for achieving the budget targets to be prepared. Budgeted income statements, budgeted cash flow statements and forecasted balance sheets are prepared using the master budget.
- (d) The master budget incorporates the targets of every department and therefore acts as a measure of performance evaluation.

2. Problems

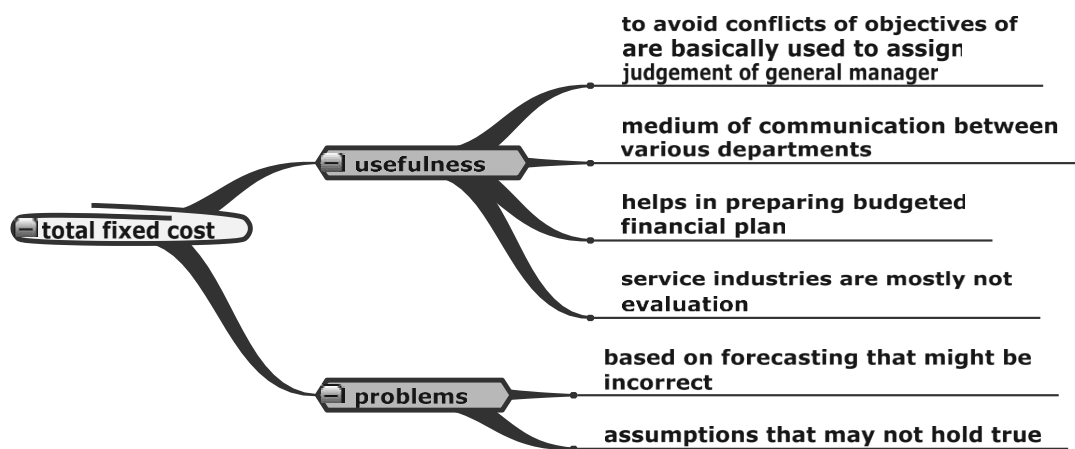
- (a) Budgets are based on forecasting. This means they are vulnerable to uncertainty in the environment.
- (b) Master budget is based on certain assumptions that may not prove correct over the period.



Example

The master budget assumes that the variable cost per unit of the production will remain the same over the budget period. This is not always the case in reality. A change in raw material price or a change in labour rate etc. may cause a change in the variable cost per unit. In this case, the master budget will be meaningless.

SUMMARY



1.6 Functional Budget

Functional budgets are prepared for an individual function. For each operation in the organisation a budget is prepared.

Sales budget, Purchase budget, Production budget, Cash budget etc. are examples of a functional budget. These budgets are consolidated to arrive at a master budget.

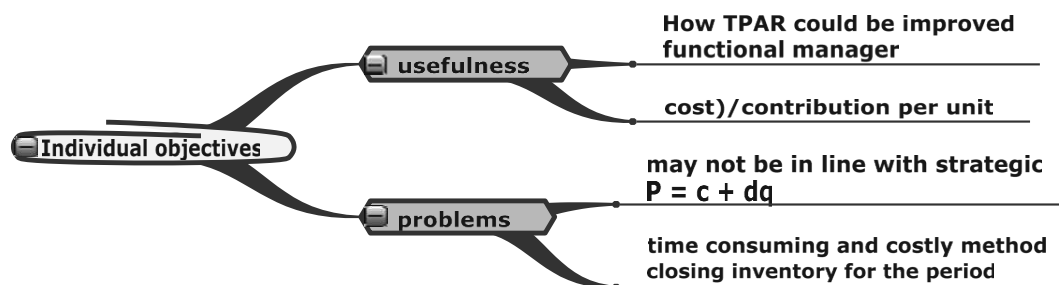
1. Usefulness

- (a) A functional budget gives targets to the individual functional manager.
- (b) Those who actually implement the budget prepare the functional budget. They are familiar with the problems at the grassroots level. Therefore the budgets are more realistic and motivating.

2. Problems

- (a) As the functional managers prepare the functional budgets, the targets may not be in line with the strategic objectives or may conflict either with the organisational objectives or inter-departmental objectives. This problem can be avoided by encouraging co-ordination between the functional managers.
- (b) Functional budgets are based on forecasts. There are many external as well as internal environmental factors (such as a change in demand for a product, non-availability of a particular raw material, high attrition causing shortage of skilled labourers, etc.) that affect the functional budgets. If these factors behave differently than predicted, this may render the budgetary system ineffective.

SUMMARY



Test Yourself 1

Splendour Plc identifies its overhead costs and their variability with changes in sales volume. Its estimated sales at 100% capacity level are TZS375 million. The following table shows how the overheads of the company behave:

Administration costs	Office salaries	TZS60 million
	General expenses	2% of sales
	Depreciation	TZS4.5 million
	Rates and taxes	TZS3.625 million
Selling costs	Salaries	9% of sales
	Travelling expenses	2% of sales
	Sales office expenses	1% of sales
	General expenses	1% of sales
Distribution costs	Wages	TZS10 million
	Rent	1% of sales
	Other expenses	5% of sales

Required:

Based on the above information, prepare a flexible budget (for sales revenue and overhead costs) for 80% and 110% capacity levels, for the year 20X7.

2. Prepare functional budgets, master budgets.**[Learning Outcome b]**

We have already seen that the operational budget of an organisation comprises the budgets for all the functional activities (known as the functional budgets) and the master budget which is a consolidation of the functional budgets and aims at predicting the profit for the organisation during the budget period. The most common operational activities for which a functional budget is prepared are sales, production, material (usage and purchase), labour and overheads.

2.1 Functional budgets**Diagram 1: Functional budgets****1. Sales budget**

The sales budget is **the sales target** for a budget period. It is usually prepared by the marketing/sales department. It shows the projected volume of sales and the estimated selling prices of each of the products that the company plans to sell. The estimates of demand and price of a product are calculated based on the performance of the previous period, feedback from the market about potential demand, information about competitors, and so on.

Sales forecasting is required for preparing the sales budget and helps an organisation to estimate its sales revenue for the budget period. The two factors that influence the projected sales revenue are:

- The projected volume of sales and
- The projected price of the product

Once the budgeted sales volume and selling price is determined, the sales budget is devised. The sales budget is normally the foundation of all the other functional budgets since in most of the cases the potential demand for the products is the principal budget factor. Based on the sales budget estimates, a production budget is prepared. As a result, the usefulness of all other functional budgets depends upon the reliability of the sales budget.



Example

The following is the information provided by the sales manager of Colourful Park Ltd for the month of December 20X9:

	Product Blue	Product Red
Budgeted sales (in units)	10,000	40,000
Budgeted selling price (TZS'000)	40	30

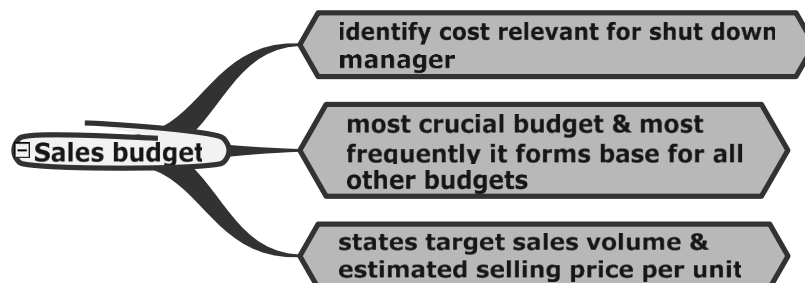
The sales budget of the company may be presented as follows:

Colourful Park Ltd Sales budget for month of December, 20X9			
Products	Budgeted sales	Budgeted sales	Total sales revenue
	Units	per unit TZS'000	TZS'000
Product: blue	10,000	40	400,000
Product: red	40,000	30	1,200,000
Total			1,600,000

In certain companies, the sales budget may be sub-divided so that managers have their individual goals. Sales budget can be sub-divided on the basis of:

- products
- management responsibility
- Area, etc.

SUMMARY





Test Yourself 2

Mark Trading Co sells two products A and B. The following estimates of sales volume are made for the year 20X9.

	Ist Quarter	IInd Quarter	IIIrd Quarter	IVth Quarter
Product A	100,000	140,000	90,000	120,000
Product B	90,000	120,000	100,000	110,000

The projected sales price for product A is TZS10,000 per unit, while that of product B is TZS20,000 per unit. You are required to prepare a sales budget for the year.

2. Production budget

A production budget is a forecast of the production volume for the budget period. It is normally devised based on the sales budget. The production plan should be in line with the sales plan and at the same time inventory levels for both raw materials inventory and finished goods inventory need to be taken into consideration.

While devising a production budget, the company must bear in mind that producing less than the sales target may run the risk of unfulfilled demand and, on the other hand, producing excess may require additional storage for the extra inventory. It also causes more funds to be invested in finished goods inventory.

The production budget helps to identify if there are any limiting factors in the production system such as availability of skilled labour, plant capacity, imbalance in machine capacities, availability of raw materials and so on. If there is a principal budget factor in the production system, the organisation should take steps to sub-contract workers or request existing workers to work for extra hours, hire additional machines or inspect new sources of raw materials.

Preparing the production budget is the responsibility of the production manager. The production budget is **expressed in quantities** of goods to be produced and might also show the cost of production.



Example

A production budget based on the information provided by the sales manager and the stores manager of Colourful Park Ltd

	Product Blue	Product Red
Budgeted sales (refer to the sales budget)	10,000 (units)	40,000 (units)
Inventory level required as at 31 December 20X9	500	4,500
Inventory as at 1 December 20X9	200	2,000

The production budget for the year may be presented as follows:

Colourful Park Ltd Production budget for month of December 20X9		
	Product Blue Units	Product Red Units
Budgeted sales	10,000	40,000
Add: closing inventory required	500	4,500
Total requirement	10,500	44,500
Less: opening inventory	200	2,000
Budgeted production	10,300	42,500

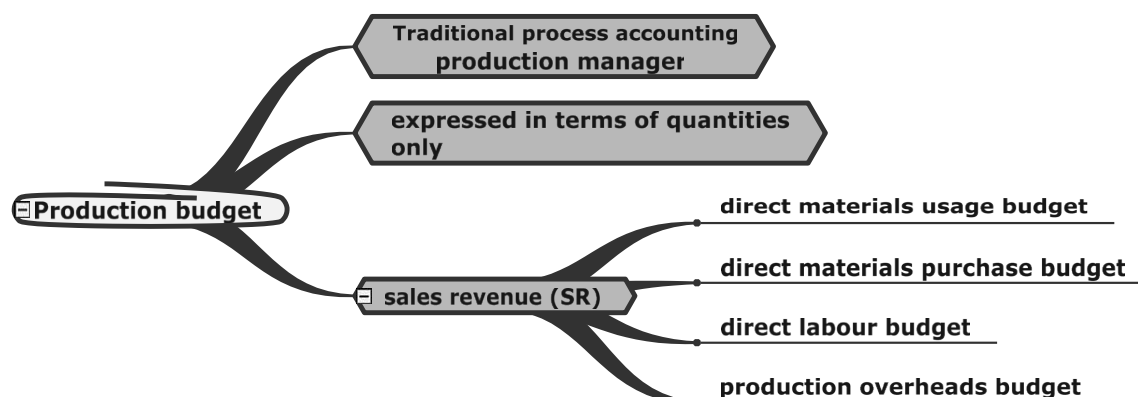


Important

The following budgets are dependent on the production budget and need to be prepared once the production budget is finalised:

- (a) Direct materials usage budget
- (b) Direct materials purchase budget
- (c) Direct labour budget
- (d) Production overhead budget

SUMMARY



Test Yourself 3

Beauty Ltd manufactures toiletries. The company's policy is to always maintain the closing inventory of 10,000 units. According to the sales budget the company has estimated that in the next year the company will achieve sales of 1,000,000 units. Show the company's production budget.

3. Direct materials budget

(a) Direct material usage budget

The direct material usage budget is the estimate of the required materials for production of the planned volume of output during the budget period. Generally, the direct material usage budget is expressed in quantity. However, it may also be expressed in quantitative as well as in monetary terms. The production manager or the production supervisors usually prepare estimates of the materials which are required to meet the production budget.

The **purposes** of the direct material usage budget are:

- (i) Assisting the purchase department in planning for the purchases in order to ensure procurement of the right quantity and quality of materials in the right time.
- (ii) Helping to establish control over the material usage. Direct material usage budget acts as a yardstick with which actual usage can be compared during the relevant period and therefore assists in evaluating performance.



Example

Continuing the previous example of Colourful Park Ltd

In addition, consider the following information given for the year ended 31 December 20X9

	Product Blue	Product Red
Budgeted production	10,300	42,500
Required quantity of material 'X' per unit	5 Kilogram	2 Kilogram
Required quantity of material 'Y' per unit	8 Kilogram	3 Kilogram

Colourful Park Ltd							
Direct material usage budget for month of December 20X9							
	Product Blue			Product Red			Total
	Production (units)	Materials consumption per unit of production	Total materials	Production (units)	Materials consumption per unit of production	Total material	Total
		(Kilogram)	(Kilogram) (a)		(Kilogram)	(Kilogram) (b)	Kilogram (a + b)
Material X	10,300	5	51,500	42,500	2	85,000	136,500
Material Y	10,300	8	82,400	42,500	3	127,500	209,900

(b) Direct material purchase budget

The direct material purchase budget derives the estimated quantity and value of the various materials needed to be purchased during the budget period. This budget is expressed in both quantitative as well as in monetary terms.

The **purposes** of the direct material purchase budget are as follows:

- This budget enables the material purchase department to plan for purchases well in advance.
- This budget helps in assessing the cash requirements for procurement of materials.
- This budget ensures that production is carried out without any interruption due to shortage of raw materials at any point of time.

The materials manager/purchase manager is the person responsible for preparation of the direct material purchase budget. Ultimately, it is his responsibility to ensure procurement of the right quantity and quality of material at the right price and at the right time.

**Example**

Information provided by Colourful Park Ltd for the month of December 20X9 is as follows:

	Material x	Material y
Inventory as at 1 December 20X9	14,000 (units)	13,800 (units)
Budgeted inventory as at 31 December 20X9	10,000 (units)	12,500 (units)
Purchase price (TZS'000)	2	3.5

The material purchase budget will be as follows:

Colourful Park Ltd		
Direct material purchase budget for the month of December 20X9		
	Material x Units	Material y Units
Quantity to be consumed according to the material usage budget	*136,500	*209,900
Add: budgeted closing inventory	10,000	12,500
	146,500	222,400
Less: planned opening inventory	14,000	13,800
Total units to be purchased	132,500	208,600
Budgeted purchase price (TZS'000)	2	3.50
Total budgeted cost of purchase (TZS'000)	265,000	730,100

*For figures see the material usage budget above.

For control purposes the materials manager is most likely to break the annual material purchase budget into twelve monthly budgets.



Test Yourself 4

The sales executive of Cool-one Ltd expects to sell 60,000 units of air coolers in the year. The production manager has estimated the requirements of the raw materials for producing each unit of air-cooler as:

Raw material X – 4 units

Raw material Y – 6 units

The opening and closing balances of the finished goods and raw materials estimated are as follows:

Item	Inventory at the beginning of the next year (Units)	Inventory at the end of the next year (Units)
X	10,000	11,000
Y	15,000	17,000
Finished goods	8,000	11,000

Prepare a purchase budget showing the total amount of raw material purchased.

4. Direct labour budget

The direct labour budget is an estimate of the direct labour requirement (for each grade) for producing the planned volume of output according to the production budget. This budget should be developed in terms of both direct labour hours and direct labour costs.

The primary purpose of devising a direct labour budget is to assess the requirement for each grade of labour well in advance and also to estimate the related cost of the labour. It also provides the relevant data to estimate the unit cost of manufacturing each product, in order to assess cash outflow requirements and establish control.

The production supervisors and the production manager prepare the direct labour budget. However, normally it is the responsibility of the HR department to determine the rates per hour payable to each grade of labour.



Example

Continuing the previous example of Colourful Park Ltd

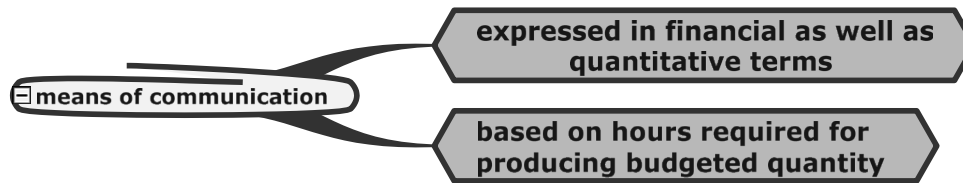
The following additional information is also given:

	Product Blue	Product Red
Labour hours required per unit of production	7 hours	3 hours
Rate per labour hour (TZS'000)	8	8

Colourful Park Ltd Direct labour budget for month of December 20X9			
	Product Blue	Product Red	Total
A. Budgeted production (in units)	*10,300	*42,500	52,800
B. Labour hours required per unit	7 hours	3 hours	-
C. Total labour hours (A X B)	72,100	127,500	199,600
D. Rate per labour hour (TZS'000)	8	8	8
E. Total wages (TZS'000) (C X D)	576,800	1,020,000	1,596,800

* For figures see the production budget for the month of December 20X9 above

SUMMARY



Test Yourself 5

Suggest a few steps that can be taken to avoid problems arising due to labour shortage.

5. Overhead budgets

The overhead budget of an organisation includes:

- (a) Production overhead budget
- (b) Selling and distribution overhead budget
- (c) Administrative overhead budget

Diagram 2: Overhead budget of an organisation



(a) Production overhead budget

The production overhead budget is the estimate of indirect expenditure to be incurred while producing the planned quantities of output during the budget period.

The **steps** required for setting a factory overhead budget are as follows:

- (i) Classify the separate production overhead costs based on their behaviour, into fixed, variable and semi-variable costs. This involves estimating the costs (variable) that will vary with a change in production volume and the costs (fixed) that are not likely to vary with any possible change in production volume.
- (ii) Estimate the costs incurred at each cost centre (e.g. department) so that the costs can be controlled at their points of origin.

Also, classify the overheads into controllable and non-controllable categories.

The purpose of devising the factory overhead budget is to provide planned data for indirect material requirements and man-hours (number of workers x average number of hours a worker would work in a day) required and to estimate the other indirect costs of manufacturing (for those workers who are not directly involved in the production process). This is also helpful in determining cash outflow requirements and for establishing control.

The indirect material and the indirect labour are first quantified e.g. in terms of kilograms, pounds, units and so on and then valued i.e. expressed in terms of money, to estimate the budgeted costs in the factory overhead budget. Other expenses (such as repairs, maintenance, power and so on) are expressed in monetary terms only.

Generally an accountant, in association with the production manager, prepares the factory overhead budget based on the historical data and the estimated volume of production / activity. In some organisations the production manager prepares this budget with respect to his department and finally senior management authorises it.



Example

The following information is about production overhead costs to be incurred by Colourful Park Ltd during the year 20X9

Variable overhead rate per unit of production		
	Product Blue	Product Red
	(TZS'000)	(TZS'000)
Indirect material	1.5	0.9
Indirect labour	0.6	1.1
Power (to the extent variable)	0.8	0.4
Maintenance (to the extent variable)	1.0	0.5
Semi-variable and fixed overhead expenses		
	Product Blue	Product Red
	(TZS'000)	(TZS'000)
Power (to the extent fixed)	25,000	20,000
Maintenance (to the extent fixed)	5,000	8,000
Depreciation	50,000	75,000
Rent	20,000	20,000

The factory overhead budget will be calculated as follows:

Colourful Park Ltd Factory overhead budget for the month December 20X9			
	Product Blue (TZS'000)	Product Red (TZS'000)	Total (TZS'000)
Variable costs			
Indirect material (W1)	15,450	38,250	53,700
Indirect labour (W2)	6,180	46,750	52,930
			106,630
Semi-variable costs			
Power (to the extent variable) (W3)	33,240	37,000	70,240
Maintenance (to the extent variable) (W4)	15,300	29,250	44,550
			114,790
Fixed costs			
Depreciation	50,000	75,000	125,000
Rent	20,000	20,000	40,000
Total			165,000
Total Costs			386,420

Workings

W1 Indirect material

Product Blue = 10,300* units X TZS15,000 = TZS15,450,000
 Product Red = 42,500* units X TZS900 = TZS38,250,000

* For figures see the production budget for the month of December 20X9 above.

W2 Indirect labour

Product Blue = 10,300 units X TZS6,000 = TZS6,180,000
 Product Red = 42,500 units X TZS1,100 = TZS46,750,000

W3 Semi-variable costs

Power

Total cost = total variable cost + total fixed cost
 Product Blue = TZS8,240,000 (10,300 units X TZS800) + TZS25,000,000 = TZS33,240,000
 Product Red = TZS17,000,000 (42,500 units X TZS400) + TZS20,000,000 = TZS37,000,000

Continued on the next page

W4 Semi-variable costs**Maintenance**

Total cost	= Total variable cost + Total fixed cost
Product Blue	= TZS10,300,000 (10,300 units X TZS1,000) + TZS5,000,000 = TZS15,300,000
Product Red	= TZS21,250,000 (42,500 units X TZS500) + TZS8,000,000 = TZS29,250,000

(b) Selling and distribution overhead budget

We have already seen how the sales budget is prepared. Once the sales budget is ready, estimating the appropriate selling and distribution expenses is a relatively straightforward task. In reality, the selling and distribution budgets are prepared separately. However, for simplicity's sake, the two overhead budgets have been presented together here. The sales manager is responsible for devising the sales budget whereas the distribution manager is responsible for devising the distribution budget.

A selling overhead budget includes:

The cost towards the sales personnel (such as salaries, commission, travelling expenses).

The cost of the sales office (such as office salaries, rental rates of office building, depreciation of office building, telephone and electricity expenses of office).

The cost of market promotion (such as cost of advertising, free samples, attractive secondary packing and so on).

A distribution budget includes **the cost of warehousing and distribution** (such as salaries of employees engaged in distribution, drivers' salaries, expenses towards vehicles, depreciation on the vehicles meant for distribution and so on).

**Example**

The following information is about selling and distribution overhead costs to be incurred by Colourful Park Ltd during the year 20X9. The sales revenue for the year ended is TZS1,600 million.

	% of sales
A. Variable expenses	
Sales commission	6%
Wages and salaries	2.5%
Travelling expenses	3 %
Advertising and promotion expenditure	1%
B. Fixed selling expenses	
Marketing staff's salary (TZS'000)	50,000
Advertising expenses (TZS'000)	30,000
Depreciation (TZS'000)	45,000
Warehousing expenses (TZS'000)	75,000

Prepare a selling and distribution expenses budget.

Solution

Colourful Park Ltd		
Selling expenses budget for month of December 31, 20X9		
	(TZS'000)	(TZS'000)
A. Variable expenses		
Sales commission (6% of TZS1,600 million)	96,000	200,000
Wages and salaries	40,000	
Travelling expenses	48,000	
Advertising and promotion expenses	16,000	
Total variable selling expenses		
B. Fixed selling expenses		
Marketing staff's salary	50,000	200,000
Advertising expenses	30,000	
Depreciation	45,000	
Warehousing expenses	75,000	
Total fixed selling expenses		
Total selling expenses		400,000

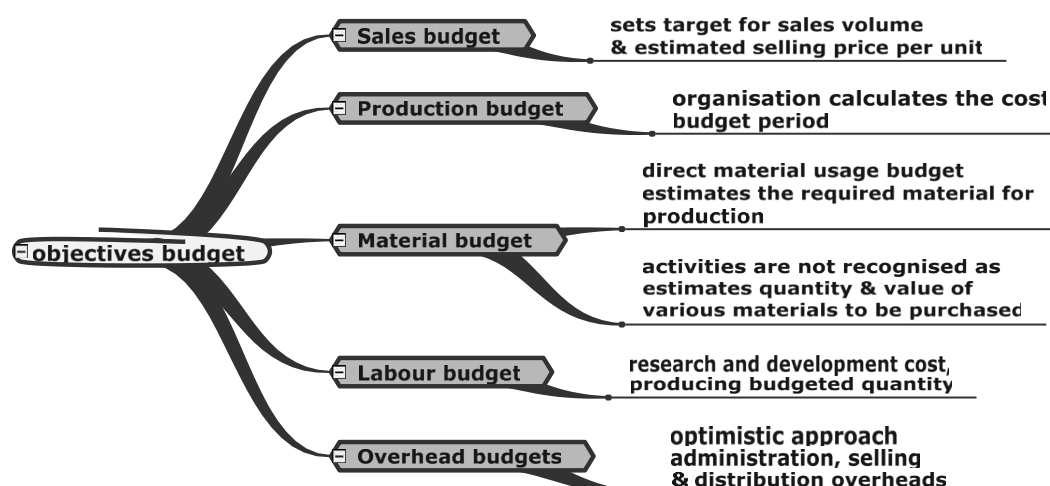
(c) Administrative overheads budget

The administration overhead budget is normally the responsibility of the head of the administration department. The major inputs for estimating the administration overhead costs for the budget period are the previous year's expenses for the same items. Most administrative costs are fixed in nature. The current budgeted figures are usually a percentage increment on the previous year's figures, taking the inflation into account.

**Example**

The administration overhead budget of Colourful Park Ltd during the year 20X9 is as follows:

Colourful Park Ltd	
Selling expenses budget for the month December 31 20X9	
	(TZS'000)
Administration overheads	
Stationery	3,000
Printing	5,000
Salaries	20,000
Office rent	2,000
Telephone charges	500
Electricity charges	900
Miscellaneous	1,600
Total	33,000

SUMMARY**SUMMARY****2.2 Master budget**

A master budget is a projected financial plan. It displays a consolidation of the functional budgets to present the overall impact of the projected operational activities on the profitability of the organisation as a whole. It is a statement showing the estimation of revenue, costs and profit (loss) for the organisation during the budget period.

A master budget normally contains all functional budgets, capital expenditure budget, budgeted SOPL (statement of profit or loss) and budgeted SOFP (statement of financial position) of the budget period. The preparation of the master budget is based on previous year's profit and loss account, the balance sheet and other information obtained for the budget period. However, the major difference between a functional budget and master budget is that the first one represents sectional goals whereas the second one deals with the company's overall plan of action for the budget period.

(a) Usefulness

- (i) The prime advantage of the master budget is that it helps to co-ordinate all the other budgets and to devise the short-term objectives of an organisation. Any conflict between departments is resolved by the master budget as it is a consolidation of all the functional budgets.
- (ii) A budget is a good medium of communication between the various departments as it consolidates the functional budgets.
- (iii) It enables preparation of an overall plan for achieving the budget targets.
- (iv) The master budget incorporates the targets of every department and therefore acts as a measure of performance evaluation.

**Example**

Camron Plc manufactures and sells two products Bing and Xing. The company is planning its budget for the forthcoming year ending on 31 December 20X9. The following are the expectations for 20X9:

1. Statement of financial position (SOFPI) for the year ended 31 December 20X8

Amazing Plc SOFPI as at 31 December 20X8		
	(TZS'000)	(TZS'000)
Assets		
Non-current assets		
Buildings		60,000
Plant and machinery at cost	249,300	
Less: Depreciation	100,000	149,300
Current assets		
Inventory	41,765	
Receivables	26,104	
Cash	5,800	
		73,669
Total assets		282,969
Equity and liabilities		
Capital and reserves		
Share capital (TZS10,000 each)		200,000
Reserves and surplus		73,600
Current liabilities		
Payables		9,369
Total equity and liabilities		282,969

2. Finished products

	Bing	Xing
Budgeted sales (units)	6,000	5,300
Budgeted selling price per unit (TZS'000)	32	44
Finished goods at 1 January 20X9	1,200	270
Finished goods at 31 December 20X9	530	1,600
Unit cost of opening inventory (TZS'000)	20	28

Continued on the next page

3. Production details

(i) Direct material

	X	Y
Material per unit of production		
Bing	1.5 kg	2 kg
Xing	0.5 kg	4 kg
Opening inventory of raw material	1,470	8,000
Closing inventory of raw material	800	1,330
Budgeted cost per kg of material purchased (TZS'000)	1.50	1.00

(ii) Direct labour

For the production of one unit of Bing and Xing, 2 and 3 direct labour hours are required respectively. Labour is paid at TZS4,800 per hour.

(iii) Factory overheads

The estimated factory overheads are TZS103,100,000 including TZS20,000,000 for depreciation. The factory overheads are absorbed on a direct labour hour basis.

(iv) The estimated selling and distribution overheads are TZS40,500,000 per annum.

(v) There is no opening and closing work-in-progress.

(vi) A capital expenditure on buildings estimated at TZS200,000,000 will be incurred in the third quarter of the year.

(vii) Quarterly budgeted receipts and payments are as follows:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
	(TZS'000)	(TZS'000)	(TZS'000)	(TZS'000)
Payments				
Payables	9,570	12,000	13,300	7,000
Staff salaries	44,000	47,320	35,320	20,000
Other expenses / payments	13,300	53,189	250,380	6,731
Receipts against sales	93,300	133,700	133,700	53,400

Required

Prepare the following budgets for the year ended 31 December 20X9 for Camron Plc:

- (i) Sales budget
- (ii) Production budget (quantities only)
- (iii) Direct material budget (usage and purchase)
- (iv) Direct labour budget
- (v) Cost of goods sold budget (using FIFO)
- (vi) Cash budget
- (vii) Budgeted SOPL
- (viii) Budgeted SOFP

Continued on the next page

Answer

(i) Sales budget

Camron Plc Sales budget for the year ended 31 December 20X9			
Products	Budgeted sales		Total sales revenue
	Units	per unit (TZS'000)	(TZS'000)
Bing	6,000	32	192,000
Xing	5,300	44	233,200
Total			425,200

(ii) Production budget

Camron Plc Production budget for the year ended 31 December 20X9		
	Product Bing Units	Product Xing Units
Budgeted sales	6,000	5,300
Add: Closing inventory of finished goods	530	1,600
Total requirement	6,530	6,900
Less: Opening inventory of finished goods	1,200	270
Budgeted production	5,330	6,630

(iii) Direct material usage budget

Camron Plc Direct material usage budget for the year ended 31 December 20X9								
	Product Bing			Product Xing			Total	
	Production (units)	Materials consumption per unit of production	Total materials	Production (units)	Materials consumption per unit of production	Total material	Total	Total
		(Kg)	(Kg) (a)		(Kg)	(Kg) (b)	(Kg) (a + b)	(TZS'000)
Material X	5,330	1.5	7,995	6,630	0.5	3,315	11,310	16,965
Material Y	5,330	2	10,660	6,630	4	26,520	37,180	37,180

(iv) Direct material purchase budget

Camron Plc Direct material purchase budget for the year ended 31 December 20X9		
	Material X Units	Material Y Units
Quantity to be consumed according to the material usage budget	11,310	37,180
Add: Budgeted closing inventory	800	1,330
	12,110	38,510
Less: Planned opening inventory	(1,470)	(8,000)
Total units to be purchased	10,640	30,510
Budgeted purchase price (TZS'000)	1.50	1.00
Total budgeted cost of purchase (TZS'000)	15,960	30,510

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(v) Direct labour budget

Camron Plc Direct labour budget for the year ended 31 December 20X9			
	Product Bing	Product Xing	Total
A. Budgeted production (in units)	5,330	6,630	11,960
B. Labour hours required per unit	2 hrs	3 hrs	
C. Total labour hours (A x B)	10,660	19,890	30,550
D. Rate per labour hour (TZS'000)	4.80	4.80	4.80
E. Total wages((TZS'000) (C x D)	51,168	95,472	146,640

(vi) Cost of goods sold budget (using FIFO)

Camron Plc Cost of goods sold budget for the year ended 31 December 20X9				
	Product Bing		Product Xing	
	Units	(TZS'000)	Units	(TZS'000)
Opening inventory	1,200	24,000	270	7,560
Add: Cost of production (W1)	5,330	109,798	6,630	194,126
Less: Closing inventory (W1)	(530)	(10,918)	(1,600)	(46,848)
Cost of goods sold	6,000	122,880	5,300	154,838

(vii) Cash budget

Camron Plc Cash budget for the year ended 31 December 20X9				
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
	(TZS'000)	(TZS'000)	(TZS'000)	(TZS'000)
Sales	93,300	133,700	133,700	53,400
Total receipts	93,300	133,700	133,700	53,400
Less: Payments				
Payables	9,570	12,000	13,300	7,000
Staff salary	44,000	47,320	35,320	20,000
Other expenses	13,300	53,189	250,380	6,731
Total payments	(66,870)	(112,509)	(299,000)	(33,731)
Net cash flow	26,430	21,191	(165,300)	19,669
Add: Opening cash balance	5,800	32,230	53,421	(111,879)
Closing balance	32,230	53,421	(111,879)	(92,210)

(viii) Budgeted SOPL

Camron Plc Statement of comprehensive income for the year ended 31 December 20X9		
	(TZS'000)	(TZS'000)
Sales		425,200
Less: Cost of goods sold		
Opening stock	31,560	
Add: Production cost		
Material (TZS16,965,000 + TZS37,180,000)	54,145	
Labour (TZS51,168,000 + TZS95,472,000)	146,640	
Overheads	103,100	
Less: Closing stock (TZS10,918,000 + TZS46,848,000)	(57,766)	(277,679)
Gross profit		147,521
Less: Selling and distribution overheads		(40,500)
Net profit		107,021

Continued on the next page

(ix) Budgeted SOFP

Amazing Plc Statement of financial position as at 31 December 20X8		
	(TZS'000)	(TZS'000)
Non-current assets		
Buildings (TZS60,000,000 + TZS200,000,000)		260,000
Plant and machinery at cost	249,300	
Less: Depreciation (TZS100,000,000 + TZS20,000,000)	(120,000)	129,300
Current assets		
Inventory (W3)		60,296
Receivables (W4)		37,204
Total assets		486,800
Equity and liabilities		
Capital and reserves		
Share capital (TZS10,000 each)		200,000
Reserve and surplus (73,600 + 107,021)		180,621
Current liabilities		
Payables (W5)		13,969
Bank overdraft		92,210
Total equity and liabilities		486,800

Workings

W1 Cost of finished goods

Product Bing

	(TZS'000)	(TZS'000)
Direct material		
X (1.5 kg x TZS1,500 per kg)	2.25	
Y (2 kg x TZS1,000 per kg)	2.00	
		4.25
Direct labour (TZS4,800 per hr x 2 hrs)		9.60
Factory overheads (TZS3,375 (W2) x 2 hrs)		6.75
Total cost of production per unit		20.60
Total cost of production (5,330 x TZS20,600)		109,798
Closing inventory (TZS20,600 x 530 units)		10,918

Product Xing

	(TZS'000)	(TZS'000)
Direct material		
X (0.5 kg x TZS1.50 per kg)	0.75	
Y (4 kg x TZS1 per kg)	4.00	4.75
Direct labour (TZS4.80 per hour x 3 hours)		14.40
Factory overheads (TZS3,375 (W2) x 3 hours)		10.13
Total cost of production per unit		29.28
Total cost of production (6,630 x TZS29,280)		194,126
Closing inventory (TZS29,280 x 1,600 units)		46,848

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W 2 Calculation of overhead absorption rate

$$\text{Factory overhead absorption rate} = \frac{\text{Factory overheads}}{\text{Total labour hours}}$$

= TZS103,100,000/30,550 hours

= TZS3,375 per hour

W3 Closing inventory

	(TZS'000)	(TZS'000)
Raw material		
X (800 kg x TZS1,500)	1,200	
Y (1,330 kg x TZS1,000)	1,330	
Total closing inventory of material		2,530
Finished goods		
Bing (530 units x TZS20,600)	10,918	
Xing (1,600 units x TZS29,280)	46,848	
Total closing inventory of finished goods		57,766
Total inventory		60,296

W4 Receivables

	(TZS'000)
Opening balance of receivables	26,104
Add: Sales (sales budget)	425,200
Less: receipts against sales (cash budget)	(414,100)
Closing balance of receivables	37,204

W5 Payables

	TZS'000
Opening balance of payables	9,369
Add: Purchases (purchase budget)	46,470
Less: payments against purchase (cash budget)	(41,870)
Closing balance of payables	13,969

3. Evaluate the difficulties of changing the type of budget used.**[Learning Outcome c]**

Before the invention of these modern budgetary systems, the incremental approach used to be followed for preparation of budgets. With the development of the zero-base budgets, activity-based budgets etc. organisations started moving towards the new budgetary systems in order to alleviate the disadvantages of the conventional budgets and prepare more realistic budgets. Obviously, while changing from one system to another, an organisation will have to face certain difficulties. These are enumerated below:

3.1 From a conventional to a zero-base budget

While moving from a conventional to a zero-base budget, the personnel responsible for preparation of the budget need to change their mindset because, under the conventional approach, they need not justify each of the programmes that they undertake. In conventional budgeting, a programme or activity can be taken up just because it existed in the previous budget. However, in ZBB, the personnel need to justify each activity involving costs. Therefore, they may not co-operate and may resist the change.

Even if the managers accept the change, they need to participate in an orientation programme to become familiar with the new budgetary system.

Introducing ZBB is a time-consuming activity and requires support from management.

3.2 From a conventional to an activity-based budget

Resistance to the change, the length of time taken to introduce the new system, the involvement of high costs to effect the changes in the cost recording system etc. are the problems faced by an organisation while changing from a conventional budget to an activity-based budget.

As this is also a new approach, an orientation programme is necessary in order to acquaint the personnel in the organisation with the new approach to budgeting and in turn to convince them to accept the change.

An activity-based budget follows a more complex system. Management should have knowledge and understanding of the activities that are essential to produce and sell the products and services and they should quantify the activity cost drivers which cause the activity costs to incur.

Moreover, in order to introduce an activity-based budgeting system, an organisation must already have implemented an activity-based costing system. Otherwise, the activity-based budget cannot be introduced.

Lastly, the problems mentioned in the section apply equally to the change from a conventional budget to an ABB.

3.3 From a fixed to a flexible budget

Flexible budgeting involves preparing budgets at various activity levels. This necessitates proper understanding and application of the behaviour of different types of costs on part of the personnel involved in the process of budgeting. Thus, there may be some resistance from the staff who are accustomed to preparing budgets at a single activity level.

One of the difficulties that may be faced while moving from a fixed to a flexible budgeting system would be the determination of the level and range of activities to be considered for preparing the flexible budget. Such a range is identified based on the maximum capacity of production and the experience of the company regarding the demand for its product(s) in the market.

In flexible budgets, the costs need to be classified not only into fixed and variable elements, but also into semi-variable and semi-fixed elements.

An example of a flexible budget, drawn at 50%, 70% and 100% capacity is as follows:

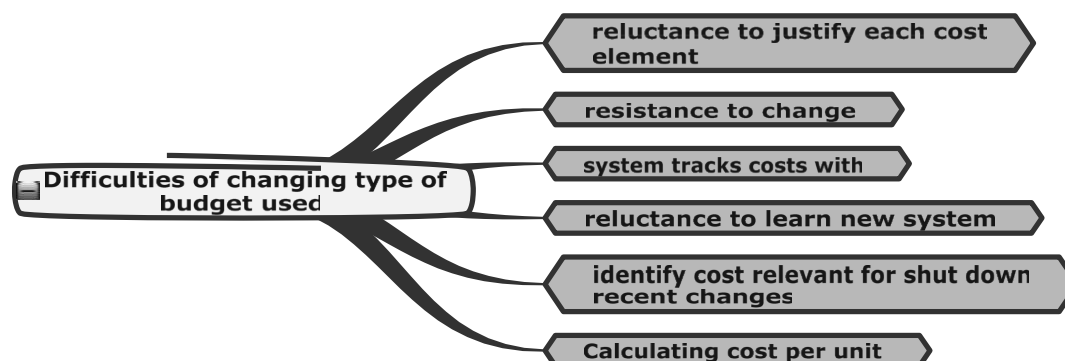
Flexible Budget

Capacity utilisation	50%	70%	100%
No. of units	50,000	70,000	100,000
Sales price per unit (TZS'000)	15	15	14
Total sales	750,000	1,050,000	1,400,000
	(TZS'000)	(TZS'000)	(TZS'000)
Variable costs			
Raw material	250,000	350,000	500,000
Direct labour	175,000	245,000	350,000
Total variable costs	425,000	595,000	850,000
Semi-variable costs			
Repairs and maintenance	40,000	44,000	48,000
Indirect labour	50,000	55,000	60,000
Total semi-variable costs	90,000	99,000	108,000
Fixed costs			
Depreciation	100,000	100,000	100,000
Administrative expenses	10,000	10,000	10,000
Total fixed costs	110,000	110,000	110,000
Total costs	625,000	804,000	1,068,000
Budgeted profits	125,000	246,000	332,000

The above budget statement shows the classification of costs into variable, semi variable and fixed elements. Semi variable costs are those that are partly fixed and partly variable in nature. Such an activity of determining the fixed and variable elements of a cost for personnel who do not have an exposure to cost behaviour may be very challenging.

Moreover, when an organisation is migrating from a fixed budget system to a flexible budget system for the first time, it would not have a base for starting the budget. This may further make it difficult for the personnel to classify costs based on their behaviour.

SUMMARY



Test Yourself 6

List the problems associated with changing a budgetary system.

Answers to Test Yourself

Answer to TY 1

Flexible budget

Expense	Basis	Levels of activity		
		80% TZS'000	100% TZS'000	110% TZS'000
Sales revenue		300,000	375,000	412,500
Variable costs				
Administration costs				
General expenses	2% of sales	6,000	7,500	8,250
Selling costs				
Salaries	9% of sales	27,000	33,750	37,125
Travelling expenses	2% of sales	6,000	7,500	8,250
Sales office expenses	1% of sales	3,000	3,750	4,125
General expenses	1% of sales	3,000	3,750	4,125
Distribution costs				
Rent	1% of sales	3,000	3,750	4,125
Other expenses	5% of sales	15,000	18,750	20,625
Total variable costs (A)		63,000	78,750	86,625
Fixed costs				
Administration costs				
Office salaries	Fixed	60,000	60,000	60,000
Depreciation	Fixed	4,500	4,500	4,500
Rates & taxes	Fixed	3,625	3,625	3,625
Distribution costs				
Wages	Fixed	10,000	10,000	10,000
Total fixed costs (B)		78,125	78,125	78,125
Total costs (A + B)		141,125	156,875	164,750
Profit (Revenue – Total costs)		158,875	218,125	247,750

Answer to TY 2**Mark Trading Co**

The sales budget for the year 20X9:

	Ist Quarter	IInd Quarter	IIIrd Quarter	IVth Quarter	Total
	TZS million	TZS million	TZS million	TZS million	TZS million
Product A	1,000	1,400	900	1,200	4,500
Product B	1,800	2,400	2,000	2,200	8,400
Total sales	2,800	3,800	2,900	3,400	12,900

Answer to TY 3

Beauty Ltd Production budget for the year ended ...	
	Soap Units
Budgeted sales	1,000,000
Add: Budgeted closing inventory	10,000
Total requirement	1,010,000
Less: Opening inventory (W1)	10,000
Required production	1,000,000

Workings**W1**

The closing inventory of last year is the opening inventory of the current year. Hence, the opening inventory is also taken to be 10,000 units.

Answer to TY 4**Steps**

1. First calculate the budgeted figure for the finished goods.
2. Then calculate the budgeted figure for direct materials purchase.

Step 1 Calculation of estimated production quantity of finished goods

	Units
Estimated sales for the year	60,000
Add: closing balance	11,000
	71,000
Less: opening balance	8,000
Estimated production	63,000

Step 2 Calculation of budgeted direct material purchase

Annual direct material purchase budget for the year to		
	Material X Units	Material Y Units
Quantity required as per material usage budget (W1) & (W2)	252,000	378,000
Add: budgeted closing inventory	11,000	17,000
	263,000	395,000
Less: planned opening inventory	10,000	15,000
Total units to be purchased	253,000	380,000

W1 63,000 units of finished goods x 4 units of raw material X

W2 63,000 units of finished goods x 6 units of raw material Y

Answer to TY 5

Some steps that organisations can take to avoid problems arising from shortage of labour hours are:

- Reducing the level of closing inventory required as this will allow a decrease in the number of units to be produced.
- Recruiting new labour can help to increase the production volume.
- Reducing the wastage or idle hours of workers enables the organisation to use the time of the available labour force much more efficiently.
- Improving the productivity ratio i.e. cutting down on the number of hours required to produce a unit.
- Convincing the existing labour force to work for additional time can help to increase the production volume.

Answer to TY 6**Problems associated with changing budgetary system**

A change is always resisted. People do not like change. While changing from one system to another, they will have to get acquainted with the new system, grasp the new concept and work accordingly.

Under zero-based budgets, each element of cost needs to be justified in order to be allowed. Also, under an activity-based budget, it is necessary to calculate the cost of individual activities and then assign the activity cost to products and services. This is a complex process which people may not want to carry out.

For budgetary systems such as rolling budgets and contingency planning, the system needs to be continuously updated with recent changes. This consumes time, money and energy and is therefore not welcomed easily.

Quick Quiz

1. Fill in the blanks:
 - (a) Under _____ budget only those resources critical to the performance of the activities are allocated.
 - (b) _____ budget is consolidation of various operational and financial budgets.
 - (c) A budget prepared for various expected levels of activities is a _____ budget.
 - (d) Under _____ budget, management should have knowledge of all the activities required to produce and sell the products and services.
2. State whether the following statements are true or false:
 - (a) A zero-base budget is a method of budgeting which requires each cost element to be specifically justified.
 - (b) A fixed budget is prepared for a range of activity levels.
3. Define an activity-based budget (ABB).
4. The budget that consolidates all other budgets to present the overall impact of the projected activities on the company's profit is called as:
 - A** Flexible budget
 - B** Cash budget
 - C** Master budget
 - D** Capital expenditure budget

Answer to Quick Quiz

1.
 - (a) Activity-based
 - (b) Master
 - (c) Flexible
 - (d) Activity-based
2.
 - (a) True
 - (b) False
3. An activity-based budget is a method of budgeting based on an activity framework, utilising cost driver data in the budget-setting together with variance feedback processes.
4. The correct option is **C**.

Master budget consolidates all functional budgets and the capital expenditure budget of the budget period to present the overall impact of the projected activities on the company's profit.

Self Examination Questions**Question 1**

- (a) Explain an incremental budget and an activity-based budget. Discuss the usefulness and problems of these budgetary systems.
- (b) Enumerate the difficulties in changing a budgetary system from a conventional budget to an activity-based budget.

Question 2

Active Ltd manufactures and sells two products, NP and SP. The company wants to prepare budgets for the quarter January to March 20Y0. The following forecasts are made for this purpose.

(i) Finished goods

	NP (units)	SP (units)
Budgeted sales	5,250	1,200
Inventory on 1 January	600	150
Inventory on 31 March	300	450
Budgeted selling price (TZS'000)	50	85

(ii) Production details:

	Alfa	Beta
Direct material required per unit of finished goods		
NP	5 kg	3 kg
SP	2 kg	4 kg
Opening inventory	8,100	Nil
Closing inventory	Nil	5,000

Required:

As a management accountant, you are required to calculate the following budgets for the quarter ended on March 20Y0:

- (i) Sales budget
- (ii) Production budget
- (iii) Material purchase budget

Question 3

Explain a master budget and a functional budget. Discuss the usefulness and problems associated with these budgets.

Question 4

Colours Ltd deals in cotton shirts. It has received an order of three types of shirts, full sleeves (FS), half sleeves (HS) and sleeveless (SL).

The following information relates to that project:

Total 50,000 shirts need to be supplied within one month. The proportion of FS, HS and SL will be in the proportion of 2:2:1. Selling price per shirt will be as follows:

	TZS'000
FS	20.00
HS	15.00
SL	12.50

Standard requirements of raw materials are as follows:

Cotton	500 gm per shirt @ TZS10,000 per kg
Threads	2 boxes per shirt @ TZS5,000 per box
Buttons	1 pack per shirt @ TZS2,000 per pack

Opening inventory and expected closing inventory of raw materials is as follows:

	Inventory on 1 April 20X1	Expected inventory on 1 May 20X1
Cotton	750 kg	1,000 kg
Threads	3,000 boxes	4,000 boxes
Buttons	1,500 pack	2,000 pack

Inventory of readymade shirts is as follows:

	Inventory on 1 April 20X1	Expected inventory on 1 May 20X1
FS	3,000	5,000
HS	2,000	1,000
SL	1,000	1,500

Standard requirements of labour hours are as follows:

Standard labour wage per hour is TZS7,500 for skilled workers and TZS5,000 for semi-skilled workers.

For each FS, 2 hours of skilled labourer and 1.5 hours of semi-skilled labourers are required.

For each HS, 1.5 hours of skilled labourer and 1.0 hours of semi-skilled labourers are required.

For each SL, 1.5 hours of skilled labourer and 0.5 hours of semi-skilled labourers are required.

Required:

Prepare functional budgets

Question 5 – Flexible Budget

Mara guest house's most recent monthly expense analysis report revealed significant cost overruns. The manager was asked to explain the deviations. Below is the budget Vs Actual expense report for the month in question.

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MARA GUEST HOUSE

Budget Vs Actual expense report for the month ending December 31, 2017

	Actual '000	Budget '000	Variance '000
Utilities	81,800	72,000	(9,800)
Laundry	32,890	28,800	(4,090)
Food service	63,000	56,000	(7,000)
Rent/taxes	100,800	100,800	-
Staff wages	88,700	85,000	(3,700)
Management salaries	70,000	72,000	2,000
Water	24,024	16,000	(8,024)
Maintenance	28,090	24,000	(4,090)
	489,304	454,600	(34,704)

The guest house has observed that utilities, water, food services and laundry costs all vary with activity. The other costs are fixed. The budget reflected above was based upon an assumed 80% occupancy rate. The new season will result to 92% occupancy rate during the month.

Required: Prepare a "flexible budget" based upon a 92% occupancy rate, and identify whether the Inn is being efficiently or inefficiently run. Comment on specific costs, and note why flexible budget can improve performance evaluations.

*Question 6

ADI Nursery School has a total of 150 students in 5 different classes with 30 students per class. The school plans for a picnic during the week-end to places such as the Dar Zoo, Kunduchi Wet & Wild, Bagamoyo Historical Sites, etc. A private transport operator has come forward to lease out the buses for taking the students. Each bus will have a maximum capacity of 50 (excluding two seats reserved for teachers accompanying the students). The school will employ two teachers for each bus, paying them an allowance of TZS. 5,000 per teacher. It will also lease out the required number of buses. The following are the other cost estimates:

Variable Costs	Cost per Student TZS.
Breakfast	500
Lunch	1,000
Tea	300
Entrance fee at zoo	200
Fixed and Semi-Variable Costs	TZS.
Rental fee	65,000 per bus
Special permit fee	5,000 per bus
Block entrance fees at the site	25,000
Prizes to students for games	25,000

No other costs are incurred in respect of the accompanying teachers.

Required:

- Prepare a flexible budget estimating the total costs for 30, 60, and 150 students. Each item of cost is to be indicated separately.
- What will be your conclusion regarding the break-even level of students if the school proposes to collect TZS. 4,500 per student?

*Question 7 - Drury

- Explain what is meant by the terms 'fixed budget' and 'flexible budget' and state the main objective of preparing flexible budgets.
- Prepare a flexible budget for 2018 for the overhead expenses of a production department at the activity levels of 80%, 90% and 100%, Using the information listed below
 - The direct labour hourly rate is expected to be TZS 3.75
 - 100% activity represents 60,000 direct labour hours
 - Variable costs:
 - Indirect labour TZS 0.75 per direct labour hour
 - Consumable supplies TZS 0.375 per direct labour hour
 - Canteen and other Welfare services 6% of direct and indirect labour costs.

- (4) Semi-variable costs are expected to correlate with the direct labour hours in the same manner as for the last five years which was:

Year	Direct labour hours	Semi-variable costs (TZS)
2014	64,000	20,800
2015	59,000	19,800
2016	53,000	18,600
2017	49,000	17,800
2018	40,000 (estimate)	16,000 (estimate)

- (5) Fixed costs:

	(TZS)
Depreciation	18,000
Maintenance	10,000
Insurance	4,000
Rates	15,000
Management salaries	25,000

- (6) Inflation is to be ignored.

- (ii) Calculate the budget cost allowance for 2019 assuming that 57,000 direct labour hours are worked.

Question 8 –Drury

The enterprise Company manufactures two products, known as alpha and Sigma. Alpha is produced in department 1 and sigma in department 2. The following information is available for 2018.

Standard material and labour costs:

	TZS
Material X	7.20 per unit
Material Y	16.00 per unit
Direct labour	12.00 per hour

Overhead is recovered on a direct labour hour basis.

The standard material and labour usage for each product is as follows:

	Model Alpha	Model Sigma
Material X	10 units	8 units
Material Y	5 units	9 units
Direct labour	10 hours	15 hours

The balance sheet for the previous year end 2017 was as follows:

	TZS	TZS	TZS
Non-current Assets			
Land		170,000	
Building and equipment	1,292,000		
Less depreciation	<u>255,000</u>	<u>1,037,000</u>	1,207,000
Current assets			
Stock, finished goods	99,076		
raw material	189,200		
Debtors	289,000		
Cash	<u>34,000</u>		
	611,276		
Less current liabilities			
Creditors	<u>248,800</u>		<u>362,476</u>
Net Assets			<u>1,569,476</u>

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Represented by shareholders interests:

1200000 ordinary shares of TZS 1 each	1,200,000	
Reserves	<u>369,476</u>	
		<u>1,569,476</u>

Other relevant data is as follows for the year 2018

	Finished Products	
	Model Alpha	Model Sigma
Forecast sales (units)	8500	1600
Selling price per unit	TZS 400	TZS 560
Ending inventory required (units)	1870	90
Beginning inventory required (units)	170	85

Direct Material

	Material X	Material Y
Ending inventory required (units)	8500	8000
Beginning inventory required (units)	10200	1700

	Dept 1 TZS	Dept 2 TZS
Budgeted variable overhead rates (Per direct labour hours)		
Indirect materials	1.20	0.80
Indirect labour	1.20	1.20
Power (variable portion)	0.60	0.40
Maintenance (variable portion)	0.20	0.40

Budgeted fixed overheads		
Depreciation	100,000	80,000
Supervision	100,000	40,000
Power (fixed portion)	40,000	2,000
Maintenance (fixed portion)	45,600	3,196

TZS

Estimated non manufacturing overheads:

Stationery etc. (administration)	4,000
Salaries	
Sales	74,000
Office	28,000
Commission	60,000
Car expenses (sales)	22,000
Advertising	80,000
Miscellaneous (office)	<u>8,000</u>
	<u>276,000</u>

Budgeted cash flows are as follows:

	Quarter 1 TZS	Quarter 2 TZS	Quarter 3 TZS	Quarter 4 TZS
Receipts from customers	1,000,000	1,200,000	1,120,000	985,000
Payments				
Material	400,000	480,000	440,000	547,984
Payment of wages	400,000	440,000	480,000	646,188
Other costs and expenses	120,000	100,000	72,016	13,642

Required:

- i. Sales budget
- ii. Production budget
- iii. Direct Material usage budget
- iv. Direct Material Purchase budget
- v. Direct Labour budget
- vi. Factory overheads budget
- vii. Selling and administrative budget
- viii. Cash Budget
- ix. Budgeted Income statement
- x. Budgeted balance sheet

Answers to Self Examination Questions**Answer to SEQ 1****(a) Incremental budget and activity based budget****(i) Incremental budget**

An incremental budget is a method of budgeting where the budget of the previous year is taken as a basis and then certain adjustments are made by adding or deleting certain amounts from the cost elements in the base budget.

Cost elements are included in the budget without taking into consideration the value addition by those cost elements.

Usefulness

An incremental budget is simple and saves cost as well as time. Therefore it is widely accepted.

Any organisation can adopt this system, as it is suitable for all organisations.

Managers like this system, as they are given a basis on which to prepare the budget and therefore they can save time and energy.

Problems

As the budget is based on the previous year's budget, the budget slacks from that budget are carried forward.

Additional budget slacks also arise because incremental budgets are prepared by merely adding or deleting from the base budget and the cost elements are not justified for inclusion in the budget.

(ii) Activity Based Budget

According to CIMA's Official Terminology, an activity-based budget is a method of budgeting based on an activity framework and utilising cost driver data in the budget-setting and variance feedback processes.

Under this system, activities that are necessary for the production and sale of the product are identified and only the costs associated with these activities are allowed.

Usefulness

Under an activity-based budget, resources are allowed only if an activity is necessary to meet the budget target. This ensures optimal utilisation of the resources.

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Problems

Identifying the activities and the costs related to these activities is difficult and complex. Managers may be reluctant to do this and therefore resist adopting this system.
It is a time and cost consuming activity.

(b) Problems while switching over to the activity-based budget from the incremental budget system

Under an incremental budget, budgets are prepared on the basis of the previous budget with certain adjustments made to it. This is quite a simple process and saves costs as well as time.

However, changing to an activity-based budget would require a lot of extra work i.e. identifying the activities and the costs related to these activities. People who are used to doing simple work are likely to oppose such a complex system.

To motivate the personnel, an orientation program is necessary. Also, the activity-based budget being a new concept; support from management is essential.

Answer to SEQ 2

(i) Sales budget

Products	Budgeted sales (units)	Selling price (TZS'000 per unit)	Sales (TZS'000)
NP	5,250	50	262,500
SP	1,200	85	102,000
			364,500

(ii) Production budget

	NP	SP	Total
Units to be sold	5,250	1,200	6,450
Add: Closing inventory	300	450	750
	5,550	1,650	7,200
Less: Opening inventory	(600)	(150)	(750)
Units to be produced	4,950	1,500	6,450

(iii) Direct material purchase budget

	Alfa	Beta	Total
Direct material for production (W1)	27,750	20,850	48,600
Add: Closing inventory	Nil	5,000	5,000
	27,750	25,850	53,600
Less: Opening inventory	(8,100)	Nil	(8,100)
Units to be produced	19,650	25,850	45,500

Working

W1

Direct material required to be purchased for the production

Alfa = (4,950 units x 5 kg) + (1,500 x 2 kg) = 27,750 kg

Beta = (4,950 units x 3 kg) + (1,500 x 4 kg) = 20,850 kg

Answer to SEQ 3

(a) Master budget

A master budget is a consolidation of the various functional budgets. Budgeted financial statements are prepared on the basis of the master budget.

(i) Usefulness

A master budget helps to co-ordinate all other functional budgets and to clarify the short-term objectives of an organisation. Departmental budgets are co-ordinated with the master budget which alleviates the conflicts between the departmental objectives and the organisational objectives.

A master budget acts as a line of communication between the various departments.

A master budget is the basis for planning. Budgeted financial statements are prepared on the basis of a master budget.

A master budget possesses the targets of all the departments and therefore acts as a basis for performance evaluation.

(ii) Problems

The main problem with any budgeting system is that it is based on forecasting and therefore subject to uncertainties.

Master budgets are prepared on the basis of certain assumptions that may not hold true in reality.

(b) Functional Budgets

Functional budgets are budgets for individual functions such as sales, purchases, production etc.

(i) Usefulness

Functional budgets give targets to individual managers.

As departmental managers prepare functional budgets, they are more realistic and motivating.

(ii) Problems

As they are prepared by functional managers, there is the possibility that they may not be in line with the strategic objectives and may conflict with the organisational objectives or the objectives of other departments unless they are properly co-ordinated.

Like any other budget, the functional budgets are also based on forecasts and therefore affected by significant changes in the environment.

Answer to SEQ 4**Sales budget**

Description of shirts	No of shirts (50,000 in 2:2:1)	Selling price per shirts (TZS'000)	Sales revenue (TZS'000)
FS	20,000	20.00	400,000
HS	20,000	15.00	300,000
SL	10,000	12.50	125,000
Total sales	50,000		825,000

Production budget

Description of shirts	Estimated sales	Closing inventory of readymade shirts	Opening inventory of readymade shirts	Required Production of shirts
FS	20,000	5,000	3,000	22,000
HS	20,000	1,000	2,000	19,000
SL	10,000	1,500	1,000	10,500
	50,000	7,500	6,000	51,500

Raw materials usage budget

Description of shirts	Required Production of shirts	Required cotton kg	Required threads' boxes	Required buttons' pack
FS	22,000	11,000	44,000	22,000
HS	19,000	9,500	38,000	19,000
SL	10,500	5,250	21,000	10,500
	51,500	25,750	103,000	51,500

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Raw materials purchase budget

Raw materials	Required	Opening inventory	Closing inventory	Required purchases	Purchase price (TZS'000)	Purchase expenses (TZS'000)
Cotton (kg)	25,750	750	1,000	26,000	10	260,000
Threads (boxes)	103,000	3,000	4,000	104,000	5	520,000
Buttons (pack)	51,500	1,500	2,000	52,000	2	104,000
						884,000

Labour budget (amount in TZS'000)

Description of shirts	Required Production of shirts	Required hours of skilled workers	Required hours of semi-skilled workers	Wages - skilled workers (TZS7,500/hr)	Wages - semi-skilled workers (TZS5,000/hr)	Total wages (TZS'000)
FS	22,000	2.00	1.50	330,000.00	165,000.00	495,000.00
HS	19,000	1.50	1.00	213,750.00	95,000.00	308,750.00
SL	10,500	1.50	0.50	118,125.00	26,250.00	144,375.00
	51,500	5.00	3.00	661,875.00	286,250.00	948,125.00

Answer to SEQ 5

Flexible budget

Mara guest house

	Rate	Flexed by 92%	Actual	Variance	
Utilities	900	1.15			
Laundry	360	82,800	81,800	1,000	F
Food service	700	33,120	32,890	230	F
Rent/taxes		64,400	63,000	1,400	F
Staff wages		100,800	100,800	0	
Management salaries		85,000	88,700	(3,700)	U
Water		72,000	70,000	2,000	F
Maintenance		16,000	24,024	(8,024)	U
		<u>24,000</u>	<u>28,090</u>	<u>(4,090)</u>	<u>U</u>
		478,120	489,304	(11,184)	U

Answer to SEQ 8

Schedule 1: sales budget			
Product	units sold	selling prices	total revenues
Apha	8500	400	3,400,000
Sigma	1600	560	896,000
			4,296,000

schedule 2: Annual production budget			
Product		Dept 1 (Alpha)	Dept 2 (Sigma)
Expected units to be sold		8500	1,600
Add: Planned closing stock/ending inventory		1870	90
Total units required for sales and stocks		10370	1690
Less: Planned opening stocks/beginning inventory		170	85
Total units to be produced		10200	1605

Schedule 3: Direct material usage									
	Dept 1 (alpha)			Dept 2 (Sigma)					
	Unit	Unit price	Total	Unit	Unit price	Total	Total Unit	Total Unit price	Total
Material X	102000	7.2	734,400	12840	7.2	92,448	114840	7.2	826,848
Material Y	51000	16	816,000	14445	16	231,120	65445	16	1,047,120
			1,550,400			323,568			1,873,968

Schedule 4: Direct material purchase budget	Material X	Material Y	
Quantity necessary to meet production(schedule 3)	114840	65445	
Add: Planned closing stock	10200	1700	100,640
	125040	67145	
less: Planned opening stock	8500	8000	
total units to be purchased	116540	59145	
Planned unit purchase price	7.2	16	
Total purchases	839,088	946,320	1,785,408
Schedule 5: Direct labour budget	DEPT1	DEPT2	Total
Budgeted production	10200	1605	
hours per unit	10	15	
total budgeted hours	102,000	24,075	126,075
Budgeted wage rate per hour	12	12	12
total wages	1,224,000	288,900	1,512,900

Schedule 6: Factory overhead budget					
	Variable overhead rate				
	per direct labour hour		Overheads		
	DEPT1	DEPT2	DEPT1	DEPT2	
Controlled overheads			102,000	24,075	
Indirect materials	1.2	0.8	122,400	19,260	
Indirect Labour	1.2	1.2	122,400	28,890	
Power (variable portion)	0.6	0.4	61,200	9,630	
Maintenance (variable portion)	0.2	0.4	20,400	9,630	
			326,400	67,410	393,810
Uncontrolled overheads					
Depreciation			100,000	80,000	
Supervision			100,000	40,000	
Power (fixed portion)			40,000	2,000	
Maintenance (fixed portion)			45,600	3,196	
			285,600	125,196	410,796
Total overheads			612,000	192,606	804,606
Budgeted department overhead rate			6	8	

404: Budgetary Planning and Control

Schedule 7: Annual Selling and Administration budget		
	TZS	TZS
Selling		
Salaries	74,000	
Commission	60,000	
Car expenses	22,000	156,000
Administration		
Stationaries	4000	
Salaries	28,000	
Advertising	80,000	
Miscellaneous	8,000	120,000
		276,000

Schedule 8: Department budget	DEPT1		DEPT2	
Direct labour S5	1,224,000		288,900	
Direct material S3	1,550,400		323,568	
		2,774,400		612,468
Controlled overheads S6				
Indirect materials	122,400		19,260	
Indirect Labour	122,400		28,890	
Power (variable portion)	61,200		9,630	
Maintenance (variable portion)	20,400		9,630	
		326,400		67,410
Uncontrolled overheads				
Depreciation	100,000		80,000	
Supervision	100,000		40,000	
Power (fixed portion)	40,000		2,000	
Maintenance (fixed portion)	45,600		3,196	
		285,600		125,196
		3,386,400		805,074

Budgeted Profit and loss account for the year 2018		
Sales (S1)		4,296,000
Add: Opening stock raw material (balance sheet)	189,200	
Purchases (S4)	1,785,408	
	1,974,608	
less: closing stock (S4)	100,640	
Cost of raw material consumed	1,873,968	
Direct labour (S5)	1,512,900	
Factory overheads (S6)	804,606	
Total manufacturing cost	4,191,474	
Add opening stock balance (balance sheet)	99,076	
	4,290,550	
Less: Closing stock (working 1)	665,984	
		3,624,566
Gross profit		671,434
Selling and Admin exp (S7)		276,000
Budgeted operating profit for the year		395,434

			Alpha	Sigma	
Working 1			1870	90	
Material X	10	8	72.0	57.6	
Material Y	5	9	80.0	144.0	
Direct labour	10	15	120.0	180.0	
Factory overheads	10	15	60.0	120.0	
Cost per unit of finished product			332.0	501.6	
			620,840	45,144	665,984

Budgeted balance sheet as at 31st December			
Fixed Assets			
Land		170,000	
Building	1,292,000		
Less: Depreciation	435,000	857,000	1,027,000
Current assets			
Stock , finished goods	665,984		
Stock , raw material	100,640		
Debtors (W2)	280,000		
Cash (Cash budget)	199,170		
	1,245,794		
Less Current liabilities			
Creditors	307,884		937,910
Net assets			1,964,910
Represented by shareholders interest			
Shares	1,200,000		
Add: profit	395,434	1,595,434	
Reserves		369,476	
			1,964,910

Cash budget					
	Q1	Q2	Q3	Q4	Annual
Opening balance Cash	34,000	114,000	294,000	421,984	34,000
Receipt from Debtors	1,000,000	1,200,000	1,120,000	985,000	4,305,000
	1,034,000	1,314,000	1,414,000	1,406,984	4,339,000
Payments					
Material	400,000	480,000	440,000	547,984	1,867,984
Wages	400,000	440,000	480,000	646,188	1,966,188
Other exp	120,000	100,000	72,016	13,642	305,658
	920,000	1,020,000	992,016	1,207,814	4,139,830
Closing balance Cash	114,000	294,000	421,984	199,170	199,170

SECTION C4: BEHAVIOURAL ASPECTS OF BUDGETING

■ Get Through Intro

The attitude of those involved in budgeting towards the budget is crucial to its effectiveness. The management accountant should study the factors influencing the behaviour of the personnel in an organisation. The aim is to resolve conflicts, motivate employees and unite them in the desired direction in order to arrive at goal congruence.

Setting the difficulty level of a budget is one of the most important tasks before management. The difficulty level balances the motivation to achieve the budget and the attainability of the budget. A change in either factor will result in a change in the other factor and could lead to a deterioration in both e.g. if an incredibly high target is set, employees will be demotivated, and the target will not be achieved.

This SECTION will help you as a management accountant to deal with the behavioural issues relating to budgeting in your working life. Also, being thoroughly acquainted with the contents of the SECTION will enable you to correctly answer the questions on the topic that may be set in your examination.

■ Learning Outcomes

- a) Identify the factors which influence behaviour.
- b) Evaluate the issues surrounding setting the difficulty level for a budget.
- c) Evaluate the benefits and difficulties of participation of employees in the negotiation of budgets.

1. Identify the factors which influence behaviour.**[Learning Outcome a]**

The effectiveness of a budgetary system is dependent on the attitude of those who are responsible for implementing it. A budget influences the behaviour of managers in the following ways:

One of the objectives of a budget is to motivate. It motivates the people in the organisation to produce high levels of output.

Higher but achievable targets motivate the personnel, however unachievable targets demotivate them.

Participation from lower level management while devising the budget, and transparency in the budgetary system helps the lower level management to be motivated.

The following are the **factors influencing the behaviour** of the employees.

1. Misunderstandings about the objectives of senior management

A budget is often understood as a cost-cutting exercise. The lower and middle level managers, who prepare the budgets may fear that upper level management may not approve the budget proposed by them, and instead, will try to cut the costs (and increase the sales target) wherever possible. Due to this, they may dislike the budgetary exercise and may not take initiative in making it successful.

Also, due to fear of cost-cutting, they may prepare budgets with slack i.e. the managers may try to set the budget targets with a margin, so that even if there is cost-cutting, their actual requirement would be fulfilled.

**Example**

A marketing manager knows that the selling and distribution expenses would be 5% more than the previous year. He may ask for a 10% increase, so that even if his superiors cut the proposed expenditure to the extent of 5%, and allow only a 5% increase, his actual requirement of 5% hike would be fulfilled.

The managers may also make a provision for the next year by spending extravagantly in the current year.

**Definition**

Budget slack is the intentional overestimation of expenses and/or underestimation of revenue in the budgeting process.

Those responsible for implementing the budget may overestimate the expenses or underestimate the revenues, so that it becomes easier for them to chase the target. As a result, the objective of motivating the subordinates to chase a higher target will be pointless. This is a very important factor influencing the success of the budget.

**Example**

Rosy, a sales manager for Pick and Pack Ltd, has targeted the sale of 56,000 units per year in the annual budget. In fact, she knows that the potential demand for sales is around 60,000 units. It will be easy for her to chase the target of 56,000 units without working hard. Here, the budget slack is 4,000 units.

Budget slack is also called budget bias, as it increases the tendency of overspending in order to show the budgeted expenditure to be realistic, and also to have a margin for the next year.

**Example**

In Flexible Ltd, the actual selling and distribution expenses are only TZS5 million. While preparing the budget, Jemmy, the manager responsible for the budget, has estimated the budget at TZS5.5 million i.e. overstated it by TZS0.5 million. He would like to spend the whole amount of TZS5.5 million during the budget year, to ensure that he won't have to explain the over-estimation of the budget before the senior management. It will also help him to obtain a favourable budget allowance without too much trouble.

When the reward system is linked to the success of the budget, there are more chances of having slack in the budget. When budget slack exists, the budgetary system will fail as a motivation tool, as well as a performance evaluation tool and also as a control system.

2. Targets set by senior managers

Targets set for the budget affect the behaviour of the personnel. In most cases, the performance of the manager / department is evaluated on the basis of budget targets. Nobody likes to be labelled a poor performer. Accordingly, when unachievable targets are set by senior management, in order to bring out the best from the subordinates, the subordinates will oppose the targets. Senior management should consult with their subordinates and try to win their co-operation in order for the budget to succeed.

If the targets are easily achievable by the subordinates, they will not motivate the employees to achieve their full potential.

Targets should be agreed to by both senior management and subordinates, and should be such that the subordinates are motivated to perform at their best without any reason to believe that the budget is unachievable.

3. Sub-optimal planning

When targets are set by individuals and approved by senior managers, there is the possibility that, due to conflicts between the organisational and divisional objectives, the targets will need to be changed. Different limiting factors may restrict an organisation from maximising its goals. Care should be taken, while devising a budget, to ensure optimum achievement. The objectives should be such that each factor contributing to the organisational performance should be utilised optimally.



Example

In Rashco Ltd, the production capacity of the plant is 50,000 units. 3 labour hours are required to produce one unit. The limiting factor is the number of labour hours available, which amounts to a total of 90,000. A maximum 30,000 units can be produced in 90,000 labour hours. It is not possible to utilise the full plant capacity in this case, however the planning should be such that the limiting factor, i.e. the number of labour hours, is utilised optimally.

Sub-optimal planning may demotivate managers.



Example

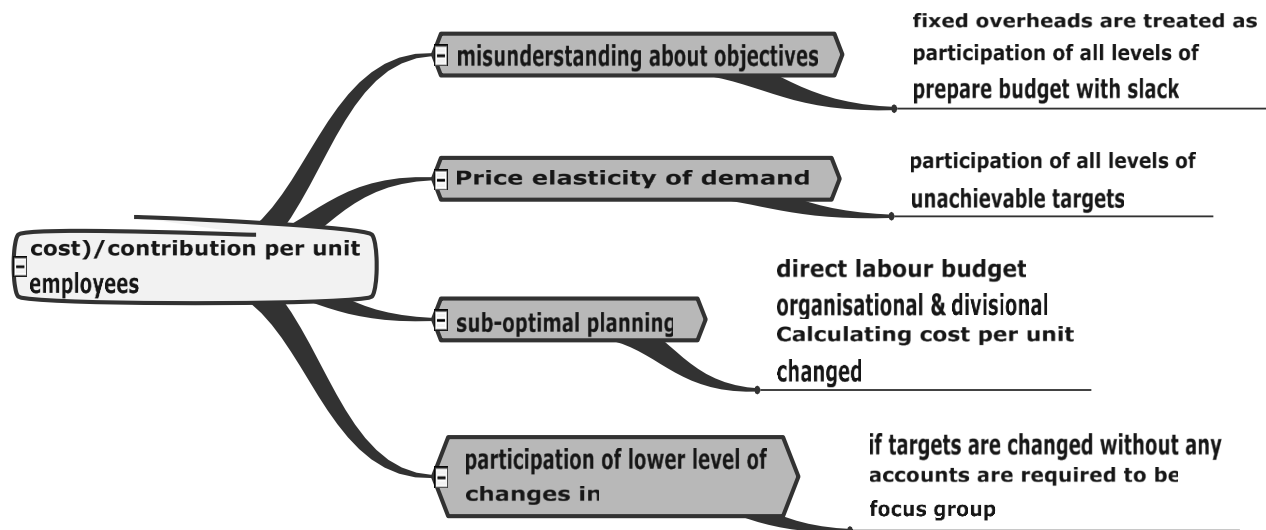
A purchase manager has set the target of purchasing a huge quantity of raw material in the budget in order to get a bulk discount. When co-ordinating the purchase manager's budget with the production budget, it was found that the quantity targeted to be purchased is much more than the requirement of the production department. The potential requirement of the raw material by the production department is the limiting factor.

Accordingly, it is necessary to modify the purchase budget. This may not be liked by the purchase manager, who may feel demotivated.

4. Participation of lower level of management

Lower level management will become motivated by the budgets, if they are involved in the process of devising and negotiating them. However, if unachievable targets are imposed on them or, during negotiation, their targets are changed without explanation, they will be demotivated.

SUMMARY



Test Yourself 1

Discuss the consequences of budget bias (budgetary slack) for cost control.

2. Evaluate the issues surrounding setting the difficulty level for a budget.

[Learning Outcome b]

There are certain issues which must be faced while preparing a budget.

2.1 Difficulty level for a budget

An easily attainable budget target may fail to bring the best out of the employees. On the other hand a budget target that is very difficult to achieve, can discourage managers from even trying to attain it. Ideally, budget targets should be challenging, yet attainable.

Difficulty level refers to a level of performance where the budget target is achievable as well as motivating. It really is a difficult task to set a budget target.

Ideally, there should be a balance between the aim to achieve targets and the aim to motivate employees. Up to this level, there is a potential to increase motivation as well as performance levels. Beyond this level, the motivation level falls sharply, as the target becomes unachievable. This is based on the fact that if the target is easy to attain, the budget may fail to achieve the objective of motivating the employees to put in their best efforts.

2.2 Setting the difficulty level for a budget

A budget serves multiple functions such as planning, controlling, co-ordinating, motivating etc. All these functions should be taken into consideration while determining the difficulty level of a budget. Planning and co-ordination require that the target should be one which is attainable by the most of the managers, and which is best for the organisational performance as a whole.

However, if a budget is considered to be a motivational tool, then the target set for most of the managers may fail to take the best from them, since they might be highly efficient, but may lack motivation.

In order to make the budget successful, the target level should be set by ensuring the participation of all levels of management in the budget preparation process, and at the same time, making the process transparent.

2.3 Issues surrounding setting the difficulty level of a budget

The following are the issues involved in setting the difficulty level of a budget:

1. Non-participation of the lower level management

The participation of the lower level management is one of the ways of resolving the issues related to target-setting. However, in many organisations, the lower level management has very little involvement in the process of budget setting. In these organisations, top management prepares budgets for the entire organisation, including those for lower level operations. This process is often referred to as authoritative budgeting. This is one of the issues for setting the difficulty level.

A participative budget is a good communication device. The process of preparing a participative budget often gives top management a better grasp of the problems faced by their subordinates and enables employees to gain a better understanding of the difficulties top management deals with. A participative budget is more likely to gain the employees' commitment to fulfil the budget targets.

2. Non-participation of top management

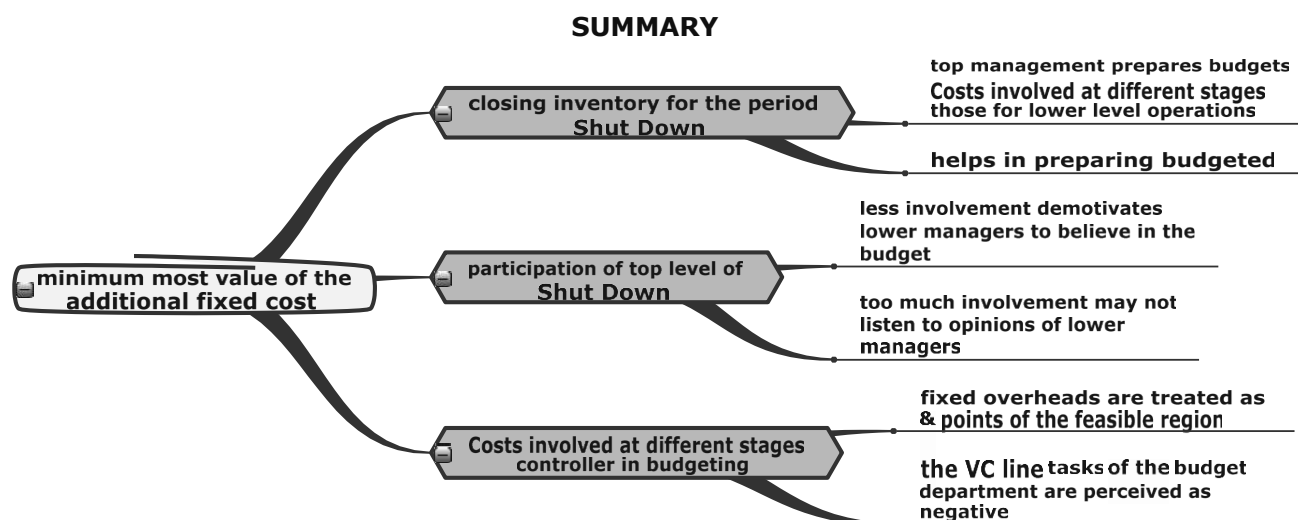
The participation of top management in the process of preparing the budget is of utmost importance. It motivates the lower level management. It also helps in identifying any slack, i.e. overestimation or underestimation in the budget. The active involvement of top management in budgeting also motivates lower management to believe in the budget, to be candid in budget preparation and to be dedicated in attaining the budget target, as they know the superior is concerned about the budget. Too much involvement, however, may turn the budget into an authoritative budget and alienate lower level managers.

In most organisations, the involvement of the top management is either less or much more than required. Ideally, there should be a balance. When the involvement of top management is less than required, it does not serve the purposes mentioned above. When it is more than required, top management may not listen to the opinions of lower management. Therefore, the budget target should be such that it will be agreed to by both.

3. Role of the budget department or controller in budgeting

The budget department or the controller is generally responsible for checking the accuracy and appropriateness of the budgets prepared by various departments. They are responsible for co-ordinating amongst different departments, and also for ensuring that the functional budgets are prepared according to the guidelines given by the senior managers to achieve goal congruence.

Unfortunately, many of the tasks the budget department has to perform are perceived as negative. At times, the budget department may have to point out slack, excessive inventory, inefficient operation, etc. These certainly are not easy tasks, yet they are necessary if an organisation is to follow an efficient and effective budget.



Test Yourself 2

What is the difficulty level of a budget? Discuss the issues involved in setting the difficulty level of a budget.

3. Evaluate the benefits and difficulties of participation of employees in the negotiation of budgets.

[Learning Outcome c]

When functional budgets are prepared, they are reviewed by the budget committee / budget department to see whether they are in line with the organisational objectives and well-coordinated with the objectives of the other departments. Sometimes, it is found that there is no goal congruence between the individual objectives and the corporate objectives. In such cases, modification of the budgets is necessary to achieve goal congruence.

Sometimes, due to sub-optimal goals set by functional managers, the functional budgets do not fall in line with the corporate objectives of achieving optimum profit. In such cases, it is necessary to resolve the conflicts between organisational and divisional objectives through a negotiation process.

This administrative process of budget negotiation and coordination takes place before finalising the budget. Participation of all the individuals involved in the process of setting the budgets, should be mandatory. This will eliminate any doubts or suspicion in the minds of the employees about the objectives of the budget.

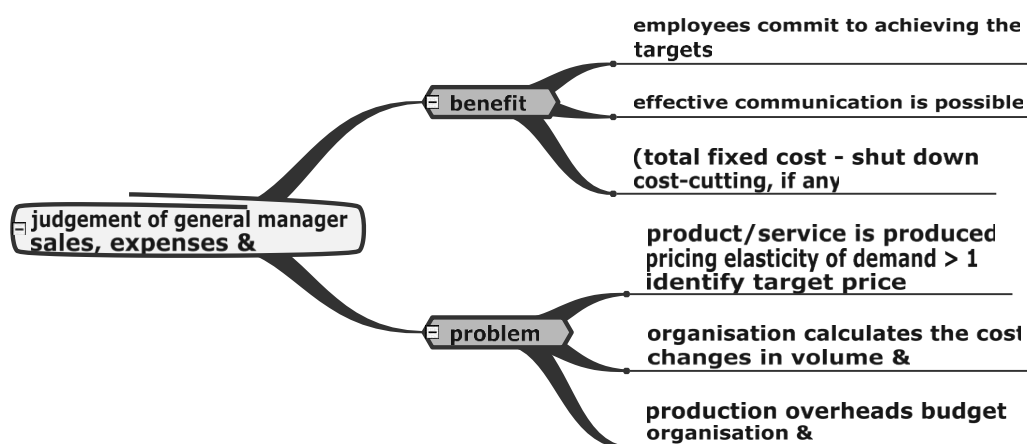
3.1 Benefits of employees' participation in the negotiation of budgets

1. Participation of the employees in negotiation enables them to understand the dilemmas faced by top management while setting the target. This may help to obtain the employees' commitment to achieve the budget targets.
2. If the employees participate in the process of negotiation, they will be able to communicate their problems to top management because they are much more aware of problems at the grass root level. This will result in setting realistic targets.
3. If the budget proposals are cut down without any explanation to the employees, the employees may get demotivated. This possibility is eliminated through participation.
4. If the targets are negotiated in consultation with the employees, they feel committed to achieving the target, as they have already agreed to it.

3.2 Difficulties in employees' participation in the negotiation of the targets

1. If the employees are involved in the process of negotiation, some of them may feel cornered to negotiate with management. They may not be able to negotiate / communicate well in front of top management and may agree with whatever top management proposes. Subsequently the objective of the negotiation process is defeated.
2. Where the process is highly programmable, i.e. where the input-output relationship is clear, the negotiation process will only waste time.
3. The personality / attitude of a person may limit the benefits of participation. If a person is introvert and does not make any suggestions, his participation in the negotiation process will not contribute anything.

SUMMARY





Test Yourself 3

Write a note on employee participation in the negotiation process.

Answers to Test Yourself

Answer to TY 1

Budget slack (budget bias) is intentional overestimation of the expenses and/or underestimation of revenues in the budget so that it is easier for managers to chase the target.

A budget acts as a control tool. In a budgetary system, actual results are compared with the budgeted figures. If the difference is significant it is investigated and corrective action is taken. Due to budget slack, the actual figures may not show a significant difference, as the budgeted figures have been adjusted. As a result, it becomes difficult to take corrective action.

There is also the possibility that people may spend more to protect the overestimations in the budget so that they can maintain the slack in the future. This attitude makes it difficult to control costs as the budget is taken as the basis for controlling costs. Budget slack damages the objective of motivating the people in the organisation to reduce costs and remove inefficiencies. Budget slack results in overspending, as the cost for a particular level of activity is higher than necessary.

Answer to TY 2

(a) Difficulty level of a budget

The difficulty level of a budget is the difficulty of completing a task or objective. Setting a difficulty level in budgeting signifies identifying the difficulties in implementing the budget successfully. A major difficulty in setting a budget target is to determine a balanced target. A balanced target is one which is achievable but, at the same time, motivates the employees.

(b) Issues surrounding setting difficulty level

(i) Non-participation of lower level of management

If the functional managers, all the employees etc. are involved in the process of budget preparation, they can put forward their own suggestions and can also communicate the difficulties in achieving the higher targets.

Even if the targets set are high, if top management discusses the reasons for the high targets with the lower management, they may be persuaded to chase the target. However, if they are not involved in the process of budget devising and negotiation, they may feel unappreciated, and may not commit themselves to achieving the targets.

(ii) Non-participation of top level of management

The participation of the senior managers in the preparation of budgets motivates the lower level of management. The involvement of senior managers also helps in identifying and avoiding budget slack i.e. overestimation or underestimation in the budgets.

If the senior managers are not involved in the process of budgeting, it may result in easy targets being set.

(iii) Role of budget department or controller

The budget department or controller is generally responsible for reviewing the budgets i.e. checking their accuracy and appropriateness. They are also responsible for ensuring that the individual departmental budgets do not conflict with each other or with the corporate objectives.

Therefore, the controller or the budget department helps in budget-setting by eliminating the conflicts between the departmental and organisational objectives. The controller helps to identify sub-optimal plans prepared by the departments, and negotiates improvements to these plans.

Answer to TY 3

The budget department, the controller or superior manager reviews the functional budgets in order to achieve goal congruence. It is also necessary to ensure that the individual department budgets do not conflict with each other.

If the budgets are not in line with the corporate objectives, or there is a conflict between the departments, due to overestimation or underestimation (budget slack) etc., it is essential to modify the budgets. The procedure of making such modifications is called a negotiation procedure.

In the negotiation process, all the functional managers, top managers, accounting staff involved in budgeting, and members of the budget committee should be involved. If the budgets are modified without consulting all the personnel involved in the process, it may result in demotivating them.

Those who prepared the budget should be informed of the reasons for the modifications.

While negotiating, both the lower as well as top level management can inform each other of their problems. Top level management may persuade lower level management to chase targets by explaining the importance behind the targets. At the same time, lower level management can also explain grass root level problems to the top level management. This will result in setting realistic budget targets which will be motivating as well as achievable.

Once the lower level of management commits to the targets through the process of negotiation, they will try their best to achieve them.

Quick Quiz

1. Name two factors influencing behaviour.
2. What is meant by budget slack?
3. Summarise the role of the budget department.
4. What is meant by budget negotiation?
5. List any two benefits of the participation of employees in budget negotiation.

Answers to Quick Quiz

1. (a) Misunderstanding the objectives of senior management
(b) Sub-optimal planning
(c) Budget slack
2. According to CIMA's official terminology, budget slack is the intentional overestimation of expenses and/or underestimation of revenue in the budgeting process.

3. Role of budget department

The budget department is responsible for coordinating the budget targets of various departments and for ensuring that individual budgets are in line with the corporate objectives. The budget department also checks the accuracy and appropriateness of the budgets.

4. Budget negotiation

When the budgets have been prepared, superior managers review them to ensure that they do not conflict with the organisational objectives, and that the targets have been set at the best possible level.

5. The following are the benefits of the participation of employees in budget negotiation:

- (a) Participation of the employees in negotiation enables them to understand the dilemmas faced by top management while setting the target. This may help to obtain the employees' commitment to achieve the budget targets.
- (b) If the budget proposals are cut down without any explanation to the employees, the employees may get demotivated. This possibility is eliminated through participation.

Self Examination Questions

Question 1

Discuss how budgets and the budgeting process can be used to motivate managers to meet the objectives of the company.

Your answer should refer to:

- (a) Setting difficulty level
- (b) Participation in the negotiation process.

Question 2

The attitude of the people involved in the process of preparation and implementation of the budget decides the success of the budget.

State the factors which influence their behaviour.

Answers to Self Examination Questions

Answer to SEQ 1

(a) Setting difficulty level

The difficulty level of a budget is the level at which the targets are balanced. In order to achieve all the objectives set by the budget, it is necessary to set the targets at a level acceptable by both the top as well as lower level management.

The target set should be neither too high nor too low. If the budget targets are balanced, i.e. motivating on the one hand but also achievable on the other, it encourages employees to put in their best efforts.

The difficulty level set for the budget also influences the motivation objective of the budget. If the targets are high but achievable, this motivates the managers; but if they are so high that they are unachievable, they will fail to motivate the managers.

(b) Participation in budget negotiation

When those responsible for the implementation of the budgets are involved in the process of budget preparation and negotiation, it motivates them to perform well because the targets are set and committed to by them. This commitment gives them a sense of responsibility.

If the budget targets are imposed, the lower and middle level managers will not be motivated.

Furthermore, when the targets set by the functional managers are modified by their superiors without consultation, the functional managers may feel irrelevant and consequently become demotivated.

Answer to SEQ 2

For a successful budget, the reaction of those responsible for its implementation is important. The behaviour of the people in the organisation can be influenced by the following factors:

(a) Fear about the objective of the senior management.

Often, a budget is seen as a cost-cutting exercise. Sometimes, functional managers may fear that whatever expenditure and revenue they estimate, senior managers will try to curtail the allowance for expenses and increase the sales target. Due to this, they may dislike the budgetary system. They may be reluctant to devise a budget.

Also, due to fear of cost-cutting, they may prepare budgets with slack and also make a provision for the next year by spending more in the current year.

These budget slacks are then carried forward into future years if the budgets are prepared on an incremental basis.

(b) Targets set by senior managers

It is really difficult to set a budget target since easy targets do not motivate employees and higher targets, if found to be unachievable, may demotivate them.

If the targets set are easy to meet, employees will not need to put in their best effort to achieve them, resulting in under-performance.

On the other hand, if the targets are too high i.e. unachievable, they will not motivate employees as they know that even if they work to their best ability they will not be able to achieve the targets.

(c) Sub-optimal planning

Plans which do not aim at optimum utilisation of resources are sub-optimal plans. The best plan is one which optimally utilises the available resources. Due to limiting factors it may not be possible to utilise all the resources to the maximum extent, but they should be used in the best possible way.

However, in most organisations, while preparing the budget for the respective departments, functional managers may not be able to explore the maximum capacity because of the functional constraints, and will therefore need to prepare sub-optimal plans. Such sub-optimal plans demotivate them.

(d) Participation of lower level of management

The involvement of lower level management in the process of budget preparation and negotiation motivates them to perform well.

SECTION D1: INTRODUCTION TO STANDARD COSTING, BASIC VARIANCES AND OPERATING STATEMENTS

Get Through Intro

Standard costs are the building-blocks for the entire exercise of cost control. A thorough understanding of the principles of standard costing is necessary for controlling costs through variance analysis. The concept of variance is intrinsically connected with planned and actual results and the effects of the difference between these results on the performance of the entity or organisation.

An analysis of variances involves comparing the budgeted, planned or standard revenues and costs with actual performances in order to obtain variances. The causes of these variances can then be ascertained and used to improve performance. This SECTION will take you through the steps of variance analysis of the elements of revenue and costs.

As an accountant, you will have to compare actual results to budgeted results and explain why there are differences. In order to do this effectively, you need to understand and memorise the methods of calculation of variances. They will get easier with practice. This is one of the most important topics from the examination point of view and therefore careful study of this SECTION will help you to answer the related questions in the examination. In your professional life also, knowledge of standard costing and variance analysis will always be useful as standard costing is widely-used globally.

Learning Outcomes

- a) Evaluate different types of standards (ideal, basic, attainable, current)
- b) Prepare Standard cost card
- Calculate and identify the cause of basic variances including:
 - i. Sales price and volume.
 - ii. Materials total, price and usage.
 - iii. Labour total, rate and efficiency.
 - iv. Variable overhead total, expenditure and efficiency.
 - v. Fixed overhead total, expenditure and, where appropriate, volume, capacity and efficiency.
- c) Produce full operating statements in both a marginal cost and full absorption costing environment, reconciling actual profit to budgeted profit.
- d) Calculate the effect of idle time and waste on variances including where idle time has been budgeted for.
- e) Calculate, using a simple situation, ABC-based variances.
- f) Illustrate the different methods available for deciding whether or not to investigate a variance cause.

1. Evaluate different types standards (ideal, basic, attainable, current)

[Learning Outcome a]

Standard Costing

Accounting systems that use standards for product costs are called standard cost systems. Standard cost systems enable management to determine the following:-

- a. How much a product should cost (standard cost)
- b. How much it does cost (actual cost)

(Reeve et al 2009)

Standards are one of important quantitative tools in the hand of management to control and measure performance of business operations. However it heavily depends on the type of standards used to decide about the control actions and to measure the performance

Types of standards

Following are different types of standards: Basic standards, Current standards, Attainable (expected) standards, Ideal (theoretical) standards.

Basic cost standards represent constant standards that are left unchanged over long periods. The main advantage of basic standards is that a base is provided for a comparison with actual costs through a period of years with the same standard, and efficiency trends can be established over time (Drury, C, 2004).

Current standards represent those standards that are based on current working conditions. They are useful when current conditions are abnormal and any other standard would provide meaningless information. The disadvantage is that they do not attempt to motivate employees to improve upon current working conditions and, as a result, employees may feel unchallenged. (ACCA performance Management complete text, 2015)

Attainable (expected) standards represent those costs that should be incurred under efficient operating conditions. They are standards that are difficult, but not impossible, to achieve. Attainable standards are easier to achieve than ideal standards because allowances are made for spoilage, machine breakdowns and lost time. The fact that these standards represent a target that can be achieved under efficient conditions, but which is also viewed as being too easy to achieve nor impossible to achieve, provides the best norm to which actual costs should be compared (Drury, C, 2004)

Ideal (theoretical) standards represent perfect performance. Ideal standard costs are the minimum costs are possible under the most efficient operating conditions. Ideal standards are unlikely to be used in practice because they may have an adverse impact on employee motivation. Such standards constitute goals to be aimed for rather than performance that can currently be achieved (Drury, C, 2004).

2. Prepare Standard cost card

[Learning Outcome b]

Standard cost card

It shows the quantity and price of each type of materials, labour, time and rate, hour and rate of variable and overheads. In summary, a standard cost card should be maintained for each product showing total unit cost of production, breaking into respective elements of costs.

Example of a Standard cost card

Cost factor	Standard quantity or hour	Standard price or rate	Standard cost
	TZS	TZS	TZS
Direct material	1 kg	7,000 per kg	7,000
Direct labour	2 hours	15,000 per hr	30,000
Variable Manufacturing overheads	2 hours	7,000 per hr	14,000
Total standard cost per unit			TZS 51,000



Example

1. Calculate and identify the cause of basic variances including:

- i. Sales price and volume.
- ii. Materials total, price and usage.
- iii. Labour total, rate and efficiency.
- iv. Variable overhead total, expenditure and efficiency.
- v. Fixed overhead total, expenditure and, where appropriate, volume, capacity and efficiency.

[Learning Outcome c]

1.1 Analysis of variance:
rationale

Variance analysis deals with the **systematic evaluation of variances**. It refers to an examination of the conditions of operations which give rise to any cost variance. It also provides management with an explanation for why the variance has occurred. This indirectly helps management to take suitable steps to control costs wherever necessary.

Variances draw to management's attention the fact that everything has not gone according to plan. They highlight that problems may exist and direct management's attention to them. If management is aware that there have been departures from standards (expectations), they will be in a position to take action to correct such departures. Significant adverse variances will, if left unchecked, have an adverse effect on profitability. If favourable variances arise, they too should be investigated. It is possible that a favourable variance has arisen because of improper consideration of the standards that can be rectified for future reference and used for the advantage of the business.

Before going into the detail of standard costing methodology, remember that budgeted costs signify estimated total costs for a budget period used in the budget. Standard costs are the budgeted cost per unit for a particular product process or activity.

The term '**standard**' refers to pre-determined, estimated unit costs and revenues. A **standard cost** is often described as a 'budget for an individual unit of production'.

Variances can be split into two types: variances showing a

price difference and/or
quantity or volume difference

Standards may be set and variances can be calculated for each element of cost (such as material, labour and overheads). It is also possible to calculate variance for each of the factors (such as price, volume and so on) which determine the cost.

The variance can either be **favourable or unfavourable (adverse)**. In order to determine whether the variance is favourable or adverse, we need to consider its impact on the profit of the entity:

A **cost variance** (such as a material price or a labour rate variance etc.) is **favourable** if the actual cost is **less** than the standard cost and vice-versa.



Tip

Do not forget to label variance as adverse or favourable. 50% of the marks for variance calculations are reserved for these labels.

A **sales variance** (such as a sales margin price or volume variance etc.) is **favourable** if the actual profit **exceeds** the standard cost and vice-versa.

In general, there are four broad causes of variances, namely:

- inaccurate recording of actual costs and revenues
- random events (e.g. an accident may damage raw materials used for production causing adverse material variance)
- operating efficiency
- setting inappropriate standards

The variances for each element of revenue and costs under absorption costing and marginal costing are explained here in detail.

As we have already learnt in a previous SECTION A1, under marginal costing, the standard production cost includes **only variable costs**. In effect, fixed costs are not allocated to products. However, under absorption costing, the standard cost of a product includes both **fixed and variable** costs.

Hence, under absorption costing we need to calculate some extra variances in relation to fixed costs (such as fixed overhead capacity variance, fixed overhead efficiency variance etc. which we will study shortly).

General rule for calculating variances:



Tip

For price variances: compare the actual price with the standard price for actual quantity.

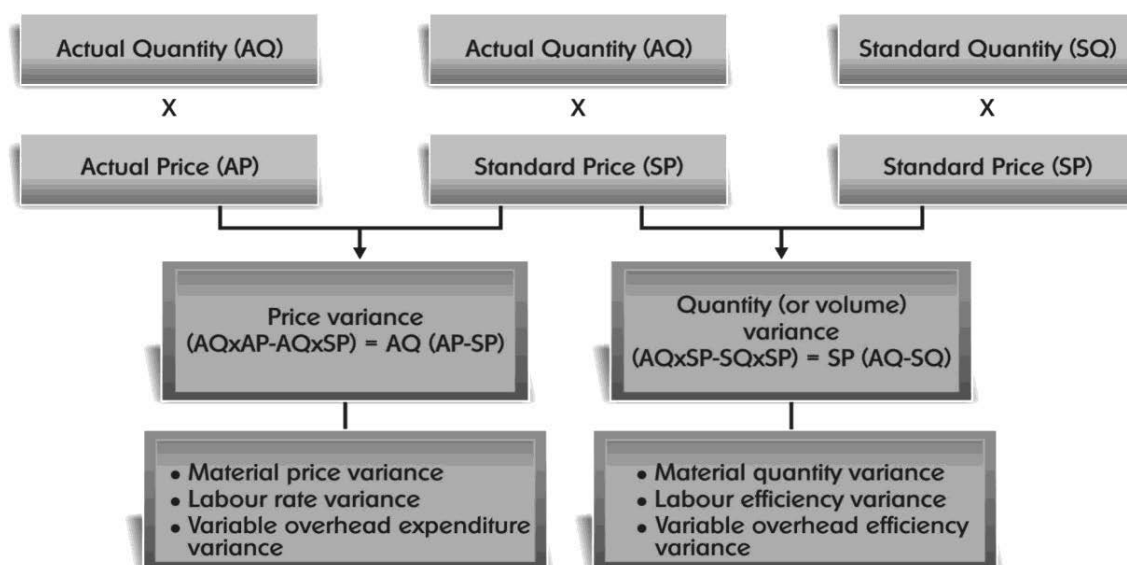
For quantity or volume variances: compare the actual quantity with the standard quantity for standard price

1.2 Fundamental concepts in brief

1. There are two basic dimensions to variances: price and quantity.
2. A price variance is always calculated for actual quantity.
3. A quantity variance is always calculated using standard price.
4. The sales variances are favourable (F) when actual figures are greater than standards and are adverse (A) when actual figures are lower than standards.
5. The cost variances (except fixed overhead efficiency variances and fixed overhead capacity variance) are favourable when actual figures are lower than standards and are adverse (A) when actual figures are greater than standards.
6. Budgeted (costs or sales) signifies estimated total (costs or sales) for a budget period as considered in the budget whereas standards (costs or sales) are budgeted (cost or sales) per unit.
7. Wherever 'standard quantity' is mentioned it should be interpreted as standard quantity for actual production. Many times standard quantity may be given as budgeted quantity in the exam.
8. If standard cost is given per unit, calculate the total standard cost for the actual level of activity.
9. For variable and fixed overheads, wherever absorption rates are given the rates are to be presumed as standard rates.

The following diagram explains how variances are calculated in general:

Diagram 1: Analysis of variance



1.3 Calculate, identify the cause of and interpret basic variances

1. Total sales variances

Total sales variance signifies the variance in profit (in absorption costing) or in contribution (in marginal costing) as a result of the combined impact of change in price and sales volume. Similarly, total sales value variance signifies the difference between actual sales and budgeted sales.

If actual sales / actual margin is greater than budgeted sales / budgeted margin, the variance is favourable (F) and otherwise, it is adverse (A).

Under absorption costing environment,

Total sales value variance = Actual sales – Budgeted sales
Total sales profit variance = Actual profit – Budgeted profit

Under marginal costing environment,

Total sales margin (contribution) variance = Actual margin – Budgeted margin

2. Sales price and volume variances

- (a) The sales price variance signifies the difference between the actual selling price per unit and the standard selling price per unit, multiplied by the actual quantity of units sold.

The variance identifies that the units are sold for more or less than their standard selling price and the overall impact on revenue due to changes in sales price. This variance may be caused by the influence of a competitive market or due to a change in pricing strategy, etc.

If actual sales price is greater than the standard sales price, it is indicative of higher revenue coming in due to higher prices charged to the customers and therefore the variance is favourable (F) and otherwise the variance is adverse (A). Sales price variance is calculated both under an absorption costing environment and in a marginal costing environment.

In an absorption costing environment, sales price variance may either be calculated as actual quantity sold multiplied by difference between the actual selling price and the standard selling price or as actual quantity sold multiplied by the difference between the actual profit per unit and the standard profit per unit.

Actual profit per unit is calculated as **actual selling price minus standard cost per unit** whereas **standard profit per unit** is calculated as **standard selling price minus standard cost per unit**.

Under the absorption costing method, **sales price variance** is calculated as follows:

Sales price variance = (Actual selling price per unit – Standard selling price per unit) x Actual quantity sold
OR
 Sales (profit margin) variance = (Actual profit margin – Standard profit margin) x Actual sales volume
 = [(Actual sales price – Standard cost per unit) – (Standard sales price – Standard cost per unit)] x Actual sales volume



Tip

Sales price variance can be calculated using any of the above formulae. The answer under both the methods will be the same.

In a marginal costing environment, **sales margin price variance** is calculated. Sales margin price variance is the difference between the actual contribution margin and the standard margin (both based on standard unit costs) multiplied by the actual sales volume.

Sales margin price variance

= (Actual contribution margin – Standard contribution margin) x Actual sales volume
 = (Actual sales price – Standard variable cost per unit) – (Standard sales price – Standard variable cost per unit) x Actual sales volume

If the actual margin is greater than the standard margin, the variance is **favourable (F)**; otherwise it is **adverse (A)**.

- (b) The sales volume variance signifies the difference between the actual quantities sold and the budgeted quantity, multiplied by either **the standard profit per unit** or **the standard contribution per unit**. It should be noted that, in absorption costing, standard profit per unit is used, whereas in a marginal costing environment.



Tip

Sales volume variances should be based on standard profit (or contribution) margin and not on standard price.

- (c) standard contribution per unit is used

The variance identifies whether the actual quantity of sales exceeded the budgeted quantity and measures the overall impact of change in sales volume on profit or contribution as the case may be.

If actual sales volume is greater than the standard sales volume, the variance is favourable (F); otherwise the variance is adverse (A).

Sales volume variance = (Actual sales quantity – Budgeted sales quantity) x Standard profit per unit or Standard contribution per unit



Example

From the information provided below, calculate the following variances:

- (i) Sales price variance
- (ii) Sales margin price variance
- (iii) Sales volume variance
- (iv) Sales margin volume variance
- (v) Total sales value variance
- (vi) Total sales margin variance

	Standard				Actual			
	Qty. (units)	Unit sales price (TZS'000)	Cost / unit TZS'000	Total sales TZS'000	Qty. (units)	Unit sales price (TZS'000)	Cost / unit TZS'000	Total sales TZS'000
A	2,000	4	3.5	8,000	2,200	4.10	3.70	9,020
B	2,500	5	4	12,500	2,000	5.25	4.30	10,500
C	1,750	6	5.25	10,500	2,000	5.75	5	11,500
	6,250			31,000	6,200			31,020

Sales price variance = (Actual selling price per unit – Standard selling price per unit) x Actual quantity sold

Product A = TZS (4,100 – 4,000) x 2,200 = TZS220,000 (F)

Product B = TZS (5,250 – 5,000) x 2,000 = TZS500,000 (F)

Product C = TZS (5,750 – 6,000) x 2,000 = TZS500,000 (A)

Sales price margin variance = (Actual contribution margin (W1) – Standard contribution margin (W2)) x Actual sales volume

Product A = TZS (600 – 500) x 2,200 = TZS220,000 (F)

Product B = TZS (1,250 – 1,000) x 2,000 = TZS500,000 (F)

Product C = TZS (500 – 750) x TZS2,000 = TZS500,000 (A)

Workings

W1 Actual margin

A = TZS4,100 – TZS3,500 = TZS600

B = TZS5,250 – TZS4,000 = TZS1,250

C = TZS5,750 – TZS5,250 = TZS500

W2 Budgeted margin

A = TZS4,000 – TZS3,500 = TZS500

B = TZS5,000 – TZS4,000 = TZS1,000

C = TZS6,000 – TZS5,250 = TZS750

Sales volume Variance = (Actual sales quantity – Budgeted sales quantity) x Standard price per unit

Product A = TZS (2,200 – 2,000) x TZS4,000 = TZS800,000 (F)

Product B = TZS (2,000 – 2,500) x TZS5,000 = TZS2,500,000 (A)

Product C = TZS (2,000 – 1,750) x TZS6,000 = TZS1,500,000 (F)

Sales margin volume Variance = (Actual sales quantity – Budgeted sales quantity) x Standard profit per unit

Product A = (2,200 – 2,000) x TZS500 = TZS100,000 (F)

Product B = (2,000 – 2,500) x TZS1,000 = TZS500,000 (A)

Product C = (2,000 – 1,750) x TZS750 = TZS187,500 (F)

Continued on the next page

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Total sales value variance = Actual sales – Budgeted sales

Product A = TZS9,020,000 – TZS8,000,000 = TZS1,020,000 (F)

Product B = TZS10,500,000 – TZS12 500,000 = TZS2,000,000 (A)

Product C = TZS11,500,000 – TZS10,500,000 = TZS1,000,000 (F)

Total sales margin variance = Actual margin – Budgeted margin

Product A = (2,200 x TZS600) – (2,000 x TZS500) = TZS320,000 (F)

Product B = (2,000 x TZS1,250) – (2,500 x TZS1,000) = NIL

Product C = (2,000 x TZS500) – (1,750 x TZS750) = TZS312,500(A)

3. Materials total, price and usage variances

(a) Total Direct Material Cost Variance (TMCV)

The direct materials total cost variance signifies the difference between actual material cost and standard material cost for the actual production.

If actual material cost is greater than the standard material cost for the actual production, the variance is adverse (A); otherwise the variance is favourable (F).

The total materials cost variance is made up of two elements:

The materials price variance: which is the difference between the actual price of the materials and the standard price for the actual quantity of goods made.

The materials usage variance: which is the difference between what was actually used and what should have been used under standard terms at standard material price.

If actual consumption is greater than quantity purchased, actual materials cost (for calculation of direct material cost variance) should be derived as the sum of the actual cost of purchase of raw material and the extent of opening inventory consumed at standard price.

Total direct material cost variance = Standard material cost for actual production - Actual material cost

Where,

Actual material cost = Actual cost of usage of raw material out of current year's purchase + Extent of opening inventory consumed at standard price (if there is opening inventory of material)

If the total of materials purchased is different from the materials actually used and raw material inventories are valued at standard cost,

the **material price variance** would be calculated based on **actual quantity** of purchase whereas the **material usage variance** would signify the difference between **actual usage** and **standard usage**.

(b) Direct Material Price Variance (MPV)

The direct material price variance signifies the difference between actual price and standard price multiplied by actual quantity purchased.

A direct material price variance occurs when raw materials are purchased at a price different from the standard price. Direct materials price variance arises due to fluctuations in market prices, purchasing non-standard lots and the consequent reduction in quantity discount, increase in or additional transport costs for a quick delivery, taking advantage of cash discount, etc.

If actual raw material price is greater than the standard raw material price, it is indicative of incurring high costs for raw materials and therefore the variance is adverse (A) and otherwise variance is favourable (F).

$$\begin{aligned}\text{Direct material price variance} &= \text{Standard material cost for actual quantity} - \text{Actual material cost} \\ &= (\text{Standard material price} \times \text{Actual quantity}) - (\text{Actual material price} \times \text{Actual quantity}) \\ &= (\text{Standard material price} - \text{Actual material price}) \times \text{Actual quantity}\end{aligned}$$

(c) Direct Material Usage Variance (MUV)

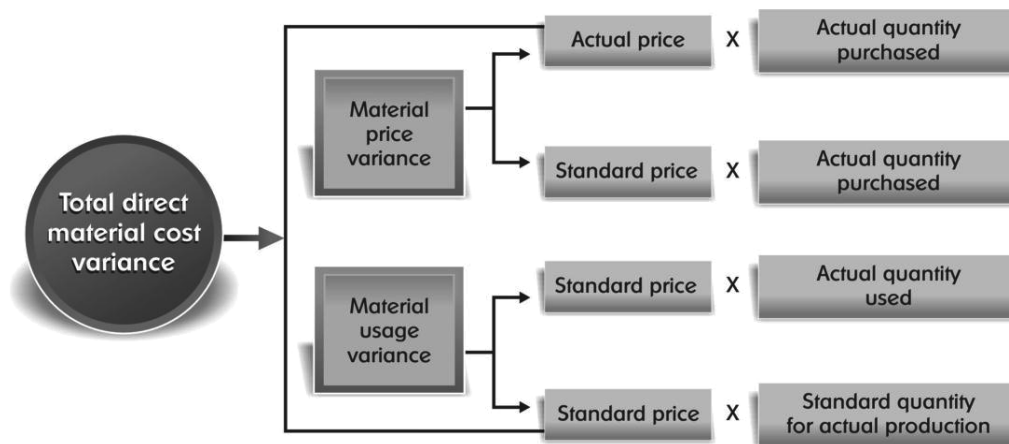
Direct material usage variance represents the difference between the actual quantities of raw materials used in production and the standard quantities that should have been used in actual production multiplied by standard price. Standard quantity for actual production should be calculated because it helps to know whether the material is properly used in the production or not.

If the actual quantities of raw materials used in production exceed the standard quantities, the variance is adverse (A); otherwise the variance is favourable (F).

A direct material usage variance is caused on account of sub-standard or defective materials, carelessness in the use or handling of materials, pilferage of materials, wastage due to inefficient production methods or unskilled employees, etc.

$$\begin{aligned}\text{Direct material usage variance} &= (\text{Standard quantity for actual production} \times \text{Standard material price}) - (\text{Actual quantity consumed} \times \text{Standard material price}) \\ &= (\text{Actual quantity consumed} - \text{Standard quantity for actual production}) \times \text{Standard material price}\end{aligned}$$

Diagram 2: Total material cost variance



Example

The standard cost card of Supernova Plc is given below:

	Standard cost/Unit
Raw materials 65 kg at TZS4,000 per kg	260,000
Direct labour 16 hours at TZS7,750/hour	124,000
	384,000

Actual performance results for the year 20X6 reveal the following:

Actual results for the year 20X6	
Production	145 units
Direct material purchases	9,000 kg at a cost of TZS40.5 million
Opening inventories: direct material	1,850 kg
Closing inventories: direct material	1,550 kg
Direct wages	TZS18.8 million for 2,350 hours

Continued on the next page

426: Standard Costing & Variance Analysis

300 units have been used during the year out of the opening inventories.

The managing director wants to know the reasons for variances in the direct costs of the company.

Answer

Total direct material cost variance = Standard materials cost for actual production - Actual materials cost

$$\begin{aligned}\text{Total material cost variance} &= \text{TZS}37,700,000 \text{ (W1)} - \text{TZS}41,700,000 \text{ (W2)} \\ &= \text{TZS}4,000,000 \text{ (A)}\end{aligned}$$

Workings

$$\begin{aligned}\text{W1 Standard material cost for actual production} &= 65 \text{ kg} \times 145 \text{ units} \times \text{TZS}4,000 \\ &= \text{TZS}37,700,000\end{aligned}$$

$$\begin{aligned}\text{W2 Actual material consumed} &= 1,850 \text{ opening inventory} + 9,000 \text{ kg purchased during the year} - 1,550 \text{ kg closing inventory} \\ &= 9,300 \text{ kg}\end{aligned}$$

Here, actual material consumed is more than the material purchased during the year. Therefore, actual material cost is derived as the sum of the actual purchase cost and the opening inventories consumed at standard price.

$$\begin{aligned}\text{Actual material cost} &= \text{TZS}40,500,000 + (300 \times \text{TZS}4,000) \\ &= \text{TZS}41,700,000\end{aligned}$$

Direct material price variance = (Standard materials price - Actual materials price) x Actual quantity

$$\text{Material price variance} = (\text{TZS}4,000 - \text{TZS}4,500) \times 9,000 \text{ kg}$$

$$\text{Material price variance} = \text{TZS}4,500,000 \text{ (A)}$$

Direct material usage variance = (Actual quantity consumed - Standard quantity for actual production) x Standard price

$$\begin{aligned}&= [9,300 \text{ kg} - (65 \text{ kg} \times 145 \text{ units})] \times \text{TZS}4,000 \text{ per kg} \\ &= \text{TZS}500,000 \text{ (F)}\end{aligned}$$

Total material cost variance can also be calculated as follows:

$$\begin{aligned}\text{Total material cost variance} &= \text{Material price variance} + \text{Material usage variance} \\ &= \text{TZS}4,500,000 \text{ (A)} + \text{TZS}500,000 \text{ (F)} \\ &= \text{TZS}4,000,000 \text{ (A)}\end{aligned}$$

4. Labour total, rate and efficiency variance

(a) Total Direct Labour Cost Variance (LCV)

The total direct labour cost variance is the difference between the standard direct wages for actual production and the actual direct wages paid.

If the standard direct wages for actual production are greater than the actual direct wages paid, this indicates the labour cost incurred was lower than estimated and therefore the variance is favourable (F); otherwise the variance is adverse (A).

$\begin{aligned}\text{Total direct labour cost variance} &= \text{Standard direct wages for production} - \text{Actual direct wages paid} \\ &= (\text{Standard labour hours for actual production} \times \text{Standard wages rate per hour}) - (\text{Actual labour hours} \times \text{Actual wages rate per hour})\end{aligned}$

The total direct labour cost variance is made up of two elements:

The direct labour rate variance: which gives the difference between the actual rate of the labour and the standard rate per hour for the actual hours worked.

The materials usage variance: which is the difference between what was actually used and what should have been used under standard terms; at the standard labour rate per hour.

(b) Direct Labour Rate Variance (LRV)

Direct labour rate variance represents the difference between the standard wages rate per hour and the actual wages rate per hour for the actual hours worked.

If the actual direct labour rate is greater than the standard rate, this indicates that higher costs for direct labour have been incurred compared to the estimated costs and therefore the variance is adverse (A); otherwise the variance is favourable (F).

The causes of labour rate variances usually are changes in basic wage rates, new workers being paid different rates from the standard rates, different rates being paid to workers employed to meet seasonal demands or to do urgent work, etc.

$$\text{Direct labour rate variance} = (\text{Standard wage rate per hour} - \text{Actual wage rate per hour}) \times \text{Actual labour hours}$$

**Tip**

Labour rate may have to be adjusted at times to reflect idle times.

(c) Direct Labour Efficiency Variance (LEV)

Direct labour efficiency variance highlights the difference between the standard labour hours for actual production and the actual labour hours worked during the period multiplied by the standard wages rate per hour.

If actual labour hours worked during the period under consideration are less than the standard labour hours for actual production, the resultant variance is favourable (F); otherwise the variance is adverse (A).

Direct labour efficiency variance arises due to insufficient training, incomplete supervision, workers' dissatisfaction, bad working conditions, use of defective machinery and equipment, fixation of incorrect standards, etc.

$$\text{Direct labour efficiency variance} = (\text{Standard labour hours for actual production} - \text{Actual labour hours worked}) \times \text{Standard wage rate per hour}$$

**Example**

Continuing the previous example of Supernova Plc

Direct labour cost variance = Standard direct wages for production - Actual direct wages paid

$$\begin{aligned} \text{Direct labour cost variance} &= (\text{TZS}124,000 \times 145 \text{ units}) - \text{TZS}18,800,000 \\ &= \text{TZS}820,000 \text{ (A)} \end{aligned}$$

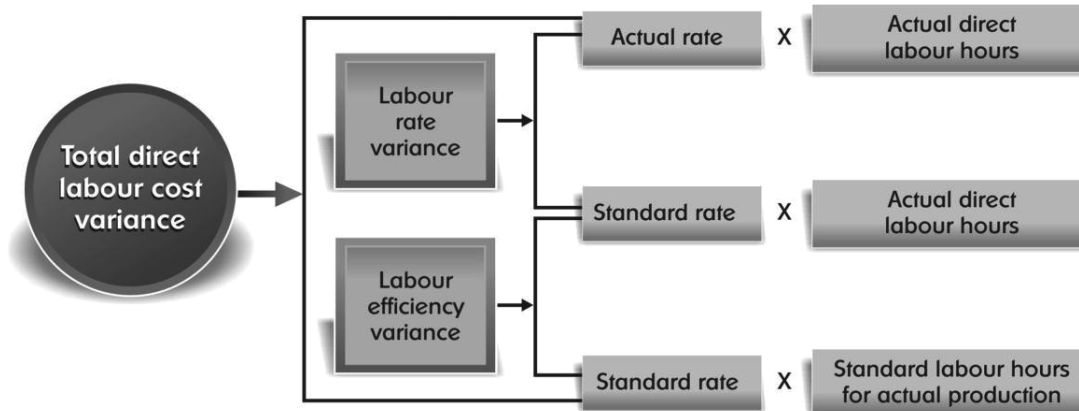
$$\begin{aligned} \text{Direct labour rate variance} &= (\text{Standard wages rate per hour} - \text{Actual wages rate per hour}) \times \text{Actual labour hours} \\ &= (\text{TZS}7,750 - \text{TZS}8,000) \times 2,350 \text{ hrs} \\ &= \text{TZS}587,500 \text{ (A)} \end{aligned}$$

It is calculated by dividing total wages paid by total hours i.e. TZS18,800,000/2,350 hours

Direct labour efficiency variance = (Standard labour hours for actual production - Actual labour hours worked) x Standard wages rate per hour

$$\begin{aligned} \text{Direct labour efficiency variance} &= [(16 \text{ hours} \times 145 \text{ units}) - 2,350 \text{ hours}] \times \text{TZS}7,750 \\ &= \text{TZS}232,500 \text{ (A)} \end{aligned}$$

Diagram 3: Total labour variance



5. Variable overhead total, expenditure and efficiency

The total variable overhead variance arises due to a difference between the variable overheads absorbed and the variable overheads actually incurred.

Overhead variances are always computed in totality as total overheads comprise of many indirect cost items. Finding individual overhead cost variance may be a complicated task. Variable overheads are absorbed using a suitable overhead absorption rate which is based on machine hours, labour hours or % of factory cost etc.

If the variable overheads absorbed in a period are greater than the variable overheads actually incurred, it is a favourable (F) variance; otherwise it is an adverse (A) variance.

$$\begin{aligned} \text{Total variable overhead variance} &= \text{Variable overhead absorbed} - \text{Actual variable overhead} \\ &= (\text{Variable overhead absorption rate per hour} \times \text{Standard hours for actual production}) - \text{Actual variable overhead} \end{aligned}$$

(a) Variable Overhead Expenditure (spending) Variance (VOXV)

The variable overhead expenditure variance represents the difference between the standard variable overhead rate and the actual variable overhead rate for the actual hours worked.

If the standard variable overhead rate is greater than the actual variable overhead rate, the variance is favourable (F); otherwise adverse (A).

Since variable overheads vary directly with output, a change in the level of output does not affect the standard variable overhead per unit and hence no expenditure variance arises. However, when the actual variable overhead rate per unit is different from the standard variable overhead rate per unit, then expenditure variance arises.

$$\begin{aligned} \text{Variable overhead expenditure variance} &= (\text{Standard variable overhead rate} - \text{Actual variable overhead rate}) \times \text{Actual hours worked} \\ &= \text{Standard variable overhead for actual hours} - \text{Actual variable overhead} \end{aligned}$$

Where, Standard variable overhead rate = Variable overhead absorption rate

(b) Variable Overhead Efficiency Variance (VOEV)

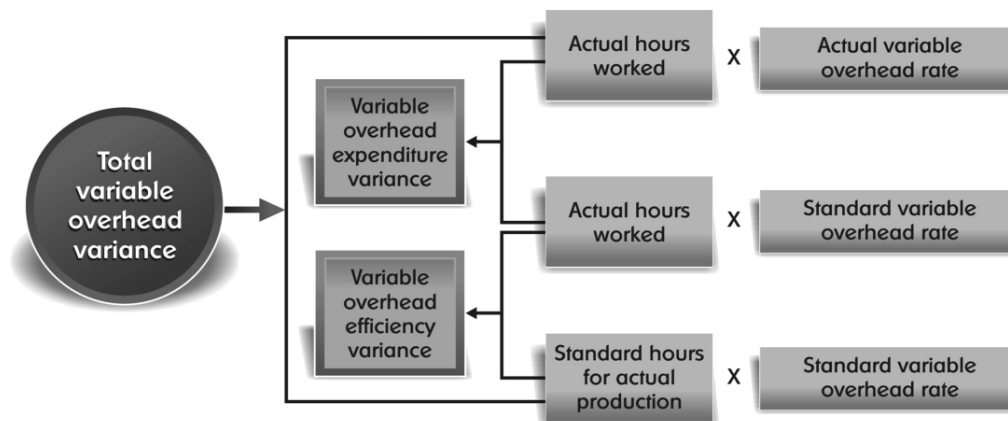
Variable overhead efficiency variance arises due to the difference between standard hours for actual production and the actual hours needed for production at the standard variable overhead rate.

This variance resembles the direct labour efficiency variance, since overhead efficiency variance arises due to efficiency / inefficiency in utilisation of labour hours.

The variance is favourable (F) if the actual hours needed for production are less than the standard hours for actual production; otherwise the variance is adverse (A).

$$\text{Variable overhead efficiency variance} = (\text{Standard hours for actual production} - \text{Actual hours}) \times \text{Standard variable overhead rate per hour}$$

Diagram 4: Variable overhead variance



Example

Particulars	
Budgeted variable production overheads	TZS360 million
Budgeted units for the period	60,000 units
Labour hours per unit	2 hours
Actual variable production overheads	TZS364 million
Actual units produced	50,000 units
Actual labour hours	112,000 hours

Total variable overhead variance = (Standard Variable Overhead Rate per Hour x Standard Hours for Actual Production) – Actual Variable Overhead

Variable overhead total variance = (TZS3,000 (W2) x 100,000 (W1)) – TZS364 million
 = TZS300 million – TZS364 million
 = TZS64 million (A)

Variable Overhead Expenditure Variance = Actual Hours Worked X (Standard Variable Overhead Rate – Actual Variable Overhead Rate)

Variable overhead expenditure variance = 112,000 hours x (TZS3,000 (W2) - TZS3,250 (W3))
 = TZS28 million (A)

Variable Overhead Efficiency Variance = Variable Overhead Absorbed – Standard Variable Overheads
= Standard Variable Overhead per Hours x (Standard Hours for Actual Production – Actual Hours)
 = TZS3,000 x (100,000 hours – 112,000 hours)
 = TZS36 million (A)

Workings

W1 Standard hours for actual production = Standard hours per unit x Actual production
 = 2 hours x 50,000
 = 100,000 hours

W2 Variable overhead absorption rate = $\frac{\text{Standard variable overheads}}{\text{Standard hours worked}}$
 = $\frac{\text{TZS360 million}}{60,000 \text{ units} \times 2 \text{ hours}}$
 = TZS3,000 per hour

W3 Standard absorption rate = $\frac{\text{Actual variable overheads}}{\text{Actual hours worked}}$
 = $\frac{\text{TZS364 million}}{112,000 \text{ hours}}$
 = TZS3,250 per hour

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430: Standard Costing & Variance Analysis

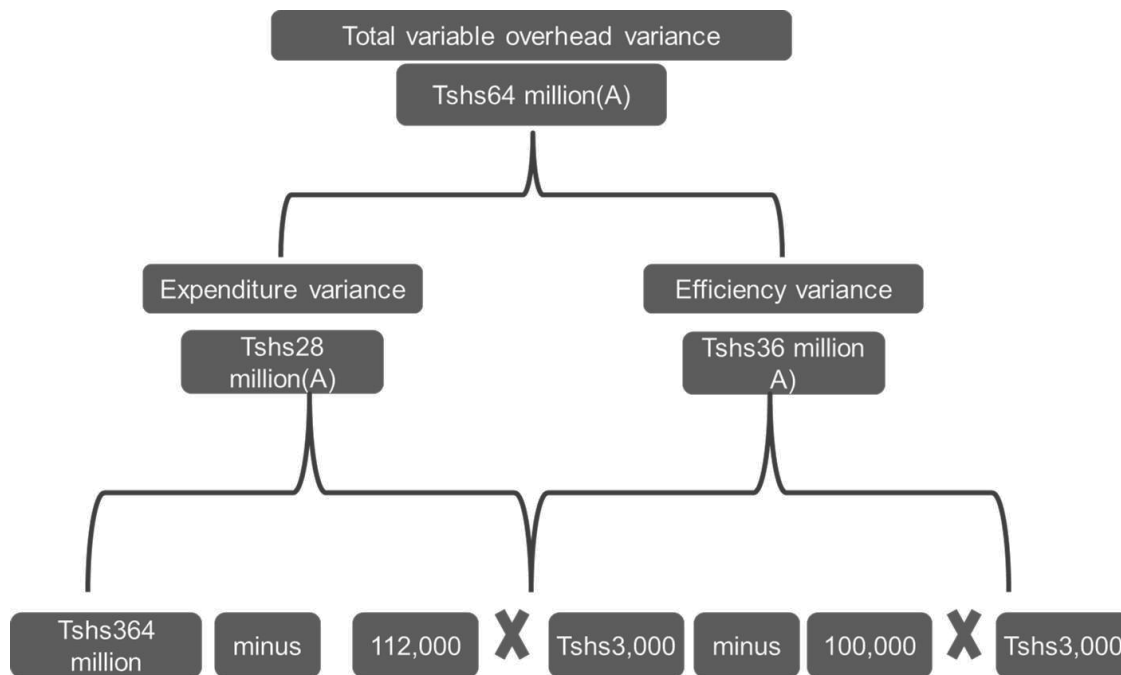
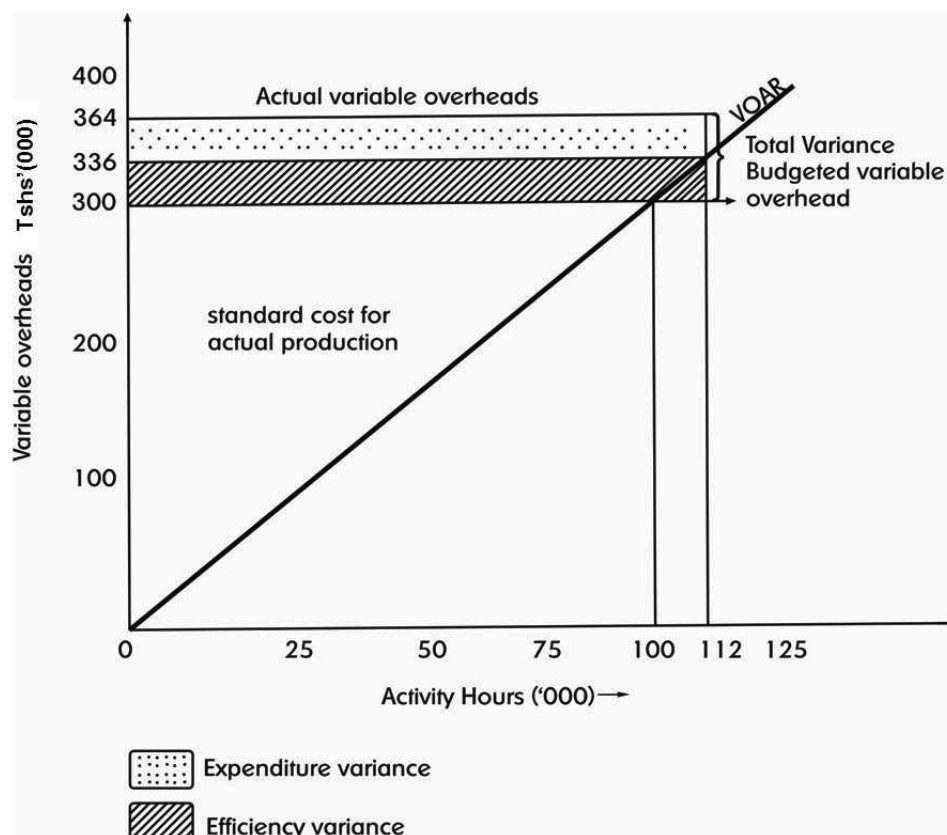


Diagram 5: Analysis of variable overhead variances



6. Fixed overhead total, expenditure, volume, capacity and efficiency variance

Under absorption costing, all production costs (such as direct or indirect, and again variable or fixed) are considered to be product costs. So, fixed manufacturing costs form a part of the product cost. This creates a fixed overhead volume variance.

Hence, under absorption costing we need to calculate both:
the fixed overhead expenditure variance and
the fixed overhead volume variance.

In contrast, under marginal costing, only the variable manufacturing costs are considered to be product costs. Fixed production costs are considered to be period costs and charged directly to the income statement for the period in which they are incurred.

Under marginal costing, fixed overheads are considered to remain the same irrespective of the activity level. Due to this assumption, there is no impact of a change in the level of production. Hence, **under marginal costing only fixed overhead expenditure variance is calculated.**

(a) Fixed Overhead Total Variance (FOTV)

Fixed overhead total variance is the difference between the fixed overhead absorbed by the actual production and the actual fixed overhead for the period.

If the actual expenditure on fixed overheads is greater than the standard, the variance will be adverse and vice versa.

$$\text{Fixed overhead total variance} = (\text{Standard hours for actual production} \times \text{Fixed overhead absorption rate}) - \text{Actual expenditure on fixed overheads}$$

Where,

$$\text{Fixed overhead absorption rate} = \frac{\text{Budgeted fixed overhead}}{\text{Budgeted activity (e.g. Standard hours)}}$$

(b) Fixed Overhead Expenditure Variance (FOXV)

Fixed overhead expenditure variance is the difference between actual fixed overheads and budgeted (or allowed) fixed overheads for the period. If the budgeted fixed overheads are higher than the actual expenditure incurred on fixed overheads, the variance will be favourable and vice versa.

$$\text{Fixed overhead expenditure variance} = \text{Budgeted fixed overhead} - \text{Actual expenditure on fixed overhead}$$

(c) Fixed Overhead Volume Variance (FOVV)

Fixed overhead volume variance is the difference between the fixed overhead absorbed by the actual production and budgeted fixed overheads for the period.

If the standard hours required for actual production are more than the budgeted hours, the variance will be favourable. This is because the actual production is more than the budget and the production capacity is optimally utilised.

Fixed Overhead Volume Variances (FOVV)

$$\begin{aligned} &= \text{Budgeted fixed overheads} - (\text{Fixed overhead absorption rate per hour} \times \text{Standard hours for actual production}) \\ &= (\text{Budgeted hours} - \text{Standard hours required for actual production}) \times \text{Fixed overhead absorption rate} / \text{Hr} \end{aligned}$$

(d) Fixed Overhead Efficiency Variance (FOEV)

Fixed overhead efficiency variance is the difference between the standard hours required for actual production and the actual labour hours, valued at the fixed overhead absorption rate.

If actual labour hours worked / paid are less than the standard hours required for the actual production, the variance will be favourable. This suggests that the labour is more efficient than originally envisaged and also optimally utilised.

$$\text{Fixed overhead efficiency variance} = (\text{Standard hours for actual production} - \text{Actual hours worked}) \times \text{Fixed overhead absorption rate}$$

(e) Fixed Overhead Capacity Variance (FOCV)

Fixed overhead capacity variance is the difference between the budgeted hours and actual hours valued at the fixed overhead absorption rate.

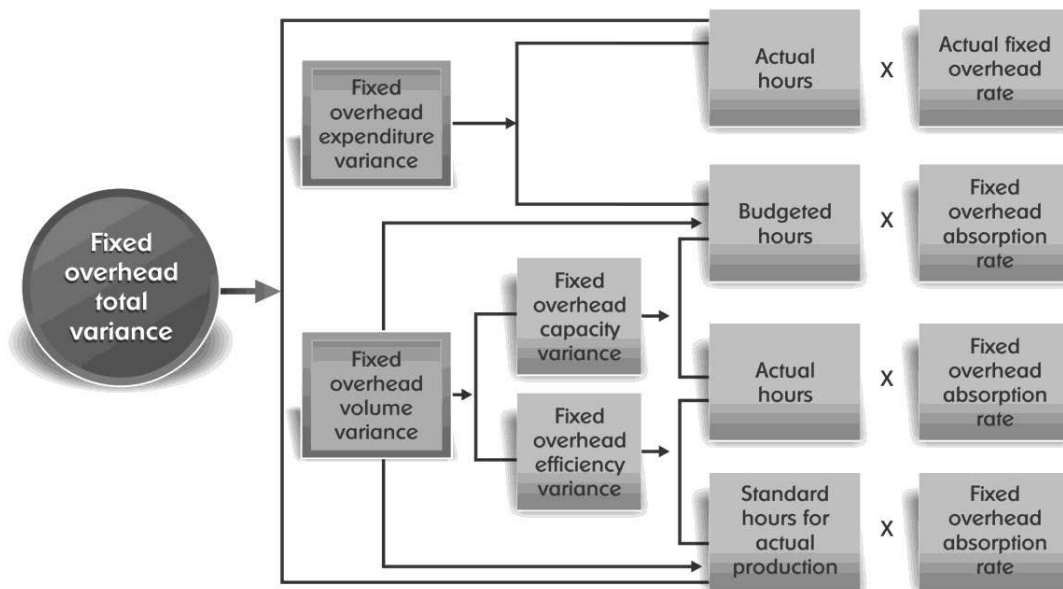
If the budgeted hours are less than actual hours, the variance will be adverse. This indicates that the labour worked for fewer hours than the originally budgeted hours which thereby decreased the budgeted capacity

Fixed overhead capacity variance

$$= \text{Budgeted fixed overheads} - (\text{Actual hours} \times \text{Fixed overhead absorption rate})$$

$$= (\text{Budgeted hours} - \text{Actual hours}) \times \text{Fixed overhead absorption rate}$$

Diagram 6: Fixed Overhead Variance



Example

A manufacturing company uses absorption costing for both internal and external reporting purposes as it has a considerable level of fixed production costs. The following information has been recorded for the past year:

	Budgeted (Normal) activity levels	Actual activity levels
Production units	62,500 units	70,000 units
Labour hours	500,000 hours	525,000 hours
Fixed production overheads	TZS2,500.00 million	TZS2,890.35 million

Required:

- Calculate the fixed production overhead **expenditure and volume variances** and briefly explain what each variance shows.
- Calculate the fixed production overhead **efficiency and capacity variances** and briefly explain what each variance shows.

Answer

(a) Fixed Production Overhead Expenditure and Volume Variances

Fixed overhead expenditure variance = (Actual expenditure on fixed overhead - Budgeted fixed overhead)

$$= \text{TZS}(2,890.35 \text{ million} - 2,500.00 \text{ million})$$

$$= \text{TZS}390.35 \text{ million (A)}$$

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This variance indicates that the company has spent more than originally budgeted.

Fixed Overhead Volume Variance = Fixed overhead absorption rate per hour x (Budgeted hours – Standard hours required for actual production)

$$= (560,000 \text{ (W1)} - 500,000) \text{ hours} \times \text{TZS}5,000 \text{ per hour (W2)}$$

$$= \text{TZS}300 \text{ million (F)}$$

This variance indicates that the additional fixed overhead costs are allocated to product because actual production exceeds budgeted.

Workings

W1

Standard hours required for actual activity

For that first we shall calculate

Budgeted hours per unit = $500,000 \text{ hours} / 62,500 \text{ units} = 8 \text{ hours per unit}$.

Standard hours required for actual activity = Actual units x Budgeted hours per unit
 $= 70,000 \text{ units} \times 8 \text{ hours per unit}$
 $= 560,000 \text{ hours}$

W2

$$\text{Fixed Overhead Absorption Rate (FOAR)} = \frac{\text{Budgeted Fixed Overhead}}{\text{Budgeted Activity (Standard Hours)}}$$

$$= \text{TZS}2,500 \text{ million} / 500,000 \text{ hours} = \text{TZS}5,000 \text{ per hour}$$

(b) Fixed Production Overhead Efficiency Variance

Fixed Overhead Efficiency Variance = Fixed overheads absorption rate x (Actual hours worked or paid - Standard hours required for actual production)

$$= \text{TZS}5,000 \times (525,000 - 560,000) \text{ hours}$$

$$= \text{TZS}175 \text{ million (F)}$$

The variance shows that the labour was more efficient than originally envisaged as it took less time than expected to achieve the production of 70,000 units.

Fixed Production Overhead Capacity Variance

Fixed Overhead Capacity Variance = (Budgeted hours – Actual hours) x Fixed overhead absorption rate

$$= (500,000 - 525,000) \times \text{TZS}5,000$$

$$= \text{TZS}125 \text{ million (F)}$$

This variance shows that labour worked for more hours than was originally budgeted thereby exceeding the budgeted capacity.

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- 1 = Actual fixed overhead
- 2 = BR x standard hours for actual production
- 3 = BR x Actual hours worked
- 4 = Budgeted fixed overhead

FOExV= Fixed overhead expenditure variance
FOVV= Fixed overhead volume variance
FOEV= Fixed overhead efficiency variance
FOCV= Fixed overhead capacity variance



Test Yourself 1

From the data given below calculate variable and fixed overhead variances.

Budgeted for period	
Fixed overheads	TZS15 million
Variable overheads	TZS13.5 million
Labour hours	3,000
Standard hours of production	3,000

Actual for period	
Fixed overheads	TZS16 million
Variable overheads	TZS18.5 million
Labour hours	3,200
Standard hours produced	2,800

2. Produce full operating statements in both a marginal cost and full absorption costing environment, reconciling actual profit to budgeted profit.

[Learning Outcome d]

So as to understand the concepts of full operational statements in both a marginal cost and full absorption costing environment, and reconciling the budgeted profits with actual profits, the following salient points of differences in full operating costing and managerial costing are enumerated below:

All manufacturing costs (direct and indirect, variable and fixed) which contribute to the manufacture of a product are treated as product costs under absorption costing.

In contrast, under marginal costing, only variable manufacturing costs are treated as product costs and fixed manufacturing overheads are treated as period cost. Therefore, fixed cost does not change with a change in volume.

Operating income under marginal costing is a function of sales volume alone (i.e. changes in production volume will not affect operating income).



Example

If sales volume increases, all variable cost items follow the same behaviour pattern. Therefore, marginal costing operating income will increase by the amount of the increase in contribution margin. If, however, sales volume remains unchanged, regardless of the change in production volume, marginal costing operating income will remain the same because the contribution margin and fixed costs will not change.

Operating income under absorption costing is a function of both sales volume and production volume (i.e., changes in either of these volumes will affect operating income).



Example

The following are the actual and budgeted figures of BSK Plc.
Budgeted figures (at a volume of 100,000 units)

	Budgeted (TZS'000)	Actual (TZS'000)
Selling price	16	16.30
Direct material	6	6.20
Direct labour	1	1.20
Variable overheads	0.50	0.60
Fixed overheads	5	5

Actual units produced and sold are 110,000.

You are asked to calculate the following variances using marginal costing and absorption costing:

- Sales price variance
- Sales volume profit variance

Also comment on the relative values obtained.

Answer

Sales price variance

Under absorption costing

$$\begin{aligned}
 \text{Sales price variance} &= (\text{Actual selling price per unit} - \text{Standard selling price per unit}) \times \text{Actual quantity sold} \\
 &= (\text{TZS}16,300 - \text{TZS}16,000) \times 110,000 \text{ units} \\
 &= \text{TZS}33 \text{ million (F)}
 \end{aligned}$$

Alternatively, it can also be calculated as:

$$\begin{aligned}
 &= (\text{Actual profit} - \text{Standard profit}) \times \text{Actual quantity sold} \\
 &= (\text{Actual price} - \text{Standard costs}) - (\text{Standard price} - \text{Standard costs}) \times \text{Actual quantity sold} \\
 &= (\text{TZS}16,300 - \text{TZS}12,500) - (\text{TZS}16,000 - \text{TZS}12,500) \times 110,000 \text{ units} \\
 &= \text{TZS}33 \text{ million (F)}
 \end{aligned}$$

It is calculated as TZS6,000 + TZS1,000 + TZS500 + TZS5,000 = TZS12,500

Under both the alternatives, the results would be the same, as in both cases, **only standard cost is considered** while analysing the effect of change in price on the profitability.

Under marginal costing

Sales margin price variance = (Actual contribution margin – Standard contribution margin) x Actual sales volume.

$$\begin{aligned}
 &= [(\text{Actual sales price} - \text{Standard variable cost}) - (\text{Standard sales price} - \text{Standard variable cost})] \times \text{Actual sales volume} \\
 &= [(\text{TZS}16,300 - \text{TZS}7,500) - (\text{TZS}16,000 - \text{TZS}7,500)] \times 110,000 \text{ units} \\
 &= \text{TZS}33 \text{ million (F)}
 \end{aligned}$$

Whether sales price variance is calculated under marginal costing or under absorption costing, there will not be any difference because this variance shows the difference between actual selling price and standard selling price and not the costing system. Marginal costing and absorption costing are methods of costing and therefore do not affect the sales price variance.

Sales volume profit variance

Under absorption costing

$$\begin{aligned}
 \text{Sales volume variance} &= (\text{Actual sales quantity} - \text{Budgeted sales quantity}) \times \text{Standard profit per unit} \\
 &= (110,000 - 100,000) \text{ units} \times \text{TZS}3,500 \\
 &= \text{TZS}35 \text{ million (F)}
 \end{aligned}$$

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Under marginal costing

Sales volume variance = (Actual sales quantity – Budgeted sales quantity) x Standard contribution per unit
 = (110,000 – 100,000) units x TZS8,500
 = TZS85 million (F)

Working

W1 Standard variable cost = Direct material + Direct labour + Variable overheads
 = TZS6,000 + TZS1,000 + TZS500
 = TZS7,500



Example

First choice Ltd provided the following information:

Budgeted figures

Budgeted production and sales: 5,000 units

	TZS'000
Direct material (1 kg at TZS30,000 per kg)	30
Direct labour (6 hours at TZS3,000 per hour)	18
Variable production overheads (6 hours at TZS1,000 per hour)	6
Fixed production overhead (6 hours @ TZS1,000 per hour)	6
Total production cost	60
Profit	15
Selling price	75

The actual data for this three month period was: number of units produced and sold - 5,400 units

	TZS'000
Materials purchased and used 5,800 kg	175,000
Labour paid for 32,600 hours costing	97,800
Variable overheads	32,400
Fixed overheads	32,000
Sales revenue	415,000
Profit	77,800

Required:

Prepare an Operating Statement under absorption costing and marginal costing

Answer

As the budgeted activity is different from the actual, first we need to determine the **budgeted amount of sales and costs at the capacity level of 5,400 units**. This helps proper comparison between actual and the budget. Therefore, we will determine the profitability at 5400 units.

Sales (units)	5,000	5,400	5400	
	Budgeted			
	Original TZS'000	Flexed TZS'000	Actual TZS'000	Variance TZS'000
Sales revenue	375,000	405,000	415,000	10,000 (F)
Direct materials	150,000	162,000	175,000	13,000 (A)
Direct labour	90,000	97,200	97,800	600 (A)
Variable overheads	30,000	32,400	32,400	NIL
Contribution	105,000	113,400	109,800	3,600 (A)
Fixed overheads	(30,000)	(30,000)	(32,000)	2,000 (A)
Profit	75,000	83,400	77,800	5,600 (A)

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Note

Volume variance of TZS8,400,000 (F) (i.e. TZS83,400,000 – TZS75,000,000) can be seen under absorption costing as the additional profit from the sales volume of 400 units @ TZS15,000 plus additional fixed overhead recovery of the 400 units @ TZS6,000 or, under marginal costing, as the increase in the contribution from the 400 units @ TZS21,000 each.

First choice Ltd			
Absorption Costing Operating Statement			
			TZS'000
Original budgeted profit (TZS15,000 per unit x 5,000 units)			75,000
Sales volume variance (5,000 - 5,400) units x TZS15,000)			6,000 (F)
Flexed budget profit			81,000
Sales price variance (TZS415 million – (5,400 units x TZS75,000))			10,000 (F)
Adjusted profit			91,000
Cost Variance	F	A	
Material price [(5,800 x TZS30,000) - TZS175 million]		1,000	
Material usage { (5,400 – 5,800) x TZS30,000 }		12,000	
Labour rate [(32,600 x TZS3,000) – TZS97.8 million]	NIL	NIL	
Labour efficiency [(5,400 x 6 hours) - 32,600] x TZS3,000}		600	
Variable overhead expenditure [(32,600 hours x TZS1,000) – TZS32.4 million]	200		
Variable overhead efficiency [(5,400 x 6 hours) – 32,600 hours] x TZS1,000		200	
Fixed overhead expenditure [(5,000 x 6 hours x TZS1,000) - 32,000]		2,000	
Fixed overhead volume (5,400 - 5,000) x 6 hours x TZS1,000	2,400		
Fixed overhead efficiency (5,400 x 6hours) – 32,600) x TZS1,000= TZS200,000 (A)			
Fixed overhead capacity (5,000 x 6hours) – 32,600) x TZS1,000= TZS2,600,000 (F)			
	2,600	15,800	13,200 (A)
Actual profit (as above)			77,800

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First choice Ltd			
Marginal Costing Operating Statement			
			TZS'000
Original budgeted contribution (TZS21,000 per unit x 5,000 units)			105,000
Sales contribution volume (5,000 – 5,400) units x TZS21,000			8,400
Flexed budget contribution			113,400
Sales contribution price variance [TZS415,000,000 - (5,400 units x TZS75,000)]			10,000
Adjusted profit			123,400
	F	A	
Cost Variance			
Material price [(5,800 x TZS30,000) - TZS175,000,000]		1,000	
Material usage { (5,400 – 5,800) x TZS30,000 }		12,000	
	NIL	NIL	
Labour rate [(32,600 x TZS3,000) – TZS97,800,000]		600	
Labour efficiency {[(5,400 x 6 hours) - 32,600] x TZS3,000}			
	200		
Variable overhead expenditure [(32,600 hours x TZS1,000) – TZS32,400,000]		200	
Variable overhead efficiency [(5,400 x 6 hours) – 32,600 hours] x TZS1,000	200	13,800	
Actual contribution (as above)			109,800
Fixed overheads- budget (5,000 units x TZS6,000)		30,000	
Expenditure variance		2,000 (A)	(32,000)
Actual profit			77,800

(F)

(F)

(A)

3. Calculate the effect of idle time and waste on variances including where idle time has been budgeted for.

[Learning Outcome e]

3.1 Effect of idle time on variances

Idle time is a sub-classification of indirect labour which includes the time lost for both direct and indirect manufacturing and service labour. Idle time allows the wages paid for unproductive time to be calculated. Idle time is always unproductive and points out the inefficiencies of the system.

Direct labour efficiency level may be influenced adversely due to loss in working hours caused by events such as machine breakdown, hold-ups on the production line because of lack of materials or stoppage in other areas of the business. The effect of such idle time on direct labour cost is known as 'Idle time variance'. Idle time variance is always an adverse variance since it always signifies inefficiency.

Idle time variance arises due to the difference between hours paid for and hours worked for, for actual production. It is a sub-variance of direct labour efficiency variance.

$$\begin{aligned}\text{Idle time variance} &= \text{Hours lost} \times \text{Standard wage rate per hour} \\ &= (\text{Hours paid} - \text{Hours worked}) \times \text{Standard wage rate per hour}\end{aligned}$$

Idle time variance is always adverse except when the hours paid are equal to the hours worked.



Example

Smart Plc has paid its workers for 116,000 hours in the year 20X9. However, the workers could actually work for only 112,000 hours during the year. The hours lost were attributable to machine breakdowns. The standard wage rate is TZS2,000 per hour.

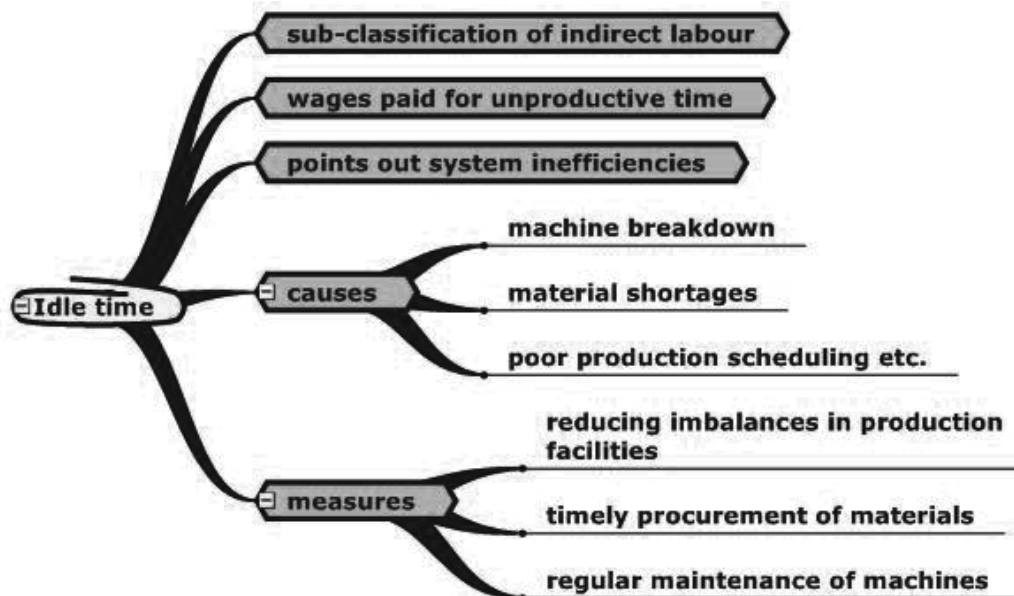
Accordingly, during the year 20X9, the idle time variance for the company will be TZS8 million (A) (116,000 hours - 112,000 hours) x TZS2,000 per hour.

Idle time may be classified into normal and abnormal idle time. Normal idle time is booked to factory overhead whereas payment for abnormal idle time is not included in costs and is adjusted through the income statement.

Idle time may be eliminated or reduced to a large extent by taking suitable preventive measures. The remedial measures to be taken will, however, depend on the particular factor or situation that caused the idle time.

Suitable measures to prevent idle time are proper planning for production in advance, thereby reducing **the imbalances in production facilities, timely procurement of materials, regular maintenance of machines** so as to avoid breakdown and careful attention to the labour utilisation statement.

SUMMARY



3.2 Effect of waste on variances

Waste is the residue arising in the course of a manufacturing process and has practically no measurable sale value or utility. In certain types of processes and operations, some material physically disappears on account of shrinkages, evaporation etc. with the result that the quantity of the output is less than the input.

Control is exercised over the total quantity of waste arising in a process or operation usually through setting standards for the normal percentages of wastes to arise in various manufacturing processes or operations. The actual waste is compared with these standards periodically and is reported to management. Where standard costing is in use, waste beyond the normal limit is reflected as material usage variance.



Test Yourself 3

ACC Plc has set a standard labour time of 1 hour per unit of product. It also expects 5% of the labour hours paid to be non-productive time. The standard wage rate per hour is TZS5,000. The actual labour hours paid for the month of January 20X9 are 3,500 hours @ TZS4,500 per hour. The actual production for the month is 3,000 units. However, it is observed that total hours lost due to machine breakdown are 250 hours.

Required:

Calculate the overall labour efficiency variance and excess idle time variance for the month of January.

4. Calculate, using a simple situation, ABC-based variances.

[Learning Outcome f]

The fundamental principles and concepts for variable manufacturing overhead costs and fixed manufacturing overhead costs are also applicable in ABC systems. We have already studied the ABC system is an approach to overhead allocation using activities consumed a base. Hence, the overheads variances need to be looked at a little differently in a company using ABC system.

ABC-based variances are calculated below for variable batch-level set-up overhead costs and fixed batch-level set-up overhead costs.

The **batch-level costs** are the costs of the activities that are related to a group of units of products or services rather than to each individual unit.

Set-up costs consist of some variable cost components and some fixed costs components (with respect to the number of set-up hours).

Variable set-up costs consist of wages paid to direct set-up labour, indirect maintenance labour, cost of maintenance of set-up equipment, and costs of indirect materials and energy used during set-ups. In contrast, **fixed set-up costs** include salaries paid to engineers and supervisors and costs of leasing set-up equipment.



Example

Excerpts of some of the budgeted and actual costs of the production unit of **Modern Ltd** for the year 20X9 are given below, for analysing the relevant variances:

	Budget	Actual
A. Units produced and sold	176,000	150,000
B. Batch size (units per batch)	160	150
C. Number of batches (a/b)	1,100	1,000
D. Set-up hours per batch	5.5	6
E. Total set-up hours (c x d)	6,050	6,000
F. Variable overhead cost per set-up-hour	TZS23,000	TZS24,000
G. Variable set-up overhead costs (e x f)	TZS139,150,000	TZS144,000,000
H. Total fixed set-up overhead costs	TZS260,000,000	TZS265,000,000

While preparing a flexible budget, it was revealed that to produce 150,000 units, the company required 938 batches (rounded off to nearest whole numbers) (i.e., 150,000 units/160 units per batch).

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Accordingly, the number of set-up hours that should have been used was 5,159 set-up hours (i.e. 938 batches x 5.5 budgeted set-up hours per batch).

Therefore, the flexible budget for variable set-up overhead costs was TZS118,657,000 (i.e. 5,159 set-up hours x TZS23,000 per set-up hour).

4.1 Variance analysis for variable set-up overhead costs

1. Total variance for variable set-up overhead costs

This variance can be calculated as the difference between **actual costs incurred** less **flexible-budget costs**.



Example

Continuing the example of Modern Ltd

Total variance for variable set-up overhead costs is:

$$\begin{aligned}
 &= \text{Actual costs incurred} - \text{Flexible budget costs} \\
 &= (6,000 \text{ hours} \times \text{TZS}24,000 \text{ per hour}) - ((938 \times 5.5) \text{ hours} \times \text{TZS}23,000 \text{ per hour}) \\
 &= \text{TZS}144,000,000 - \text{TZS}118,657,000 \\
 &= \text{TZS } 25,343,000 \text{ (A)}
 \end{aligned}$$

2. Variable set-up overhead efficiency variance

This variance can be calculated as follows:

Variable overhead (of an activity) efficiency variance

$$\begin{aligned}
 &= (\text{Actual quantity of variable overhead cost-allocation base used for actual production} - \text{Budgeted quantity of} \\
 &\quad \text{variable overhead cost-allocation base allowed for actual output}) \\
 &\quad \times \text{Budgeted variable overhead cost per unit of cost-allocation base}
 \end{aligned}$$



Example

Continuing the example Modern Ltd

Variable set-up overhead efficiency variance is:

$$\begin{aligned}
 &= (\text{Actual quantity of variable overhead cost-allocation base used for actual production} - \text{Budgeted quantity of} \\
 &\quad \text{variable overhead cost-allocation base allowed for actual output}) \times \text{Budgeted variable overhead cost per unit of} \\
 &\quad \text{cost-allocation base} \\
 &= (6,000 \text{ hours} - 5,159 \text{ hours}) \times \text{TZS}23,000 \text{ per hour} \\
 &= 841 \text{ hours} \times \text{TZS}23,000 \text{ per hour} \\
 &= \text{TZS}19,343,000 \text{ (A)}
 \end{aligned}$$

3. Variable set-up overhead spending variance

This variance can be calculated as follows:

Variable overhead spending (with respect to an activity) variance

$$\begin{aligned}
 &= (\text{Actual variable cost per unit of cost allocation base} - \text{Budgeted variable overhead cost per unit of cost} \\
 &\quad \text{allocation base}) \times \text{Actual quantity of variable overhead cost allocation base used for actual production}
 \end{aligned}$$



Example

Continuing the example of Modern Ltd

Variable set-up overhead spending variance is:

$$\begin{aligned}
 &= (\text{Actual variable cost per unit of cost allocation base} - \text{Budgeted variable overhead cost per unit of cost} \\
 &\quad \text{allocation base}) \times \text{Actual quantity of variable overhead cost allocation base used for actual production} \\
 &= (\text{TZS}24,000 \text{ per hour} - \text{TZS}23,000 \text{ per hour}) \times 6,000 \text{ hours} \\
 &= \text{TZS}1,000 \text{ per hour} \times 6,000 \text{ hours} \\
 &= \text{TZS}6,000,000 \text{ (A)}.
 \end{aligned}$$

4.2 Variance analysis for fixed set-up overhead costs

1. Flexible budget variance for fixed set-up overhead costs (or, fixed set-up overhead spending variance)

This variance can be calculated as the difference between the **actual costs incurred** and the **flexible budget cost**. Here, flexible budget cost is the same as static budget amount since fixed costs cannot be flexed.

Fixed overhead (with respect to an activity) flexible-budget variance or fixed set-up overhead (with respect to an activity) spending variance
 = Actual costs incurred – Flexible budget costs



Example

Continuing the example of Modern Ltd

Fixed set-up overhead flexible-budget variance **or** Fixed set-up overhead spending variance is:
 = Actual costs incurred – Flexible budget costs
 = TZS265 million - TZS260 million
 = TZS5 million (A)

2. Production volume variance for fixed set-up overhead costs

Production volume variance for fixed overhead costs (with respect to an activity) = Budgeted fixed overhead costs – Fixed overhead allocated with budgeted input allocated for actual output units produced



Example

Continuing the example of Modern Ltd

The cost allocation base for fixed set-up overhead costs is set-up hours for the company. Budgeted set-up hours and fixed set-up overhead costs for 2006 are 6,050 hours and TZS260 million hours respectively.

Therefore, Budgeted fixed set-up overhead cost per unit of cost allocation base
 = Budgeted total costs in fixed overhead cost pool/Budgeted total quantity of cost allocation base
 = TZS260 million/6,050 set-up-hours
 = TZS42,975 per set-up-hour.

Production volume variance for fixed set-up overhead costs
 = Budgeted fixed set-up overhead costs – Fixed set-up overhead allocated using budgeted input allocated for actual output units produced

= TZS260,000,000 – (938 batches x 5.5 hours per batch) x TZS42,975/hour
 = TZS260,000,000 – (5,159 hours x TZS42,975 per hour)
 = TZS260,000,000 – TZS221,708,025
 = TZS38,291,975 (A)

5. Illustrate the different methods available for deciding whether or not to investigate a variance cause.

[Learning Outcome g]

5.1 Investigation of variances

Identifying and reporting variances are the first steps towards controlling variances and improving operations. An effective standard cost system requires that management respond properly to variances because a variance left uncorrected can affect the entity for many periods. An unnecessary corrective action, on the other hand, wastes resources and can cause performance to regress.

Not all variances call for investigation and corrective action. The proper response to a variance depends on the type of standard the firm uses, the expectation of the firm, the magnitude and impact of variances, and the causes and controllability of variances.

5.2 Different methods available for deciding whether or not to investigate a variance cause

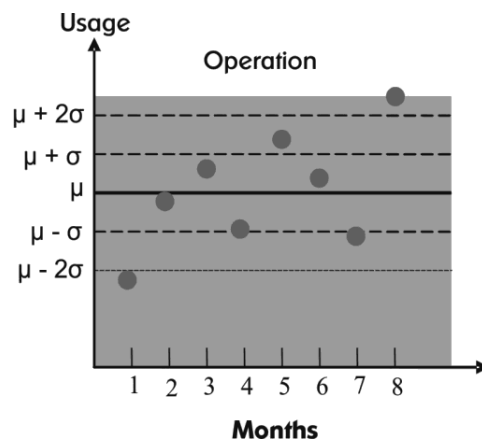
The different methods available for deciding whether or not to investigate a variance cause are:

1. The simplest method is to set criteria arbitrarily such as investigating if the absolute size of a variance is greater than a certain amount or if the ratio of the variance to the total standard cost exceeds some pre-determined percentage.
2. A method of investigating cost variance is to determine the statistical probability that a variance occurs in an in-control distribution. An investigation is undertaken when the probability that an observation comes from an in-control distribution falls below some arbitrarily determined probability level. The statistical models that are considered assume that two mutually exclusive states are possible.

One state assumes that the system is 'in control' and a variance is simply due to random fluctuations around the expected outcome. The second possible state is that the system is 'out of control' and corrective action is warranted. The state of affairs can be expressed in the form of a probability distribution such as a normal one.

Ultimately, the variances can be monitored by recording the number of standard deviations from the mean of the in-control distribution on a **statistical control chart**. Historical data is used to calculate the standard deviation which determines the tolerance limits in the chart.

Diagram 8: Statistical control chart



3. Statistical decision models have been extended to incorporate the costs and benefits of investigation. It is considered in the model that two mutually exclusive states are possible. It is assumed in this model that if an investigation is undertaken when the process is out of control, the cause can be found and corrective action can be taken to ensure that the process returns to its in-control state. This assumption is appropriate for controlling the quality of output from a production process, but may not be appropriate when extended to the investigation of standard cost variances.

A cost benefit approach can be used as follows:

- (a) Investigate the variance if the expected value of benefits derived from the control action surpasses the cost of investigation.
- (b) Do not investigate the variance if the expected value of benefits derived from the control action does not surpass the cost of investigation.

The expected cost of investigation is calculated using the following formula. The **expected cost** to check the valve is

$$C(1 - p) + (C + M)p$$

Where,

C = Cost of investigation (i.e. cost of checking valve)

M = Cost of correction of out of control process (i.e., cost of adjusting valve)

P = Probability of process being out of control (i.e., probability of valve needing adjustment)

L = Total loss if the event is out of control and when no corrective action is taken

This is to be noted that the control action would be needed if the system is found to be out of control and the variance is controllable.



Example

The Bilco Oil Co currently sets three grades of gasoline: regular, premium, and regular plus, which is a mixture of regular and premium. Regular plus is advertised as being 'at least 50% premium'. Although any mixture containing 50% or more premium gasoline could be sold as 'regular plus', it is less expensive to use exactly 50%. The percentage of premium gasoline in the mixture is determined by the small valve in the blending machine. If the valve is properly adjusted, the machine provides a mixture that is 50% premium and 50% regular.

Assume that, if the valve is out of adjustment, the machine provides a mixture that is 60% premium and 40% regular. Once the machine is started, it must continue until 100,000 gallons of 'regular plus' have been mixed.

Cost data available

Cost per gallon - premium	TZS320
Cost per gallon - regular	TZS300
Cost of checking the value	TZS80,000
Cost of adjusting the value	TZS40,000

Subjective estimates of the probabilities of the valve's condition are estimated to be:

Event	Probability
Valve in adjustment	0.7
Valve out of adjustment	0.3

Answer

The conditional cost of not checking the valve when it is out of adjustment is equal to the difference between the cost of 100,000 gallons of output when the valve is out of adjustment and the cost of 100,000 gallons of output when the desired mixture is used.

	TZS'000
Cost of out-of-adjustment mixture (60,000 gallon at TZS320 + 40,000 gallon at TZS300)	31,200
Less: Cost of desired mixture (50,000 gallon at TZS320 + 50,000 gallon at TZS300)	(31,000)
Conditional cost of not checking the valve when it is out of adjustment (i.e. cost that would be saved by correcting the adjustment)	200

The **expected cost** to check the valve is $C(1 - p) + (C + M)p$

Where,

C = Cost of investigation (i.e. cost of checking valve)

M = Cost of correction of out of control process (i.e., cost of adjusting valve)

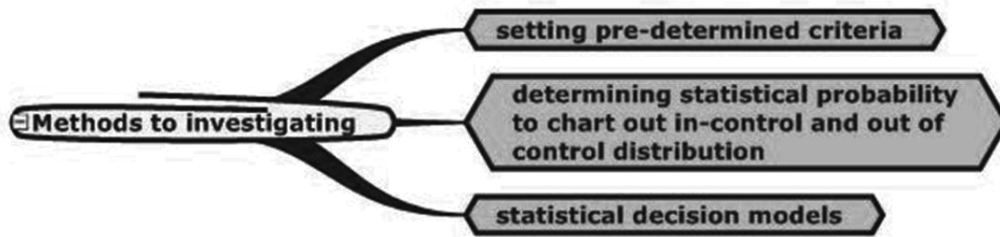
P = Probability of process being out of control (i.e., probability of valve needing adjustment)

L = Total loss if the event is out of control and when no corrective action is taken

Action	Events		Expected costs
	In control	Out of control	
	(1 - p = 0.7)	(p = 0.3)	
Investigate	C = TZS80,000	C + M = TZS120,000 (TZS80,000 + TZS40,000)	(TZS80,000 × 0.7) + (TZS120,000 × 0.3) = TZS92,000
Do not investigate	0	L = TZS200,000	(TZS0 × 0.7) + (TZS200,000 × 0.3) = TZS60,000

From the expected costs calculated above, the company should opt not to investigate since it would incur lower cost.

SUMMARY



Test Yourself 4

Gems Plc is using a standard costing system. For the past year it has identified significant variances. Lucy, a management accountant, is of the opinion that the standards should be revised. However, the managing director is of the opinion that a detailed investigation should be made of the variances.

The cost of the investigation is TZS5.6 million and the further cost of correction is TZS6.8 million. If further investigation is not made, the cost involved for correction is TZS15.2 million.

The probability of the process being in control is 0.80 and that it is out of control is 0.20.

Required:

Based on the above information, comment on whether or not management should investigate further.

Answers to Test Yourself

Answer to TY 1

Total variable overhead variance = (Standard Variable Overhead Rate per Hour x Standard Hours for Actual Production) – Actual Variable Overhead

Variable overhead total variance

= (TZS4,500 (W2) x 2,800 (W1)) – TZS18.5 million

= TZS300 million – TZS364 million

= TZS5.9 million (A)

Variable Overhead Expenditure Variance

= Actual Hours Worked X (Standard Variable Overhead Rate – Actual Variable Overhead Rate)

Variable overhead expenditure variance

= 3,200 hours x (TZS4,500 (W2) - TZS5781.25 (W3))

= TZS4.1 million (A)

Variable Overhead Efficiency Variance = Variable Overhead Absorbed – Standard Variable Overheads
= Standard Variable Overhead per Hours x (Standard Hours for

Actual Production – Actual Hours)

= TZS4,500 x (2,800 hours – 3,200 hours)

= TZS1.8 million (A)

446: Standard Costing & Variance Analysis

Workings

W1 Standard hours for actual production

= Standard hours per unit x Actual production

= 1 hour x 2,800 units

= 2,800 hours

W2 Standard

Variable overhead absorption rate = $\frac{\text{Standard variable overheads}}{\text{Standard hours worked}}$

= $\frac{\text{TZS13.5 million}}{3,000 \text{ hours}}$

= TZS4,500 per hour

W3 Actual variable overhead absorption rate

= TZS18.5 million/3,200 hours

= TZS5781.25

(c) Fixed Production Overhead Expenditure and Volume Variances

Fixed overhead expenditure variance = (Budgeted fixed overhead – Actual expenditure on fixed overhead - Budgeted fixed overhead)

= TZS(15 million – 16 million)

= TZS1 million (A)

This variance indicates that the company has spent more than originally budgeted.

Fixed Overhead Volume Variance = Fixed overhead absorption rate per hour x (Budgeted hours – Standard hours required for actual production)

= (TZS5,000 x (3,000 – 2,800))

= TZS1 million (F)

This variance indicates that the additional fixed overhead costs are allocated to product because actual production exceeds budgeted.

Workings

W1 Standard hours required for actual activity

For that first we shall calculate

Budgeted hours per unit = 3,000 hours/3,000 units = 1 hour per unit.

Standard hours required for actual activity = Actual units x Budgeted hours per unit

= 2,800 units x 1 hour per unit

= 2,800 hours

W2

Fixed Overhead Absorption Rate (FOAR) = $\frac{\text{Budgeted Fixed Overhead}}{\text{Budgeted Activity (Standard Hours)}}$

= TZS15 million/3,000 hours = TZS5,000 per hour

(d) Fixed Production Overhead Efficiency Variance

Fixed Overhead Efficiency Variance = Fixed overheads absorption rate x (Standard hours required for actual production - Actual hours worked or paid)

$$= \text{TZS}5,000 \times (2,800 - 3,200) \text{ hours}$$

$$= \text{TZS}2 \text{ million (A)}$$

The variance shows that the labour was not enough efficient than originally envisaged as it took more time than expected to achieve the production of 2,800 units.

Fixed Production Overhead Capacity Variance

Fixed Overhead Capacity Variance = (Budgeted hours – Actual hours) x Fixed overhead absorption rate

$$= (3,000 - 3,200) \times \text{TZS}5,000$$

$$= \text{TZS}1 \text{ million (A)}$$

This variance shows that labour worked for more hours than was originally budgeted thereby exceeding the budgeted capacity.

Answer to TY 3

Labour efficiency variance = (Standard labour hours for actual production - Actual labour hours paid) x Standard wage rate per hour

$$= (3,000 \text{ hours} - 3,500 \text{ hours}) \times \text{TZS}5,000 \text{ per hour} = \text{TZS}2,500,000 \text{ (A)}$$

Idle time variance = (Expected idle time – Actual idle time) x Standard wage rate per hour

$$= (175 - 250 \text{ hours}) \times \text{TZS}5,000 \text{ per hour} = \text{TZS}375,000 \text{ (A)}$$

Answer to TY 4

The expected cost to check the value is **C (1 – p) + (C + M) p**

Where,

C = Cost of investigation (i.e. cost of checking value)

M = Cost of correction of out of control process (i.e. cost of adjusting value)

p = Probability of process being out of control (i.e. probability of value needing

adjustment) L = Total loss if the event is out of control and when no corrective action is

taken

Action	Events		Expected costs
	In control	Out of control	
	(1-p = 0.8)	(p = 0.2)	
Investigate	C = TZS5.6 million	C + M = TZS12.4 million (TZS5.6 million + TZS6.8 million)	(TZS5.6 million x 0.8) + (TZS6.8 million x 0.2) = TZS5.84 million
Do not investigate	0	L = TZS15.2 million	(TZS0 x 0.8) + (TZS15.2 million x 0.2) = TZS3.04 million

From the expected costs calculated above, the company should not opt to investigate since this would incur less cost.

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Quick Quiz

Fill in the blanks

1. _____ and _____ are the two basic dimensions to variances.
2. The sales variances are _____ when actual sales are greater than standard sales and are _____ when actual sales are lower than standard sales.
3. Direct material price variance = (Standard materials price - Actual materials price) x _____.
4. When standard costs are greater than actual costs, cost variances are _____.
5. When standard costs are less than actual costs, cost variances are _____.

Answers to Quick Quiz

1. Price, quantity
2. Favourable, adverse
3. Actual material quantity
4. Favourable
5. Adverse

Self-Examination Questions

Christiania Ltd manufactures and sells product PQR. The company operates a standard marginal costing system.

The standard cost card for PQR includes the following:

	TZS'000/unit
Direct materials	20
Direct labour (6 hours @ TZS7,500 per hour)	45
Variable production overheads	27
Total	92

The budgeted and actual activity levels for the last month were as follows:

	Units	
	Sales	Production
Budget	20,000	20,000
Actual	19,000	21,000

The actual costs incurred last month were:

	TZS'000
Direct materials	417,900
Direct labour (124,950 hours)	949,620
Variable production overheads	565,740

Required:

- Calculate the total variances for
 - direct material,
 - direct labour and
 - variable production overheads
- Provide an appropriate breakdown of the total variance for direct labour calculated in part (a) above.
- Suggest two possible causes of each variance calculated in (b)

Question 2

Fortune Ltd provides the following information for the month of June 2013.

	Actual		Budgeted	
	Product A	Product B	Product A	Product B
Units	480	790	400	800
Cost Price	TZS4,600	TZS2,900	TZS4,500	TZS3,000
Sales Price	TZS4,750	TZS3,900	TZS5,000	TZS4,000

Required:

From the above information of Fortune Ltd calculate:

- Sales price variance
- Sales margin price variance
- Sales volume variance.
- Total sales value variance
- Total sales margin variance

Question 3

Converse the factors to be considered in deciding whether a variance should be investigated.

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Question 4

Consider the following information provided by Blue-Chip Ltd. Calculate all the variances under marginal costing and then reconcile the budgeted profit with actual profit. Blue-Chip Ltd provided the following standard cost card. Its budgeted production and sales for December 20X9 were 10,000 units @ TZS200,000 per unit. Budgeted fixed overheads were TZS200 million.

Standard cost card of Blue-chip Ltd:

	TZS'000
Direct material	
4 kg of A at TZS5,000 per kg	20
2 kg of B at TZS20,000 per kg	40
Direct labour	75
(5 hours per unit of production at TZS15,000 per hour)	
Variable overhead (5 hours at TZS5,000 per labour hour)	25
Total variable cost	160

The company has also provided the actual results for December 20X9. (All the units produced during the period were sold. There is no closing inventory).

	TZS'000	TZS'000
Sales 10,500 units at TZS199,000		2,089,500
Direct material		
A. 40,000kg at TZS6,000 per kg	240,000	
B. 23,000kg at TZS20,000 per kg.	460,000	
Direct labour		
63,000 hours at TZS15,000 per hour	945,000	
Variable overheads		
63,000 hours at TZS4,000 per hour	252,000	(1,897,000)
Actual contribution		192,500
Actual fixed overheads		(178,000)
Actual profits		14,500

Answers to Self Examination Questions

Answer to SEQ 1

(a) Material variance

Direct material variance

= Standard quantity for actual production at standard price - Actual quantity at actual price

= (TZS20,000 x 21,000 units) - TZS417,900,000

= TZS420,000,000 - TZS417,900,000

= TZS2,100,000 (F)

Direct labour variance

= Standard hours for actual production at standard rate – Actual hours at actual rate

= (21,000 units x TZS45,000) - TZS949,620,000

= TZS945,000,000 - TZS949,620,000

= TZS4,620,000 (A)

Variable production overhead variance

= Standard cost of actual production - Actual cost of production

= (21,000 units x TZS27,000) – TZS565,740,000

= TZS567,000,000 – TZS565,740,000

= TZS1,260,000 (F)

(b) Labour variance**Direct labour rate variance**

= Actual hours at actual rate - Actual hours at standard rate

= TZS949,620,000 – (124,950 hours x TZS7,500)

= TZS949,620,000 - TZS937,125,000

= TZS12,495,000 (A)

Direct labour efficiency variance

= Standard hours for actual production at standard rate - Actual hours at standard rate

= (6 hours x 21,000 units x TZS7,500) – (124,950 hours x TZS7,500)

= TZS945,000,000 – TZS937,125,000

= TZS7,875,000 (F)

Breakdown of the total direct labour variance is as follows

Total direct labour variance = Direct labour rate variance + Direct labour efficiency variance

= TZS12,495,000 (A) + TZS7,875,000 (F)

= TZS4,620,000 (A)

(c) Causes of direct labour rate and efficiency variance**(i) Direct labour rate variance**

High graded workers paid at a higher rate

New workers being paid at rates different from the standard rates

Higher than expected wage settlement for the company

(ii) Direct labour efficiency variance

Highly motivated workers

Insufficient training

Incomplete supervision

Workers' dissatisfaction

Bad working conditions

Use of defective machinery and equipment etc.

Answer to SEQ 2

(a) Sales price variance = (Actual selling price per unit – Standard selling price per unit) x Actual quantity sold

Product A = TZS(4,750 – 5,000) x 480 units = TZS120,000 (A)

Product B = TZS(3,900 – 4,000) x 790 units = TZS790,000 (A)

(b) Sales margin price variance = (Actual contribution margin – Standard contribution margin) x Actual sales volume

Product A = TZS(250 – 500) x 480 units = TZS120,000 (A)

Product B = TZS(900 – 1,000) x 790 units = TZS790,000 (A)

Refer below workings

Workings**W1 Standard contribution margin**

A = TZS(5,000 – 4,500) = TZS500,

B = TZS(4,000 – 3,000) = TZS1,000

W2 Actual contribution margin

A = TZS(4,750 – 4,500) = TZS250

B = TZS(3,900 – 3,000) = TZS900

(c) Sales margin volume variance = (Actual quantity – Budgeted quantity) x Standard margin

Product A = (480 – 400) units x TZS500 = TZS40,000 (F)

Product B = (790 – 800) units x TZS1,000 = TZS10,000 (A)

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(d) Total sales value variance = Actual sales – budgeted sales

Product A = TZS2,280,000 - TZS2,000,000 = TZS280,000 (F)

Product B = TZS3,081,000 - TZS3,200,000 = TZS119,000 (A)

(e) Total sales margin variance = Actual margin – budgeted margin

Product A = (480 units x TZS250) - (400 units x TZS500) = TZS80,000 (A)

Product B = (790 units x TZS900) – (800 units x TZS1,000) = TZS89,000 (A)

Answer to SEQ 3

The following factors are of prime importance in order to ascertain whether or not a variable should be investigated:

Size

Larger cost savings are likely to arise from taking action to correct large variances and a policy could be established of investigating all variances beyond a given amount. Minimum amount of variance can be ascertained by linking the underlying variable in percentage terms as a test of significance: for example, a policy could be established to investigate all variances of 5% or beyond.

Adverse or favourable

It is natural to concentrate on adverse variances in order to bring business operations back in line with the budget. However, whether a variance is adverse or favourable should take prime importance as criteria to decide on whether to investigate or not. The reasons for favourable variances may also need to be investigated, since they may indicate the presence of budgetary slack or suggest ways in which the budgeting process could be improved. Favourable variances may also indicate areas where the budget is easy to achieve, suggesting that the motivational effect of a budget could be improved by introducing more demanding targets.

Cost versus benefits

If the expected benefit from correcting a variance surpasses the costs of investigating a variance, it is worthwhile to decide to investigate.

Historic pattern of variances

A variance which does not take place usually or historically may be worth investigating. Statistical tests of significance may be used in order to highlight such variances.

Reliability and quality of data

If reliability and quality of data and the recording system thereof are good enough, it ensures that benefits will arise from investigation of variances.

Answer to SEQ 4

Material price variance = (Standard material price - Actual material price) x Actual quantity

Material A	Material B
= (TZS5,000 - TZS6,000) x 40,000kg = TZS40,000,000(A)	= (TZS20,000 - TZS20,000) x 23,000kg = 0

Material usage variance is = (Standard quantity for actual production - Actual quantity) x Standard material price

Material A	Material B
= ((4 kg x 10,500 units) – 40,000) x TZS5,000 = 10,000,000 (F)	= ((2 kg x 10,500 units) – 23,000) x TZS20,000 0 = TZS40,000,000 (A)

Labour rate variance = (Standard wage rate per hour – Actual wage rate per hour) x Actual labour hours
= (TZS15,000 - TZS15,000) x 63,000 hours
= 0

$$\begin{aligned}
 \text{Labour efficiency variance} &= (\text{Standard hours for actual production} - \text{Actual hours}) \times \text{Standard wage rate per hour} \\
 &= ((5 \text{ hours} \times 10,500 \text{ units}) - 63,000 \text{ hours}) \times \text{TZS}15,000 \\
 &= \text{TZS}157,500,000 \text{ (A)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Variable overhead expenditure variance} &= (\text{Variable overhead absorption rate} - \text{Actual variable overhead rate}) \times \text{Actual hours worked} \\
 &= (\text{TZS}5,000 - \text{TZS}4,000) \times 63,000 \text{ hours} \\
 &= 63,000,000 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Variable overhead efficiency variance} &= (\text{Standard hours for actual production} - \text{Actual hours}) \times \text{Standard variable overhead absorption rate} \\
 &= (52,500 - 63,000) \text{ hours} \times \text{TZS}5,000 \text{ per hour} \\
 &= 52,500,000 \text{ (A)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Fixed overhead efficiency variance} &= (\text{Standard hours for actual production} - \text{Actual hours worked}) \times \text{Fixed overheads absorption rate} \\
 &= ((10,500 \text{ units} \times 5 \text{ hours}) - 63,000 \text{ hours}) \times \text{TZS}4,000 \text{ (W1)} \\
 &= (52,500 - 63,000) \times \text{TZS}4,000 \\
 &= \text{TZS}42,000,000 \text{ (A)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Fixed overhead capacity variance} &= (\text{Budgeted hours} - \text{Actual hours}) \times \text{Fixed overhead absorption rate} \\
 &= (10,000 \text{ units} \times 5 \text{ hours}) - 63,000 \times \text{TZS}4,000 \text{ per hour} \\
 &= \text{TZS}52,000,000 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Fixed overhead expenditure variance} &= \text{Budgeted fixed overheads} - \text{Actual fixed overheads} \\
 &= \text{TZS}200,000,000 - \text{TZS}178,000,000 \\
 &= \text{TZS}22,000,000 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Sales margin volume variance} &= (\text{Actual sales volume} - \text{Budgeted sales volume}) \times \text{Standard contribution margin} \\
 &= (10,500 \text{ units} - 10,000 \text{ units}) \times \text{TZS}40,000 \text{ (W2)} \\
 &= \text{TZS}20,000,000 \text{ (F)}
 \end{aligned}$$

$$\begin{aligned}
 \text{Sales margin price variance} &= (\text{Actual contribution margin} - \text{Standard contribution margin}) \times \text{Actual sales volume} \\
 &= (\text{TZS}39,000 \text{ (W3)} - \text{TZS}40,000 \text{ (W2)}) \times 10,500 \text{ units} \\
 &= \text{TZS}10,500,000 \text{ (A)}
 \end{aligned}$$

Workings

W1 Fixed overhead absorption rate

$$\begin{aligned}
 \text{Fixed overhead absorption rate} &= \frac{\text{Budgeted fixed overhead}}{\text{Budgeted activity (Standard hours)}} \\
 &= (\text{TZS}200,000,000 / 50,000 \text{ hours}) = \text{TZS}4,000 \text{ per hour}
 \end{aligned}$$

W2 Standard contribution margin

$$\begin{aligned}
 \text{Standard contribution margin} &= (\text{Budgeted selling price} - \text{Budgeted variable cost}) \\
 &= \text{TZS}200,000 - \text{TZS}160,000 \text{ per unit} \\
 &= \text{TZS}40,000 \text{ per unit}
 \end{aligned}$$

W3 Actual contribution margin

$$\begin{aligned}
 \text{Actual contribution margin} &= \text{Actual selling price per unit} - \text{Standard cost per unit} \\
 &= \text{TZS}199,000 - \text{TZS}160,000 = \text{TZS}39,000 \text{ per unit}
 \end{aligned}$$

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Reconciliation of budgeted profit with actual profit for the month of December 20X9

	Favourable	Adverse	Total
	TZS'000	TZS'000	TZS'000
Budgeted contribution (TZS40,000 x 10,000)			400,000
Sales variance			
Sales margin volume variance	20,000		
Sales margin price variance		10,500	
Direct material variance			
Material usage variance (a)	10,000		
Material usage variance (b)		40,000	
Material price variance (a)		40,000	
Material price variance (b)		NIL	
Direct labour variance			
Labour rate variance		NIL	
Labour efficiency variance		157,500	
Variable overhead variance			
Variable overhead expenditure variance	63,000		
Variable overhead efficiency variance		52,500	
Total	93,000	300,500	207,500(A)
Actual contribution			192,500
Less: Budgeted fixed overheads		200,000	
Less: Fixed overhead expenditure variance		22,000 (F)	(178,000)
Actual profit			14,500

Note: (F) stands for favourable and (A) stands for adverse.
Add all favourable variances and subtract all adverse variances.

SECTION D2: MATERIAL MIX AND YIELD VARIANCES

■ Get Through Intro

In several industries, and the process industry in particular, it is very common to mix two or more raw materials in order to obtain the desired output. The mix of the raw materials is decided according to the standard norm for producing a product. Wherever substitute materials can be used in the mix without affecting the technical acceptability of the final product, it remains the task of the organisation to mix the materials in such a way that will cause the total cost of production to reduce.

By deviating from the standard mix of raw materials, an organisation may affect the yield and cost per unit of output. Either such deviations can occur as a result of a conscious response to changes in material prices, or because of a failure to adhere to the standards as a consequence of operational inefficiency.

This SECTION discusses mix and yield variances and how to calculate them. The SECTION also explores the wider issues involved in changing mix, apart from the interrelationship between price, mix and yield. Careful study of this SECTION will enable students to analyse the variances to identify their root causes and also to attempt the related question or part of a question in the exam.

■ Learning Outcomes

- a) Calculate, identify the cause of, and explain material mix and yield variances.
- b) Explain the wider issues involved in changing material mix such as cost, quality and performance measurement issues.
- c) Identify and explain the relationship of the material price variance with the material mix and yield variances.

1. Calculate, identify the cause of, and explain material mix and yield variances.**[Learning Outcome a]**

The material usage variance arises due to quantity variation between the standard and actual. Such variation when further analysed could give insight into the causes of the variance. The two important reasons for quantity variation are:

- use of material in a proportion different than the standard
- the material losses in the production process being more or less than the standard set for it.

1.1 Material Mix Variance (MMV)

Meaning and cause: The mix variance arises in cases where more than one item of raw material are mixed or blended together in standard proportion to get one unit of finished product. This standard proportion is termed a standard mix. If the mix changes, it may affect the production quantity as well as quality of the product. As this is related to relative quantities consumed, this variance is a part of the total material usage variance.

Material mix variance is the difference between the material cost in the flexible budget based on actual input used at actual mix and the material cost in the flexible budget based on actual input used at standard (budgeted) mix. Standard costs are used in constructing these flexible budgets.

**Definition**

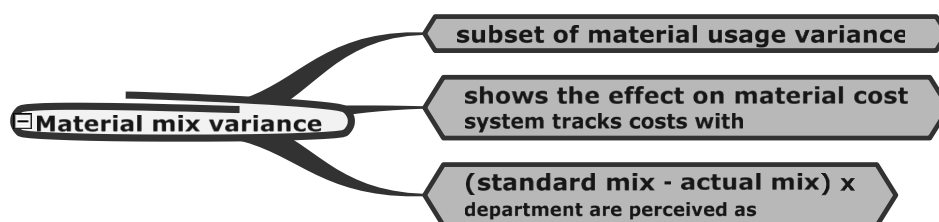
Direct materials mix variance is a subset of the direct usage variance, applicable when materials are applied in a standard proportion. It shows the effect on cost of variations from the standard proportion.

Calculation

$$\text{Material mix variance} = (\text{Standard mix of raw materials on actual input} - \text{Actual mix of raw materials on actual input}) \times \text{Standard cost per unit of raw materials}$$

The material mix variance identifies that part of the total material cost variance which is caused by a change in the mix of input raw materials.

The variance is favourable (F) when it has a positive effect on operating income i.e. when actual mix on actual input is less than standard mix on actual input. Otherwise, the variance is adverse (A).

SUMMARY**1.2 Material Yield Variance (MYV)**

Meaning and cause: The material yield variance is the difference between the material cost in the flexible budget based on actual input used at standard (budgeted) mix and that amount in the flexible budget based on standard input allowed at standard mix. Standard costs are used in constructing these flexible budgets.

**Definition**

Direct materials yield variance is a subset of the direct materials usage variance applicable when materials are combined in standard proportion.

Calculation

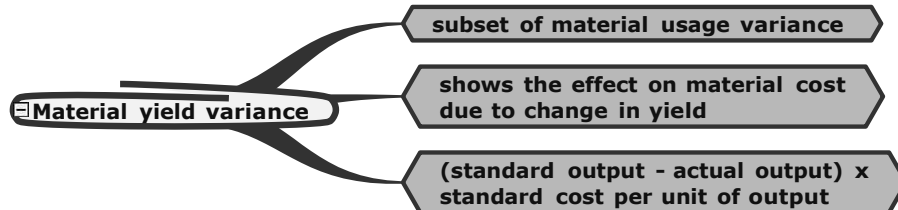
$$\text{Material yield variance} = (\text{Standard yield for actual mix} - \text{Actual yield for actual mix}) \times \text{Standard weighted average cost per unit of all material in the mix}$$

**Tip**

$$\text{MYV} = (\text{Standard output (yield)} - \text{Actual output (yield)}) \times \text{Standard cost per unit of output}$$

This variance is favourable when it has a positive effect on operating income i.e., when the cost of actual input used at standard mix is greater than the cost of standard input allowed at standard mix. Otherwise the variance is adverse (A). This variance identifies the change in raw material costs due to a change (from standard) in input quantity when used at standard mix.

SUMMARY



Example

Destruction Ltd manufactures 'Centex' explosive from Centive and Amex. The standard cost is:

	kg	TZS'000/kg	TZS'000
Centive	5	2	10
Amex	10	3	30
Total cost of one batch			40

In a period, 80 batches of Centex were produced from 500 kg of Centive and 730 kg of Amex. Calculate Material usage variance, Material mix variance and Material yield variance

Material usage variance = (Standard quantity for actual production - Actual quantity) x Standard price

For Centive = $((5 \text{ kg} \times 80) - 500 \text{ kg}) \times \text{TZS}2,000 \text{ per kg} = \text{TZS}200,000 \text{ (A)}$

For Amex = $((10 \text{ kg} \times 80) - 730 \text{ kg}) \times \text{TZS}3,000 \text{ per kg} = \text{TZS}210,000 \text{ (F)}$

Material mix variance = (Actual quantity in standard mix - Actual quantity in actual mix) x Standard cost of output

Input	Actual quantity in standard mix (W1)	Actual quantity in actual mix	Difference	Standard price	Variance
Centive	410 kg	500 kg	(90) kg	TZS2,000	TZS180,000 (A)
Amex	820 kg	730 kg	90 kg	TZS3,000	TZS270,000 (F)
Total	1,230 kg	1,230 kg			TZS90,000 (F)

Material Yield Variance = (Standard yield from actual mix - Actual yield from actual mix) x Standard price

$(5 \text{ kg} \times 80) + (10 \text{ kg} \times 80)$

$= (1,200 - 1,230) \times \text{TZS}2,666.67 \text{ per kg}$
 $= \text{TZS}80,000 \text{ (A)}$

It is the average standard material cost per kg. $(\text{TZS}40,000/15 \text{ kg})$

Working

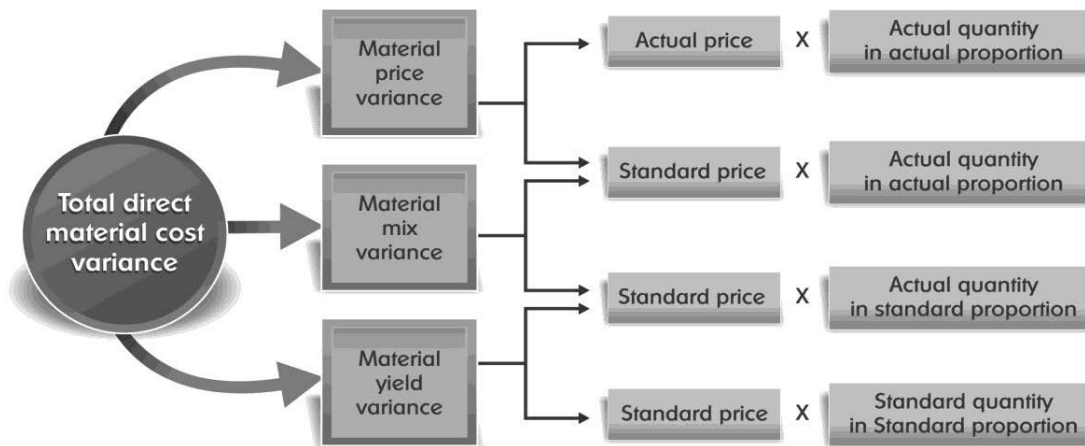
W1

In order to ascertain **actual quantity in standard mix**, apply standard ratio on actual quantity

For Centive = $5 \text{ kg}/15 \text{ kg} \times 1230 \text{ kg} = 410 \text{ kg}$

For Amex = $10 \text{ kg}/15 \text{ kg} \times 1230 \text{ kg} = 820 \text{ kg}$

Diagram 1: Total direct material cost variance



Test Yourself 1

The standard cost of a certain chemical mixture is as follows:

Material	%	TZS'000/ tonne
X	40	150
Y	60	190

A standard loss of 5% is accepted in production. The following is actual cost data:

Material	Tonnes	TZS'000/tonne
X	200	130
Y	250	215

The total production is 423 tonnes.

Calculate

- Material price variance (MPV)
- Material usage variance (MUV)
- Material mix variance (MMV)
- Material yield variance (MYV)

2. Explain the wider issues involved in changing material mix such as cost, quality and performance measurement issues.

[Learning Outcome b]

The standard material mix is the cheapest possible combination of materials which fulfils the technical requirements of the output, with regard to the relative prices, the characteristics of the materials and the process yield expected when the standard was set. Wherever the materials can be substituted, e.g. if the characteristics of the materials are variable and / or where there are relative price changes, then the optimal material mix may be continually changing.

The choice of the optimal mix of materials in any given circumstances is a subtle one involving balancing the current material prices, availability and characteristics, the extent of technical substitutability and the requirement of the finished production. In order to tackle all these issues, industries use linear programming techniques on a continuous basis to select the optimum raw material mix for production.

Although, theoretically, a constant correlation between physical inputs and output is assumed regardless of the mix of inputs, in reality this assumption is illogical and contravenes the concept of an optimum mix. Again, although a change in mix might reduce the cost of material, it is necessary to consider issues such as the technical acceptability and marketability of the output.

The issues involved in changing the material mix can be summarised as follows

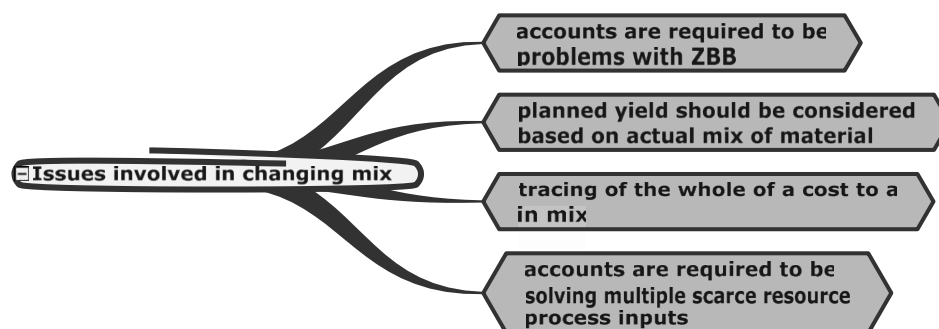
1. The relative prices, availabilities and technical characteristics of the input materials at the time of selecting mix
2. The technical substitutability of alternative materials
3. The planned yield should be considered based on any given actual mix of materials rather than considering the standard mix
4. The interdependencies between the material variances and the other process inputs



Example

A mix of materials, which takes into account the relative prices of materials, may show a favourable material cost variance. However, this advantage may be offset by the requirement of additional spending towards labour cost.

SUMMARY



3. Identify and explain the relationship of the material price variance with the material mix and yield variances.

[Learning Outcome c]

Total material cost variance is caused by three factors, namely: price, mix and yield. **The interrelationship or interdependence of price, mix and yield determines the direct material cost variance.** Therefore, this interrelationship needs to be examined so as to identify the real causes of concern leading to overall adverse costs.

If management decides to purchase cheaper materials for a job, there is the possibility that the quality of the raw material will be poor. This decision, therefore, may result in a favourable price variance but an adverse usage variance (more specifically, yield variance).

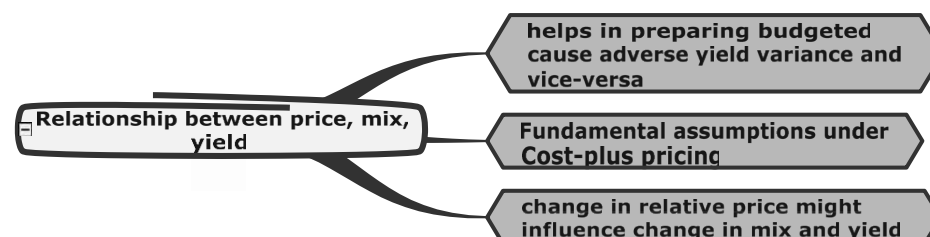
On the other hand, if management ensures that the quality of the materials is very good; this might lead to an adverse price variance but at the same time should cause a favourable yield variance.

Similarly, a favourable raw material mix may lead to poor output (i.e. yield) ultimately offsetting the benefits of the favourable mix.

Under the prevailing circumstances (considering the same price, product features, technical acceptability of the product, etc.) if either of mix or yield is adverse then the other will be favourable and vice versa. Accordingly, calculating the sub-variances of usage variance i.e. mix and yield variance has little value.

The mix and yield variances are calculated under the condition of standard price. However, in reality, when prices vary from standard, the change in relative price might lead to changes in mix and yield. Moreover, if the overall impact of changes in price, mix and yield calculations are not considered it becomes more difficult to judge the correctness, or otherwise, of managerial decisions.

SUMMARY





Test Yourself 2

Briefly explain the interrelation between material price, mix and yield variances.

Answers to Test Yourself

Answer to TY 1

(a) Material price variance (MPV)

PV = (Standard materials price - Actual materials price) x Actual quantity

	MPV
Material X TZS(150,000 – 130,000) x 200	TZS4,000,000 (F)
Material Y TZS(190,000 – 215,000) x 250	TZS6,250,000 (A)
Total material price variance	TZS2,250,000 (A)

(b) Material usage variance (MUV)

MUV = (Standard quantity for actual production - Actual quantity) x Standard price

	MUV
Material X (178.10 – 200) x TZS150,000	TZS3,285,000 (A)
Material Y (267.16 – 250) x TZS190,000	TZS3,260,400 (F)
Total material usage variance	TZS24,600 (A)

(c) Material mix variance (MMV)

MMV = (Standard mix of raw materials on actual input - Actual mix of raw materials on actual input) x Standard cost per unit of raw materials

Material X (180 – 200) x TZS150,000	TZS3,000,000 (A)
Material Y (270 – 250) x TZS190,000	TZS3,800,000 (F)
Total material mixed variance	TZS800,000 (F)

(d) Material yield variance (MYV)

MYV = (Standard output (yield) - Actual output (yield)) x Standard cost per unit of output

MYV = (427.5 (W3) – 423) x TZS183,156 = TZS824,202 (A)

Workings

W1 Calculation of standard quantity of input to produce 423 tonnes

If standard loss is 5%, 95% of the standard input quantity of X and Y will be required for standard production. 423 tonnes of output requires 423/95% = 445.26 tonnes of input.

Standard quantity of material X is 40% of total input.
445.26 tonnes x 40% = 178.10 tonnes

Standard quantity of material Y is 60% of total input.
445.26 tonnes x 60% = 267.16 tonnes

Material	%	Std. Qty.	Std. Rate TZS	Amount TZS	Actual Qty.	Actual Rate TZS	Amount TZS
X	40	178.10	150,000	26,715,000	200	130,000	26,000,000
Y	60	267.16	190,000	50,760,000	250	215,000	53,750,000
		445.26		77,475,000	450		79,750,000
Loss(balancing figure)		(22.26)			(27)		
Total		423.00	183.16*	77,475	423		79,750

* Standard cost per unit of output = TZS 77,475,000/423 = TZS183,156 per unit

W2 Actual quantity is 450 tonnes.

Therefore:

Std. mix for Actual Qty.		
Material	%	Qty.
X	40	$450 \times 40\% = 180$
Y	60	$450 \times 60\% = 270$
		450

W3 Standard loss on actual input = 450 tonnes $\times$ 5% = 22.5 tonnes

Hence Standard output (yield) = 450 - 22.5 = 427.50

Answer to TY 2

Total material cost variance is influenced by price, mix and yield. Purchasing cheaper materials might have a direct impact on quality. Even though this results in a favourable price variance, it may cause an adverse usage variance, especially, yield variance.

On the other hand, if it is ensured that the quality of the materials is very good; this might lead to adverse price variance but, at the same time, should cause a favourable yield variance.

Similarly, a favourable raw material mix may lead to poor output / yield ultimately offsetting the benefits of the favourable mix.

Under the prevailing circumstances if either of mix or yield is adverse then the other will be favourable and vice versa.

Accordingly, it is apparent that calculating the sub-variances of usage variance i.e. mix and yield variance has little value.

Quick Quiz

1. State true or false

- (i) Direct material yield variance is a subset of direct usage variance, applicable when materials are combined in standard proportion.
- (ii) $MMV = (\text{Actual input} - \text{Standard input}) \times \text{Standard cost per unit}$
- (iii) Cheaper material may result in a favourable price variance.

2. Fill in the blanks

- (i) The planned yield should be considered based on any given _____ of material rather than considering _____
- (ii) If the quality of material is very good, this might lead to _____ price variance and, at the same time, should cause a _____ yield variance.

Answers to Quick Quiz

1. True or false

- (i) True
- (ii) False
- (iii) True

2. Fill in the blanks

- (i) actual mix, standard mix
- (ii) adverse, favourable

Self Examination Questions

Question 1

The standard cost of a certain chemical mixture is:

Material	%	Cost per tonne (TZS'000)
A ₁₁	30	120
A ₁₂	70	180

A standard loss of 8% is expected in production. During a period, materials used are:

Material	Tonnes	Cost per tonne (TZS'000)
A ₁₁	130	100
A ₁₂	170	220

The weight produced is 270 tonnes of goods production.

Required:

Calculate the following variances:

- (a) Material price variance (MPV)
- (b) Material usage variance (MUV)
- (c) Material mix variance (MMV)
- (d) Material yield variance (MYV)

Question 2

Tasty Cookies Plc produces cookies from wheat flour. The following is the standard cost data for a batch of cookies:

Wheat flour	4,000 kg at TZS600 per kg
Sugar	6,000 kg at TZS400 per kg
Vegetable oil	2,000 kg at TZS3,500 per kg

Standard output is 5,000 units.

Margins are tight and the firm operates a system of standard costing for each batch of cookies.

In the budget year, the wheat crop was damaged which resulted in a low national yield. As a consequence, the price of the wheat increased by TZS100 per kg. The sugarcane yield was also poor and the country had to import sugar which resulted in an increase in prices of 5%.

The actual results for the batch were:

Wheat flour	4,200 kg at TZS720 per kg
Sugar	6,100 kg at TZS450 per kg
Vegetable oil	2,150 kg at TZS3,500 per kg

Actual output was 5,100 kg of cookies.

Required:

- (a) Calculate the material mix and material yield variances.
- (b) Verify your answer by calculating the material usage variance.

Answers to Self Examination Questions

Answer to SEQ 1

(a) **Material price variance (MPV) = (Standard materials price - Actual materials price) x Actual quantity**

	MPV
Material A ₁₁ TZS(120,000 – 100,000) x 130 tonnes	TZS2,600,000 (F)
Material A ₁₂ TZS(180,000 – 220,000) x 170 tonnes	TZS6,800,000 (A)
Total material price variance	TZS4,200,000 (A)

(b) **Material usage variance (MUV) = (Standard quantity for actual production - Actual quantity) x Standard price**

	MUV
Material A ₁₁ (88.04 – 130) tonnes x TZS120,000	TZS5,035,000 (A)
Material A ₁₂ (205.44 – 170) tonnes x TZS180,000	TZS6,379,000 (F)
Total material usage variance	TZS1,344,000 (F)

(c) **Material mix variance (MMV) = (Standard mix of raw materials on actual input - Actual mix of raw materials on actual input) x Standard cost per unit of raw materials**

	MMV
Material A ₁₁ (90 – 130) tonnes x TZS120,000	TZS4,800,000 (A)
Material A ₁₂ (210 – 170) tonnes x TZS180,000	TZS7,200,000 (F)
Total material mixed variance	TZS2,400,000 (F)

(d) **Material yield variance (MYV) = (Standard quantity in standard proportion - Actual quantity in standard proportion) x Standard Cost per unit of materials**

	MYV
Material A ₁₁ (88.04 – 90) tonnes x TZS120,000	TZS235,200 (A)
Material A ₁₂ (205.44 – 210) tonnes x TZS180,000	TZS820,800 (A)
Total material mix variance	TZS1,056,000 (A)

Working

W1 Calculation of standard quantity of input to produce 270 tonnes

If standard loss is 8%, 92% of the standard input quantity of A₁₁ and A₁₂ will be required for standard production.

270 tonnes of output requires 270/92% = **293.4873 tonnes of input**.

Standard quantity of material A₁₁ is 30% of total input.

293 tonnes x 30% = 88.04348 tonnes

464: Standard Costing & Variance Analysis

Standard quantity of material A₁₂ is 70% of total input.

293 tonnes x 70% = 205.4348 tonnes.

Material	%	Std. Qty.	Actual Qty in standard proportion	Actual Qty.
A ₁₁	30	88.04	90.00	130.00
A ₁₂	70	205.44	210.00	170.00
		293.00	300.00	300.00
Loss		23.00	30.00	30.00
Output		270.00	270.00	270.00

Answer to SEQ 2

(a) **Material mix variance (MMV) = (Standard mix of raw materials on actual input – Actual mix of raw materials on actual input) x Standard cost per unit of raw materials**

Wheat flour = (4,150 – 4,200) kg x TZS600	TZS30,000 (A)
Sugar = (6,225 – 6,100) kg x TZS400	TZS50,000 (F)
Vegetable oil = (2,075 – 2,150) kg x TZS3,500	TZS262,500 (A)
	TZS242,500 (A)

(b) **Material yield variance (MYV) = Standard quantity in standard proportion - Actual quantity in standard proportion) x Standard Cost per unit of materials**

(12,000/5,000) x 5,100

= (12,240 – 12,450) kg x TZS983.3
= TZS206,500 (A)

This is the average standard cost per unit of material
i.e. (4,000 x TZS600) + (6,000 x TZS400) + (2,000 x TZS3,500)/12,000

Working

W1 Calculation of standard and actual quantities

Material	Std. Qty.	Actual Qty.	Actual Qty in standard proportion	Standard Qty for actual production
Wheat flour	4,000	4,200	4,150	4,080
Sugar	6,000	6,100	6,225	6,120
Vegetable	2,000	2,150	2,075	2,040
Total input	12,000	12,450	12,450	12,240
Output	5,000	5,100	5,100	5,100

(c) **Material usage variance (MUV) = (Standard quantity for actual production - Actual quantity) x Standard price**

	MUV
Wheat flour (4,080 – 4,200) kg x TZS600	TZS72,000 (A)
Sugar (6,120 – 6,100) kg x TZS400	TZS8,000 (F)
Vegetable oil (2,040 – 2,150) kg x TZS3,500	TZS385,000 (A)
Total material usage variance	TZS449,000 (A)

The calculation of material mix and yield variance can be crossed verified in the following way:

Material usage variance = Material mix variance + Material Yield variance
= TZS242,500 (A) + TZS206,500 (A)
= TZS449,000 (A)

SECTION D3: SALES MIX AND QUANTITY VARIANCES

■ Get Through Intro

Sales variances arise when the actual prices and quantities sold deviate from the standards set. While this simplistic approach is applicable for single product companies, there is a need to perform an in depth analysis for multi-product companies.

If a firm sells more than one product, the total sales will comprise the sale of individual products. A firm would normally budget for a certain mix of different products to be sold at different prices during the budget period. In such a case, the sales variances must be further analysed into sales mix variance and sales quantity variances.

This section will enable the students to understand the concept of these variances and the way they are computed.

■ Learning Outcomes

- a) Calculate, identify the cause of, and explain sales mix and quantity variances.
- b) Identify and explain the relationship of the sales volume variances with the sales mix and quantity variances.

1. Calculate, identify the cause of, and explain sales mix and quantity variances. Identify and explain the relationship of the sales volume variances with the sales mix and quantity variances.

[Learning Outcomes a and b]

Various cost and sales related variances have been discussed in detail in the earlier SECTION D1. Here is a recap of the sales variances.

1. Total sales variances

Under absorption costing environment:

Total sales value variance = Actual sales – Budgeted sales
Total sales profit variance = Actual profit – Budgeted profit

Under marginal costing environment:

Total sales margin (contribution) variance = Actual margin – Budgeted margin

2. Sales price variances

Under the absorption costing method, **sales price variance** is calculated as follows:

$$\text{Sales price variance} = (\text{Actual selling price per unit} - \text{Standard selling price per unit}) \times \text{Actual quantity sold}$$

OR

$$\begin{aligned}\text{Sales (profit margin) variance} &= (\text{Actual profit margin} - \text{Standard profit margin}) \times \text{Actual sales volume} \\ &= [(\text{Actual sales price} - \text{Standard cost per unit}) - (\text{Standard sales price} - \text{Standard cost per unit})] \times \text{Actual sales volume}\end{aligned}$$


Tip

Sales price variance can be calculated using any of the above formulae. The answer under both the methods will be the same.

Actual profit per unit is calculated as **actual selling price** minus **standard cost per unit**, whereas **standard profit per unit** is calculated as **standard selling price** minus **standard cost per unit**.

In a marginal costing environment, the **sales margin price variance** is calculated. Sales margin price variance is the difference between the actual contribution margin and the standard margin (both based on standard unit costs) multiplied by the actual sales volume.

Sales margin price variance
$$= (\text{Actual contribution margin} - \text{Standard contribution margin}) \times \text{Actual sales volume}$$
$$= (\text{Actual sales price} - \text{Standard variable cost per unit}) - (\text{Standard sales price} - \text{Standard variable cost per unit}) \times \text{Actual sales volume}$$

3. Sales volume variances



Tip

Sales volume variances should be based on **standard profit (or contribution) margin**, and not on standard price.

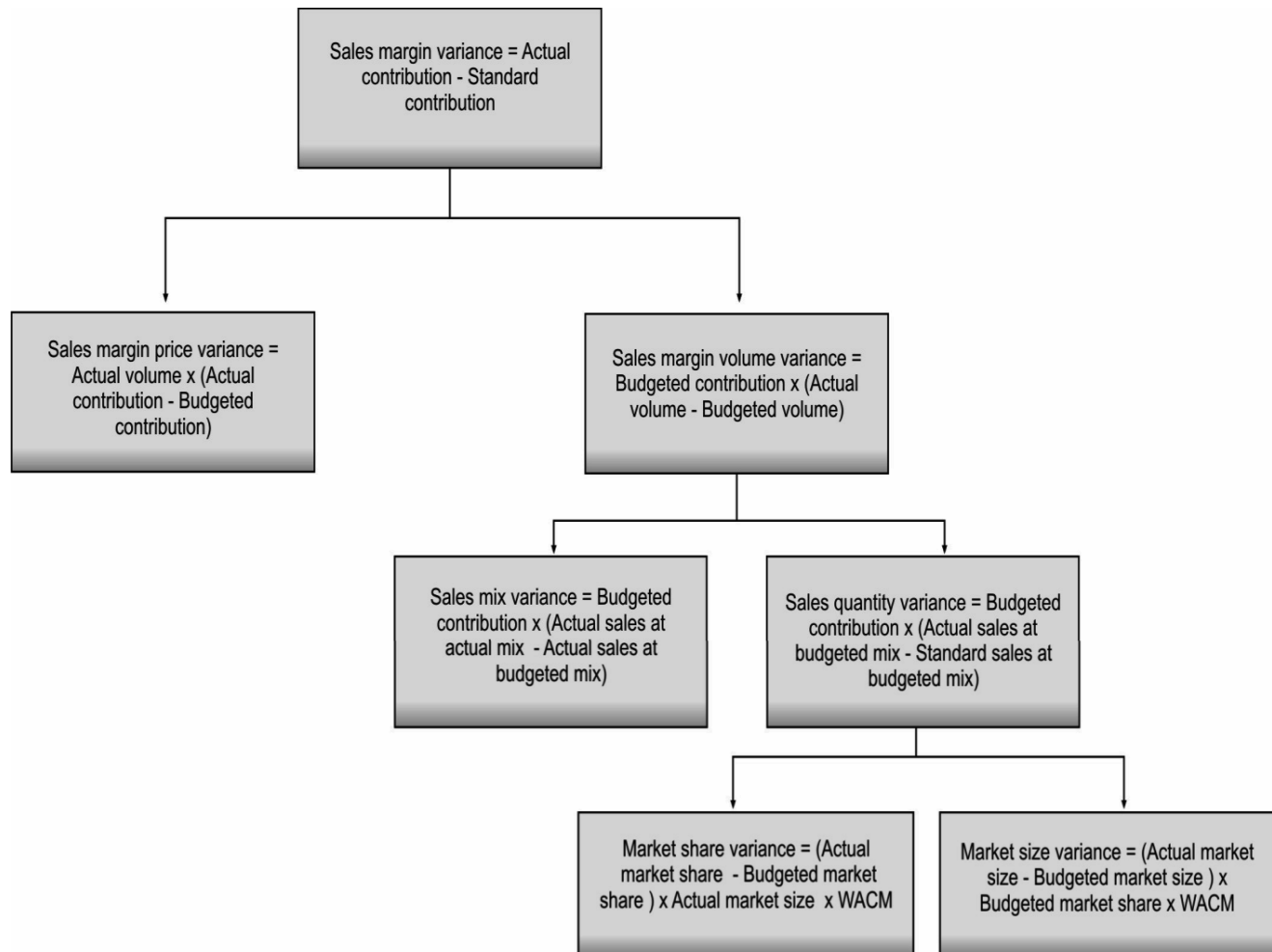
$$\text{Sales volume variance} = (\text{Actual sales quantity} - \text{Budgeted sales quantity}) \times \text{Standard profit per unit or Standard contribution per unit}$$

The sales volume variance signifies the difference between the actual quantities sold and the budgeted quantity, multiplied by either the standard profit per unit or the standard contribution per unit.

Sales variances give an idea of the effect of various factors affecting the sales, such as the prices, quantity and sales mix on the overall sales value.

As shown in the below diagram, sales volume variance is further divided into two sub parts, sales quantity variance and sales mix variance.

Diagram 1: Relationship of sales margin variances



1.1 Relationship of sales volume variances with sales mix and quantity variances

This Section mainly focuses on sales mix and quantity variances.



Tip

If a company sells more than one product (and the organisation can control the proportions of products sold), it is possible to analyse the sales volume variance into two different variances, namely, sales mix variance and sales quantity variance. In other words, **sales mix and quantity variances replace the individual volume variances**.

1. Sales mix variance

Sales mix refers to the proportion of different products in the total sales. The mix may be decided by the organisation based on its strategies for each product, the relative position of each product in the market etc. The actual product-wise proportion in the total sales quantity may be different than the budgeted mix and this may affect the profitability positively or negatively.

The sales mix variance can either be measured at the sales value or, more often, as margin variance which would directly assess the impact of change in the mix on profits. Sales mix variance indicates the impact on profit of changing the mix of actual sales from the standard mix. The products having a contribution margin greater than the average standard contribution margin are known as 'high-profit' products. Similarly, products having a lesser contribution margin are known as 'low-profit' products.



Example

According to the sales budget, the sales of products A and B were 800 and 1,200 units at a contribution margin of TZS5,000 and TZS8,000 respectively. However, the actual sales of products A and B were 500 and 1,500 units.

The total budgeted sales would differ from the actual sales even though the total number of units sold is the same. This is because of change in the sales mix.

Budgeted sales mix: 800: 1,200 = 2:3

Actual sales mix: 500: 1,500 = 1:3

Sales mix variance = Budgeted contribution margin per unit x (Actual sales at actual mix – Actual sales at budgeted mix)

Product A: TZS5,000 x (500 – 800) = TZS1,500,000 A

Product B: TZS8,000 x (1,500 – 1,200) = TZS2,400,000 F

Sales mix variance = TZS1,500,000 A + TZS2,400,000 F = TZS900,000 F

Due to favourable sales mix variance, actual profit will be TZS900,000 more than the budgeted profit, which is beneficial for the company.

2. Sales quantity variance

Sales quantity variance indicates the effect on profit of selling a different total quantity from the budgeted total quantity. Sales quantity variance will be favourable only if actual sales exceed budgeted sales.



Example

According to the sales budget of 15,000 units, budgeted sales mix is 2:3 for two products, X and Y. The actual sales of products X and Y are 4,000 and 12,000 units at TZS10,000 and TZS8,000 respectively. The variable costs are 60% of sales.

Actual sales at budgeted mix:

Product X: 16,000 x 2/5 = 6,400 units

Product Y: 16,000 x 3/5 = 9,600 units

Standard sales at budgeted mix:

Product X: 15,000 x 2/5 = 6,000 units

Product Y: 15,000 x 3/5 = 9,000 units

Here, total budgeted units are different from actual sales units. Sales quantity variance will arise in such a case.

Sales quantity variance = Budgeted contribution margin per unit x (Actual sales at budgeted mix – Standard sales at budgeted mix)

Product X: TZS4,000 x (6,400 – 6,000) = TZS1,600,000 F

Product Y: TZS3,200 x (9,600 – 9,000) = TZS1,920,000 F

Sales quantity variance = TZS1,600,000 F + TZS1,920,000 F = TZS3,520,000 F

A favourable sales quantity variance indicates that due to change in sales quantity, actual profit is TZS3,520,000 more than the budgeted profit.



Test Yourself 1

Eat-well is a small scale unit, manufacturing various types of biscuits. The following data relates to standard and actual sales of biscuits.

	Budgeted sales units	Actual sales units	Budgeted contribution (TZS'000)	Actual contribution (TZS'000)
Chocolate biscuits	150	135	60	56
Coconut biscuits	90	96	68	72
Cream biscuits	45	42	80	68
Salty biscuits	15	21	140	136

Required:

Calculate sales volume, mix and quantity variances.

1.2 Market share variance and market size variance

Sales quantity variances help management to control the proportions of the product sold. It can be split into two different variances namely, market share variance and market size variance. The reason for breaking the variance into these two parts is that they represent two very different causes of the sales quantity variance and require very different reactions from the management. Typically, the market size variance is regarded as 'uncontrollable', whereas the market share variance is much more within the company's control. Market share gives the proportion of industry sales accounted for by a company. Market size is the total revenue for the company.

Market share variance is the difference between the actual market share percentage and the budgeted market share percentage.



Example

ShellMore Co sells two products of soft-drinks, shell and more. The related details are given below:

	Shell	More
Budgeted contribution margin (TZS)	3,000	6,000
Budgeted sales (units)	3,000	9,000
Actual sales	4,700	7,500

ShellMore has anticipated a 15% market share and the actual total industry market was 100,000 units.

Sales margin volume variance

Sales margin volume variance = Budgeted contribution per unit x (Actual sales at actual mix – Standard sales at budgeted mix)

Shell: TZS3,000 x (4,700 units – 3,000 units) = TZS5,100,000 F

More: TZS6,000 x (7,500 units – 9,000 units) = TZS9,000,000 A

Sales margin volume variance = TZS5,100,000 - TZS9,000,000 = TZS3,900,000 Adverse

Sales margin mix variance

Sales margin mix variance = Budgeted contribution margin per unit x (Actual sales at actual mix – Actual sales at budgeted mix)

Shell: TZS3,000 x (4,700 units – 3,050 units) = TZS4,950,000 F

More: TZS6,000 x (7,500 units – 9,150 units) = TZS9,900,000 A

Sales margin mix variance = TZS4,950,000 - TZS9,900,000 = TZS4,950,000 A

Continued on the next page

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Sales margin quantity variance

Sales margin quantity variance = Budgeted contribution margin per unit x (Actual sales at budgeted mix – Standard sales at budgeted mix)

Shell: TZS3,000 x $\frac{3,000}{12,000}$ x 12,200 units - 3,000 units

TZS3,000 x (3,050 units – 3,000 units) = TZS150,000 F

More: TZS6,000 x (9,150 units – 9,000 units) = TZS900,000 F

Sales margin quantity variance = TZS150,000 + TZS900,000 = TZS1,050,000 F

Market share variance

Market share variance = (Actual market share - Budgeted market share) x Actual market size x WACM
 = (0.1220 – 0.15) x 100,000 units x TZS5,250
 = TZS14,700,000 A

Actual market share = 12,200 units/100,000 units x 100 = 12.20%

Market size variance

Market size variance = (Actual market size – Budgeted market size) x Budgeted market share x WACM
 = (100,000 units – 80,000 units) x 0.15 x TZS5,250
 = TZS15,750,000 F

Budgeted market size = 100/15 x 12,000 units = 80,000 units

WACM = (TZS3,000 x 3,000 units) + (TZS6,000 x 9,000 units)/12,000 units = TZS63,000,000/12,000 units = TZS5,250



Tip

Sales Margin Volume variance = Sales margin mix variance + Sales margin Quantity variance
 = TZS4,950,000 A + TZS1,050,000 F
 = **TZS3,900,000 A**

Sales Margin Quantity variance = Market share variance + Market size variance
 = TZS14,700,000 A + TZS15,750,000 F
 = **TZS1,050,000 F**



Test Yourself 2

The Krueger Company produces headrests for wooden chairs in three different colours: red, blue, and black. Its budget for the accounting period was based on the following:

	Product Line			
	Red headrest	Blue headrest	Black headrest	Total
Sales price	TZS8,000	TZS12,000	TZS10,000	
Variable expenses	TZS4,000	TZS9,000	TZS4,000	
Budgeted volume	3,000	7,500	4,500	15,000
Budgeted revenue	TZS24,000,000	TZS90,000,000	TZS45,000,000	TZS159,000,000
Actual volume	2,000	4,000	6,000	12,000
Actual revenue	TZS12,000,000	TZS64,000,000	TZS78,000,000	TZS154,000,000

Krueger Company anticipated a 20% market share and the actual total industry market was 70,000 units.

Continued on the next page

Compute the following variances:

- (a) Sales revenue variance
- (b) Sales volume variance
- (c) Sales price variance
- (d) Sales margin volume variance
- (e) Sales margin quantity variance
- (f) Sales margin mix variance
- (g) Market share variance
- (h) Market size variance

1.3 Aspects of sales mix and quantity variances

The following are the two aspects of sales mix and quantity variances:

1. The unit method of calculating variances
2. The revenue method of calculating variances

1. Unit method

Under this method, the sales mix variances can be calculated similar to materials mix variances, while the volume variances (i.e. sales mix variance and sales quantity variance) is calculated as the difference between the actual sales volume for the budgeted proportions and the budgeted sales volumes, multiplied by the standard margin.



Example

The following data has been provided by Sunshine Ltd for calculating variances under unit method.

	Actual sales	Budgeted sales	Budgeted contribution per unit
X	1,200 units	1,250	TZS4,000
Y	800 units	1,250	TZS3,000

Sales volume variance = Budgeted contribution per unit x (Actual sales at actual mix – Budgeted sales at budgeted mix)

X: TZS4,000 x (1,200 – 1,250) = TZS200,000 A

Y: TZS3,000 x (800 – 1,250) = TZS1,350,000 A

Total sales volume variance = TZS200,000 A + TZS1,350,000 A = TZS1,550,000 A

Sales quantity variance = Budgeted contribution per unit x (Actual sales at budgeted mix – Budgeted sales at budgeted mix)

X: TZS4,000 x (1,000 – 1,250) = TZS1,000,000 A

Y: TZS3,000 x (1,000 – 1,250) = TZS750,000 A

Total sales quantity variance = TZS1,000,000 A + TZS750,000 A = TZS1,750,000 A

Sales mix variance = Budgeted contribution per unit x (Actual sales at actual mix – Actual sales at budgeted mix)

X: TZS4,000 x (1,200 – 1,000) = TZS800,000 F

Y: TZS3,000 x (800 – 1,000) = TZS600,000 A

Total sales mix variance = TZS800,000 F + TZS600,000 A = TZS200,000 F

2. Revenue method

Under this method, the sales mix and quantity variances are based on the sales revenue rather than on the number of units sold. This method is the most useful when an organisation is engaged in the sales of multi-products and the selling price per unit for each product is significantly different so that basing the standard mix on the number of units could cause misrepresentations.



Example

The selling prices of a gold ring and a gold necklace can be significantly different even though the price of gold per gram is the same.

There can also be a huge difference between the selling prices of two rings or two necklaces. In such circumstances, the revenue method is more useful compared to the unit method.

Sales mix and quantity variances calculated by the revenue method will be totally different from the variances calculated by the previous (sales units) method. The analysis of mix and quantity variances will differ according to the method used. It is possible that by using the unit method, the sales mix variance is favourable and by using the revenue method, the same variance is adverse.

The purpose behind both these methods is completely different.

Variances are calculated under the unit method to help control the **proportion of units** sold of each product.

However, variances are calculated under the revenue method to help control the **proportion of revenue** obtained from each product.

In the revenue method, sales revenue is measured at **standard sales price**, not actual sales price. It means that:

Actual sales revenue = Actual sales units x Standard sales price per unit



Example

Crystal Stores has provided the following data related to sales of diamond necklaces and diamond earrings for the last week in order to analyse sales variances using an appropriate method.

Average sale of diamond necklaces was estimated to be TZS30 million for 5 necklaces. And average sale of earrings was estimated to be TZS200,000 for 10 earrings.

Actual sales of diamond necklaces were TZS132.916 million for 4 necklaces and TZS3.392 million for 16 earrings.

Here,

Budgeted sales mix = 1:2 for necklace and earrings

While, actual sales mix = 1:4 for necklace and earrings.

Considering the sales mix (the number of units sold), actual sales are 20% less than the budgeted sales for the necklaces and actual sales are 60% more than the budgeted sales for the earrings. It shows that in the case of sales of earrings, Crystal Stores has earned a huge profit while in the case of sales of necklaces it has borne a slight loss.

However, considering the sales revenue (Actual units x Standard Selling price) of the two items, profit earned from the sales of earrings is much lower than the loss incurred by the sale of necklaces.

	Budgeted sales revenue (Budgeted units x Standard Selling price)			Actual sales revenue (Actual units x Standard Selling price)		
Necklace	5 necklaces x	TZS150 million	98.69%	4 necklaces x	TZS120 million	97.40%
Earrings	10 earrings x	TZS2 million	1.31%	16 earrings x	TZS3.2 million	2.60%
		TZS152 million	100.00%		TZS123.2 million	100.00%

Answers to Test Yourself

Answer to TY 1

Total sales margin variance = Actual contribution margin – Standard contribution margin = 636,000 A

Sales contribution margin variance = Actual sales x (Actual contribution – Budgeted contribution) = 744,000 A

Sales volume variance = Budgeted contribution x (Actual sales quantity – Budgeted sales quantity) = 108,000 F

Sales quantity variance = Budgeted contribution x (Actual sales quantity at budgeted mix – Standard sales quantity at budgeted mix) = 416,000 A

Sales mix variance = Budgeted contribution margin per unit x (Actual sales quantity at actual mix – Actual sales quantity at budgeted mix) = 524,000 F

Workings

(Amount in TZS'000)

	Standard contribution margin	Actual contribution margin	Sales margin variance	Contribution margin variance	Sales Volume variance	Sales Quantity variance	Actual sales at budgeted mix	Sales Mix variance
	I	II	III = (II) - (I)	IV	V = (III) - (IV)	VI	VII	VIII = (V) - (VI)
Chocolate biscuits	9000	7560	(1440)	(540)	(900)	(180)	147	(720)
Coconut biscuits	6120	6912	792	384	408	(122)	88	530
Cream biscuits	3600	2856	(744)	(504)	(240)	(72)	44	(168)
Salty biscuits	2100	2856	756	(84)	840	(42)	15	882
	20820	20184	(636)	(744)	108	(416)	294	524
Variance			A	A	F	A		F

Answer to TY 2

(a) Sales revenue variance

Sales revenue variance = Actual sales revenue – Budgeted sales revenue

= TZS154,000,000 - TZS159,000,000

= TZS5,000,000 A

(b) Sales price variance

Sales price variance = Actual sales volume x (Actual sales price - Budgeted sales price)

Red headrest	= 2,000 units x (TZS6,000 - TZS8,000)	= TZS4,000,000 A
Blue headrest	= 4,000 units x (TZS16,000 - TZS12,000)	= TZS16,000,000 F
Black headrest	= 6,000 units x (TZS13,000 - TZS10,000)	= TZS18,000,000 F
Sales price variance		= TZS30,000,000 F

(c) Sales volume variance

Sales volume variance = Budgeted sales price x (Actual sales volume – Budgeted sales volume)

Red headrest	= TZS8,000 x (2,000 units – 3,000 units)	= TZS8,000,000 A
Blue headrest	= TZS12,000 x (4,000 units – 7,500 units)	= TZS42,000,000 A
Black headrest	= TZS10,000 x (6,000 units – 4,500 units)	= TZS15,000,000 F
Sales volume variance		= TZS35,000,000 A

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(d) Sales margin volume variance

Sales margin volume variance = Budgeted contribution margin per unit x (Actual sales – Budgeted sales)

Red headrest	= TZS4,000 x (2,000 units – 3,000 units)	= TZS4,000,000 A
Blue headrest	= TZS3,000 x (4,000 units – 7,500 units)	= TZS10,500,000 A
Black headrest	= TZS6,000 x (6,000 units – 4,500 units)	= TZS9,000,000 F
Sales volume variance		= TZS5,500,000 A

(e) Sales quantity variance

Sales quantity variance = Budgeted contribution margin x (Actual sales at budgeted mix – Standard sales at budgeted mix)

Red headrest	= TZS4,000 x (2,400 units – 3,000 units)	= TZS2,400,000 A
Blue headrest	= TZS3,000 x (6,000 units – 7,500 units)	= TZS4,500,000 A
Black headrest	= TZS6,000 x (3,600 units – 4,500 units)	= TZS5,400,000 A
Sales quantity variance		= TZS12,300,000 A

Actual sales at budgeted mix

Red headrest	12,000 x 3/15	= 2,400
Blue headrest	12,000 x 7.5/15	= 6,000
Black headrest	12,000 x 4.5/15	= 3,600

Alternative method of weighted average contribution margin

Use budgeted contribution margins for the remaining variances:

A weighted average CM

$$WACM = TZS4,000 \times (3/15) + TZS3,000 \times (7.5/15) + TZS6,000 \times (4.5/15)$$

$$WACM = TZS4,100$$

Or:

Budgeted total contribution margin/Budgeted sales

$$WACM = TZS61,500,000/15,000$$

$$= TZS4,100$$

$$\text{Sales quantity variance} = (\text{Actual sales volume} - \text{Budgeted sales volume}) \times WACM$$

$$= (12,000 - 15,000) \times TZS4,100$$

$$= TZS12,300,000 A$$

(f) Sales mix variance

Sales mix variance = Budgeted contribution margin per unit x (Actual sales at actual mix – Actual sales at budgeted mix)

Red headrest	= TZS4,000 x (2,000 units – 2,400 units)	= TZS1,600,000 A
Blue headrest	= TZS3,000 x (4,000 units – 6,000 units)	= TZS6,000,000 A
Black headrest	= TZS6,000 x (6,000 units – 3,600 units)	= TZS14,400,000 F
Sales mix variance		= TZS6,800,000 F

Alternative method of weighted average contribution margin:

$$\text{Sales mix variance} = (\text{Change in red headrests' sales}) \times (TZS4,000 - TZS4,100) + (\text{Change in blue headrests' sales}) \times (TZS3,000 - TZS4,100) + (\text{Change in black headrests' sales}) \times (TZS6,000 - TZS4,100) = TZS6,800,000 F$$

(g) Market share variance

$$\text{Market share variance} = (\text{Actual market share} - \text{Budgeted market share}) \times \text{Actual market size} \times WACM$$

$$= (0.1714 - 0.20) \times 70,000 \text{ units} \times TZS4,100$$

$$= TZS8,200,000 A$$

$$\text{Actual market share} = 12,000 \text{ units} / 70,000 \text{ units} \times 100 = 17.14\%$$

(h) Market size variance

$$\begin{aligned}
 \text{Market size variance} &= (\text{Actual market size} - \text{Budgeted market size}) \times \text{budgeted market share} \times \text{WACM} \\
 &= (75,000 \text{ units} - 70,000 \text{ units}) \times 0.20 \times \text{TZS}4,100 \\
 &= \text{TZS}4,100,000 \text{ A}
 \end{aligned}$$

Budgeted market size = $100/20 \times 15,000 \text{ units} = 75,000 \text{ units}$

Quick Quiz

1. Sales volume variances can be analysed into _____ and _____ variances.
2. What is sales mix?
3. What is the use of sales quantity variances?

Answers to Quick Quiz

1. Sales volume variances can be analysed into **sales mix** and **sales quantity** variances.
2. Sales mix refers to the proportion of different products in the total sales.
3. Sales quantity variances help management to control the proportions of the products sold.

Self-Examination Question**Question 1**

Calibre Inc is a publishing firm producing magazines and weekly bulletins / newspapers. During the last financial year, its budgeted sales were 2,800 magazines more than the actual sales volume. Furthermore, actual volume of bulletins sold was 20% less than the budgeted.

The actual selling price per magazine was 15% higher than the budgeted selling price. Actual sales were TZS108,560,000 at the selling price per magazine of TZS2,300 and the variable overheads incurred were TZS81,420,000. On the other hand, total sales revenue generated from the bulletins was TZS7,500,000 at the selling price of TZS1,500 per bulletin. There is no change in the budgeted and actual selling prices for bulletins.

The estimation of the proportion of variable costs has remained unchanged.

Calibre has anticipated a 40% market share and the actual total industry market was 150,000 magazines and 25,000 bulletins.

Required:

Derive sales variances and analyse them.

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Answer to Self-Examination Question

Answer to SEQ 1



Tip

For calculating variances, it is advisable to collect all the relevant data in a tabular form as shown below, so that it is easier to put the required data in the formulae.

	Standard / Budgeted	Actual
Sales volume		
Magazines (W1)	50,000	47,200
Bulletins (W2)	6,250	5,000
Sales price		
Magazines (W1)	TZS2,000	TZS2,300
Bulletins	TZS1,500	TZS1,500
Variable cost (W1)	75% of the sales	75% of the sales
Contribution margin	25% of the sales	25% of the sales
Magazines (W1)	TZS500	TZS575
Bulletins (W2)	TZS375	TZS375

Sales margin variance	= Actual contribution – Standard contribution	
Magazines:	= (47,200 units x TZS575) – (50,000 units x TZS500)	= TZS2,140,000 F
Bulletins:	= (5,000 units x TZS375) – (6,250 units x TZS375)	= TZS468,750 A
Total sales margin variance		=TZS1,671,250 F

Sales price margin variance	= Actual sales volume x (Actual contribution – Standard contribution)	
Magazines:	= 47,200 units x (TZS575 - TZS500)	= TZS3,540,000 F
Bulletins:	= 5,000 units x (TZS375 - TZS375)	= NIL
Total sales price margin variance		=TZS3,540,000 F

There will be no price margin variance for the sales of bulletins as budgeted and actual contribution is the same.

Sales margin volume variance	= Standard contribution x (Actual sales volume – Budgeted sales volume)	
Magazines:	= TZS500 x (47,200 units – 50,000 units)	= TZS1,400,000 A
Bulletins:	= TZS375 x (5,000 units – 6,250 units)	= TZS468,750 A
Total sales price margin variance		= TZS1,868,750 A

Sales mix variance	= Budgeted contribution per unit x (Actual sales at actual mix – Actual sales at budgeted mix)	
Magazines:	= TZS500 x (47,200 units – 46,400 units)	= TZS400,000 F
Bulletins:	= TZS375 x (5,000 units – 5,800 units)	= TZS300,000 A
Total sales price margin variance		=TZS100,000 F

Sales quantity Variance	= contribution per unit x Actual sales at budgeted mix – Budgeted sales at budgeted mix)	
Magazines:	= Tshs 500 x (46,400 units – 50,000 units)	= TZS 1,800,000 A
Bulletins:	= Tshs 375 x (5,800 units – 6,250 units)	= TZS 168,750 A
	Total sales price margin variance	= TZS 1,968,750 A

Market share variance = (Actual market share - Budgeted market share) x Actual market size x WACM
= (0.2983 – 0.4000) x 175,000 units x TZS486.11
= TZS8,651,542.725 A

Market size variance = (Actual market size – Budgeted market size) x Budgeted market share x WACM
= (175,000 units – 140,625 units) x 40% x TZS486.11
= TZS6,684,012.5 F

Workings

W1 C/S ratio, budgeted sales volume, budgeted selling price and budgeted contribution for magazines

Actual contribution = Sales revenue – Variable overheads
= TZS108,560,000 - TZS81,420,000
= **TZS27,140,000**

C/S ratio = TZS27,140,000/TZS108,560,000 x 100 = 25%

Hence,

It will remain as it is - as mentioned in the example.

Budgeted contribution = Budgeted sales revenue x 25%
= Budgeted sales volume x Budgeted selling price x 25%
= 50,000 units x TZS2,000 x 25%
= **TZS25,000,000**

Where,

Budgeted sales volume = Actual sales volume + 2,800 units
= (TZS108,560,000/TZS2,300) + 2,800 units
= 47,200 units + 2,800 units
= 50,000 units

And,

Suppose, budgeted selling price is X

Actual selling price = Budgeted selling price + 15% of budgeted selling price

TZS2,300 = X + 0.15X

Hence, Budgeted selling price X = TZS2,300/1.15 = TZS2,000

Budgeted contribution per magazine = Selling price per magazine – Variable cost per magazine
= TZS2,000 – 75% of TZS2,000
= TZS500

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W2 C/S ratio, budgeted sales volume, budgeted selling price and budgeted contribution for bulletins

C/S ratio will be 25% only as no other information has been provided.

Actual sales volume = TZS7,500,000/TZS1,500 = 5,000 bulletins

Budgeted sales volume = 5,000 x 100/80 = 6,250 bulletins

Budgeted contribution per bulletin = Selling price per bulletin – Variable cost per bulletin
= TZS1,500 – 75% of TZS1,500
= TZS375

W3 Actual sales at budgeted mix

Magazines = 52,200 x 50,000/56,250 = 46,400 units

Bulletins = 52,200 x 6,250/56,250 = 5,800 units

W4 Weighted average contribution margin

= Standard contribution of Magazines x Budgeted mix of magazines in total standard sales + Standard contribution per unit of Bulletins x Budgeted mix of bulletins in total standard sales
= TZS500 x 50,000/56,250 + TZS375 x 6,250/56,250
= TZS444.44 + TZS41.67
= TZS486.11

W5 Actual market share

= Actual total units sold / Market sales x 100
= (47,200 + 5,000)/(150,000 + 25,000) x 100
= 52,200/175,000 x 100
= 29.83%

W6 Budgeted market size

= Budgeted total sales/Budgeted market share
= 56,250/40%
= 140,625 units

SECTION D4: PLANNING AND OPERATIONAL VARIANCES

■ Get Through Intro

The business environment is ever-changing. During the time lag between the preparation of a budget and actual execution of the plan, a lot of change in the environment might take place. It is therefore important to set the standards so that they reflect achievable performance by the managers in the environment in which they operated rather than the environment that was foreseen by the standard setters.

Once the budget has been revised, this revised budget can then be analysed for variances. This makes the variance analysis more meaningful and it also draws management's attention towards the controllable parts of the variance. This will enable them to then take corrective action.

This SECTION discusses the methods of calculating a revised budget, identifies and explains those factors that could and could not be allowed to revise an original budget and also explores other related issues. Knowledge of how to revise a budget and to calculate planning and operational variances will not only equip students to successfully discharge their responsibilities in the future but also will enable students to answer questions on the topic that may be set in the exam.

■ Learning Outcomes

- a) Calculate a revised budget.
- b) Identify and explain those factors that could and could not be allowed to revise an original budget.
- c) Calculate planning and operational variances for sales.
- d) Evaluate the dysfunctional nature of some variances in the modern environment of JIT and TQM.
- e) Assess the effect that variances have on staff motivation and action.

1. Calculate a revised budget.

Identify and explain those factors that could and could not be allowed to revise an original budget.

[Learning Outcomes a and b]

1.1 Reasons for revising a budget

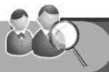
Successful budgets should have adequate flexibility to meet changing business conditions. Since budgets are used for planning, operation, co-ordination and control, they should be revised if changes occur in the business environment.

One of the objectives of the budget is to provide a yardstick for performance evaluation. If the budgets are not revised in line with the changing environment / conditions, comparing actual results with budgeted will not give appropriate results. Therefore it is necessary to revise budgets and analyse the causes of variance with the adjusted standards (i.e. revised budgets).

**Example**

At the time of preparing the budget for a labour intensive company, the labour hour rate was considered as TZS23,000 per hour. After two months a labour strike demanded a labour hour rate at TZS32,000. Due to scarcity of skilled labour, management had to agree the new rate. This will cause a major shortfall in achieving the profit target. If the budget is not revised, considering the reality of the labour price, the performance evaluation will be misleading.

Revision of budgets may be necessary due to the following factors:

1. Emergence of unforeseen and unanticipated situations which may cause the budget to be revised.**Example**

Due to a labour strike, production stopped for 2 months. This affected the production. In such a situation it is necessary to modify the production budget as well as sale and other related budgets.

2. Changes in internal factors, such as production forecast, sales forecast, capacity utilisation, etc.**Example**

At the time of preparation of the sales budget, it was determined that 5,000 units could be sold at TZS50,000 per unit (revenue TZS250 million). Later on the marketing manager found that if the sales price decreased by 5%, it would result in an increase in the sales volume by 10% (revenue TZS261.25 million). Ultimately, this caused an increase in revenue by TZS11.25 million. In this case, the sales budget as well as the production and other related budgets need to be revised.

3. Changes in external factors, like market trends, nature of economy, prices of inputs and resources, consumers' tastes and fashions, and input cost structure.**Example**

After preparing the original budget, it was discovered that the raw material budgeted for is in short supply or is not available. A substitute of the material can be used to achieve the budgeted production volume. Under this circumstance, it is necessary to revise the budget.

4. Errors committed in preparing the budgets which may subsequently be discovered, causing the budgeted figures to be rectified.

Of the factors that can influence the future outcome of an organisation, only the uncontrollable factors should cause an organisation to revise its original budget. If there is any change in the parameters of a budget due to any uncontrollable change in the budget factors, the budget should be modified to give effect to the changed parameters. This would make comparison of the actual results with the budget meaningful.

Revision of budget is dependent on the above factors. However, to which extent each of the factors is capable of influencing the budget or the actual outcome is a point that needs to be discussed.

1.2 Conditions under which budgets should NOT be revised

Revision of a budget should be avoided under the following circumstances:

In case the impact of change in a factor is insignificant, the original budget should not be revised

It is meaningless to revise a budget for any controllable factor since it might affect determination of the actual performance. Rather, corrective measures should be imposed to check the adverse effect, if any, of the factors concerned on the future outcome.



Example

For example, in spite of the purchases department procuring the right quantity of raw material, wastage may take place in the production department. In such a situation, the production department manager cannot ask for revision of the raw material usage budget or the wastage allowance, since the situation was under the manager's controllable factors.

Budget revision may involve a huge cost in terms of time and administrative costs.



Test Yourself 1

State any two factors that necessitate a revision of the budget.

1.3 Calculating a revised budget

The same procedure used for setting normal budgets is adopted for revising budgets. The circumstances driving the revision are discovered, the revised forecast is scrutinised and coordinated with other budgets, and the final sanction is accorded for the revision by the appropriate authority.



Example

The following is the budget of Starlight Ltd for the year ended 31 December 20X9

Starlight Ltd Budget for the year ended 31 December 20X9		
		TZS'000
Budgeted Sales (a)	120,000 units @ TZS40,000	4,800,000
Budgeted Costs		
Raw material	120,000 units @ TZS3,000	360,000
Labour charges	240,000 hours @ TZS10,000	2,400,000
Indirect material	120,000 units @ TZS2,200	264,000
Indirect labour	120,000 units @ TZS300	36,000
Inspection charges		90,000
Maintenance costs		84,000
Supervision charges		200,000
Depreciation: plant and machinery		85,000
Administrative expenses		165,000
Selling expenses		120,000
distribution expenses		120,000
Total budgeted cost (b)		(3,924,000)

During the first month there is a machinery breakdown stopping production for a month. Loss of production in units is 10,000. Therefore, actual production begins in the second month. As a result there is a change in the sales budget as well as all other related budgets. Suppliers had offered a discount of 2%.

However, now Starlight will not get the discount and therefore the material cost will increase by 2%.

Also the sales budget will change as it was targeted that all that was produced would be sold. The marketing manager has come up with the suggestion of increasing the selling price by 2%.

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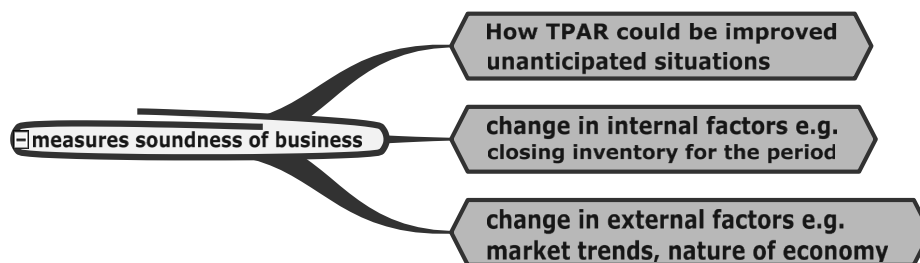
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According to him, even if selling price is increased by 2% they can achieve the revised target of selling 110,000 units by incurring additional market promotion expenses of TZS40 million.

As a cost accountant, students are asked to calculate a revised budget.

Starlight Electrical Ltd Revised Budget for the year ended 31 December 20X9		
		TZS'000
Budgeted Sales (a)	110,000 units @ TZS40,800	4,488,000
Budgeted costs:		
Raw material	110,000 units @ TZS3,060	336,600
Labour charges	220,000 hours @ TZS10,000	2,200,000
Variable overheads (Indirect material + Indirect labour)	(110,000 x TZS2.2) + 110,000 x TZS300)	275,000
Supervision charges		200,000
Distribution expenses	110,000 units @ TZS1,000	110,000
Selling expenses (including market promotion)	TZS110,000,000+TZS40,000,000	150,000
Fixed overheads		
Inspection charges		90,000
Maintenance cost		84,000
Depreciation - plant and machinery		85,000
Administrative expenses		165,000
Total budgeted cost (b)		(3,695,600)
Total budgeted profits (a - b)		792,400

SUMMARY



Test Yourself 2

Admire Plc manufactures and sells only one product, Beta. The following budget is prepared for a period of July-September 20X9:

Output and sales	10,000 units
Selling price per unit	TZS400,000
Direct material per unit	TZS95,000
Direct wages per unit	TZS52,000
Variable overheads per unit	TZS105,000
Fixed overheads	TZS950 million

Due to the scarcity / non-availability of raw material, production stopped for 10 days. This has resulted in the following changes:

- Production of Beta lost by 10%.
- Due to the scarcity of material, the company had to pay 5% extra per unit cost.
- Selling price was increased by 3% in order to combat the effects of shortage of raw material.
- Direct wages and variable overheads decreased by 5%.
- Fixed overheads increased by TZS80 million.

Required:

Prepare a budget for a period of July-Sept 20X9 after taking into consideration the effects of raw material shortage.

2. Calculate planning and operational variances for sales.

[Learning Outcome c]

In the previous Learning Outcome, we looked at the need for the revision of budgets. Likewise, an organisation may need to revise its standards also for variance analysis, as budgeting and standard costing are inter-related.

2.1 Causes of planning and operational variances

The traditional approach to variance analysis takes into account a predetermined standard to compare with actual performance for identifying variances. In this approach, the computed variances will be valuable to the organisation only if the standard prepared previously is still a realistic target in the current business conditions.

However, if there have been **uncontrollable changes in internal or external operating conditions** then the standard may not now be a realistic one and the calculated variances will be of little or no value and may even be misleading.

This is a real problem particularly in **volatile conditions** and an attempt to overcome this is to separate out the total variances into planning variances and operational variances.

Normally, planning and operational variances are calculated more specifically for each of the materials, labour and sales.

1. Planning variances

Planning variances intend to quantify and analyse the extent to which the original standard needs to be adjusted in order to reflect changes in operating conditions between the current situation and that envisaged when the standard was originally calculated. In effect it means that the original standard is brought up to date so as to set a realistic target in current business conditions.

$$\text{Planning variance} = (\text{Original budgeted quantity} - \text{Revised budgeted quantity}) \times \text{Standard margin}$$

Similarly, planning usage, efficiency and price variances are also calculated for material, labour etc.

- (a) **Planning usage variance** signifies the difference between standard quantity of materials used and quantity of material that should have been used for actual production at the standard rate of material.
- (b) **Planning efficiency variance** signifies the difference between standard labour hours and the labour hours that should have been used for actual production at the standard labour rate.
- (c) **Planning price variance** measures the difference between budgeted price and revised price of material / labour for actual quantity of materials / labour hours used.

2. Operational variances

Operational variances indicate the extent to which attainable targets (i.e., the adjusted standards) have been achieved. Operational variances would be calculated after the planning variances have been established and are therefore a realistic way of assessing performance.

$$\text{Operational variance} = (\text{Revised budgeted quantity} - \text{Actual performance in quantity}) \times \text{Standard margin}$$

- (a) Additionally, **operational usage variance** measures the difference between the quantity of material that should have been used for actual production (i.e. revised budget) and actual quantity of materials used at standard rate of material.
- (b) **Operational efficiency variance** measures the difference between the labour hours that should have been used for actual production (i.e. revised budget) and actual labour hours used at standard labour rate.
- (c) **Operational price variance** signifies the difference between revised prices of material / labour and actual price for actual quantity of materials / labour hours used.

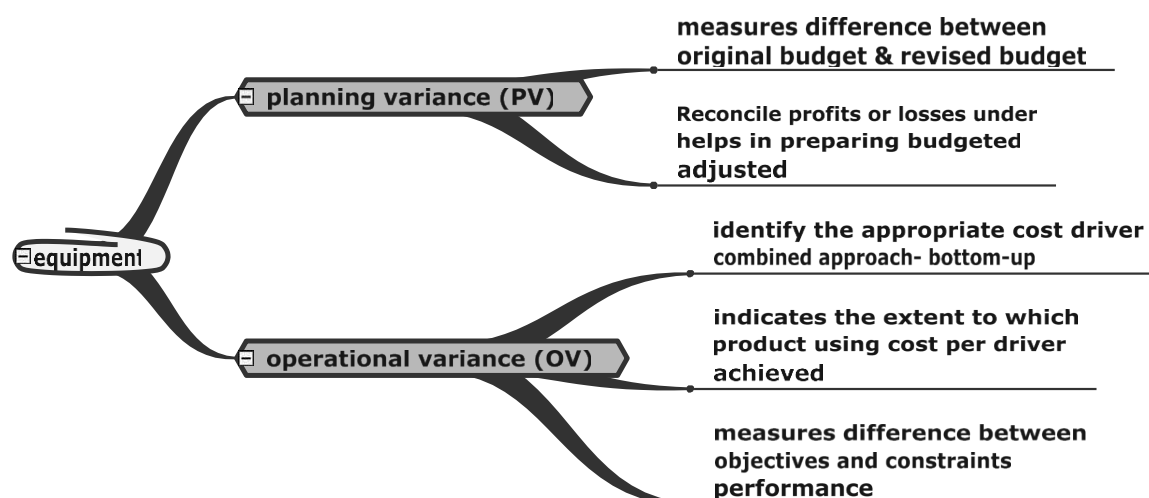
Professor Demski (1977) has argued that it was important to adjust for changes in the business environment occurring after standards were set so that variances were calculated against a standard that reflected achievable performance by the managers in the environment in which they operated rather than that foreseen by the standard setters.

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This is referred to as '**Ex post variance analysis**' and, in essence, it is a more sophisticated stage in flexing the budget with the same objective of measuring variances against a standard that is meaningful.

In ex-post variance analysis, the original budget and standards are known as ex-ante standards, whereas the standards that are set to be attainable in the changed circumstances are known as ex-post standards.

SUMMARY



Tip

The planning variance represents the uncontrollable element, and the operational variance represents the controllable element.



Example

In a four week period Sigma Ltd budgeted to make and sell 9,000 units of its single product with a budget as follows:

Budgeted for one month period

	TZS million
Production and sales (9,000 units at TZS20,000 each)	180
Less: Variable costs (9,000 at TZS8,000 each)	72
Contribution	108
Less: Fixed cost	50
Profit	58

Due to storm damage there was an external power line failure and three days production out of 20 days were lost. The actual results were:

	TZS million
Production and sales (8,000 units at TZS20,000 each)	160,000
Less: Variable costs (8,000 at TZS8,000 each)	64,000
Contribution	96,000
Less: Fixed costs	50,000
Profit	46,000

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In the situation, the **planning and operating variances** will be as following:

With retrospection a more realistic revised (i.e. ex-post) budget for the period would have been 9,000 units less standard production for three days i.e., (9,000 – 1,350) units = 7,650 units.

Therefore the **planning variance** would be the original (i.e. ex-ante) budget less the revised (i.e. ex-post) budget at the standard margin, i.e., (9,000 – 7,650) units x TZS12,000 = TZS16,200,000 (A).

Standard margin per unit is calculated as selling price less variable cost i.e. TZS20,000 - TZS8,000 = TZS12,000

The **operational variance**, which is deemed to be the controllable portion, is the difference between the more realistic ex-post budget and actual output at the standard margin i.e., (7,650 – 8,000) units x TZS12,000 = TZS4,200,000 (F).

Traditionally, the **sales margin volume variance**

= (Original budgeted quantity – Actual sales volume) x Standard margin
 = (9,000 - 8,000) units x TZS12,000
 = TZS12,000,000 (A), which is equal to the summation of the planning and operational variances above.

2.2 Planning and operational sales variances

Planning and operational variances for the sale price are very much similar to material price and labour rate variances. However, planning and operational variances for sales volume are different.



Tip

Planning sales volume variance is called market size variance, and operational sales volume variance is called market share variance.

2.3 Market size and market share variances

While analysing sales variances, we calculate sales margin price and sales margin volume variances. In an organisation dealing in more than one product we can go in to further detail to analyse the reason for variance and calculate the sales margin mix and the sales margin quantity variances. The sales quantity variance can then be further analysed as market share and market size variances.

1. Market size variances

This variance shows the expected additional contribution needed by an organisation to maintain the same market size when actual sales for the industry as a whole are more than the budgeted sales of the industry.

This is calculated as:

$$\text{Market size variance} = \left(\text{Budgeted market share percentage} \right) \times \left(\text{Actual industry sales volume in units} - \text{Budgeted industry sales volume in units} \right) \times \left(\text{Budgeted average contribution margin per unit} \right)$$

2. Market share variances

This variance shows the contribution lost as a result of not attaining the expected market share or additional contribution on account achieving an additional share in the market than budgeted.

This is calculated as:

$$\text{Market share variance} = \left(\text{Actual market share percentage} - \text{Budgeted market share percentage} \right) \times \left(\text{Actual industry sales volume in units} \right) \times \left(\text{Budgeted average contribution margin per unit} \right)$$



Example

The budgeted sales for the Monta Calio Company for year 20X9 were:

Product	Units	Unit Contribution Margin (TZS'000)	Total contribution (TZS'000)
X	20,000	15	300,000
Y	18,000	8	144,000
Z	12,000	6	72,000
	50,000		516,000

And the actual sales were:

Product	Units	Unit Contribution Margin (TZS'000)	Total contribution (TZS'000)
X	16,000	15	240,000
Y	17,500	8	140,000
Z	22,000	6	132,000
	55,500		512,000

Budgeted industry sales are 500,000 units and the actual sales are 650,000 units.

(a) Sales quantity variance = (Actual sales quantity in budgeted proportion – Budgeted sales quantity) x Standard margin

Applying this formula gives the following calculations:

Product X = (22,200 – 20,000) units x TZS15,000 per unit = TZS33,000,000(F)

Product Y = (19,980 – 18,000) units x TZS8,000 per unit = TZS15,840,000(F)

Product Z = (13,320 – 12,000) units x TZS6,000 per unit = TZS7,920,000 (F)

Total sales quantity variance = TZS33,000,000 + TZS15,840,000 + TZS7,920,000
= TZS56,760,000 (F)

Working

W1 Actual sales in budgeted proportion

Product X = 55,500 x 40% = 22,200

Product Y = 55,500 x 36% = 19,980

Product Z = 55,500 x 24% = 13,320

(b) Market size variance

$$\begin{aligned}
 \text{Market size variance} &= \left(\text{Budgeted market share percentage} \right) \times \left(\text{Actual industry sales volume in units} - \text{Budgeted industry sales volume in units} \right) \times \left(\text{Budgeted average contribution margin per unit} \right) \\
 &= 10\% \text{ (W2)} \times (650,000 - 500,000) \times \text{TZS10,320 (W1)} \\
 &= \text{TZS154,800,000 (F)}
 \end{aligned}$$

(c) Market share variance

$$\begin{aligned}
 \text{Market share variance} &= \left(\text{Actual market share percentage} - \text{Budgeted market share percentage} \right) \times \left(\text{Actual industry sales volume in units} \right) \times \left(\text{Budgeted average contribution margin per unit} \right) \\
 &= (8.53846\% \text{ (W2)} - 10\%) \times 650,000 \times \text{TZS10,320} \\
 &= \text{TZS98,040,000 (A)}
 \end{aligned}$$

Continued on the next page

**Tip**

You can verify your answer for market share variance and market size variance by calculating sales quantity variance in the following way:

$$\begin{aligned}\text{Sales quantity variance} &= \text{Market share variance} + \text{Market size variance} \\ &= \text{TZS}98,040,000 \text{ (A)} + \text{TZS}154,800,000 \text{ (F)} \\ &= \text{TZS}56,760,000 \text{ (F)}\end{aligned}$$

Workings**W1 Budgeted average contribution margin per unit**

$$= \text{TZS}516,000,000 / 50,000 \text{ units} = \text{TZS}10,320 \text{ per unit}$$

W2 Market percentages

$$\text{Actual market share percentage} = 55,500 \text{ units} / 650,000 \text{ units} \times 100 = 8.53846\%$$

$$\text{Budgeted market share percentage} = 50,000 \text{ units} / 500,000 \text{ units} \times 100 = 10\%$$

**Test Yourself 3**

Tasty Cookies Plc produces cookies from wheat flour. The following is the standard cost data for a batch of raspberry jam cookies:

Wheat flour	4,000 kg at TZS600 per kg
Sugar	6,000 kg at TZS400 per kg
Vegetable oil	2,000 kg at TZS3,500 per kg
Butter	160 kg at TZS1,000 per kg

The standard output is 5,000 units.

Margins are tight and the firm operates a system of standard costing for each batch of cookies.

In the budget year the wheat crop was damaged and resulted in a low national yield. As a consequence prices of the wheat increased by TZS100 per kg. Also sugarcane yield was not good and the country has to import sugar, resulting in an increase in prices by 5%.

The actual results for the batch of cookies are:

Wheat flour	4,200 kg at TZS720 per kg
Sugar	6,100 kg at TZS450 per kg
Vegetable oil	2,150 kg at TZS3,500 per kg
Butter	190 kg at TZS1,000 per kg

The actual output was 5,100 kg of cookies.

Required:

Calculate the ingredients' planning and operational variances.

3. Evaluate the dysfunctional nature of some variances in the modern environment of JIT and TQM.

[Learning Outcome d]

3.1 Dysfunctional nature of variances and Just in Time

Recent technological advancements in production systems have had a great impact on manufacturing and standard costs. No distinction between units purchased and units used is necessary in calculating variances for direct materials for firms that maintain a minimal inventory or firms that use a **Just-in-time system**.



Definition

Just in Time (JIT) is a technique of production employed to reduce waste and increase efficiency by holding as little inventory as possible.

Firms adopting the JIT system will be maintaining very less amount of inventory of raw materials, work in progress and finished goods. Thus, the quantity of raw materials purchased in a period is almost the same as, if not exactly equal to, the amount used during the period.



Example

Ramco Plc follows a just-in-time system. The JIT inventory management system discourages holding any inventory and rather prescribes to purchase materials 'just in time'. Accordingly, for the company, in a given period the total purchase of materials should be equal to the total consumption of materials.

Furthermore, firms using JIT systems have less interest in materials purchase price variances. The reason is that they purchase materials from suppliers under long-term contracts and the prices they negotiate are subject to short-term fluctuations. Also, JIT firms emphasise the total cost of operations, not just material purchase costs. Factors such as quality, reliability and availability often outweigh the purchase cost.

In a JIT environment, the goal is not to have high efficiency in the use of labour if such efficiency results in the production of unneeded goods. The goal is to produce only as needed to meet demand rather than to just fill labour time. Therefore, labour variances are often adverse in a JIT environment. When companies switch from a traditional system to JIT, it is often found that JIT does not work because of misplaced emphasis on efficiency variances.

With the advent of new technologies, such as automation, flexible manufacturing systems, and cell manufacturing, and introduction of these technologies into organisations, the importance of direct labour variances also decreases.



Example

Hewlett-Packard Company, at its factory in Fort Collins, Colorado, uses little or no direct labour since its manufacturing system is fully automated. This kind of organisation attaches little importance to labour rate and efficiency variances.

Again, the concept of 'throughput' time focuses on all elements of manufacturing – not just labour time. These other elements, which are independent of labour time, show greater efficiency each month, as the company eliminates non-value-added activities in the plant.

SUMMARY



3.2 Variance analysis and Total Quality Management

In recent years, the advocates of 'Total Quality Management' (TQM) have sought to eliminate all defects and waste and continuous improvement in quality, rather than continually build them into standards. As a result, allowances for waste and spoilage that are built into standards should be reduced over time.



Definition

Total Quality Management (TQM) is an approach to quality assurance by working towards continuous improvement in quality, processes and productivity, with the aim of meeting customers' expectations.

Standard costing (and variance analysis) emphasizes on cost control and cost reduction which may be against the principle of TQM, which aims at continuous improvement in quality (and may be achieved only at higher costs). Thus, co-existence of standard costing / variance analysis and TQM practices in an organization would not motivate staff towards working for either.

Standard costing is based on a predetermined 'standard'. While practicing TQM, such a 'standard' may lose relevance as TQM stands for **continuous improvements** to quality. Further, since TQM is a customer centric approach, the concept of a 'standard product' may not be appropriate.



Test Yourself 4

Firms using JIT systems often have a minimal interest in material price variances. Why?

Assess the effect that variances have on staff motivation and action.

[Learning Outcome d]

Achieving an organisational objective is only possible if actions influenced by drive and determination are directed towards it. Clearly, staff motivation can bring in the desired drive and determination. It is clearly desirable that managers and supervisors are motivated by the standard costing system.

Research shows that, although budgeting and standard costing systems sometimes gave positive motivational effects, all too often they produce undesirable negative reactions.

The standard costing technique relies absolutely upon the people who have to work to the budgets and standards. Due to the detailed nature of standard costing and its involvement with foremen and production workers, communication is of even greater importance.

Managers' performance may be directly linked to the variances "produced" by their departments. Thus, they may work towards ensuring positive variances or may indulge in manipulating standards. In case adverse variances occur due to use of ideal standards or making the managers responsible for costs which are beyond their control, such situations would demotivate them. Let us look at the following examples to **understand how some variances can affect employee motivation**:

Material variance: this variance is adverse if either material price variance or material usage variance (or both) is (are) negative. The purchase manager is responsible for controlling the cost of raw materials purchased whereas the production manager is responsible for the efficiency of the material usage. In order to achieve a positive material price variance, the purchase manager may buy materials of improper quality. This may result in adverse material usage variance (as more quantity of materials may be required for production due to poor quality of material), thus affecting the performance of the production manager responsible for it. In this case, the production manager may be demotivated.

Labour variance: the responsibility for the labour rate variance may lie with either the production manager or the human resource manager (depending upon the company's policy). An adverse labour rate variance would indicate that the labour costs have not been controlled. But, this may be a result of the government passing a legislation to increase the minimum wages. Thus, the concerned manager may be demotivated as the negative variance is a result of variables beyond the control of the manager. But, at the same time, if the labour efficiency variance is positive, it would indicate that the workforce has been positively motivated by the wage enhancement.

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Sales variance: the sales manager is responsible for the sales price and volume variances. A negative sales variance would indicate a not very desirable performance on the part of the sales manager. But, the poor sales may have resulted from a slack in the total market demand (an uncontrollable variable for the sales manager). In this case, the sales manager would be demotivated.

A positive sales variance would indicate good performance on the part of the sales manager. But, the good sale may be a result of product quality decisions taken by the production team. In such a situation, if due recognition is not given to the production team, they would not be motivated to contribute in a similar fashion in future.

Labourers frequently regard any form of performance evaluation with deep suspicion and, if a cost-conscious, positive attitude is to be developed, close attention is to be paid to the behavioural aspects of the system. Full participation, realistic standards, prompt and accurate reporting, no undue pressure or censure – all contribute to an acceptable system.

Answers to Test Yourself

Answer to TY 1

Factors that necessitate the revision of a budget:

- Emergence of unforeseen and unanticipated situations
- Changes in internal factors, such as sales forecast, production forecast etc.
- Changes in external factors such as prices of inputs / resources, market trends etc.
- Errors committed in preparation of budgets, subsequently discovered

Answer to TY 2

Admire Plc Budget for the period July to September 20X9

Output and sales		9,000
		TZS'000
Budgeted Sales (a)	9,000 units x (TZS400,000 x 1.03)	3,708,000
Budgeted Costs:		
Direct material	9,000 units x (TZS95,000 x 1.05)	897,750
Direct wages	9,000 units x (TZS52,000 x 0.95)	444,600
Variable overheads	9,000 units x (TZS105,000 x 0.95)	897,750
Fixed overheads	(TZS950,000,000 + TZS80,000,000)	1,030,000
Total budgeted cost (b)		(3,270,100)
Total budgeted profits (a - b)		437,900

Answer to TY 3

Original standard costs

	TZS'000
Wheat flour	2,400
Sugar	2,400
Vegetable oil	7,000
Butter	160
	11,960

Revised standards

		TZS'000
Wheat flour	4,000 kg x TZS700	2,800
Sugar	6,000 kg x TZS420	2,520
Vegetable oil	2,000 kg x TZS3,500	7,000
Butter	160 kg x TZS1,000	160
		12,480

Actual

		TZS'000
Wheat flour	4,200 kg x TZS720	3,024
Sugar	6,100 kg x TZS450	2,745
Vegetable oil	2,150 kg x TZS3,500	7,525
Butter	190 kg x TZS1,000	190
		13,484

(a) Planning variances

Material price variance = (Original material rate – Revised material rate) x Actual material usage

For wheat flour = (TZS600 - TZS700) per kg x 4,200 kg
= TZS420,000 (A)

For sugar = (TZS400 – TZS420) per kg x 6,100 kg
= TZS122,000 (A)

For vegetable = (TZS3,500 - TZS3,500) per kg x 2,100 kg
= Nil

For butter = (TZS1,000 - TZS1,000) per kg x 190 kg
= Nil

(b) Operating variances

Material price variance = (Revised material price – Actual material price) x Actual material usage

For wheat flour = (TZS700 - TZS720) per kg x 4,200 kg
= TZS84,000 (A)

For sugar = (TZS420 - TZS450) per kg x 6,100 kg
= TZS183,000 (A)

For vegetable oil = (TZS3,500 - TZS3,500) per kg x 2,150 kg
= Nil

For butter = (TZS1,000 - TZS1,000) per kg x 190 kg
= Nil

Answer to TY 4

Firms using JIT systems have less interest in materials purchase price variances. The reason is that they purchase materials from suppliers under long-term contracts and the prices they negotiate are not subject to short-term fluctuations.

Moreover, JIT organisations emphasise the total cost of operations, not just material purchase costs. Factors such as quality, reliability, and availability often outweigh the purchase cost.

Quick Quiz

1. A budget should be revised when the factors influencing the future outcome of an organisation are_____.
2. For analysing variance, the total variances are separated into _____ and _____.
3. In ex-post variance analysis, the original budget and standards are known as _____ standards and the revised standards are known as _____ standards.
4. State the formula for calculating:
 - (a) Planning variance
 - (b) Operating variance
5. State true or false.
Even though the impact of change in a factor influencing the budget is insignificant, for every change, the original budget should be revised so as to give meaningful results of performance evaluation.

Answers to Quick Quiz

1. Uncontrollable
2. Planning and operational variance
3. Ex-ante, Ex-post
4. Planning variance = (Original budgeted quantity – Revised budgeted quantity) x Standard margin
Operational variance = (Revised budgeted quantity – Actual performance in quantity) x Standard margin
5. False; Only if the impact is significant, should the original budget be revised.

Self Examination Questions

Question 1

Spike Co provides the following data relating to its product, leather bound diaries, for the period 20X9 to date:

Budget

Sales volume	180,000 units
Sales price	TZS17,000 per unit
Standard variable cost	TZS10,000 per unit

The total market for diaries in this period was estimated in the budget to be 1.8 million units. In fact, the actual total market shrank to 1.6 million units for the period under review.

Actual results for the same period:

Sales volume 176,000 units
Sales price TZS16,400 per unit

Required:

- Calculate the total sales price and total sales volume variance.
- Analyse the total sales volume variance into components for market size and market share.

Question 2

Prime Plc has produced the following standard applied and actual results for costs and selling price during the three-month period.

	Standard	Actual
Selling price (TZS'000 per unit) Direct	24.00	23.00
material usage (kg per unit) Direct	2.37	2.10
material price (TZS'000 per kg) Direct	1.70	1.80
labour efficiency (hours per unit) Direct	1.10	1.15
labour rate (TZS'000 per hour) Sales	9.00	9.50
(units)		90,000

A management accountant of the company decided to revise the standard costs at the end of the period, considering the following:

- An increase of TZS200 per kg in the direct material price.
- A labour rate increase of 5%.
- The standard labour efficiency expected to decrease by 10% if new machinery is installed. On the other hand, it may lead to 5% saving in material usage.

Required:

- Using the information provided, calculate each planning and operational variances
- Explain the importance of separating variances into planning and operational elements.

Question 3

The master budget of Ronald Ltd for the year 20X9 is as follows:

Ronald Ltd – Budget for the year 20X9

	TZS'000	TZS'000
Production and sales (20,000 units @ TZS25,000 each)		500,000
Less: Variable costs		
Direct materials (2 kg per unit of production @ TZS5,000 per kg)	200,000	
Direct labour (3 hours per unit of production at TZS2,000 per hour)	120,000	
Overhead (3 hours per unit of production at TZS1,000 per hour)	60,000	
		(380,000)
Contribution		120,000
Less: Fixed costs		(60,000)
Profit		60,000

After a **lapse of two months** of budget period, the management of the company found that the following changes in the budgetary provision need to be incorporated so that the budget can reflect the changes in the environment. The factors that warranted revision of the budget are as following:

- Due to an accident caused in one production shop (out of a total of three shops), total **production and sales** would be **restricted to 80%**.
- The sales price would remain more or less at the same level as envisaged in the budget but **cost per kg of direct material would go up by TZS500**.
- The **consumption of the raw materials** would be **20% higher** than envisaged due to the use of a substitute for non-availability of the original planned raw materials.
- The **direct wage rate** would remain **unaltered** whilst the **variable overhead** would be **absorbed @ TZS1,200 per hour** in the **remaining period**.

(All the figures have been rounded off to multiples of ten)

Required:

Based on information given, prepare a revised budget for the year 20X9.

***Question 4**

K Ltd makes a single product. Information regarding one of those products is given below:

Budgeted output/sales for the year is 900 units

Standard details for one unit

Direct materials	40 square metres at TZS. 5.30 per square metre
Direct wages	Bonding department: 24 hours at TZS. 5.00 per hour
	Finishing department: 15 hours at TZS. 4.80 per hour
Variable overhead	TZS. 1.50 per bonding labour hour
	TZS. 1 per finishing labour hour
Fixed production overhead	TZS. 36,000
Fixed non-production overhead	TZS. 27,000

Note: Variable overheads are recovered (absorbed) using hours; fixed overheads are recovered on a unit basis.

Required:

- Prepare a standard cost card for one unit and enter on the standard cost card the following subtotals:
 - Prime cost
 - Variable production cost
 - Total production cost

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- (iv) Total cost
(b) Calculate the selling price per unit allowing for a profit of 25% of the selling price.

*Question 5

The following data relate to actual output, costs and variances for the four-weekly accounting period number 4 of a company that makes only one product. Opening and closing work in progress figures were the same.

Actual production of product XY	18 000 units
Actual costs incurred:	
Direct materials purchased and used (150000kg)	210,000
Direct wages for 32 000 hours	136,000
Variable production overhead	38,000
Variances:	
Direct materials price	15,000 F
Direct Usage price	9,000 A
Direct labour rate	8,000 A
Direct labour efficiency	16,000 F
Variable production overhead expenditure	6,000 A
Variable production overhead efficiency	4,000 F

Variable production overheads varies with labour hours worked.
A standard marginal costing system is operated.

Required:

- Present a standard product cost sheet for one unit of product XY,
- Describe briefly three types of standard that can be used for a standard costing system, stating which is usually preferred in practice and why.

*Question 6

Newcastle Limited uses variance analysis as a method of cost control. The following information is available for the year ended 30 September 2018:

Budget	Production for the year	12,000 units
	Standard cost per unit:	TZS
	Direct material (3kg at TZS10/kg)	30
	Direct labour(4 hours at TZS 6/hour)	24
	Overheads (4 hours at TZS 2/hour)	8
		62
Actual	Actual production units for year	11 500 units
	Labour-hours for the year	45 350 hours
	Labour- Cost for the year	TZS 300 000
	Materials-kg used in the year	37 250 kg
	Materials- Cost for the year	TZS 345 000

Required;

- Prepare a reconciliation statement between the original budgeted and actual prime costs.
- Explain what the labour variances calculated in (a) show and indicate the possible interdependence between these variances.

*Question 7

As a recently appointed assistant management accountant you are attending a monthly performance meeting. You have with you a statement of monthly actual costs, a summary of cost variances and other pieces of information you have managed to collect, as shown below:

	TZS
Actual cost of direct material purchased and used	62,700
Actual direct wages paid	97,350
Variable overheads incurred	19,500
Fixed overheads incurred	106,500
The variances from standard cost were as follows:	
Direct material price variance	5,700 A
Direct material usage variance	3,000 F
Direct labour rate variance	1,650 F
Direct labour efficiency variance	9,000 F
Variable overheads variance	1,500 A
Fixed overheads expenditure variance	1,500 A
Fixed overheads volume variance	15,000 A

The actual wage rate paid for the period was TZS. 8.85 per hour. It takes three standards hours to produce one unit of the finished product.

The single direct material used in the period cost TZS. 0.30 per kg above the standard price. Five kilograms of raw material input is allowed for as standard for one unit of output.

All figures relate to the single product which is manufactured at the plant. There were no stocks at the beginning or end of the accounting period. Variable and fixed overhead absorption rates are based on standards hours produced.

Managers from various functions have brought to the meeting measures which they have collected for their own areas of responsibility. In order to demonstrate the link between the accounting values and their measures, you decide to work from the variances to confirm some of them.

REQUIRED:

- a) Using variance formulae or otherwise determine the following:
 - i) The actual number of direct labour hours worked
 - ii) The standard rate of pay per direct labour hour
 - iii) The standard of hours of production
 - iv) The actual production in units
 - v) The actual quality of direct material consumed
 - vi) The actual price paid for the direct material (per kilogram)
 - vii) The standard direct material usage in kilogram for the actual number of units produced.

From (a) above and any other calculations which may be appropriate, compute the standards cost per unit of finished product. Show separately standards quantities of each element of cost.

Question 8 – ACCA

Secure Net (SN) manufacture security cards that restrict access to government owned buildings around the world.

The standard cost for the plastic that goes into making a card is TZS4 per kg and each card uses 40g of plastic after an allowance for waste. In November 100,000 cards were produced and sold by SN and this was well above the budgeted sales of 60,000 cards.

The actual cost of the plastic was TZS5.25 per kg and the production manager (who is responsible for all buying and production issues) was asked to explain the increase. He said 'World oil price increases pushed up plastic prices by 20% compared to our budget and I also decided to use a different supplier who promised better quality and increased reliability for a slightly higher price. I know we have overspent but not all the increase in plastic prices is my fault'

The actual usage of plastic per card was 35g per card and again the production manager had an explanation. He said 'The world-wide standard size for security cards increased by 5% due to a change in the card reader technology, however, our new supplier provided much better quality of plastic and this helped to cut down on the waste.'

SN operates a just in time (JIT) system and hence carries very little inventory.

Required:

- (a) Calculate the total material price and total material usage variances ignoring any possible planning error in the figures.
- (b) Analyse the above total variances into component parts for planning and operational variances in as much detail as the information allows.
- (c) Assess the performance of the production manager.

Question 9 – ACCA

Bedco manufactures bed sheets and pillowcases which it supplies to a major hotel chain. It uses a just-in-time system and holds no inventories.

The standard cost for the cotton which is used to make the bed sheets and pillowcases is TZS5 per m². Each bed sheet uses 2 m² of cotton and each pillowcase uses 0.5 m². Production levels for bed sheets and pillowcases for November were as follows:

	Budgeted production levels (units)	Actual production levels (units)
Bed sheets	120,000	120,000
Pillowcases	190,000	180,000

The actual cost of the cotton in November was TZS5.80 per m². 248,000 m² of cotton was used to make the bed sheets and 95,000 m² was used to make the pillowcases.

496: Standard Costing & Variance Analysis

The world commodity prices for cotton increased by 20% in the month of November. At the beginning of the month, the hotel chain made an unexpected request for an immediate design change to the pillowcases. The new design required 10% more cotton than previously. It also resulted in production delays and therefore a shortfall in production of 10,000 pillowcases in total that month.

The production manager at Bedco is responsible for all buying and any production issues which occur, although he is not responsible for the setting of standard costs.

Required:

- (a) Calculate the following variances for the month of November, for both bed sheets and pillow cases, and in total:
 - (i) Material price planning variance;
 - (ii) Material price operational variance;
 - (iii) Material usage planning variance;
 - (iv) Material usage operational variance.
- (b) Assess the performance of the production manager for the month of November.

Question 10

As a recently appointed assistant management accountant you are attending a monthly performance meeting. You have with you a statement of monthly actual costs, a summary of cost variances and other pieces of information you have managed to collect, as shown below:

	TZS.
Actual cost of direct material purchased and used	62,700
Actual direct wages paid	97,350
Variable overheads incurred	19,500
Fixed overheads incurred	106,500

The variances from standard cost were as follows:

Direct material price variance	5,700A
Direct material usage variance	3,000F
Direct labour rate variance	1,650F
Direct labour efficiency variance	9,000F
Variable overheads variance	1,500A
Fixed overheads expenditure variance	1,500A
Fixed overhead volume variance	15,000A

The actual wage rate paid for the period was TZS.8.85 per hour. It takes three standard hours to produce one unit of the finished product.

The single direct material used in the period cost TZS.0.30 per kg above the standard price. Five kilograms of raw material input is allowed for as standard for one unit of output.

All figures relate to the single product which is manufactured at the plant. There were no stocks at the beginning or end of the accounting period. Variable and fixed overhead absorption rates are based on standard hours produced.

Managers from various functions have brought to the meeting measures which they have collected for their own areas of responsibility. In order to demonstrate the link between the accounting values and their measures, you decide to work from the variance to confirm some of them.

Required:

- (a) Using variance formulae or otherwise determine the following:
 - (I) The actual number of direct labour hours worked.
 - (II) The standard rate of pay per direct labour hour.
 - (III) The standard of hours of production.
 - (IV) The actual production in units.
 - (V) The actual quantity of direct material consumed
 - (VI) The actual price paid for the direct materials (per kilogram)
 - (VII) The standard direct material usage in kilogram for the actual number of units produced.

- (b) From (a) above and any other calculations which may be appropriate, compute the standard cost per unit of finished product. Show separately standard quantities for each element of cost.

Question 11

Mohamed Ltd manufactures special meat pies, which it sells in bulk to delicatessen shops. The only variable cost is raw materials, which consists of three types of raw meat. The standard cost of the raw materials used in the manufacture of each 100 kilograms of special meat special meat pie is as follows:

Raw material	Kilograms	Standard Price per Kilogram in TZS.
Type A	25	2
Type B	60	3
Type C	40	4
Total Input	125	
Normal Loss (20% of Input)	<u>(25)</u>	
Output	100	

In preparing its budget for 2014, the company assumed that there would be a market in Tanzania for 125,000 kilograms of special meat pie and that Mohamed's product would have a 40% share of this market. The budget also assumed a selling price of TZS.6 per kilogram for Company's product. However, during 2014 both Mohamed and its competitors were adversely affected by diminishing consumer confidence in meat products. The actual total market size was only 110,000 kilograms of special meat pie (instead of the anticipated 125,000 kilograms), and Mohamed sold only 33,000 kilograms of its product.

The Managing Director of the company recently explained how his company attempted to respond to the difficulties which it faced in 2014: 'First, we reduced our selling price from TZS.6 to TZS. 5.90. This was a modest price reduction in comparison with those of our smaller competitors. Second, we took advantage of falling market prices for some of the types of meat which we use as raw material for our product. With benefit of hindsight, we should perhaps have done more to increase consumers 'confidence in the safety and quality of meat products in general and our own product in particular'.

The actual raw materials used by Mohamed Ltd in 2014 were as follows:

Raw Material	Kilograms	Actual Price per Kilogram TZS.
Type A	8,800	TZS.1.7
Type B	19,200	TZS.3
Type C	<u>12,000</u>	TZS.4
Total Input	40,000	

The company had no opening or closing stocks of raw materials or finished product.

Required:

Calculate:

- Raw materials price; raw materials mix and raw materials yield variances.
- Sales Price and Sales Volume Variances.

Answers to Self-Examination Questions

Answer to SEQ 1

(a) Total sales price and total sales volume variance

$$\begin{aligned}\text{Sales price variance} &= (\text{Actual Selling Price} - \text{Standard Selling Price}) \times \text{Actual Sales Quantity} \\ &= (\text{TZS}16,400 - \text{TZS}17,000 \text{ per unit}) \times 176,000 \text{ units} \\ &= \text{TZS}105,600,000 \text{ (A)}\end{aligned}$$

$$\begin{aligned}\text{Sales volume variance} &= (\text{Actual Sales Quantity} - \text{Budget Sales Quantity}) \times \text{Standard Contribution per unit} \\ &= (176,000 - 180,000) \text{ units} \times (\text{TZS}17,000 - \text{TZS}10,000) \text{ per unit} \\ &= \text{TZS}28,000,000 \text{ (A)}\end{aligned}$$

(b) Market size and market share variances

$$\begin{aligned}\text{Market size variance} &= \left[\begin{array}{c} \text{Budgeted} \\ \text{market share} \\ \text{percentage} \end{array} \right] \times \left[\begin{array}{c} \text{Actual} \\ \text{industry} \\ \text{sales} \\ \text{volume in} \\ \text{units} \end{array} - \begin{array}{c} \text{Budgeted} \\ \text{industry} \\ \text{sales} \\ \text{volume in} \\ \text{units} \end{array} \right] \times \left[\begin{array}{c} \text{Budgeted} \\ \text{average} \\ \text{contribution} \\ \text{margin per} \\ \text{unit} \end{array} \right] \\ &= 10\% \times (1.6\text{million units} - 1.8\text{million units}) \times \text{TZS}7,000 = \text{TZS}140,000,000 \text{ (A)}\end{aligned}$$

$$\begin{aligned}\text{Market share variance} &= \left[\begin{array}{c} \text{Actual market} \\ \text{share} \\ \text{percentage} \end{array} - \begin{array}{c} \text{Budgeted} \\ \text{market share} \\ \text{percentage} \end{array} \right] \times \left[\begin{array}{c} \text{Actual} \\ \text{industry sales} \\ \text{volume in} \\ \text{units} \end{array} \right] \times \left[\begin{array}{c} \text{Budgeted} \\ \text{average} \\ \text{contribution} \\ \text{margin per} \\ \text{unit} \end{array} \right] \\ &= (11\% - 10\%) \times 1.6\text{million units} \times \text{TZS}7,000 \text{ per unit} = \text{TZS}112,000,000 \text{ (F)}\end{aligned}$$

Answer to SEQ 2

Revised budget

Direct material price = TZS1,900 per kg (TZS1,700 + TZS200)

Direct material usage = 2.37 kg x 95% = 2.25 kg

Direct labour rate = TZS9,000 per hour x 1.05 = TZS9,450 per hour

Direct labour hours = 1.10 hour x 90% = 1.00 hour

Planning variances

Direct material price variance = (Original material rate – Revised material rate) x Actual material quantity
 = (TZS1,700 – TZS1,900) x 90,000 units x 2.10 kg = TZS37,800,000 (A)

Direct material usage variance = (Original budgeted material usage – Revised material usage) x Original standard material price
 = [(2.37 kg – 2.25 kg) x 90,000 units] x TZS1,700 = TZS18,360,000 (F)

Direct labour rate variance = (Original budgeted labour rate – Revised labour rate) x Actual labour hours
 = [(TZS9,000 – TZS9,450) x 90,000 units] x 1.15 hours = TZS46,575,000 (A)

Direct labour efficiency variance = (Original budgeted labour hours – Revised labour hours) x Original standard labour rate
 = [(1.10 hours – 1.00 hours) x 90,000 units] x TZS9,000 = TZS81,000,000 (F)

Operational variances

Direct material price variance = (Revised standard material price – Actual material price) x Actual material usage
 = [(TZS1,900 – TZS1,800) x 90,000 units] x 2.10 kg = TZS18,900,000 (F)

Direct material usage variance = (Revised standard material usage – Actual usage) x Standard price
 = [(2.25 kg – 2.10 kg) x 90,000 units] x TZS1,700 = TZS22,950,000 (F)

Direct labour rate variance = (Revised labour rate – Actual labour rate) x Actual labour hours
 = [(TZS9,450 – TZS9,500) x 90,000 units] x 1.15 hours = TZS5,175,000 (A)

Direct labour efficiency variance = (Revised standard labour hours – Actual hours) x Standard labour rate
 = [(1 hour – 1.15 hours) x 90,000 units] x TZS9,000 = TZS121,500,000 (A)

If an operating statement is prepared without considering the relevant changes in the business environment, it would have been reported in the planning variances. These variances may contain controllable as well as uncontrollable elements.

In order for the variance analysis to be more useful, the controllable and uncontrollable elements may be reported separately. Accordingly, each variance is split into a planning (uncontrollable) and an operational (controllable) variance. Managers cannot be held responsible for planning variances since they do not have any control over this. As operational variances are controllable, it is worthwhile for the managers to pay attention to them. The planning variances indicate where investigation may result in an improvement in the planning and budgeting process.

500: Standard Costing & Variance Analysis

Answer to SEQ 3

Based on the above information the revised budget for the period from 1 March 20X9 to 31 December 20X9 would be as follows:

Ronald Ltd

Revised Budget for year 20X9

	TZS'000	TZS'000
Production and sales (13,333 units @ TZS25,000 each) (W1)		333,330
Less: Variable costs		
Direct materials (W2) (2.4 kg per unit of production @ TZS5,500 per kg)	176,000	
Direct labour (W3) (3 hours per unit of production at TZS2,000 per hour)	80,000	
Variable overhead (W4) (3 hours per unit of production at TZS1,200 per hour)	48,000	304,000
Contribution		29,330
Less: Fixed costs (W5)		50,000
Profit / Loss		(20,670)

Workings

W1 Calculate the number of units produced and sales

Given that,
Period of revised budget 10 months (1 March 20X9 to 31 December 20X9)
Due to accident, total production and sales restricted to 80%.

$20,000 \text{ units} \times 80\% \times (10/12) \text{ months} = 13,333 \text{ units}$

W2 Direct materials

$13,333 \text{ units} \times 2.4 \text{ kg per unit} \times \text{TZS}5,500 \text{ per kg} = \text{TZS}176,000,000$

W3 Direct Labour

$13,333 \text{ units} \times 3 \text{ hours per unit} \times \text{TZS}2,000 \text{ per hour} = \text{TZS}80,000,000$

W4 Variable overhead

$13,333 \text{ units} \times 3 \text{ hours per unit} \times \text{TZS}1,200 \text{ per hour} = \text{TZS}48,000,000$

W5 Fixed overhead (Period cost)

$\text{TZS}60,000,000 \times (10/12) \text{ months} = \text{TZS}50,000,000$

Answer to SEQ 8

1. Secure Net

- (a) The planning variances are calculated by comparing the original budget and the revised standards after adjustment for factors outside the control of the organisation. On this basis the revised standards would be a price of TZS4.80 per kg with revised usage at 42g per card.

Planning price variance = $(\text{TZS}4.80 - \text{TZS}4) 4,200 = \text{TZS}3,360$ Adverse

Planning usage variance = $(4,200 - 4,000) \text{TZS}4 = \text{TZS}800$ Adverse

The total planning error (Variance) is TZS4,160 Adverse

The operational variances compare the actual spend with the revised budget figures.

Operational price variance = $(\text{TZS}5.25 - \text{TZS}4.80) 3,500 \text{ kg} = \text{TZS}1,575$ Adverse

Operational usage variance = $(3,500 - 4,200) \text{TZS}4.80 = \text{TZS}3,360$ Favourable

The total operational variance is TZS1,785 Favourable

- (b) The production manager is subject to external pressures which appear beyond his control. The size of the security card has to fit the reader of that card and if the industry specification changes there is nothing that he can do about that. This is, then, a 'planning' error and should not form part of any assessment of his performance.

Equally if world-wide oil prices increase (and hence plastic prices) then the production manager cannot control that. This would be allocated as a planning error and ignored in an assessment of his performance.

The performance of the production manager should be based on the operational variances (And any relevant qualitative factors). The decision to use a new supplier 'cost' an extra TZS1,575 in price terms. On the face of it this is, at least potentially, a poor performance. However, the manager seems to have agreed to the higher price on the promise of better quality and reliability. If this promise was delivered then this could be seen as a good decision (and performance). The savings in waste (partly represented by the usage variance) amount to TZS3,360 favourable. This would seem to suggest better quality. The fact that the production level jumped from 60,000 to 100,000 also suggests that supplier's reliability was good (in that they were able to deliver so much). The net variance position is relevant at a saving of TZS1,785.

It is also possible that such a large increase in volume of sales and production should have yielded a volume based discount from suppliers. This should also be reflected in any performance assessment in that if this has not been secured it could be seen as a poor performance.

This is backed up by the lack of obvious quality problems since we are told that 100,000 cards were produced and sold in the period, a huge increase on budget. The ability of a production manager to react and be flexible can often form a part of a performance assessment.

In conclusion the manager could be said to have performed well.

Alternative answer:

Planning Variances

RSQap		RSP			
0.042 kg x 100,000 units	x	TZS4.8/kg	=	20,160	
					3,360 A Material Price

Variance

RSQap		SP			
0.042 kg x 100,000 units	x	TZS4/kg	=	16,800	
					800 A Material Usage

Variance

SQap		SP			
0.04 kg x 100,000 units	x	TZS4/kg	=	16,000	

Operational Variances

AQ		AP			
0.035 kg x 100,000 units	x	TZS5.25/kg	=	18,000	
					1,575 A Material Price

Variance

AQ		RSP			
0.035 kg x 100,000 units	x	TZS4.8/kg	=	16,800	

RSQap		RSP			3,360 F Material

Usage Variance

0.042 kg x 100,000 units	x	TZS4.8/kg	=	20,160	

502: Standard Costing & Variance Analysis

Answer to SEQ 9

. Bedco

(a) Planning and operational variances

(i) Material Price Planning Variance (MPPV) (Standard price – revised price) x actual quantity

Sheets (TZS5 – TZS6) x 248,000 = TZS248,000

adverse

Pillow cases (TZS5 – TZS6) x 95,000 = TZS95,000 adverse

Total TZS343,000 adverse

(ii) Material Price Operational Variance (MPOV) (Revised price – actual price) x actual quantity

Sheets (TZS6 – TZS5·80) x 248,000 = TZS49,600

favourable

Pillow cases (TZS6 – TZS5·80) x 95,000 = TZS19,000 favourable

Total TZS68,600 favourable

(iii) Material Usage Planning Variance (MUPV) (Standard quantity for actual production – revised quantity for actual production) x standard price

RQ for each pillow case = 0·5 m x 1·1 = 0·55 m

Sheets (240,000 – 240,000) x TZS5 = 0

Pillow cases (90,000 – 99,000) x TZS5 = TZS45,000 adverse

Total TZS45,000 adverse

(iv) Material Usage Operational Variance (MUOV) (Actual quantity – revised quantity for actual production) x standard price

Sheets (248,000 – 240,000) x TZS5 = TZS40,000

adverse

Pillow cases (95,000 – 99,000) x TZS5 = TZS20,000 favourable

Total TZS20,000 adverse

Note: The MPPV could be calculated using the revised quantity rather than the actual quantity. Similarly, the MUOV could be calculated using the revised price rather than the standard price. Marks will be given where this alternative method is used instead. However, it should be used for both the MPPV and the MUOV, otherwise the figures cannot be reconciled back to the difference between actual spend and the budget for spend as flexed for actual production levels (TZS339,400 adverse).

(b)

Performance of the production manager In total, there has been an overspend of TZS339,400, which looks poor. However, when the reasons for this are examined, together with the variances calculated in (a), it is apparent that the production manager cannot be held solely responsible for the overspend. In fact, he has had little control over the situation.

Increase in cotton price

Since cotton is used to make bed sheets and the price of this rose in the world market by 20%, the production manager's performance has to be looked at in light of this. Because of the increased market price, the adverse material price planning variance is very high, since the budgeted cost of TZS5 per m² was far below the actual market price of TZS6 per m². The production manager cannot be held responsible for this since he does not set the standard costs. He can only be held responsible for any difference in price between the TZS6 market price and the TZS5·80 actual price paid. Since the TZS5·80 paid per m² is less than the market price of TZS6 per m², the manager performed well, as shown by the favourable material price operating variance of TZS68,600.

Increase in amount of cotton used

Since more cotton was used for actual production than budgeted, a total adverse material usage variance of TZS65,000 (TZS45,000 + TZS20,000) arose. However, of this, TZS45,000 (material usage planning variance) arose because of the request for a change in the design of the pillowcases by Bedco's customer. This was not within the control of the production manager and his performance should not therefore be assessed on it. However, an adverse material usage operational variance of TZS20,000 also arose; the performance of the production manager is weak here. Most of the adverse operational variance actually related to the production of bed sheets rather than pillowcases. It is not clear why this arose but it is definitely poor.

Bedco was also unable to produce all the pillowcases ordered by its customer in November as the order fell short by 10,000 units. If this was genuinely because of the late design change, however, it seems unfair to judge the production manager on this

Answer to SEQ 11

- (a) (i) Actual hours = TZS. 97,350/TZS 8.85 = 11,000 hours
- (ii) Actual hours @ standards rate = TZS 97,350 + TZS. 1,650 = TZS 99,000
Actual hours = 11,000 standard rate = TZS. 9 per hour
- (iii) Standard hours @ std rate = TZS 99,000 = TZS 108,000
Standard rate = TZS. 9 per hour, standard hours = 12,000 hrs
- (iv) It takes three std. hrs. to produce one unit
Actual production = 12,000hrs/3=4,000 units
Actual quantity @ actual price = TZS 62,700
- (v) The material price variance was TZS. 0.30 per kg used and came to TZS. 5,700 in total 5,700/0.3 = 19,000kg were used
- (vi) These 19,000kg cost TZS 62,700 and the cost per kg was TZS 3.30
- (vii) From (iv)
- | | |
|------------------------------|-------------|
| Actual production | 4,000 units |
| Standard usage x | 5kg |
| Standard qty for actual prod | 20,000kg |
- (b) Materials 5kg@TZS 3 per kg 15.00
Labour 3hours@ TZS 9 per hour 27.00
Variable overhead 3 hours @ TZS 1.50 per hour 4.50
Fixed overhead 3 hours @ TZS 7.50 per hour 22.50
69.00

Solution

- (a) Variances
Raw material Price Variance

Raw material Price Variance			
Type	Actual Price	Standard Price	[Actual Price-Standard price) x Actual Quantity
Type A	TZS. 1.7	TZS 2	[1.7-2] x 8800 = 2,640F
Type B	TZS 3	TZS 3	NIL
Type C	TZS 4	TZS 4	NIL
Total Material Price Variance			TZS 2,640 F

504: Standard Costing & Variance Analysis

Material Mix Variance

	Standard input	Weight	Actual Quantity in Actual Mix	Actual Quantity in Standard Mix	Standard Price per Kg	[AQ in actual mix – AQ in standard mix] x standard price per Kg
Type A	25	20%	8800	20% x 4000 = 8000	2	[8800 – 8000] x 2 = 1,600U
Type B	60	48%	19200	48% x 40000 = 19200	3	NIL
Type C	40	32%	12000	32% x 40000 = 12800	4	[12,000 – 12,800] x 4 = 3,200F
Total	125	100%	40000	40000		1,600F

Material Yield Variance

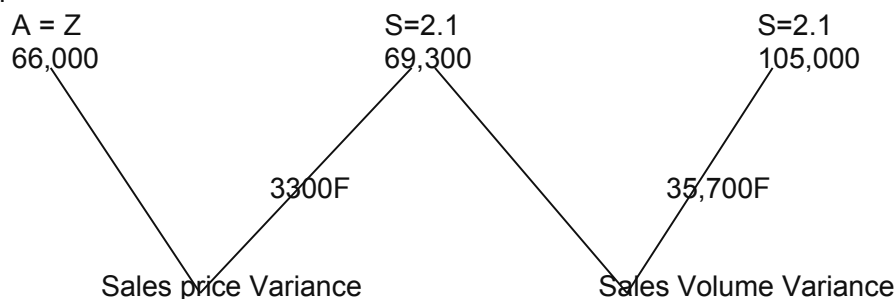
Actual material used = 40,000 Kgs
 Workings for material yield variance
 Actual Input at Standard Mix at
 Standard Cost
 40,000 Kg

Standard Impact based on output
 at Standard Mix at Standard cost

	(3)	(2-1)	
A 20% x 40,000 = 8,000 kg	41,250 x 20% = 825 kg	250F@2=	500F
B 40% x 40,000 = 19,200 kg	41,250 x 48% = 19,800 kg	600F@3 =	1,800F
C 32% x 40,000 = 12,800 kg	41,250 x 32% = 13,200 kg	400F @4 =	1,600F
		Total Variance	3,900F

Sales Variance

Quantity A 33,000 kg
 Margin



(b) Sales Price Variance (SPV)

Sales Volume Variance			
Actual Quantity AQ	Budgeted Quantity BQ	Standard contribution per Kg (SCMU)	[AQ-BQ] x SCMU
3300kg	50000kgs	2.1 TZS	SVV = [3300-50000] x 2.1 = 35,700U

Sales price variance (SPV)

Sales Volume Variance			
Actual Price (AP)	Budgeted Price (BP)	Actual Quantity (AQ)	[AP-BP] x AQ
5.9 TZS	6 TZS	33000 kgs	SPV =[5.9-6] x 33000 = 3,300U

SECTION E1: THE SCOPE OF PERFORMANCE MEASUREMENT

Get Through Intro

Performance measurement aims to establish how well an organisation or its personnel is doing. It is about how organisations measure the quality of their activities and services, and is a vital part of the control process. As a management accountant, you have to be able to identify a suitable performance measure for a department, a person or an organisation.

Performance measure is termed as a key performance indicator (KPI). KPI can be separated into financial performance indicators (FPIs) and non-financial performance indicators (NFPIs).

This SECTION discusses various performance measures.

Learning Outcomes

- a) Select and calculate suitable financial performance measures for a given business from given data and information provided.
- b) Evaluate the results based on business objectives and advise on management action.
- c) Explain and assess the use of balanced scorecard methods including evaluation of performance from given data and information.
- d) Explain and evaluate the use of value for money (VFM) techniques in performance management.
- e) Select and explain stakeholder based measures of performance that may be used to evaluate social or environmental performance of a business.

1. Select and calculate suitable financial performance measures for a given business from given data and information provided.

[Learning Outcome a]

Financial statements are used by management, suppliers, investors and others to judge the operating performance and financial position of a firm. Users further identify the financial strengths and weaknesses of the firm with the help of financial analysis. Financial analysis is the process of identifying relationships between the items of the statement of financial position (SOFP) and the statement of comprehensive income (SOC) to evaluate the financial performance of a firm. Ratio analysis is a powerful tool for measuring financial performance.

The **measurement and evaluation of financial performance** are central to control the affairs of an organisation. Performance measurement can be sub-divided into financial measures and non-financial measures.

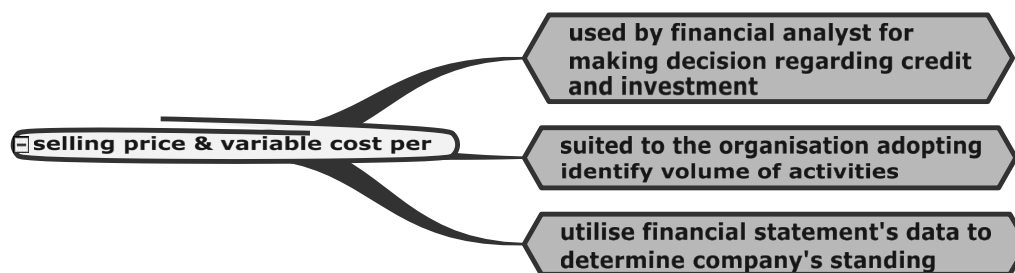
1.1 Financial performance indicators (FPI)

Financial performance indicators are the tools used by financial analysts for making decisions regarding credit and investments. This method utilises the data found in financial statements to determine a company's standing. Analysts will compare the company's ratios to its past performance, as well as to industry statistics to determine risks, trends and to identify any peculiarities. This analytical tool facilitates inter-company as well as intra-company comparisons.

These can be used for analysing profitability, liquidity and risk in both manufacturing and service businesses.

The profitability (operating) ratios gauge an organisation's operating success over a given period of time; liquidity ratios measure the short-term ability of a company to pay its debts and to meet unexpected cash needs. On the other hand, the leverage ratios are the good measures of the risk perceptions of an organisation.

SUMMARY



1. Profitability Indicators

Profitability ratios are good indicators of the operating efficiency of an organisation. The management of an organisation is usually keen to measure its operating efficiency. Again, the owners/ shareholders invest their funds in the expectation of reasonable returns. The operating efficiency of a firm and its ability to ensure ample returns to its owners/ shareholders depends basically on the profits earned by it. The profitability ratios of an organisation are gross profit margin ratio, operating profit ratio, net profit ratio, expenses ratios (like cost of goods sold ratio, operating expenses ratio and operating ratio), return on capital employed, return on shareholder's equity, earning per share and price earning ratio (P/E ratio), etc.

(a) Gross profit margin ratio

Gross profit margin ratio indicates how efficiently the materials and labour are used by an organisation in order to produce a product at a lower cost. Higher percentage shows better control over the costs and reasonable profit on sales.

$$\text{Gross profit margin ratio} = \frac{\text{Gross profit}}{\text{Sales}} \times 100$$

In the above formula, gross profit is calculated by deducting cost of goods sold from sales revenue.

(b) Operating profit ratio

Operating profit is an income of the company that is generated from its own operations. It excludes income from investment in other businesses. The ratio illustrates what proportion of sales revenue was retained in the form of profits before the deduction of interest and tax. The operating profit ratio measures the operating efficiency and pricing efficiency through cost control.

A company with a high operating profit margin ratio has high gross profit and low fixed costs. This provides management with more flexibility while determining prices. Investors can measure the quality of the company's operations looking at the operating profit margin ratio over the period of time and comparing it with other competitors in the industry.

$$\text{Operating profit ratio} = \frac{\text{Earning before interest and taxes (EBIT)}}{\text{Net Sales}}$$

(c) Expenses ratio

Expense ratio calculates the percentage of sales that have been consumed by cost of goods sold or other operating expenses. High expense ratio is unfavourable since it indicates that expenses are more as compared to income.

$$\text{Cost of goods sold ratio} = \frac{\text{Cost of goods sold}}{\text{Net Sales}} \times 100$$

$$\text{Operating expenses ratio} = \frac{(\text{Administrative expenses} + \text{Selling expenses})}{\text{Net Sales}} \times 100$$

$$\text{Administrative expenses ratio} = \frac{\text{Administrative expenses}}{\text{Net Sales}} \times 100$$

$$\text{Selling expenses ratio} = \frac{\text{Selling expenses}}{\text{Net Sales}} \times 100$$

$$\text{Operating ratio} = \frac{(\text{Cost of goods sold} + \text{Operating expenses})}{\text{Net Sales}} \times 100$$

$$\text{Financial expenses ratio} = \frac{\text{Financial expenses}}{\text{Net Sales}} \times 100$$

(d) Return on capital employed (ROCE)

ROCE is probably the most popular ratio for measuring general management performance in relation to the capital invested in the business. ROCE defines capital invested in the business as total assets less current liabilities, which measures profitability in relation to total assets.

This ratio expresses profits earned as a proportion of capital employed. It illustrates how efficiently the company is using its capital to generate profits.

$$\begin{aligned} \text{Return on capital employed} &= \frac{\text{Earning before interest and taxes}}{\text{Averaged total capital employed}} \times 100 \\ &= \frac{(\text{Net profit after taxes} + \text{Interest} - \text{Tax advantage on interest})}{\text{Averaged total capital employed}} \times 100 \\ &= \frac{(\text{Net profit after taxes} + \text{Interest} - \text{Tax advantage on interest})}{(\text{Average total capital employed} - \text{Average intangible assets})} \times 100 \end{aligned}$$

**Example**

Traco Co's accountant provides the following details. Financial goal of the company for the year 20Y0: ROCE of 10% (minimum). The actual figures are as follows:

	TZS million
Earnings before interest and tax (EBIT)	480,000
Sales revenue	8,000,000
Average capital employed (Equity + Long-term debt)	5,647,000
Previous year's (20X9) ratios were:	
ROCE	9%
Operating profit margin	5%
Asset turnover ratio	1.8

Required:

Comment on the achievement of the financial objective.

Answer

$$\begin{aligned}
 \text{Return on capital employed (ROCE)} &= \frac{\text{EBIT} / \text{Operating profit}}{\text{Capital employed}} \times 100 \\
 &= \text{TZS}480,000 \text{ million} / \text{TZS}5,647,000 \text{ million} \times 100 \\
 &= 8.50\%
 \end{aligned}$$

Actual ROCE of 8.50% is not only below the target ROCE of 10% but also lower than the previous year's ROCE.

The previous year's ROCE of 9% was achieved through an operating margin of 5% and a capital turnover ratio of 1.8 ($5\% \times 1.8 = 9\%$). If the management wanted to increase the ROCE to 10%, it should have raised either the operating margin or the capital turnover ratio or both.

Further analysis

$$\begin{aligned}
 \text{Operating profit margin} &= \frac{\text{EBIT (i.e. Operating profit)}}{\text{Sales revenue}} \times 100 \\
 &= \text{TZS}480,000 \text{ million} / \text{TZS}8,000,000 \text{ million} \times 100 \\
 &= 6\%
 \end{aligned}$$

$$\begin{aligned}
 \text{Asset turnover ratio} &= \frac{\text{Sales revenue}}{\text{Average capital employed}} \\
 &= \text{TZS}8,000,000 \text{ million} / \text{TZS}5,647,000 \text{ million} \\
 &= 1.42
 \end{aligned}$$

It can be seen from the above that the operating profit margin has increased from 5% to 6%. However, this increase was outweighed by the decrease in the asset turnover ratio from 1.8 to 1.42 equating to a 21% ($(1.8 - 1.42) / 1.8 \times 100$) decrease.

A deterioration of the asset turnover ratio indicates that the assets are not being used to generate sales as efficiently as before. It may be that selling prices have been inflated resulting in higher margins but lower sales.

(e) Return on investment (ROI)

In order to overcome the shortcoming of using profit as a measure of performance evaluation, ROI is considered to be the most appropriate performance measure. Return on investment (ROI) is the ratio of profit to investment in operational assets. It is normally expressed as a percentage, and the larger the percentage, the better the ROI.

ROI is normally interchangeable with ROCE as a measure of profitability. ROI is normally used for divisional or investment centre performance appraisal.

$$\begin{aligned} \text{ROI} &= \text{Return on sales} \times \text{Operating asset turnover} \\ &= \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Operating assets employed}} \end{aligned}$$

ROI indicates the profit earned for each dollar invested in the operating assets of a business. Return on investment is the measure which takes into consideration the revenues, costs and investments, by combining these factors into a single percentage.

(f) Return on shareholder's equity (ROE)

Return on equity (ROE) measures how much the shareholders earned on their investment by comparing net income to the average shareholder's equity. High percentage indicates effective utilisation of equity and better return on owner's investment.

$$\text{Return on shareholders equity} = \frac{(\text{Net profit after taxes} - \text{Preference dividend})}{\text{Average shareholder's equity or net worth}} \times 100$$

Where, shareholder's equity or net worth = Paid up share capital + Share premium + Reserves and Surplus – Accumulated losses

Or Net Worth = Total Assets – Total Liabilities

(g) Earning per share (EPS)

The earning per share (EPS) ratio is widely used to measure the profitability of the shareholders' investment. EPS represents the amount of profits attributable to each ordinary share or, what each share has generated in terms of profits. In other words, EPS are the portion of a company's profit allocated to each outstanding share of common inventory. Often, investors compare the EPS of the company with the industry average and with the EPS of other companies before taking investment decisions.

$$\text{Earning per share} = \frac{\text{Net profit available to equity holders}}{\text{Number of ordinary shares outstanding}}$$

(h) Price earning ratio (P/E ratio)

Price earning ratio (P/E ratio) compares current market price of each share with the per-share earnings in order to assess the company's performance. It reflects investors' expectations about the increase in the firm's earnings. A high P/E ratio indicates that investors are expecting higher growth in future compared to companies with low P/E ratio. It is more useful to compare one company's P/E ratio with that of the other companies in the same industry or the market in general and with the company's own P/E ratio of preceding years.

$$\text{Price earning ratio} = \frac{\text{Market price per share}}{\text{EPS}} \times 100$$

(i) Residual Income

In contrast to ROI, which is expressed as a percentage, residual income is expressed in absolute terms (i.e. as a dollar amount). It is the net income earned after deducting a charge (i.e. interest) for the funds invested in the division or investment unit. The charge is determined by taking the organisation's desired minimum rate of return and multiplying it by the amount of the investment. It is calculated as follows:

$$\begin{aligned} \text{Residual Income} &= \text{Profit of the unit} - \text{Charge on investment} \\ \text{Where, charge on investment} &= \text{Investment} \times \text{Desired rate of return} \end{aligned}$$



Example

The management of a company is considering taking up one of two independent projects i.e. Project X or Project Y. The following information is provided:

	Project X (TZS'000)	Project Y (TZS'000)
Sales	31,920	44,900
Cost of sales	23,600	35,600
Investment	146,300	160,200

Note: Rate of return is 5% p.a.

Advise the management on which of the two projects should be accepted, using ROI and RI as measures of performance.

Answer

	Project X	Project Y
Calculation of ROI		
Profit (Revenue – Cost of sales)	TZS8,320,000	TZS9,300,000
$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} \times 100$	$= \text{TZS}8,320,000 / \text{TZS}146,300,000 \times 100$	$= \text{TZS}9,300,000 / \text{TZS}160,200 \times 100$
ROI =	= 5.70%	= 5.81%

Calculation of RI

Charge on investment	TZS7,315,000	TZS8,010,000
= (Investment x Rate of return)	(TZS146,300,000 x 5%)	(160,200,000 x 5%)
	TZS1,005,000	TZS1,290,000
	(TZS8,320,000 –	(TZS9,300,000 –
RI = Income – Charge on investment	TZS7,315,000)	TZS8,010,000)

If return on each dollar invested (ROI) is used for performance evaluation, project Y shows a better return and hence it should be selected. If the residual income basis is used, project Y should be selected because it shows a higher residual income by TZS285,000 (TZS1,290,000 - TZS1,005,000) than project X.

2. Liquidity Indicators

Liquidity ratios measure the ability of a firm to meet its short-term obligations and reflect the short-term financial strength/solvency of an organisation. The liquidity indicators of an organisation are net working capital, current ratio, acid-test ratio or liquid ratio, operating cash-flow ratio, and turnover ratios, etc.

(a) Net working capital ratio

Net working capital (NWC) ratio is used to measure a company's liquidity position. It indicates the amount of funds tied up in inventory. High NWC ratio indicates that the company has a large amount of inventory on hand which affects potential sales opportunities. Therefore, a high ratio is not favourable.

Net working capital ratio	$\frac{\text{Net working capital}}{\text{Net asset}}$

Where, net working capital = Total current assets – Total current liabilities

(b) Current ratio

Current ratio measures the short-term solvency of a firm. It shows the availability of current assets for every one dollar of current liability. The higher the current ratio, the larger is the amount of current assets in relation to current liabilities and the company's ability to meet its current obligations is greater too. If the current ratio is 2:1 or more, the company is generally considered to have good short-term financial strength. If the current ratio is less than 1 (liabilities exceed current assets), the company may face difficulties in meeting its short-term obligations.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

Where, current assets are all assets which can be converted into cash within a year. For example inventories, receivables, cash, bank etc.

Current liabilities are all liabilities which mature within a year. For example, short-term loan, payables, bank overdrafts etc.

(c) Acid-test ratio / liquid ratio

Quick ratio determines the relationship between quick or liquid assets and current liabilities. Liquid assets are the assets that can be easily and immediately converted into cash without loss of value. A quick ratio of 1 to 1 or more represents a satisfactory current financial position of a firm.

$$\text{Acid - test ratio / liquid ratio} = \frac{\text{Quick assets}}{\text{Current liabilities}}$$

Where, Quick assets = Current assets – Inventories

(d) Operating cash-flow ratio

Operating cash flow ratio measures how well the cash flow generated by an organisation's operations covers its current liabilities. It helps to determine a company's liquidity in the short term. If, for a particular year, the ratio is less than one, it means the company has generated less cash during the year than it needs to pay off the current liabilities. It indicates a need to raise money to cover the current liabilities.

$$\text{Operating cash flow ratio} = \frac{\text{Cash flow from operations}}{\text{Current liabilities}}$$

(e) Turnover ratio

Inventory turnover ratio

Inventory turnover ratio identifies the efficiency of an organisation in producing and selling its product. It shows the number of times the inventory is sold or replaced during the given period. A high ratio indicates strong sales or ineffective buying and a low ratio indicates poor sales and excess inventory.

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{average inventory}} \text{ (Times p.a.)}$$

Where,

$$\text{Average inventory} = \frac{\text{Beginning inventory} + \text{Ending inventory}}{2}$$

Receivables turnover ratio

The ratio shows **how long an organisation takes to collect payments from its customers**. It indicates the number of times the receivables turn over each year. The higher the receivables turnover ratio, the better is the **efficiency of the credit management** in the organisation.

$$\text{Receivables turnover} = \frac{\text{Credit sales}}{\text{Average receivables}} \text{ (times p.a.)}$$

This ratio helps the management to analyse and compare (with competitors), its **relationship with its customers and cash management systems**.

Payables turnover ratio

This ratio shows **how long an organisation takes to pay its suppliers**.

$$\text{Payables turnover} = \frac{\text{Credit purchases}}{\text{Average payables}} \text{ (times p.a.)}$$

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Where,

Credit purchases = Gross credit purchases - Returns to suppliers

Average payables = Average of payables (including bills payable) outstanding at the beginning and at the end of the year

$$\text{Defensive - interval ratio} = \frac{\text{Liquid assets}}{\text{Projected daily cash requirement}}$$

Where,

$$\text{Projected daily cash requirement} = \frac{\text{Projected cash operating expenditure}}{\text{Number of days in year (365 days)}}$$

3. Financial risk indicators (Leverage ratios)

Leverage or capital structure ratios are indicative of the long-term solvency of an organisation. Long term solvency of an organisation is the ability of it to assure that long-term lenders with regard to periodic payment of interest during the period of the loan and repayment of the principal on maturity or in predetermined instalments at due dates.

(a) Debt-Equity (D/E) ratio

Lenders and potential investors will look at the ratio to determine if a business is operating efficiently. If the debt-to-equity ratio is too high (i.e. the business is carrying too much debt), lenders will view the business as high risk and the owners may have trouble obtaining new financing. Also, if a business has too little equity, lenders may question how committed the owners are to the business.

A debt-to-equity ratio that is too low usually indicates that the business is not using its cash and profits effectively to obtain business assets. This may discourage investors because it will mean that less profits are distributed to them.

$$\begin{aligned} \text{D/E ratio} &= \frac{\text{Long - term debt}}{\text{Shareholder's equity}} \\ &= \frac{\text{Total debt}}{\text{Shareholder's equity}} \end{aligned}$$

(b) Debt to total capital ratio

This ratio measures a company's financial leverage. The debt-to-capital ratio helps investors to know a company's financial structure, its financial strength etc. The higher the debt-to-capital ratio, the more debt the company has compared to its equity. It indicates whether a company is using debt financing or equity financing more.

$$\text{Debt to total capital ratio} = \frac{\text{Long term debt}}{\text{Permanent capital}}$$

Where, Capital = Shareholder's equity + Debt

(c) Financial leverage (FL)

Financial leverage appears when a company has a fixed financial charge (i.e. interest on debt financing). It helps to determine the level of fixed financial charge and debt financing. The lower the level of the fixed financial charge, the lower will be the financial leverage and vice versa. It is calculated as follows:

$$\text{Financial leverage} = \frac{\text{EBIT}}{(\text{EBIT} - \text{Interests})}$$

(d) Operating leverage (OL)

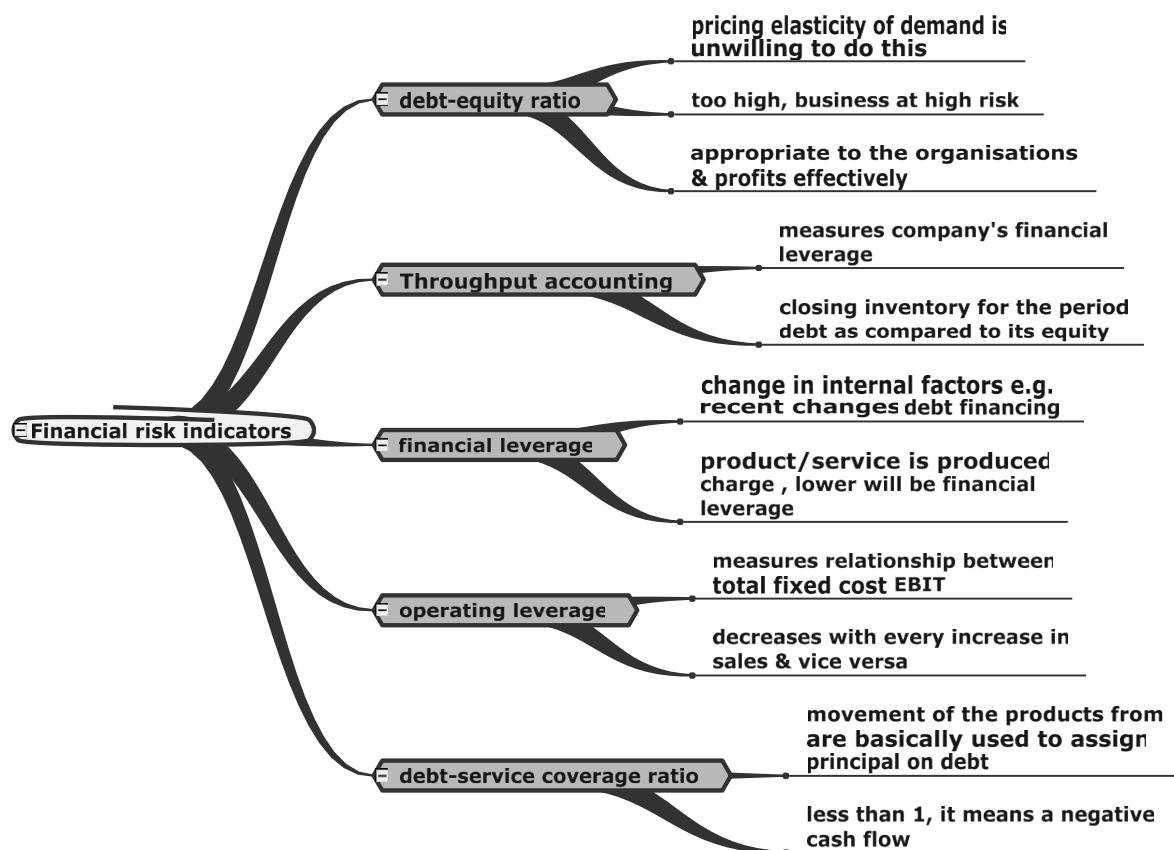
Operating leverage measures the relationship between the sales revenue and the EBIT. It depends upon the level of sales revenue. Operating leverage decreases with every increase in sales and vice versa. It is calculated as follows;

$$\text{Operating leverage} = \frac{(\text{Sales} - \text{Variable costs})}{\text{EBIT}}$$

(e) Debt service coverage ratio (DSCR)

This ratio helps to check a company's ability to pay the total of the principal repayment as well as the interest. The ratio measures cash available to meet annual interest and repayment of principal on debt. If a DSCR is less than 1, it shows a negative cash flow. It indicates that the company does not have enough net operating income to cover debt payments. For example if a DSCR is 85, it means that an organisation is having only enough net operating income to cover 85% of annual debt payments (interest + principal).

$$\text{Debt service coverage ratio} = \frac{(\text{Profit after tax} + \text{interest})}{(\text{Interest} + \text{Repayment of principal})}$$

SUMMARY



Test Yourself 1

The following information is available from the financial statements of Bright Co.

	20X9 (TZS'000)
Current assets	
Inventory	310,000
Trade receivables	440,000
Cash	93,250
Total current assets	843,250
Current liabilities	
Trade payables	313,500
Bank overdraft	66,500
Total current liabilities	380,000

Required:

Calculate current ratio and quick ratio and based on this, assess the liquidity position of Bright Co.

2. Evaluate the results based on business objectives and advise on management action. [Learning Outcome b]

2.1 Business objectives

Business objectives must be in line with the mission statement. Examples of common business objectives include:

- Profitability
- Survival
- Customer satisfaction
- Employee retention
- Maximisation of shareholder value

Organisations develop various strategies to achieve business objectives. Once the objectives are identified, the next step is to break down each objective into action plans. Action plans should be small and manageable projects so that they can be accomplished in time. For example, the objective of increasing annual sales of 12,000 units can be broken down into action plans for increasing sales volume of 250 units per week.

This helps an organisation to make business manageable and less stressful.

The following examples demonstrate the importance of evaluating business results to be used for management action.



Example

	Business objective	Strategy to achieve the objective
1.	Customer satisfaction	Create more interactive and cooperative relationships with customers.
2.	Improving productivity	Enable faster decision making, build trust within and beyond the organisation, and promote innovation.
3.	Controlling costs	Reduce costs by simplifying technology while extending more flexible teamwork options to employees.
4.	Employee engagement	Provide employees with better information access, flexible work options, and more ways to participate.
5.	Innovation and growth	Development of new and innovative ideas to support new products, process improvements, or growth.

2.2 Evaluation of business results

Business results, usually, are very difficult and expensive to measure precisely. However, it is important to evaluate and analyse business results since evaluating the performance of any business is an essential practice to assist in early identification of potential problems and to determine both positive and negative trends in business activities.

Once the evaluation process is complete, management need to focus on improving business performance to bring it in line with the recommendations from the evaluation.

Broadly, financial business results can be measured by:

- Profitability measures
- Cash flow, liquidity and solvency measures
- Efficiency measures

These measures are discussed in Learning Outcome 1.

Non-financial performance of the business can be measured by various techniques like balanced scorecard, VFM technique, performance pyramid, performance prism, building blocks, etc. Some of these are discussed in the later Learning Outcomes.

2.3 Management action to achieve business objectives

Based on the evaluation of business results, management need to take action to achieve their business goals and objectives. It is required especially where objectives are changing. A business may change its objectives over time due to the following reasons:

A business may achieve an objective and will need to move onto another one (e.g. survival in the first year may lead to an objective of increasing profit in the second year).

With a change in the competitors' product designs, the competitive environment may change, which in turn will change the organisational objectives.

Changes in technologies bring changes in product designs. In such cases, sales and production targets might need to be recalculated.

Obviously, in reality, taking action is not as easy as in theories. Hence, the first step is to ensure that the management approach is in the right place. They need to know what they want to achieve, and how they will achieve it. The following steps are required prior to taking any action.

1. Setting goals and deadlines

An organisation needs to build appropriate strategies and set relevant deadlines to achieve business goals.



Example

Plaza Corp wishes to launch a new product in the next half of the current financial year. It needs to build a strategy and set proper deadlines for activities such as research, product design, campaigning, etc. to accomplish the established goal.

2. Structuring time frame to achieve the goal

Relevant deadlines should be broken down into small time frames so that goals can be easily achieved and progress can be effectively monitored.



Example

Continuing the previous example of Plaza Corp

Plaza needs to work out how many hours in each day or week are needed to reach those targets. Accordingly, time frames can be prepared e.g. per day or per week. Plaza also needs to factor idle time while calculating the required labour hours.

3. Being flexible to adopt change

However strong a plan is, it is always subject to change because of changes in market trends, changes in customer preferences, changes in raw material availability, etc. Organisations should always be flexible, and be able to alter the plan in accordance with changes in the internal and external environment.

In conclusion, the following general characteristics of management are essential in order to succeed and effectively and efficiently support the mission, goals and objectives of that organisation.

- Practical programme planning
- Functional management direction
- Innovative management
- Work ethics

3. Explain and assess the use of balanced scorecard methods including evaluation of performance from given data and information.

[Learning Outcome c]

Robert S Kaplan and D. P. Norton (1994) through their study of twelve corporations found that traditional measures of company performance fail to provide guidance to management operating in a competitive environment. Realising the need for a balanced measurement system, they had developed a new measurement system called the Balanced Scorecard. It links the short-term operational goals of an organisation to its long-term objectives and strategy by forcing to control and monitor day to day operations. It defines the entire road map of lead indicators for achieving the goals and constantly reveals what is happening in an organisation.

The balanced scorecard starts with defining the mission, outlining the strategies to achieve the mission, understanding the core customer requirement, defining the internal business process and assessing the organisational infrastructure needed to achieve the objectives. This continually tests the theories underlying management's strategy. The emphasis of the Balanced Scorecard is on progress and improvement rather than on meeting any specific standards.

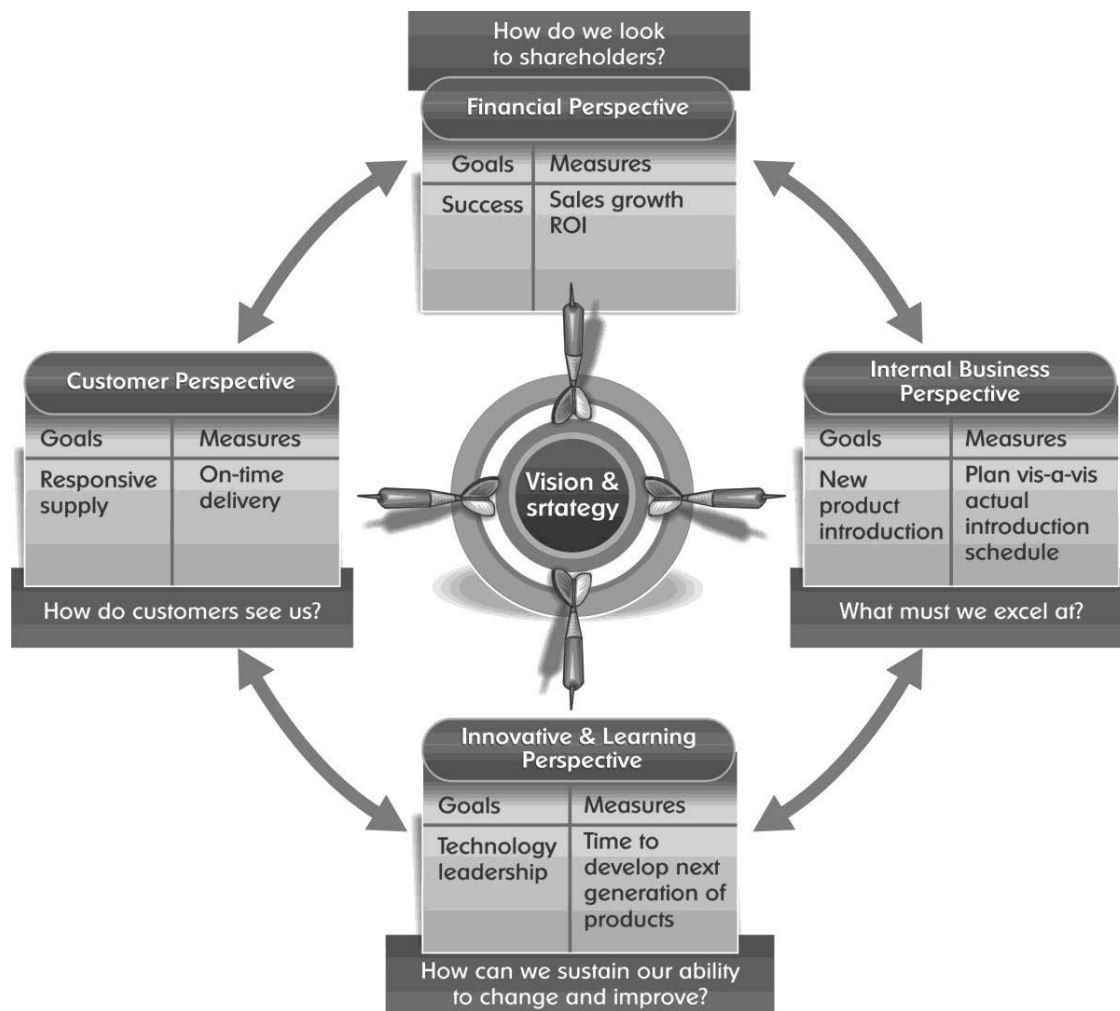
A useful approach for a complete strategic performance evaluation is to include both financial and non-financial factors for an organisation, using the balanced scorecard. The balanced scorecard measures an organisation's performance in four key areas:

- Customer satisfaction
- Financial performance
- Internal business process
- Learning and growth

The main concept of the balanced scorecard is that no one measure can properly evaluate the organisation's progress to strategic success. Rather, multiple measures typically grouped in the four key areas provide the desired comprehensive evaluation of the organisation's performance. Moreover, by attending directly to the firm's critical success factors, the balanced scorecard effectively links the performance measurement / evaluation to the organisation's strategy. The Balanced Scorecard is made of the following components:

- Formulation of strategy in tune with the institutional vision and mission.
- Translation of institutional strategy into measurable performance goals for each unit based on cause and effect relationship.
- Define assessment policies and procedures including criteria of success.
- Design data collection and analysis tools.
- Monitor and measure actual performance.
- Align strategies, intended outcomes and assessment procedures in the light of assessment results.
- Report recommendations for improvements to the strategic committee for review and use in strategic planning.

Diagram 1: A format of Balanced Scorecard



3.1 The key performance indicators

For each of these perspectives, there are different performance measures.

1. Financial

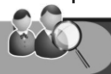
This covers the financial performance measures. This area assesses whether the organisation's strategy and its implementation contribute to the bottom line improvement of the company. This stage represents the long-term performance. According to the founders, Kaplan and Norton, this can be assessed in three stages i.e. rapid growth, sustain and harvest.

Stages	Measures
Growth	Sales volumes, increase in profit etc.
Sustain	Return on investment, the return on capital employed
Harvest	Payback periods and revenue volume

Other measures in this perspective include EVA, increase in revenue and reduction in cost.

2. Customer

Customers are one of the most important stakeholders of the organisation. An organisation cannot grow, sustain and harvest in the long run if it ignores the customer. A customer has a perception of organisations which will help him to take purchase decisions.



Example

Apple is known for its innovative products. This is the image Apple has amongst customers. Therefore someone who wants a new personal computer or laptop may choose to buy from Apple rather than another company. An organisation may be known for its good customer service. Again, this will attract customers to the organisation.

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The image a company has amongst customers can be assessed by customer retention rate, customers' complaints, on-time delivery, % sale of new product etc.

3. Internal business processes

This is about deciding what the organisation should do to satisfy and retain its customers. Internal business processes aim at operations, customer management and innovation e.g. introducing an innovative process or providing after-sales service.



Example

The following objectives and measures fall under this perspective:

Objectives	Measures
Technological capability	Manufacturing geometry vs. competition
Innovative new product	% of sales from new products
Manufacturing excellence	Cycle time, unit cost and yield
Decrease launch time of new product	Actual launch date vs. plan, actual time taken to launch a new product
Increase design productivity	Engineering efficiency

4. Learning and growth

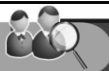
This is about focusing on the resources and intangible assets of the organisation, such as the capabilities of its personnel, its employee satisfaction and its information systems that are needed to conduct the activities decided in the internal business processes.



Example

The following objectives and measures fall under this perspective:

Objectives	Measures
Technology leadership	Time to develop next product
Manufacturing learning	Process time to maturity
Information system excellence	Cost feedback available, % of available on-line information to customers
Time to market	Time taken vs. competitors, actual time taken
Product focus	% of products that equal 80%

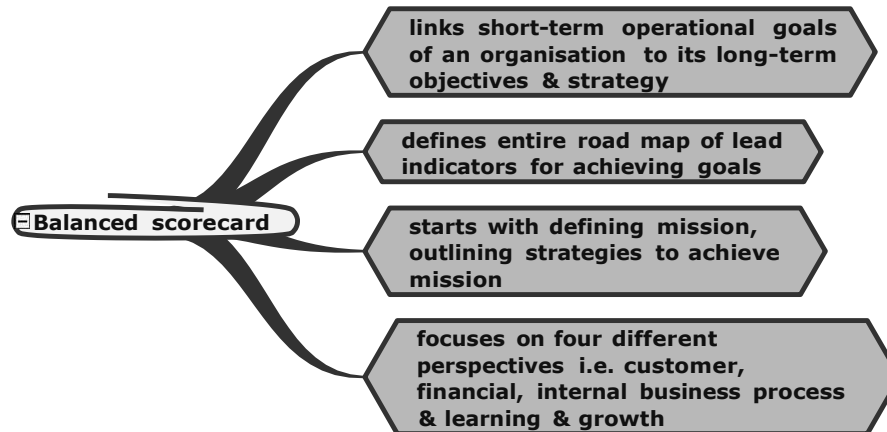


Example

Fly-high is an aviation company operating in Scotland and uses a balanced scorecard method. The objectives, measures, targets and initiatives of Fly-high are presented in the table below:

Perspective	Objectives	Measures	Targets	Initiatives
Financial	Profitability	Market value	25% per year	Optimise routes
	Reduced costs	Plane lease cost	5% per year	Standardise planes
Customer	On-time flights	On-time arrival rating	Leader in industry	Quality management
	Increased customers	Number of customers	99% satisfaction	Loyalty programme
Internal business processes	Reduced delays	Number of delays vs. total take-offs OR On-time arrivals / departures vs. total arrivals / departures	Reduce by 6%	Cycle time optimisation
Learning and growth	Product focus (routes)	Route producing 80% sales	Year 1 - 12 Year 2 - 14 Year 3 - 15	
	Employee development	Employee training	Year 1 - 75% Year 2 - 90% Year 3 - 100%	Training programmes

SUMMARY



Test Yourself 2

Categorise the following into Financial, Customer, Internal Business Processes or Learning and Growth:

Objective	Measure
1. To be the cost leader in the market by 20X8	a) Actual launch date vs. plan
2. To reduce customer complaints by 99% within 12 months	b) Customer retention rates
3. To reduce product launch delays	c) Return on capital employed (ROCE)
4. To reduce the time to market to a minimum by 20X8	d) Engineering efficiency
5. To increase profitability by 20% by 20X7	e) Time compared to that of competitors
6. To achieve 99% customer satisfaction within 5 years	f) Unit cost
7. To increase market share by 10% by 20X7	g) Employee training
8. To increase design productivity	h) Revenue growth
9. To train and develop all team leaders by 20X7	i) Cycle time
10. To bring manufacturing excellence by 20X8	j) Number of new customers
11. To acquire 10% new customers	k) Customer feedback or complaints

4. Explain and evaluate the use of value for money (VFM) techniques in performance management.

[Learning Outcome d]

Value for money generally signifies the following three elements relating to the internal operations of an organisation and its use of money:

economy
efficiency
effectiveness



Definition

- Economy** implies the principle of prudence i.e. minimum cost should be incurred for acquiring / using resources, while maintaining the appropriate quality.
- Efficiency** is concerned with the relationship between the resources (input) and the output of goods, services or other results. Ideally, minimum input should be used for a given output and maximum output should be achieved for a given input
- Effectiveness** is concerned with the relationship between the planned results and the actual results of projects, programmes or other activities. To what extent do the outputs of goods and services or other results successfully achieve policy objectives, operational goals and other planned effects?

It is important to remember that regardless of the type of organisation, the basic assessment techniques of the three Es – economy, efficiency and effectiveness – remain the same. The three measures may be in conflict with each other, but also may sometimes complement each other.



Example

Purchasing a cheap version of an item (economy) may help maximise the number of units that may be obtained for a given sum of money (efficiency). This may be at conflict with the desired objective of a high standard of performance from each of the units (effectiveness).



Example

An example from a housing department viewpoint could be the desire to improve the quality of housing to occupants through a policy of installing double glazed windows. The purchase of cheap window units (economy) may help to increase the number of houses which can be converted (efficiency). But this economy could possibly lead to dissatisfaction due to poor performance of the units e.g. high condensation and poor sound proofing and hence the non-achievement of improved quality of living (effectiveness).

A management accounting system should be capable of providing information to management about value for money. Whether VFM could be achieved or not and reasoning for the action should be reported to management.

Ideally, the assessment of these factors is carried out as a routine activity in business organisations. This is because business organisations (i.e. profit oriented organisations) have financial objectives which automatically take these Es into consideration. However, this is not the case with not-for-profit organisations which have non-financial objectives. Therefore, such organisations must make a conscious effort to assess whether their activities follow the three Es.

VFM considers financial performance. However, non-profit seeking firms also consider non-financial performance, such as quality.

Diagram 2: Value for money



Example

Brilliant Academy is a public sector school. It offers vocational education to students and provides them with the necessary materials at very low prices. The academy participated in an education fair with the objective of promoting the organisation and attracting more students. The volunteers working in Brilliant Academy went to the fair to explain how the organisation works.

Discuss various criteria to assess the 'value for money' of the participation in the education fair.

Answer

To assess the VFM of the participation in the education fair, the 3 Es should be evaluated i.e. economy, efficiency and effectiveness.

This can be carried out by considering the following factors:

1. Objectives

The effectiveness of the seminar can be assessed by measuring how far the objectives of the seminar were achieved. Brilliant Academy participated in the education fair to promote the organisation and attract more students. The higher the number of students who visited Brilliant Academy's stall, the better the objective has been achieved. Therefore the number of students who visited Brilliant Academy's stall can be used as a measure of value for money.

Continued on the next page

2. Cost incurred

The main cost of participating in the fair was the cost of occupying a stall. In addition to this, other costs such as the cost of the brochures distributed at the fair and the opportunity cost of the volunteers working at the fair should also be considered.

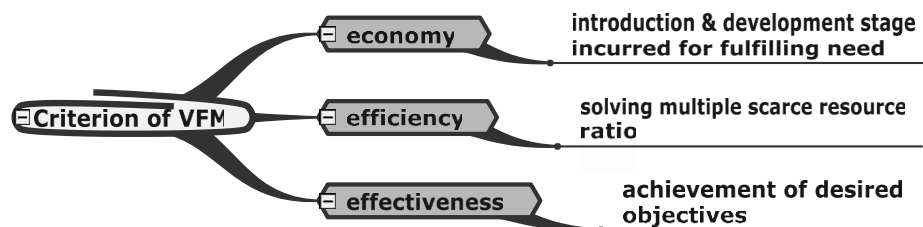
3. Explaining the operation of the organisation

The objective of Brilliant Academy and the activities that it conducts etc. should have been explained at the fair. The volunteers should have been well equipped to do this. They should have a thorough knowledge of the organisation and be able to talk about their experiences of working for the organisation with the students.

4. Response

The best way of assessing the effectiveness and analysing the cost benefit of participation in the fair is to assess the response of the students immediately after the fair. The higher the number of students who enrol at the academy, the more effectively the objective has been achieved.

SUMMARY



Test Yourself 3

Sunshine is a hospital run on a not-for-profit basis. It has a staff of 600 people. Harry has recently joined the management of Sunshine. In his first year of working at the hospital, he notices that the hospital is spending a lot on housekeeping expenses.

He also notices the following facts:

1. There is 25 staff appointed to clean 30 rooms.
2. Average salary paid to the housekeeping staff is TZS2 million per month per person.
3. The housekeeping workers take excessive time to clean the rooms and therefore more people are hired than are actually necessary.

Harry immediately reduces the number of housekeeping staff employed to 18.

Required:

Evaluate the value for money of the housekeeping staff.

5. Select and explain stakeholder based measures of performance that may be used to evaluate social or environmental performance of a business.

[Learning Outcome e]

Stakeholders are people who have an interest or stake in the operations of the company. Decisions made by a business are likely to affect one or more of these "stakeholder groups". The following are the prime stakeholders of an organisation:

- Board of directors
- Shareholders
- Employees
- Institutional investors
- Customers
- Government and other authorities
- Pressure groups

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An important development in stakeholder engagement has been the rapid growth in reporting to stakeholders on environmental performance, then social performance.

5.1 Stakeholder based measures of performance

In most of the organisations, formal performance measurement systems are used that are extensions of their financial reporting systems. However, criticisms of conventional performance measurement systems have been increasing. Critics are of the opinion that financial performance measures lack the essential variety to give decision makers the range of information they need to manage processes. The conclusion is that performance measurement systems lack the focus and strength required for internal management and control. They ignore important issues like customer satisfaction and provide little or no basis to judge the effectiveness of processes like personnel relations systems.

A stakeholder approach of developing a model of performance measurement captures strategic planning issues. Stakeholders can determine the performance of a business through measures like balanced scorecard, EVA, SVA and the environmental and social reporting of the organisations.



Tip

Social performance measures how well an organisation has transformed its social goals into practice through the principles, actions and corrective measures implemented.
Environmental performance evaluates the track record of national governments against specified objectives of environmental quality and resource use efficiency.

5.2 Impact of environmental, social and ethical factors on performance measurement

1. Environmental factors

Environmental factors may include matters such as the efficient use of resources (energy, raw materials and other inputs) product biography (effect of the products on humans and the surrounding environment), waste management and pollution.

2. Social and ethical factors

Social and ethical factors would include employees' satisfaction, health & safety standards, corruption and compliance with local laws.

They are interrelated: environmental, social and ethical factors are all closely related. In fact, one issue may have more than one facet i.e. environmental, social and ethical.



Example

A chemical company releases chemical waste into a nearby river. This contaminates the river water and poses a health risk to the people using that water. The polluted water also kills fish and other species in the water. The company's action is therefore wrong from environmental, social as well as ethical points of view.

Gone are the days when the performance of an entity was measured only on the basis of the financial profit shown by its statement of comprehensive income. Increasing awareness of environmental and social responsibilities has increased people's expectations of companies. They expect companies to earn profits and not only to abstain from damaging the environment but also to contribute positively to the improvement of the environment and society.

Companies must aim at sustainable development. According to the Global Reporting Initiative (GRI), the goal of sustainable development is to "meet the needs of the present without compromising the ability of future generations to meet their own needs."

Twenty-first century companies are including performance on economic, environmental as well as social fronts in their performance measurement. This is called a **triple bottom line approach**. (3BL) Companies are voluntarily shouldering corporate responsibility. Corporate responsibility is a mechanism by which companies voluntarily integrate social and environmental concerns into their operations and their interaction with stakeholders. These commitments are over and above their legal responsibilities.



Case Study

A typical 3BL performance report may include issues such as those mentioned in the following case study relating to Megablock Ltd

Economic performance	US \$6 billion in turnover US \$20 billion in market capitalisation
Environmental performance	Water positive corporation for 3rd successive year Moving towards being a carbon positive corporation Targeting zero solid waste
Social performance	Empowering 7.5 million farmers Providing health care for over 80,000 women and children

This Case Study illustrates how environmental and social factors may affect the assessment of investments. Investors prefer companies which are performing well on all fronts.

However, this assumes that the reporting on these issues is done honestly. An environmental audit is conducted to ensure honest reporting of factors related to the environment. As mentioned earlier, some reporting frameworks are being used to standardise the process. However, reporting on these issues is still evolving.

5.3 Environmental report

Many companies have started to provide environmental reports in addition to their financial reports. The following is a specimen of the contents of one such report:



Case Study

Glowell's environmental report contents

Our Commitment to Environmental Management

Company Profile

Raw Materials

Significant Environmental Effects

Environmental Policy

Responsibility & Accountability for Environmental Management

- Environmental Audits
- Risk Assessment
- Objectives and Targets
- Training
- Research and Development

Our Stakeholders

- Customers
- Regulators
- Suppliers
- Employees
- Shareholders
- Community
- Finance

Objectives and Targets

Data

Conclusions

- What are the three most important environmental priorities?
- What are the three best accomplishments?
- What are the three biggest challenges?
- In what ways are we addressing sustainability?

Validation Statement

5.4 Why might entities include disclosures relating to the environment and society?

1. Performance

Investors prefer to invest their money in companies or managed funds that share their values and beliefs about 'what is right' not only economically, but also environmentally and socially. Nowadays, there is an increasing belief that environmental, social and governance issues have a material impact on portfolio value.

There are many new frameworks available to help companies measure their performance on environmental, social and ethical issues.

Financial performance can be measured in tangible terms such as the amount of profit. Issues such as the impact of a company's operations on the environment and its relationships with staff, suppliers and the communities in which it operates its business are less tangible. However, for investors deciding whether or not to invest in the company, this performance is as important as the financial performance.

Ethical performance takes into consideration not only traditional investment practices, but also the values and beliefs of the person or organisation. Investors will compare the performance of an entity against the values and beliefs it claims to be guided by. Ethical issues tend to be subjective and will have varying degrees of importance depending on the values of the individual or organisation



Example

A person may decide not to invest in the alcohol manufacturing industry because they believe that it encourages alcoholism.

Much research has been carried out into whether companies following socially responsible policies give better financial returns to investors.

The European Centre for Corporate Engagement (ECCE) concluded from these studies that "Even though they do not present irrefutable evidence that socially responsible investments generate higher returns than "normal" investments, most studies have found that they do not result in worse performance, either, while, at the same time, they might actually decrease risk exposure."

Companies usually collect and deal with a lot of environmental, economic and social information. The challenge is to summarise this large amount of information into a limited number of key indicators, so that the company can measure its performance and take decisions about further progress.

2. Risks

While investors may find it difficult to quantify environmental and social factors, they find it easier to identify that there is a risk involved in a certain investment if it performs badly on environmental, social or ethical fronts. It is natural for investors to avoid risky investments.

Institutional investors are more proactive in that they demand disclosures related to the environment and society. Unless companies keep their investors happy, they will find it difficult to attract capital.

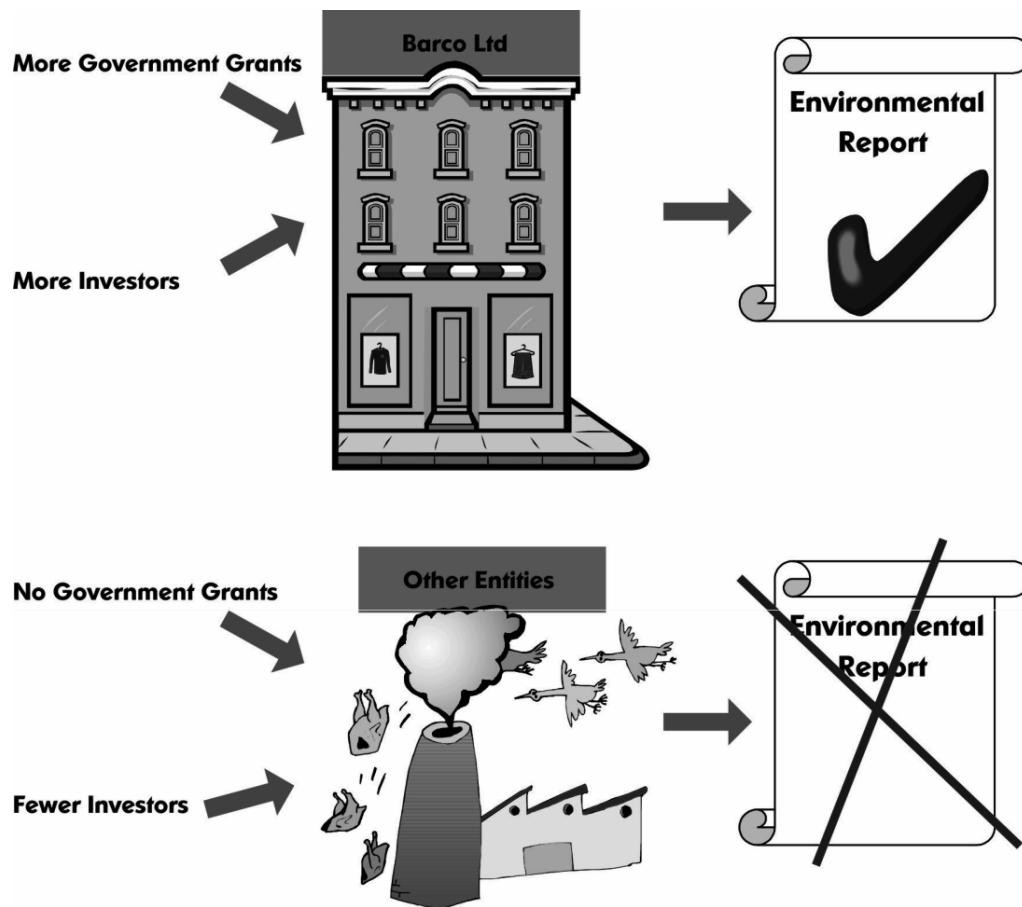
The government also encourages entities to follow ethical practices and report their performance by giving external awards and endorsements e.g. environmental league tables and employer awards. Similarly, awards are given by professional bodies such as the ACCA.

These are some of the reasons for which companies might include disclosures relating to the environment and society.

However, previously, information on these matters was not provided at all, or the information provided was descriptive and not quantified. Recently, some initiatives have been taken which attempt to set out a framework for reporting.

Market forces themselves will not achieve the degree of consistency required in environmental reports. These reports need to be regulated by an official national or international standard-setting body.

Diagram 3: Benefits of environmental reporting for entities



Need for voluntary disclosure

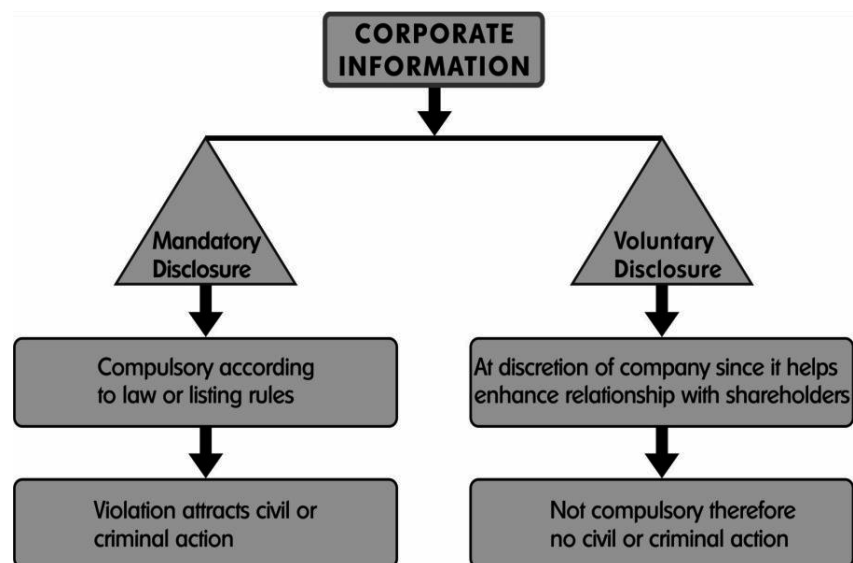
Apart from mandatory disclosures which we have discussed in various IFRS/IASs, there are certain other voluntary disclosures that companies make. These are also components of the annual report and are disclosed although they are not mandated by law or regulation.

Voluntary disclosures made by companies may include:

- (a) The chairman's and the CEO's statements regarding the company position. These are required since they will instil a sense of confidence in the company amongst the readers. Even if this information is provided voluntarily, it needs to be given to enhance the value of the report.
- (b) A corporate social responsibility report that contains details of the CSR activities carried out by the company. These are generally referred to as sustainability reports now.
- (c) A narrative operating and financial review report that is understandable to all readers of the statements i.e. not just understandable to the technical experts. This document should be future-oriented and should narrate the financial performance and prospects of the company. Investors generally demand a report of this kind in order to obtain an idea of the various risks and the social and environmental projects carried out by the company.
- (d) An annual report circulated in the AGM that provides a picture of the company. Beyond this annual report, the company may also make disclosures through the various media forms e.g. press releases, analyst's reports on the company's performance and forecasts made by management.

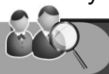
The major difference between mandatory and voluntary disclosures is that **mandatory disclosures are always compulsory** under a provision in company law, the Listing Rules or any other regulations applicable. **Voluntary disclosures are, however, at the discretion of the company.** These disclosures are given by the companies since they add value to the reports and help to improve relations with shareholders.

Diagram 4: Corporate information



The main motivations behind voluntary disclosures in a principles-based reporting environment are:

1. The new reporting regime requires companies to address their social responsibilities and accept corporate accountability for any actions and decisions they take. Many companies use these disclosures as a tool to build social relationships with shareholders. Social and environmental reporting has been used by companies to portray an ethical image so that the share value of the company increases.
2. Ethical companies might provide information in the annual report regarding the various risks that the business faces and the environmental programmes that the company has undertaken since they believe that the shareholders need to know this.
3. Providing voluntary disclosures in the annual reports helps to improve a company's communication with its shareholders since it encourages dialogue and a sense of ownership of the company. Such disclosures in the annual report may help to initiate a discussion at the AGM itself. Stakeholders' confidence in the company may also increase.
4. Voluntary disclosures regarding the risks and opportunities that the business faces also help to bridge the information asymmetry between the directors and the shareholders.



Example

Ninja Plc manufactures pesticides. Its annual report for the year 20X7 contained a disclosure that the company faces an operational risk if its market competitors reduce the price of their product from the existing TZS5,000 per litre of pesticide to TZS4,000 per litre of pesticide. This is because the company will make losses if it sells the pesticides at a price of TZS4,000 per litre.

5. Increased transparency in reporting through various voluntary disclosures can help to attract and retain institutional and other major investors in the company. This, in turn, helps to reduce the cost of capital since shareholders continue to invest in the company on the same terms, i.e. without the incentive of higher returns, because they believe in the company.



Example

Excellor Plc has been regularly reporting in its annual report about the various foundations it supports and the social benefits that women and children from various backward areas have received through its initiatives. It also keeps the shareholders informed of any upcoming projects along with the various risks that the business faces in the form of competitors, finance requirements, labour unions etc.

Pension Funds (an institutional investor) has been investing in the company for the last 10 years and wishes to continue investing even though the company has increased its rate of dividend only once in the last 5 years. This is because the transparency in its operations that Excellor has maintained confirms that it is an ethical company and hence investors can always earn money by trading its shares on the market. This has helped to reduce the cost of capital for Excellor.

6. Many countries have now made several voluntary disclosures compulsory under law as a part of corporate governance best practices. Any non-compliance can result in civil action in courts. E.g. companies in the UK are required to publish CSR reports regarding the various social activities they have undertaken.
7. Mandatory external reporting of internal controls and risks will ensure accountability. This in turn will mean that internal control failures and business probity risks will be intimated to the shareholders at an early stage and will be nipped in the bud as the existing board can be replaced before the position becomes more serious.
8. Information on internal controls would enhance shareholder confidence and satisfaction.
9. Compulsory external reporting on internal controls will encourage good practice in the company.



Test Yourself 4

Crazy Shapes Plc owns a plant producing plastic products. The company has been fined by the authorities for damaging the environment through improper disposal of harmful waste. In response, Crazy Shapes has hired a consultant to seek advice on how to avoid this situation. The consultant presents a report stating that Crazy Shapes is not only disposing of harmful waste but is also consuming a large amount of energy and its carbon emissions are also high. The report also states that Crazy Shapes could safely dispose of its waste by treating it before disposal.

Crazy Shapes Plc took the following steps during the current year:

1. steadily reduced its emissions
2. used electricity from renewable sources
3. did not breach any local environment laws
4. obtained further advice on its carbon emissions and steps to reduce these emissions

Required:

State the content of Crazy Shapes Plc's environmental report which will be helpful for stakeholders to measure performance.

Answers to Test Yourself

Answer to TY 1

Calculation of Current ratio

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{\text{TZS}843,250,000}{\text{TZS}380,000,000} = 2.22 : 1$$

This implies that Bright Co has TZS2.22 worth of current assets for each TZS1 worth of current liabilities. In other words, the current assets of Bright Co are more than double its current liabilities. This means that Bright Co has enough current assets to convert into cash to pay its current liabilities.

In addition, Bright Co has a high proportion of assets in the form of receivables which are considered to be more liquid than inventory, because converting inventory into cash may take a long time as it depends on sale of the inventory. On the contrary, a trade receivable can be converted into money quickly provided the receivables are not bankrupt.

Calculation of Quick ratio

$$\begin{aligned} \text{Quick ratio} &= \frac{\text{Quick assets}}{\text{Current liabilities}} \\ &= \frac{\text{TZS}(843,250,000 - 310,000,000)}{\text{TZS}380,000,000} \\ &= \frac{\text{TZS}533,250,000}{\text{TZS}380,000,000} \\ &= 1.4 : 1 \end{aligned}$$

Remember to deduct the amount of inventory from total current assets.

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This shows that Bright Co has TZS1.4 worth of quick assets for each TZS worth of current liabilities. This means that Bright Co has sufficient assets to quickly convert into cash, if its current liabilities fall due. The quick ratio of Bright Co can be considered satisfactory as it is not below 1.

Hence the analysis of both ratios indicates that Bright Co has a strong liquidity position and sound short-term solvency.

Answer to TY 2

1. Finance

Objective	Measure
To be the cost leader in our market by 20X7	Unit cost
To increase profitability by 20% by 20X7	Return on capital employed (ROCE)
To increase market share by 10% by 20X7	Revenue growth

2. Customer

Objective	Measure
To reduce customer complaints by 99% within 12 months	Customer feedback or complaints
To achieve 99% customer satisfaction within 5 years	Customer retention rates
To acquire 10% new customers	Number of new customers

3. Business processes

Objective	Measure
To reduce launch delays	Actual launch date vs. plan
To bring manufacturing excellence by 20X8	Cycle time
To increase design productivity	Engineering efficiency

4. Learning and growth

Objective	Measure
To reduce the time to market to a minimum by 20X8	Time compared to that of competitors
To train and develop all team leaders by 20X6	Employee retention rates

Answer to TY 3

The value for money can be assessed with the help of the 3 Es i.e. economy, efficiency and effectiveness.

(a) Economy

Economy evaluates how wisely funds are utilised. By reducing the number of people working in housekeeping, Harry achieves economy. He saves TZS14 million per month.

(b) Efficiency

In this case, efficiency is the performance of an act in the required time. Harry takes the decision to reduce the number of housekeeping staff immediately i.e. without wasting any time. He noticed that the workers were not working efficiently and therefore there were more housekeeping staff than required which led to idle time. It is likely that, due to Harry's decision, the workers will begin to work efficiently. This is because they know that unless they perform efficiently, it is unlikely that they will retain their job. In this way, Harry will also improve the efficiency of the workers.

However, if the time taken by the workers is actually necessary and the standards were wrong then Harry's decision will result in a reduction in the efficiency of the workers.

Nevertheless, Harry was very efficient in taking his decision since he took the decision very quickly.

(c) Effectiveness

According to VFM, effectiveness is the achievement of the optimal solution for the proposed problem. The work has to be carried out within a required time using the available resources. In this case, Harry has reduced the number of staff on the basis that too many had been appointed. This step will reduce the hospital's costs. It can be said that Harry is effective in taking quick decision. However, the results of the decision are not known i.e. whether, after reducing the number of staff, the housekeeping service will be good.

However, at the same time, the issue of patient satisfaction arises. There may be times when the volume of patients in the hospital will suddenly increase, e.g. at weekends. It is not yet known whether, having reduced the number of staff members, the housekeeping staff will still be able to provide a good service at these times.

Answer to TY 4

The content of Crazy Shapes Plc's environmental report would include the following points:

- (a) Disclosure of the environmental policy stating the business activity in total (the use of renewable electricity and the reduction of emissions could be included in this)
- (b) The management strategy implemented in the minimisation of environmental risks
- (c) The environmental training given to the staff
- (d) The statistics of its verified emissions to air / water and land, and a report on its environmental performance in these areas.
- (e) Its line of action to further reduce emissions (this may include the operating site reports for local communities for businesses with high environmental impact)
- (f) The data on emissions presented in the form of graphs, the current emissions of carbon dioxide and the electricity used compared to those of previous periods (this would give a clear idea of the entity's environmental performance and improvement during the current period)
- (g) Details of any fines and penalties
- (h) The historical trends for key indicators in comparison with the corporate targets

Quick Quiz**1. State true or false**

- i. Effectiveness implies the maximising of the output input ratio.
- ii. Economy focuses on the achievement of the desired objectives.

2. Fill in the blanks

- i. The value for money principle focuses on _____, _____ and _____ in any activity of the organisation.
- ii. _____ should be capable of providing information to management about _____.
- iii. _____ are the tools used by financial analysts for making decisions regarding credit and investments.
- iv. _____ starts with defining the mission, and outlining the strategies to achieve the mission

3. Categorise the following under the headings "environmental factors" and "social & ethical factors":

efficient use of resources
 employees' satisfaction
 product biography
 waste management
 health and safety standards
 corruption
 compliance with local laws
 pollution

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4. State whether the following statement is true or false: "Environmental and social & ethical factors are not related to each other. They are separate factors."
5. State the environmental and social performance indicators.

Answers to Quick Quiz

1. True or false

- i. False. Effectiveness is concerned with success in achievement of desired objectives.
- ii. False. Economy focuses on obtaining inputs at the lowest possible cost.

2. Fill in the blanks

- i. Economy, efficiency and effectiveness
- ii. Management accounting system, value for money
- iii. Financial performance indicators
- iv. Balanced scorecard

3.

Environmental factors	Social and ethical factors
Efficient use of resources	Employees' satisfaction
Product biography	Health and safety standards
Waste management	Corruption
Pollution	Compliance with local laws

4. **False.** Environmental and social and ethical factors are closely related as one issue may have more than one aspect i.e. environmental as well as ethical and social.

5. The environmental performance indicators are:

materials
energy
water
biodiversity
emissions, effluents, and waste
products and services
compliance
transport

Social performance indicators are:

community
corruption
public policy
anti-competitive behaviour
compliance

Self Examination Questions

Question 1

Mike is responsible for the purchases in a hospital which is run to serve the needy and not to make profit. Whenever a medicine is in short supply, a purchase request is sent to Mike. As soon as Mike receives the purchase request, he calls up a particular supplier on the list of approved suppliers and places an order for the medicine. The supplier assures 'next day delivery'.

Shelly is the newly appointed management accountant and she has noticed that, in certain invoices, the supplier has charged an additional TZS100,000 for 'next day delivery'.

Required:

Evaluate the matter in the context of value for money.

Question 2

Taste-Me is a company that manufactures consumable edible products. Statistics related to performance evaluation are as follows:

Details	20X7 (TZS'000)	20X6 (TZS'000)	Target (TZS'000)
Cost per unit (average)	125.00	130.00	121.00
Selling price per unit (average)	172.00	159.00	170.00
Selling price of competitors	165.00 to 170.00	155.00 to 160.00	
Return on capital employed	18%	20%	22%
Revenue growth	6%	4%	8%
Customer complaints	5%	10%	Reduce by 80%
Customer retention rate	47%	48%	Increase by 30%
Number of new customers	360	300	Increase by 25%
New food products launched	25	20	30
Employee retention rate	78%	75%	85%
Delivery on time with reference to orders placed	92%	90%	98%

Required:

Evaluate the company's performance using the balanced scorecard.

Answers to Self Examination Questions**Answer to SEQ 1**

Value for money (VFM) is continually associated with the achievement of the 3 Es i.e. effectiveness, efficiency and economy in operations.

(i) Effectiveness

Being effective means getting the work done. Mike is very effective in the sense that he obtains the medicine within a very short time period i.e. instead of say, five days he obtains the medicine within one day.

(ii) Efficiency

Efficiency is related to factors such as time. The information states that "as soon as Mike receives the purchase request"; he places the order. Therefore Mike is efficient in carrying out his work.

(iii) Economy

Economy is how prudently money is used. In the given case, money is not used prudently. This is because, for certain orders, an extra TZS100,000 was paid. This cost could have been avoided by placing the order in advance.

In addition, Mike procures the orders from "a particular supplier on the list of approved suppliers" without making enquiries into the rates and delivery charges of the other approved suppliers. This particular supplier may not have offered the cheapest terms.

Mike was therefore effective and efficient in the achievement of his objective but did not take the most economic course of action.

532: Performance Measurement and Control

Answer to SEQ 2

Evaluation on the basis of the balanced scorecard

(i) Financial perspective

Measures	Actual 20X7	Previous year 20X6	Targets	Evaluation of performance
	TZS'000			
Cost per unit	125	130.00	121	Cost per unit has reduced by TZS5,000. It is better than the previous year, but the target has not been achieved.
Selling price per unit	172	159.00	170	Selling price per unit has increased by TZS13,000. Competitors are also increasing their prices. However, the increase by Taste-me is higher. This may affect the quantity of sales / number of customers.
Return on capital employed	18%	20%	22%	ROCE has reduced by 2%. This is poor in comparison to the previous year and the target.
Revenue growth	6%	4%	8%	Sales revenue growth has increased to 6%. The target was to increase to 8%. Taste-me did not meet the target.

(ii) Customer perspective

Measures	Actual 20X7	Previous year 20X6	Targets	Evaluation of performance
Customer complaints	5%	10%	Reduce by 80%	Target was to reduce customer complaints by 80% but they were only reduced by 50%
Customer retention rate	47%	48%	Increase by 30%	Customer retention rate decreased by 1%. This may be related to the selling price. Since the selling price is high, customers may have gone to competitors.
Number of new customers	360	300	25% rise	Target was to increase by 25%, however, actual increase was only 20%.

(iii) Business processes perspective

Measures	Actual 20X7	Previous year 20X6	Targets	Evaluation of performance
Launched new food products	25	20	30	Launched 5 new products compared to previous year. However, target is not achieved.
Employee retention rate	78%	75%	85%	Increase of 3% compared to the previous year. However, target is not achieved.

(iv) Learning & growth perspective

Measures	Actual 20X7	Previous year 20X6	Targets	Evaluation of performance
Delivery on time with reference to orders placed	92%	90%	98%	Ratio has increased by 3%. Better than previous year, but lower than target.

SECTION E2: DIVISIONAL PERFORMANCE AND TRANSFER PRICING

Get Through Intro

The transfer of products and services between the divisions of an organisation is very common in the case of vertically-integrated organisations. Determining the exchange price is a challenge for management because the ideal price is one that is desirable not only by management but also accepted by the tax authorities. In the era of global integration, transfer price is often used as a tax evasion technique by organisations which have a business arm in different countries.

Although transfer price does not affect the performance of the organisation as a whole, it has an impact on the performance of the divisions. The transfer pricing policy normally has an influence on performance measures such as 'return on investment' and 'residual income' of the departments / divisions.

A management accountant can perform an important strategic role in the transfer pricing policy by successfully fulfilling the many objectives of transfer pricing. This SECTION takes you through the various bases of determining transfer price, other measures of performance evaluation and also tells you how transfer price influences divisional performances. The knowledge obtained from this SECTION will not only help you, in your future role as a management accountant, to determine a transfer price that will be accepted by management as well as the tax authorities; but also to answer the relevant questions in your examination.

Learning Outcomes

- Describe and illustrate the basis for setting a transfer price, variable cost, full cost, market based approach, negotiated approach and the principles behind allowing for intermediate markets.
- Illustrate how transfer prices can distort the performance assessment of divisions and decisions made.
- Describe the meaning of, and calculate, Return on Investment (ROI), Residual Income (RI), Economic Value Added (EVA) and Shareholder Value Added (SVA) and assess their benefits and shortcomings.
- Describe the nature of, and calculate the productivity measures.

1. Describe and illustrate the basis for setting a transfer price, variable cost, full cost, market based approach, negotiated approach and the principles behind allowing for intermediate markets.

[Learning Outcome a]

1.1 What is 'transfer price'?

A transfer price is the price one department / division charges for a product or service supplied (i.e. transferred) to another department / division of the same organisation. In other words, transfer price is **a price at which the goods / services are internally transferred from one division to another within an organisation.**

The goods which are transferred in this way are called the intermediate product. The transfer may be made either for further processing or for sale by the transferee unit. The transfer price creates revenue for the transferor department and on the other hand incurs purchase costs for the transferee department accordingly affecting each department's operating income.



Example

A division of Automotive Ltd produces brakes to be used in cars. It has an external market i.e. the brakes can be directly sold to outside customers at TZS1.05 million per unit. The brakes can also be used in the cars made by the assembly division of Automotive Ltd. The price that would be charged to the assembly division for internal transfer is called transfer price. The transfer price may be equal to or less than TZS1.05 million per unit.

In decentralised organisations, where the divisional managers have autonomy to take various decisions and are responsible for the profitability of the division, decisions regarding transfer pricing help to achieve goal congruence, to maintain divisional autonomy and to evaluate the performance of the division.

1.2 Objectives of transfer pricing

1. **Achieve goal congruence:** the transfer price should not encourage sub-optimal decision-making. The prices should enable goal congruence to be achieved i.e. to maximise divisional earnings in line with the objectives of the organisation as a whole.
2. **Maintain divisional autonomy:** by allowing divisional managers to set their own transfer prices and by allowing other divisions to decide whether or not to trade at the prices quoted, the autonomy of individual divisions is encouraged. This, in turn, should help to motivate divisional managers.
3. **Facilitate evaluation of divisional performance:** in the evaluation of divisional performances, the parameters are linked to profitability which is, in turn, influenced by transfer pricing. In many organisations, ROI and residual income are used for performance evaluation. ROI is affected by transfer pricing as the price set by one division is the cost to the other; and the profit of one division is the loss for the other. Setting an appropriate transfer price can, therefore, be important in deriving a valid measure of divisional profit for evaluation purposes.
4. **Promoting the optimisation of profits for the business:** transfer prices may seek to optimise profits for the business as a whole. For example, a division may be prevented from quoting a transfer price for goods that will make buying divisions seek cheaper sources of supply from outside the business.
5. **Allocating divisional resource:** transfer prices are important in determining the level of output for particular goods and services. The level of return from inter-divisional sales can be important in deciding the level of sales and investment relating to a particular product or group of products.
6. **Tax minimisation:** where a business has operations in various countries, it may be beneficial to set transfer prices such that the bulk of profits are reported in divisions where the host country has low corporation tax rates. However, tax laws operating in many countries will seek to prevent this kind of profit manipulation.

1.3 Basis for setting a transfer price

Transfer pricing is the process of determining the transfer price i.e. the price at which the goods can be transferred internally from one department / division to another department / division.

The following are some of the methods used to determine the transfer pricing:

1. Cost-based transfer prices
2. Negotiated transfer prices
3. Market-based transfer prices

1. Cost-based transfer pricing

This method can be used when either the market price is not available or it is inappropriate to consider. The costs used in cost-based transfer prices can be actual costs or budgeted costs. Sometimes, the cost-based transfer price includes a mark-up or profit margin that represents a return on departmental / divisional investment.

Under this method, either variable / marginal cost or full costs of the intermediate products are the widely-used bases for transfer pricing.

(a) Variable / marginal cost

Under this method, transfer price is the variable production cost for the product. This cost includes all the direct costs of producing the product as well as the variable indirect production costs.



Example

Roly Plc has two divisions, East and West. East division manufactures an intermediate product, Alfa which can be used by West division in manufacture of product Beta. East division can sell Alfa internally, as well as in the external market. East division provided the following information.

	TZS'000
Material cost (per unit)	62.50
Labour (per unit)	43.75
Variable overheads (per unit)	18.75
Total fixed cost	125,000
Budgeted production	5,000 units

Calculate the transfer price to be charged to West division based on marginal cost.

As the transfer price is determined on the basis of marginal cost, all direct costs of manufacturing Alfa and indirect variable costs are considered. Therefore, transfer price to be charged to West division will be

	TZS'000
Material cost	62.50
Labour	43.75
Variable overheads	18.75
Transfer price per unit	125.00

(i) Advantages

This method is worth considering when there is idle production capacity in the selling division and the **overall performance** of the organisation is given **more importance than the divisional performance**. This method facilitates decision-making by not considering fixed costs in the transfer price. For the transferee division, cost comparison for taking a decision between buying an item from the market and getting it from another division of the same organisation becomes easier.

(ii) Disadvantages

The disadvantage of this method is that the performance of the transferring unit gets affected as the fixed costs allocable to the products meant for transfer to another department / division are not taken into consideration.



Example

The cost of wear and tear of the machinery (i.e. depreciation of assets), incurred while producing the transferred units is not taken into consideration while determining the transfer price. As a result, the selling division has to bear the cost which could otherwise be transferred to the ultimate buyer.

(b) Full cost

Under this method, the full cost (both variable and fixed) is taken as a basis for the transfer price. The cost of production plus the costs of other business functions such as research & development, design, marketing, distribution etc. allocated to the product are included in the full cost.



Example

Continuing the example of Roly Plc

If East division decided to transfer Alfa at full cost, calculate the transfer price to be charged to West division.

Under the full cost method, both variable and fixed costs are considered for determining the transfer price. Therefore,

	TZS'000
Material cost	62.50
Labour	43.75
Variable overheads	18.75
Total variable cost	125.00
Add: Fixed cost	25.00
Total cost per unit	150.00

The budgeted fixed cost per unit is calculated as TZS125 million/5,000 units = TZS25,000 per unit

(i) Advantages of this method are:

This method is simple to understand and easy to implement. The information of the cost is readily available. One does not need to segregate the costs on the basis of their behaviour.

In the case of multinational organisations, where the divisions are spread over different countries each has a different tax structure, transfer price is used as a tax evasion technique. Therefore tax authorities are keen to know the basis for determining the transfer pricing. This method is preferred by the tax authorities as it takes into consideration the total production cost of the product.



Example

Global Ltd a multinational company with a division in India, transfers goods to another division in China. The tax rate in China is 30% on net profit which is lower than the tax rate in India i.e. 40%. The division in India has transferred 50,000 units on the basis of variable cost of TZS100 million. The total cost of the goods is TZS175 million. In this case, the profit of the division in India will be TZS75 million less and the profit in China will TZS75 million more than the profit the division would have been earned had the goods been transferred at full cost. As a result, the organisation can save tax of TZS7.5 million i.e. 10% (difference in tax rates) on TZS75 million.

(ii) Disadvantages

This method is criticised for using fixed cost in the transfer price since it places the transferee division at a cost disadvantage. This is because the transferee division would earn more profit if the units were transferred at the variable cost.

The calculated cost is only accurate at one level of output. When the transferor division has excess capacity, this method may lead to sub-optimal decisions.

(c) Cost-plus based

Under this method, a mark-up is added to the total cost so as to ensure some profit for the selling department / division. The mark-up or profit margin represents a return on departmental / divisional investment.

This method is welcomed by the transferor division as their profitability will increase if they add up their margin to the production cost of the transferred units.

For all the cost-based methods, a common disadvantage is that the inefficiency of the transferor division is transferred to the transferee division. If the transferor division incurs more cost as a result of inefficiency or working at low volume, the same cost is transferred to the transferee division.



Example

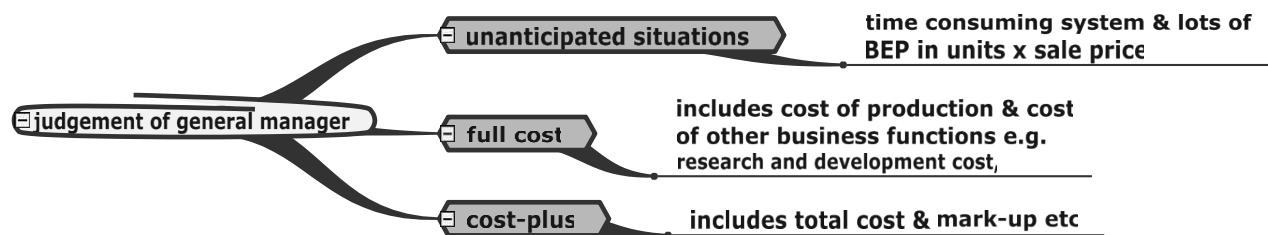
Continuing the example of Roly Plc

If East division decided to transfer Alfa at a profit of 10% on the total cost, calculate the transfer price to be charged to West division.

The East division decided to use cost plus method for determining the transfer price. Therefore,

	TZS'000
Material cost	62.50
Labour	43.75
Variable overheads	18.75
Total variable cost	125.00
Add: Fixed cost	25.00
Total cost per unit	150.00
Add: 10% mark-up	15.00
Transfer price per unit	165.00

SUMMARY



2. Negotiated transfer pricing

Negotiated price is determined by a **bargaining process between the selling unit and the buying unit**. It is the price agreed to by both the selling as well as the buying unit. This approach is adopted when some market imperfection exists for the intermediate product such as there being different selling costs for the internal and external markets or there being several market prices.

In most cases, market price is referred to negotiate the price.

(i) Advantages

The advantage of this method is that it **motivates managers to take decisions**.

If the managers allow bargaining to take place freely, the decision taken usually results in maximisation of the profit of the organisation as a whole.

(ii) Disadvantages

If any unit is in a better position than another, this weakens the bargaining power of the weaker unit. This means that, if the decided **price is based on negotiating skills and bargaining power**, then the transfer price may not be close to the optimal one. This method is not perfect for evaluating divisional performance as the price depends upon the negotiating skills of the managers.

This method is also not easily accepted by the tax authorities, as there is no concrete basis for this price and tax evasion may be the purpose behind allowing negotiation.

3. Market-based transfer pricing

Market price is the **listed price of the product or of a similar product or the actual price at which the product is sold in the external market** in an arm's length transaction. Some adjustments are made to the market price e.g. deducting the sales and promotion overheads as saved by selling internally, in order to arrive at the transfer price.

This is a widely-accepted basis for transfer pricing because of its multiple advantages, described below.

(a) Advantages

- (i) The transfer price can be calculated easily. This is done by taking into consideration the **market price** which is **readily available** and making a few adjustments to it.
- (ii) The transfer price is a close reflection of the market price of the commodity and hence, this transfer price mechanism is **favoured by management as well as the tax authorities**.

The tax authorities of different countries are keen to know the basis for determining the transfer price. Market price is normally found to be the most acceptable transfer price by the tax authorities because this is the most realistic price and the transfer is treated as if it is a sale.

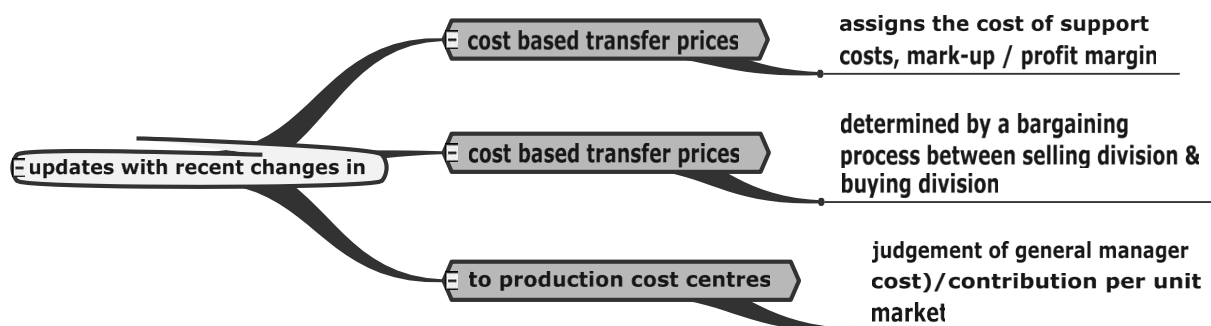
- (iii) This method maintains the autonomy of the divisions as the transfer is treated as a sale from one division to another. It **preserves the independence of the selling as well as the buying division**. For the selling division, it is just like a sale to the external market and, similarly, for the buying division, it is like buying from the market. This facilitates the performance evaluation of the divisions.
- (iv) This method **motivates managers in decision-making**. When the market price is the basis for the transfer price, this motivates the manager of the buying division to decide amongst the alternatives, i.e. buying from the market or buying internally, as both charge more or less the same price. Similar options are available to the manager of the selling division.
- (v) Transfer pricing based on market price allows the **performance of the divisions to be evaluated realistically**.

(b) Disadvantages

It is **difficult to determine the market price for the intermediate products** (except if the intermediate product has an external market). If there is no external market for the intermediate product, the market price is decided by considering factors such as price of similar products, profit margin required etc.

Sometimes a market for the intermediate product exists but the market is not perfectly competitive. Even if the market price is available, it may not be representative. Accordingly, the transfer price becomes largely dependent on the subjective decisions of the divisional managers.

SUMMARY



Test Yourself 1

Briefly explain the basis for determining the transfer price.

2. Illustrate how transfer prices can distort the performance assessment of divisions and decisions made.

[Learning Outcome b]

In order to make performance evaluation of the departments / divisions useful, the 'selling' division should be credited with the revenue for the products and services transferred. By the same token, the 'buying' division needs to be charged with the expense of using the goods or service supplied by the 'selling' division.

Where inter-divisional transfers represent a large part of the total sales or purchases of a division, transfer pricing is a very important issue. Any small change in the transfer price of the product or service transferred can result in large changes in profits for the division concerned.

The performances of divisional managers are often assessed according to the profits generated by the division concerned. Accordingly, setting transfer price can become a sensitive issue between divisional managers. The level at which the transfer price for a particular goods or service is set could lead divisional managers to make decisions which are in the interest of their division but which are not in the interest of the business as a whole.



Example

Trolly Co has two departments, P and Q. The product manufactured by P department can be used by Q department as an intermediate product in the production of the final product, PQ. Both departments have the option to sell / buy the product internally as well as externally. Transfer price charged by department P is TZS150,000 per unit. However, department Q can acquire the product at TZS145,000 from the external market.

The transfer price of the product (TZS150,000) is high compared to its market price (TZS145,000). Department Q may opt to buy the item from the market instead of buying it from the selling division (i.e. department P). In this situation, the profit of department P and that of Trolly Co as a whole may be adversely affected.

Here, we shall discuss **how different transfer pricing methods affect the performance of both the divisions** i.e. the selling division as well as the buying division.

2.1 Effect of the method on the divisional performance

1. Cost-based method

Under cost-based methods, one needs to be careful to determine the efficiency of the transferor division. If the transferor division works less efficiently, this inefficiency will be transferred to the transferee division and will ultimately affect its performance.

(a) Variable cost method

As, in this method, the fixed cost burden is not passed on to the transferee division, it is favoured by the transferee division. The profitability of the transferee division will be comparatively more in the case of units transferred at variable cost as compared to the transfer price based on full cost.

This method is the one most disliked by the transferor department because, under this method, the fixed costs incurred in producing the transferred units are borne by the transferor department and therefore distort its profitability.

(b) Full cost method

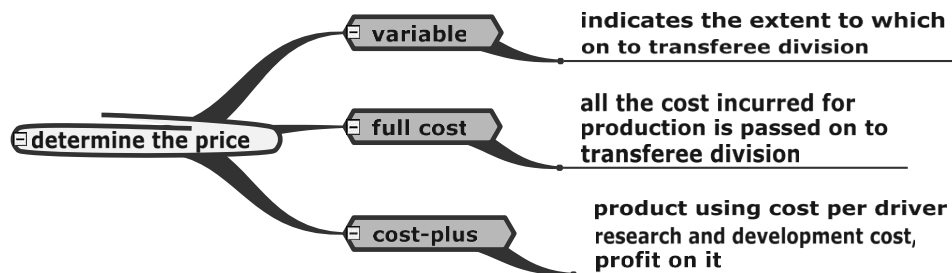
Under this method all the costs incurred for the production of the transferred units are passed on to the transferee division. However, this method also causes the selling division to sacrifice the profit that it would have earned had the product been sold in the market.

Under this method, although the transferee division has to pay the full cost of the product, this price is lower than the price on the external market. As a result, the division will make more profit compared to the situations where it would have been required to buy at market price or at transfer price based on the cost-plus method.

(c) Cost-plus method

Under this method, the transferor department / division transfers the related costs to the transferee department / division and in addition, charges a certain amount of profit. By adopting this method of transfer pricing, the divisions concerned can eliminate a price bias in favour of any of the dealing departments / divisions.

SUMMARY



2. Market price method

This method achieves most of the objectives of transfer pricing such as goal congruence, divisional autonomy etc. This method does not favour any department / division. The transferor department has the freedom either to sell the products to the transferee division or in the external market. On the other hand, the transferee division has the freedom either to purchase from outside or from the transferor division.

3. Negotiated price method

Under this method, divisions which have good bargaining skills will be at an advantage. Accordingly, this method does not present a rational transfer price and leads to distorted performance levels for the departments involved in the transfer of goods or services.



Example

Geary Equipment Ltd manufactures motors. Its division E manufactures the metal casing that is used to cover the motor. These metal casings can be sold externally as well as internally to division M of the same organisation.

Division M also has autonomy to purchase goods either from division E or from the external market.

The following is the information about the cost of division E:

Fixed cost	TZS300 million absorption rate is TZS20,000 per unit.
Variable costs (per unit)	TZS100,000
Gross margin	10% on cost

Fixed costs include machine set-up cost (Set-up cost is TZS700,000 per set up of 1,500 units). The only avoidable fixed cost is set-up cost.

The same metal casing is available on the market at TZS135,000 per unit. It is expected that division M would buy 20% of the metal casings from division E. Division E has the capacity to produce 30,000 units. What would be the effect on the profitability of division E and M if the transfer price is based on?

- (i) Variable cost
- (ii) Full cost
- (iii) Cost-plus
- (iv) Market price

Answer

(i) Variable cost

Division E

As set up cost is avoidable, and division E has to incur additional cost for the units transferred to the division M, the profit of division E will be reduced to this extent. If consider that division M purchased 20% of the total production i.e. 15,000 units $(TZS300 \text{ million} / TZS20,000) \times 20\% = 3,000 \text{ units}$. The set up cost incurred by division E for 3,000 units would be $(3,000 / 1,500) \text{ units} \times TZS700,000 = TZS1.4 \text{ million}$. The profit of division E would be more if these 3,000 units were not transferred to division M.

Continued on the next page

Division M

In the case of division M, it is beneficial if the goods are transferred at the variable cost because it is the lowest possible cost to division M. If the metal casings are purchased from the external market, division M will have to pay TZS135,000 per metal casing instead of the TZS100,000 transfer price and as a result, profit will be increased by TZS105 million (TZS35,000 difference between cost from internal and external seller x 3,000 units).

(ii) Full cost**Division E**

If the metal casings are transferred at full cost i.e. TZS120,000, division E will be able to pass the additional burden of the fixed cost incurred for the metal castings transferred to division E. Accordingly, the burden of the unavoidable fixed costs can be shifted to division M, which ultimately, will increase the profit of division E.

Division M

If the transfer price is full cost, the profitability of division M will be lower than if the transfer price had been the variable cost but higher than if the transfer price had been the market price.

(iii) Cost-plus**Division E**

When the metal castings are transferred at a cost-plus profit margin, this will benefit division E as the division can pass the burden of all the related costs and also earn a profit.

In the given case, if the metal castings are transferred on a cost-plus basis, the selling price would be TZS120,000 + 10% i.e. TZS132,000. The profit of division E will be increased by TZS3,000 x 3,000 = TZS9 million as compared to the market price.

Division M

The profitability of division M will be reduced if the transfer price is cost-plus.

In this method, both divisions have the autonomy to take decisions regarding transfer of the engines. When a division is at a loss, as a result of the internal transfer, they are free to sell or buy in the external market.

(iv) Market price**Division E**

For metal castings, an external market is available therefore the market price can be determined easily. Even if the cost-plus price is more than the market price, there is the possibility that division M will purchase from the external market as the market price is less than the cost-plus price of division E. If division M also purchases from the market then it will not be possible for division E to transfer the burden of the fixed cost to division M. As a result, the profitability of division E will decrease.

Division M

If the transfer cost is a market price, division M will work off if compared to the full cost or variable cost based price.

**Test Yourself 2**

In High Tech Computers, a manufacturer of digital watches, there are two divisions i.e. the manufacturing unit (division M) and the Del-chip unit (division D). Division M can purchase chips either from division D unit or from the external market. On the other hand, division D can sell inside or outside the firm.

Division D unit is working at full capacity (160,000 units).

One Del-chip is needed for each computer manufactured by High Tech.

Other information	TZS'000
Sales price of an HTC computer (per unit)	910
Variable manufacturing cost of the computer (per unit, excluding Del-chip)	680
Variable Del-chip manufacturing cost for HTC's division D (per unit)	70
Price of Del-chip from outside supplier, to division M (per unit)	90
Selling price of Del-chip (HTC's division D)	100

Compare the profitability of the buying division under both the situations i.e. when purchased from the external market or internally (at market price).

3. Describe the meaning of, and calculate, Return on Investment (ROI), Residual Income (RI), Economic Value Added (EVA) and Shareholder Value Added (SVA) and assess their benefits and shortcomings.

[Learning Outcome c]

In this SECTION the performance measurements in the case of divisionalised organisation are discussed in detail. In the case of divisionalised organisations, divisional managers have the autonomy to take various decisions. In order to motivate managers and to ensure that the decisions taken by managers are in the best interests of the organisation, the performance of the division is evaluated.

The common measurements used for evaluating performance include standard costing; controllable profit; ROI; RI; EVA; SVA, etc. The degree of decentralisation, to some extent, affects the selection of a performance measurement.



Example

If a manager has the autonomy to take decisions on cost only and not on revenue and assets, generally standard costing is used to measure the performance of that division. This is because standard costing will allow variances between the cost and the standards to be identified and accordingly performance can be measured. On the other hand, if the manager is responsible for taking decisions on cost, revenue and assets, the ROI or RI will be a better measurement than standard costing.

The above mentioned performance measurements are discussed below.

1. Standard costing

As discussed above, standard costing is a good measurement for evaluating divisional performance when the manager has the autonomy to take decisions on costs only. This is a traditional method of performance measurement.

Under standard costing, deviations from the standards are identified and any significant variances are investigated so that corrective measures can be taken in the future.

The advantages and disadvantages of using standard costing are discussed in detail in Paper F5. In a rapidly changing environment, there are certain behavioural problems associated with the use of standard costing.

2. Controllable profit

Controllable profit reflects only those costs and revenues that managers have influence or control over. It is a good indicator of how well the division is managed. The concept of controllable profit ensures that items which are beyond the control of the manager are not allowed to affect the performance of the manager.



Example

The depreciation on divisional machinery is beyond the control of the divisional manager and therefore should not be considered while determining the controllable profit of the division. If the depreciation is considered, the profit will be reduced.

Controllable profit is used when managers are responsible for revenue as well as costs. An advantage of this method is that it is more logical since only the items which the managers are capable of controlling are considered. The method is criticised since it is difficult to decide what is controllable and what is not controllable.

3. Return on investment (ROI)

(a) Meaning and Formula

Return on investment (ROI) is the ratio of profit to investment in operational assets. It is normally expressed as a percentage, and the larger the percentage, the better the ROI.

ROI is normally interchangeable with ROCE as a measure of profitability. ROI is normally used for divisional or investment centre performance appraisal.

$$\text{ROI} = \text{Return on sales} \times \text{Operating asset turnover}$$

$$= \frac{\text{EBIT}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Operating assets employed}}$$

ROI indicates the profit earned for each dollar invested in the operating assets of a business. Return on investment is the measure which takes into consideration the revenues, costs and investments, by combining these factors into a single percentage. ROIs for successful firms range from 10 to more than 50 per cent, although each firm's ROI must be evaluated in the light of the industry average ROI and the economic factors facing that particular entity or strategic business unit.



Example

The following is the information on two independent projects, of Sebra Inc, which management is considering taking up. Using ROI as a measure of performance, select one of these projects

	Project A	Project B
	TZS million	TZS million
Sales	24.00	33.80
Cost of sales	18.50	26.80
Investment	110.00	120.50

Answer

Calculation of ROI	Project A	Project B
Profit (Revenue – Cost of sales)	TZS6.50 million	TZS7.00 million
$ROI = \frac{\text{Profit}}{\text{Investment}} \times 100$	$= \frac{\text{TZS6.50 million}}{\text{TZS110.00 million}} \times 100$	$= \frac{\text{TZS7.00 million}}{\text{TZS120.50 million}} \times 100$
ROI	= 5.91%	= 5.81%

If profit is used as a measure for performance evaluation, project B would be selected, as its profit is higher than that of project A. However, if return on each dollar invested (ROI) is used for performance evaluation, project A shows a better return and hence will be selected.

When using ROI for divisional performance measurement, in order to achieve better results, only the capital traceable to the division and controllable by the manager should be taken into consideration (as in the case of controllable profit).

Therefore the ROI (for divisional performance measurement) can be calculated as:

$$ROI = \frac{\text{Divisional profit}}{\text{Division's capital employed}}$$

(b) Merits

Versatility

When calculating ROI, various aspects such as revenues and costs as well as investments are considered. It is therefore more logical to evaluate the performance of divisions using ROI.

Comparability

ROI considers the investment made in the division and therefore enables divisions of different sizes to be compared.

Flexibility

ROI can be modified in accordance with the circumstances.

Simplicity

It is very simple to calculate. All the required figures can be taken from the financial records.

Expressed in percentage

Since ROI is expressed in percentage terms and not in absolute terms, it calculates the relative profitability and therefore provides good comparability.

(c) Shortcomings of ROCE and ROI

ROCE or ROI may be better alternatives to profit as a performance measure for divisions or investment projects. However, ROCE and ROI also have certain shortcomings that limit their use as performance evaluation criteria.

These shortcomings are:

Ignore time value of money

ROCE and ROI ignore the time value of money. The concept of the time value of money is that the value of money changes over time i.e. the value of a dollar / pound today is different from the value of a dollar / pound tomorrow and accordingly the purchasing power of the same unit of money undergoes a change.

**Example**

Consider two projects: project A which has 5 years' payback and project B which has 3 years' payback with the actual pay-off starting in a later period (back-loaded) i.e. the payback period starts after a two year gestation period. The time value of the profit of project B will be different from the time value of the profit of project A. ROI does not take this fact into consideration and therefore may select project B. In reality, it may so happen that, due its actual pay-off starting earlier, it may be preferable to select project A.

Ignore risk associated with the project / division

ROCE and ROI also ignore the risks associated with the project. While taking a decision regarding projects with different levels of risk, using ROCE and ROI may result in ignoring a good project which has lower risk and accepting a project with high return and corresponding high risks.

Flexibility

It is an advantage that ROCE and ROI can be modified to fit the situation. However, this advantage turns out to be a disadvantage when the flexibility is used to manipulate the results by expressing them in a different way.

Inconsistency

There is no consistency when calculating different items. For example, income is sometimes taken as before interest and tax; sometimes as after interest and tax. Similarly, investment sometimes considers net assets and, sometimes, the gross value of assets. Due to this, there is a possibility that this flexibility may be misused to manipulate the results. In other words, due to flexibility, different results may be shown.

**Example**

The following information is related to a division of Snell Ltd:

Cost of capital of Snell is 15%.

Investment (assets employed excluding depreciation) is TZS240 million

Profit is TZS30 million

Depreciation on assets is TZS60 million

$$\text{ROI taking gross value of assets} = \frac{\text{TZS30 million}}{\text{TZS240 million}} \times 100 = 12.5\%$$

$$\text{ROI taking net value of assets} = \frac{\text{TZS30 million}}{\text{TZS240 million} - \text{TZS60 million}} \times 100 = 16.67\%$$

This is how the modification in calculating ROI affects the performance evaluation. If gross value is taken, the ROI of the division is lower than that of the company and therefore the division would be said to be not performing well but, if ROI is calculated using the net value of assets, the division is shown to be contributing to an increase in the ROI of the company as a whole.

Short-term analysis

The calculation of ROCE and ROI only take into consideration short-term investments. Long-term costs such as maintenance and software upgrades are ignored. Therefore, projects with heavy long-term costs may show a high return on investment in the initial period.

Variation in calculations

There are different methods of calculating depreciation. With a change in method, the value of the asset also changes. In addition, methods of valuing non-current assets may differ from division to division. This inconsistency in the valuation of an investment will vary from division to division and therefore comparison between divisions will be difficult.



Example

The asset value may be taken at historical cost, replacement cost, net realisable amount etc. With the change in method, the value of the assets employed and therefore the ROI will change.

(In addition, the method of depreciation also affects the calculation of ROI in which the net value of assets is considered.)

Lack of goal congruence

Since performance is evaluated on the basis of the ROI, managers tend to take decisions which will show good ROI rather than decisions which are good for the organisation as a whole.

If the ROI of a project is higher than the ROI of the division then the project is accepted, otherwise it is rejected. This is criticised because, even if the ROI of the project is lower than the cost of capital, the project is selected solely because its ROI is higher than that of the division. There may be occasions when the basis of this decision is not optimal.



Example

The following are the estimates of project B and project Y. The managers of divisions Amy and Bennie are considering the two projects. The cost of capital to the company is 15%. The current ROI of division Amy is 20% and the current ROI of division Bennie is 11%.

	Project B (TZS million)	Project Y (TZS million)
Average annual profit (before interest and tax)	20	14
Average investment (assets employed)	120	120

Profit given is calculated after considering the depreciation on assets employed.

$$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} \times 100$$

Project B: TZS20 million/TZS120 million $\times 100 = 16.67\%$

Project Y: TZS14 million/TZS120 million $\times 100 = 11.67\%$

The ROI of project B is 16.67%.

The current ROI of division Amy is 20%. If division Amy accepts project B, the current ROI of division Amy will decrease and therefore the manager of division Amy will not accept the project.

However, the ROI of the project is higher than the company's cost of capital. Therefore it is beneficial to accept the project considering the company's objective of profit maximisation.

The ROI of project Y is 11.67%.

The current ROI of division Bennie is 11%. Accepting project Y will increase the current ROI of the division. Therefore the manager will be willing to accept the project.

However, the ROI is lower than the cost of capital of the company. Therefore, considering the overall profitability of the company, it is advisable that division Bennie does not accept project Y.

Therefore, the decisions taken by using ROI are not appropriate because they do not make reference to the company's cost of capital.

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Using ROI as a performance measurement may motivate managers to reject profitable projects if the project is likely to lower the ROI.

As a result, a conflict arises between the goals of the managers and the goal of the organisation as a whole, i.e., goal congruence is not obtained.

4. Residual income (RI)

(a) Meaning and Formula

In contrast to ROI, which is expressed as a percentage, residual income is expressed in absolute terms (i.e. as a dollar amount). It is the net income earned after deducting a charge for the funds invested in the division or investment unit. The charge is determined by taking the organisation's desired minimum rate of return and multiplying it by the amount of the investment. It is calculated as follows:

$$RI = \text{Income} - \text{Charge on investment}$$

$$\text{Charge on investment} = (\text{Investment} \times \text{Desired rate of return})$$



Example

Using the abovementioned example of Sebra Inc and assuming the rate of return at 10%, calculate Residual Income (RI) and select a project on the basis of RI.

Answer

Calculation of RI	Project A TZS million	Project B TZS million
Profit (Revenue – Cost of sales)	6.50	7.000
Less: Charge on investment = (Investment x Rate of return) [(110 million x 5%); (120.5 million x 5%)]	5.50	6.025
RI = Income – Charge on investment	1.00	0.975

If profit is used as a measure of performance, project B will be selected, as its profit is higher than the profit of project A. However, if return on each dollar invested (ROI) is used for performance evaluation, project A will show a better return and hence will be selected.

If the residual income basis is used, project A will be selected because it shows a higher residual income than project B.

(b) Merits

(i) Decision-making

RI is a good tool for decision-making. This is because, in this case, if the residual income is positive, the project is accepted and vice versa. This is good for the organisation as a whole.

(ii) Consideration of risk

In RI, the various risks associated with the divisions and the projects are considered and therefore RI is a better tool for performance measurement than ROI.

(c) Shortcomings

(i) No consideration for the size

Although the risk is considered and the investment is taken into account indirectly through the charge on investment, RI does not take into consideration the variation in the size of the different divisions and therefore is not a good tool for comparison.



Example

Able Ltd is evaluating the performance of two independent divisions with different investments. The investment in division X is TZS40 million and the investment in division Y is TZS75 million. The profit earned by divisions X and Y respectively is TZS5.5 million and TZS6 million. The cost of capital is 10%.

RI of division X will be:

$$\text{TZS5.5 million} - (10\% \times \text{TZS40 million}) = \text{TZS1.5 million}$$

RI of division Y will be:

$$\text{TZS9.5 million} - (10\% \times \text{TZS75 million}) = \text{TZS2.0 million}$$

From this, it can be concluded that division Y is performing well since its RI is higher than that of division X. However, if we calculate ROI the result will be different:

ROI of division X will be:

$$\text{TZS5.5 million} / \text{TZS40 million} \times 100 = 13.75\%$$

ROI of division Y will be:

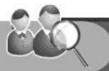
$$\text{TZS9.5 million} / \text{TZS75 million} \times 100 = 12.67\%$$

ROI directly considers the size of the divisions and therefore, according to ROI, the return on investment for division Y is lower than for division X. Hence, if performance is measured using ROI, division X is performing better.

(ii) Not expressed in percentage

Since RI is expressed in terms of absolute figures, and not as a percentage, there is the possibility that a project with higher residual value will be accepted even if it is less profitable than another project whose performance, if expressed in percentage terms, is better than the accepted project. This may lead to the wrong decisions being taken.

When comparing two divisions, it is not wise to say that the division with the higher RI has performed better than the division whose RI is lower but ROI is higher.



Example

Zest Ltd is evaluating the following two independent divisions using RI as a measure of performance. Rate of return on capital is 9%.

	Division A TZS million	Division B TZS million
Income	60	80
Assets employed	500	700

Answer

$$\text{ROI} = \frac{\text{Profit}}{\text{Investment}} \times 100$$

Division A: ROI = TZS60 million / TZS500 million $\times$ 100 = 12.00%

Division B: ROI = TZS80 million / TZS700 million $\times$ 100 = 11.43%

RI = NOI – Charge on investment

Continued on the next page

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Division A

$$\begin{aligned}\text{RI} &= \text{TZS}60 \text{ million} - (\text{TZS}500 \text{ million} \times 9\%) \\ &= \text{TZS}60 \text{ million} - \text{TZS}45 \text{ million} \\ &= \text{TZS}15 \text{ million}\end{aligned}$$

Division B

$$\begin{aligned}\text{RI} &= \text{TZS}80 \text{ million} - (\text{TZS}700 \text{ million} \times 9\%) \\ &= \text{TZS}80 \text{ million} - \text{TZS}63 \text{ million} \\ &= \text{TZS}17 \text{ million}\end{aligned}$$

Here, on the basis of RI, division B is performing well. On the other hand, if we calculate ROI division A is performing well.

The major limitation of this method is that, because residual income is not expressed as a percentage, it is not useful for comparing units of significantly different sizes. It favours larger units that would be expected to have larger residual income, even with relatively poor performance.



Example

Residual income for Cyber City

Financial data	Income TZS'000	Average net book value TZS'000
Leeds	39,000	288,750
Kensington	57,750	318,000
Manchester	25,275	199,500

Return on investment

Leeds	13.51 %
Kensington	18.16 %
Manchester	12.67 %

Residual income (Minimum rate of return = 12%)

Leeds	$\text{TZS}4,350,000 = \text{TZS}39,000,000 - 0.12 \times \text{TZS}288,750,000$
Kensington	$\text{TZS}19,590,000 = \text{TZS}57,750,000 - 0.12 \times \text{TZS}318,000,000$
Manchester	$\text{TZS}1,335,000 = \text{TZS}25,275,000 - 0.12 \times \text{TZS}199,500,000$

The effect of the size of the unit and the minimum desired rate of return on residual income

	Business unit I TZS million	Business unit II TZS million
Investment	15,000.00	1,125.00
Income	2,250.00	168.75
ROI = (Profit/Investment) x 100		
(TZS2,250 million/TZS15,000 million) x 100		
(TZS168.75 million/TZS1,125 million) x 100	15%	15%
Residual income at minimum desired return of 12%		
TZS2,250 million – (0.12 x TZS15,000 million)		
TZS168.75 million – (0.12 x TZS1,125 million)	450.00	33.75

(iii) Consideration of the expected rate of return (which may be misleading)

While calculating the residual income, the expected rate of return is considered.

However, the expected rate of return itself may be incorrect and this may make the performance evaluation inaccurate.

It is difficult to deciding on what should be the desired rate of return.

Considering a wrong rate of return may misguide the decision-maker.



Example

For Sophia Ltd, calculate the RI of the division A from the given information:

	Division A
Net operating income	TZS24 million
Total assets employed	TZS200 million
Expected rate of return	10%

Also calculate RI when the expected rate of return is 12%.

Answer

Residual Income (RI) = Net operating income – Charge on investment
 = Net operating income – (Assets employed x Expected rate of return)

For Sophia Ltd,

When expected rate of return is 10%,

RI = TZS24 million – (TZS200 million x 10%)
 = TZS4 million

When expected rate of return is 12%,

RI = TZS24 million – (TZS200 million x 12%)
 = Nil

With the change in the rate of return, the residual income and accordingly the decision changes therefore it is necessary to decide the expected rate of return with caution.

5. Economic value added (EVA)

Economic value added is a performance measure which calculates true economic profit. It is a variant of residual income (RI). In RI, the market value / book value of assets is considered when calculating the capital invested whereas in EVA, the market value of the equity and the interest-bearing debts are considered to be capital employed.

Therefore EVA is calculated as:

EVA = NOPAT – cK

Where,

NOPAT is net operating profit after tax
 c is the weighted average cost of capital
 K is capital employed

Here, NOPAT is arrived at after making certain adjustments to the accounting profit. The calculation of NOPAT is quite complex.

Examples of the adjustments required in the NOPAT are as follows:

Interest on debts

NOPAT is arrived at after deducting the interest on the debt capital. However, for the purpose of the EVA calculation, the NOPAT should be before deducting the interest on debt capital. Therefore the net interest on debt should be added back to the figure of NOPAT from accounting information. Here, net interest refers to the interest on debt less tax relief.

Non-cash expenses

Non-cash expenses should not be deducted from profit. As a result, they should be added back to the accounting profit. However, the charge on the non-current assets should be allowed to the extent of the economic use of the non-current assets during the year. Therefore, the non-cash expenses including depreciation should be added back to the accounting profit but economic depreciation should be deducted. When the economic and accounting depreciation are the same, only the other non-cash expenses (if any) should be added back.

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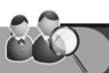
K stands for preference shares, equity and all the interest-bearing liabilities i.e. it also takes into consideration any interest-bearing current liabilities such as bank overdrafts. K is calculated as:

$$\text{Capital employed} = \text{Book value of all the assets} - \text{Current (non-interest-bearing) liabilities}$$

WACC is calculated as follows:

$$\text{WACC} = R_d (1 - T_c) \frac{D}{V} + R_e \frac{E}{V}$$

R_d = Pre-tax cost of debt. Based on the current yield on traded company debt instruments or estimated, taking account of company gearing, size, industry risk, etc.
 T_c = Corporate tax rate
 D = Market value of the business' debt
 E = Market value of equity
 R_e = Cost of equity
 V = $D + E$



Example

Calculate the EVA of the following:

Units produced	10,000
Variable cost per unit	TZS10,000
Total fixed cost (excluding interest on 5% debentures of TZS150 million)	TZS120 million
Selling price per unit	TZS30,000
Total assets employed	TZS200 million

WACC is 12.5% in this business.

Also show the residual income and return on investment. Assume the corporate tax rate to be 35%.

	TZS million
Sales (10,000 units x TZS30,000)	300
Less: Variable costs (per TZS10,000)	(100)
Contribution	200
Less: Fixed costs	(120)
EBT (for EVA)	80
Less: Tax @35%	(28)
NOPAT	52

$$\begin{aligned}
 \text{EVA} &= \text{NOPAT} - \text{Charge on investment} \\
 &= \text{TZS52 million} - \text{TZS200 million} \times 12.5\% \\
 &= \text{TZS52 million} - \text{TZS25 million} \\
 &= \text{TZS27 million}
 \end{aligned}$$

	TZS million
Sales (10,000 units x TZS30,000)	300.000
Less: Variable cost @ TZS10,000	(100.000)
Contribution	200.000
Less: Fixed costs	(120.000)
EBIT	80.000
Less: Interest on debentures	(7.500)
EBT	72.500
Less: Taxation @ 35%	(25.375)
Net operating income	47.125

$$\begin{aligned}
 \text{RI} &= \text{Net operating income} - \text{Charge on investment} \\
 &= \text{TZS47.125 million} - \text{TZS25 million} \\
 &= \text{TZS22.125 million}
 \end{aligned}$$

Continued on the next page

$$\text{ROI} = \frac{\text{Net operating income}}{\text{Assets employed}} \times 100$$

$$= \frac{\text{TZS47.125 million}}{\text{TZS200 million}} \times 100$$

$$= 23.56\%$$

(a) Advantages of EVA

- (i) EVA is a true indicator of the actual wealth created for the shareholders by the company. This is because this method calculates the value of an organisation after considering a charge for the use of capital made by that organisation. Therefore, it is a better measure of divisional performance.
- (ii) Since it does not take figures directly from the accounting information but instead makes certain adjustments to the calculation to make it more justifiable, it is a good measure for performance evaluation.
- (iii) The decision taken is based on the cash flows and therefore there is a lower possibility of the decision being affected by the accounting policies.
- (iv) It is simple to understand and therefore widely used.
- (v) It is widely used to evaluate the performance of managers and divisions.

(b) Disadvantages of EVA

- (i) It is complex to calculate. This is because it does not take the figures of profit and cost of capital directly from the accounting information, but instead makes certain adjustments to these figures.
- (ii) Since the decision taken is based on historical information, it does not consider the future flow.
- (iii) EVA uses CAPM to estimate the weighted average cost of capital, which itself is based upon various assumptions which may not hold true in reality.
- (iv) EVA is not good for comparison since it does not consider the size of the organisation / division.
- (v) EVA is a calculation of historic value addition and does not take into consideration the future flows and other estimates. Therefore EVA cannot be used to make decisions about the future.

6. Shareholder Value Added (SVA)

Shareholder value added (SVA) indicates a company's worth to shareholders in the absence of liabilities and capital costs. SVA recommends whether or not it is worthwhile for an investor to acquire shares in a company. It is expressed as a company's capital costs from shares and bond issues subtracted from its net operating profit after tax (NOPAT).

$$\begin{aligned} \text{SVA} &= \text{NOPAT} - \text{Weighted Average Cost of Capital} \\ &= \text{NOPAT} - (\text{Capital} \times \text{WACC}) \end{aligned}$$



Example

If a company's NOPAT is TZS200 million and its capital costs are TZS50 million, its SVA would be TZS150 million (TZS200 million – TZS50 million = TZS150 million)



Tip

Dividends increase SVA while additional issues of shares lower SVA.

(a) Merits

- (i) If SVA is used as a performance measurement, managers will be provided with an improved focus on maximising shareholder value.
- (ii) Unlike traditional accounting performance measures, SVA concentrates primarily on the operating performance of the firm by adjusting NOPAT by the allocation of a capital charge along with the economic operations of the business.
- (iii) SVA takes into consideration one significant factor which most traditional accounting measures don't - i.e. the employed capital.
- (iv) SVA combines data of income statement and statement of financial position to determine the surplus returns available to all capital holders.

(b) Demerits

- (i) It is an aggregate measure.
- (ii) SVA does not provide a clear measure of corporate social responsibility and environmental issues like employment, ethical business practices etc.
- (iii) A reduction in direct government funding would result in a decrease in SVA.
- (iv) Short-term focus on shareholder value can be harmful to long-term shareholder value; temporary increase in a share's value can have a negative impact on its long term value.

**Test Yourself 3**

The following details are taken from the income statements of division Select and division Choice for the year ending March 20X7.

	Select	Choice
	TZS million	TZS million
Sales revenue	100	120
Operating cost	64	75
Interest cost	6	10
Capital invested	122	150

WACC	10%	12.5%
Rate of corporate tax	40%	44%

(Assume that economic and accounting depreciation are the same.)

Required:

Calculate NOPAT as adjusted for EVA and also calculate EVA for both the divisions.

4. Describe the nature of, and calculate the productivity measures.

[Learning Outcome d]

4.1 Meaning and nature of productivity measures

An organisation's productivity is simply defined as the relative measure of outputs produced by the organisation and the resources consumed in the process.

$$\text{Productivity} = \frac{\text{Output}}{\text{Inputs}}$$

Output can be measured in terms of volume, quantity of items produced, dollar value etc.

Where,

Output refers to the **quantity of and services produced** by an organisation

Input refers to the **quantity of resources** (e.g. labour, material, land, energy, assets, etc.) **consumed for producing** that output.

Productivity is used to measure the degree to which certain outputs can be generated from a given input. There can be many types of productivity measurement methods depending on the type of resources considered. Some of the most common types of productivity measurements include labour productivity, machine or capital productivity, material productivity, and land productivity. Here, the term 'land' is used to denote all natural resources rather than just land.

4.2 Importance of productivity measures

1. Defining how well the resources of an organisation are being used for production.
2. Used for planning, monitoring and improving performance at national levels.
3. Providing a means to managers to determine, plan, control and improve efficiency at different stages of organisation.
4. Helping in evaluation of performance of different companies within a market or industry. This helps managers set improvement targets for an organisation's long-term strategic plans, and in building an appropriate competitive strategy.
5. Important for motivating employees through incentives for high productivity. In addition, the accessibility of comparative performance data itself becomes a tool for self-motivation of employees.

4.3 Calculation of productivity measures

1. **Labour productivity (LP)** is the ratio of the output to the input of labour. Typically, it is measured as the amount of output produced per hour worked.

Steps to calculate productivity

- (a) Select the unit of measurement on output (some organisations prefer to base their calculations on monetary output, while others would relatively use the number of goods produced).
- (b) Decide on time period for which productivity is to be calculated i.e. week, month, quarter, year, decade, etc.
- (c) Define how much output was produced in the above selected time period.
- (d) Determine the labour hours spent in the above selected time period.
- (e) Compute the estimated worker productivity.



Example

Consider the following data:

Total output during a month: 10,000 units worth TZS200 million

Labour hours during a month: 5,000 hours

Labour productivity (in dollar value) for that month = $\frac{\text{TZS200 million}}{5,000 \text{ hours}} = \text{TZS40,000 per hour}$

Labour productivity (in production units) for that month = $\frac{10,000 \text{ units}}{5,000 \text{ hours}} = 2 \text{ units per hour}$

2. **Multifactor productivity (MFP)** is the ratio of output to the combined input of labour and capital. Sometimes this measure is referred to as total factor productivity. Multifactor productivity measures reflect the joint effects of many factors including new technologies, economies of scale, managerial skill, and changes in the organisation of production.



Example

Consider the following data:

Output: 5,920 units @ TZS15,000 each

Input:

Labour: TZS1,200,000

Materials: TZS740,000

Overheads: TZS2,500,000

Multifactor productivity (in dollar value)

$$= \frac{\text{Total output}}{\text{Labour} + \text{Materials} + \text{Overheads}}$$

$$= \frac{\text{TZS88,800,000}}{\text{TZS1,200,000} + \text{TZS740,000} + \text{TZS2,500,000}}$$

$$= 20 \text{ units output per TZS}$$

The measures of productivity are important for good performance in all organisations. Organisations cannot continue to operate for long-term without considering some productivity measures, and their performance is influenced by the nature of productivity measures used.



Test Yourself 4

A coaching centre offers three crash courses and charges TZS100,000 per semester. The centre also provides transport facility for the semester at the rate of TZS50,000 per student. Labour costs are TZS5,000,000 per class, material costs are TZS30,000 per student, and overhead costs are TZS20,000,000 per class.

Normal batch size for each course is 50 students.

Required:

- Compute the multifactor productivity ratio.
- Each semester lasts for 14 weeks. If tutors deliver lecture 9 hours per week, what is the labour productivity ratio?

Answers to Test Yourself

Answer to TY 1

Bases for determining transfer prices are as follows:

(a) Cost-based transfer pricing

This method offers a choice of various options as the basis for deciding the transfer price. These are:

(i) Variable / marginal cost

Under this method, units are transferred at the variable cost incurred for those units. Fixed cost is borne by the transferor department.

(ii) Full cost

Under this method, the total cost incurred for the unit is considered when deciding the transfer price. This cost includes all the fixed costs as well as the variable costs of the product.

(iii) Cost-plus method

In this method, a mark-up is added to the cost so as to cover the profit share of the transferor division. As a result, although the profitability of the transferee division increases, the overall profitability of the organisation as a whole remains the same.

(b) Market-based method

Here, the listed price of the product is considered when determining the transfer price. This method has many advantages and is often considered to be the most suitable method. One disadvantage of this method is that, for most of the intermediate products, an external market is not available and it is therefore difficult to determine their market price.

(c) Negotiated prices

In this method, the transferee and transferor divisions negotiate and then arrive at a price acceptable to both the divisions. In most cases, market price is taken as a basis for determining the negotiated transfer price. Under this method, a division with poor bargaining skills loses out and a division with strong bargaining skills is at an advantage.

Answer to TY 2

In the given question, both the departments will enjoy the autonomy of taking decisions about whether to sell / buy the intermediate product from the other department or not. Here, variable cost to division D is TZS70,000 and one Del-chip is available in the market at TZS90,000. This means the variable cost of the department is less than the market price. It is given that division D is working at full capacity implying that there is no additional capacity. Therefore we need to calculate the contribution to High Tech Computers as a whole from both the options.

Calculation of the contribution**When purchased from Outside**

	Division M TZS million	Division D TZS million	Total TZS million
Sales revenue (@ TZS910,000; TZS100,000)	145,600	16,000	161,600
Less: Variable costs			
Del-chip (TZS90,000 x 160,000 units))	(14,400)		(14,400)
Manufacturing cost (TZS680,000 x 160,000 units)	(108,800)		(108,800)
Manufacturing cost (TZS70,000 x 160,000 units)		(11,200)	(11,200)
Contribution margin	22,400	4,800	27,200

Purchases from inside at market price

	Division M TZS million	Division D TZS million	Total TZS million
Sales revenue (@ TZS910,000; TZS100,000)	145,600	16,000	161,600
Less: Variable costs Del-chip (TZS100,000) Manufacturing cost (TZS680,000 x 160,000 units) Manufacturing cost (TZS70,000 x 160,000 units)	(16,000) (108,800)		(16,000) (108,800)
		(11,200)	(11,200)
Contribution margin	20,800	4,800	25,600

As the overall contribution margin is greater if Del-chips are purchased from outside, it is a better option to purchase from the external market.

Answer to TY 3

Income statement

	Select TZS million	Choice TZS million	Total TZS million
Sales revenue	100	120.0	220.0
Less: Operating costs	64	75.0	139.0
EBIT	36	45.0	81.0
Less: Interest	6	10.0	16.0
EBT	30	35.0	65.0
Less: Tax @ 40% & 44%	12	15.4	27.4
Earnings after tax	18	19.6	37.6

NOPAT as adjusted EVA (ignoring interest)

	Select TZS million	Choice TZS million	Total TZS million
Sales revenue	100.0	120.0	220.0
Less: Operating cost	64.0	75.0	139.0
Net profit (before tax)	36.0	45.0	81.0
Less: Tax@ 40% & 44%	14.4	19.8	34.2
Earnings after tax	21.6	25.2	46.8

Earnings after tax reduce if interest is not taken into consideration.

In the above example, the NOPAT for EVA is calculated as TZS21,600,000 for Select.

EVA can be calculated as:

$$\text{EVA} = \text{NOPAT} - cK$$

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Select division

$$\begin{aligned}\text{EVA} &= \text{TZS}21,600,000 - (0.10 \times 122,000,000) \\ \text{EVA} &= \text{TZS}9,400,000\end{aligned}$$

Choice division

$$\begin{aligned}\text{EVA} &= \text{NOPAT} - (0.125 \times 150,000,000) \\ &= \text{TZS}25,200,000 - \text{TZS}18,750,000 \\ &= \text{TZS}6,450,000\end{aligned}$$

Answer to TY 4

$$\begin{aligned}\text{Value of output per class} &= 50 \text{ students} \times 3 \text{ courses} \times \text{TZS}150,000 \\ &= \text{TZS}22,500,000 \text{ per class}\end{aligned}$$

$$\begin{aligned}\text{Value of input per class} &= \text{Labour} + \text{Materials} + \text{Overheads} \\ &= \text{TZS}5,000,000 + (\text{TZS}30,000 \times 50) + \text{TZS}20,000,000 \\ &= \text{TZS}26,500,000 \text{ per class}\end{aligned}$$

$$\text{Multifactor productivity} = \frac{\text{Total output}}{\text{Labour} + \text{Materials} + \text{Overheads}} = \frac{\text{TZS}22,500,000}{\text{TZS}26,500,000} = 0.849$$

$$\text{Labour productivity ratio} = \frac{\text{Total output}}{\text{Labour hours per class}} = \frac{\text{TZS}22,500,000}{14 \text{ weeks} \times 9 \text{ hours}} = \text{TZS}178,571.42 \text{ per hour}$$

Quick Quiz

1. What is transfer price?
2. What are the bases for setting a transfer price?
3. State the formulae of ROI and RI.
4. State the effect of variable cost transfer price on the transferor division.
5. What is negotiated price?
6. State any two disadvantages of ROI.

Answers to Quick Quiz

1. Transfer price is an exchange price between two different divisions of an organisation.
2. Cost-based transfer pricing, Market-based transfer pricing, Negotiated transfer prices.
3. Return on Investment

$$\text{ROI} = \text{Return on sales} \times \text{Asset turnover}$$

$$= \frac{\text{Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}$$

Residual Income (RI)

$$\text{RI} = \text{Income} - \text{Charge on investment}$$

$$\text{Charge on investment} = (\text{Investment} \times \text{Rate of Return})$$

4. Effect of variable cost-based transfer price

Transferor division

If the goods are transferred at the variable cost, the transferor division has to bear the fixed cost incurred on the transferred units. As a result, the profitability of that division will be affected.

5. Negotiated price is a bargained price between the two divisions. This price is agreed upon between the two departments. A division which is strong in negotiation will influence the transfer price.

6. Shortcomings of ROI

- Ignores time value
- Flexibility
- Ignoring risk associated with the project
- Inconsistency in terms income and investments

Self Examination Questions

Question 1

Elegant Ltd has two divisions, Stylish and Graceful. Graceful division is operating at full capacity (10,500 hours).

Graceful produces two products, X and Y, using the same labour force for each product. For the next year, the Graceful division has committed to selling 4,000 kg of Y, the remainder of its capacity being used on X.

Direct costs of these two products are

	X (TZS'000)	Y (TZS'000)
Direct materials	27	21
Direct wages	22 (1 production hour)	11 (1/2 production hour)

Graceful division's overheads are TZS189 million per annum of which TZS105 million are variable.

Graceful prices its products with a 66.67% mark-up on its total costs.

Stylish wishes to buy from Graceful 3,000 kg of product X which it proposes to adapt and sell, as product Z, for TZS135,000 per kg. The direct cost of adaptation is TZS16,000 per kg. The Stylish division will have to incur additional variable overheads of TZS3,000 per kg.

Required:

You are required to recommend, as the management accountant of Elegant Ltd,

- (a) At what transfer price, if at all, 3,000 kg of X should be sold to Stylish.
- (b) What other points should be borne in mind when making any recommendations about transfer price in the above circumstances.

Question 2

Euro-products Ltd is a chemical division of a large industrial corporation. Jim, the divisional General Manager, is choosing which of two plants, Newcastle or Sheffield, to use for the production of a new product. Both have the same capacity and an expected life of four years, with different capital costs and expected net cash flows. The following information is provided:

	Newcastle TZS million	Sheffield TZS million
Initial capital investment	4,800	3,900
Net cash flows (before tax)		
20X6	1,800	1,950
20X7	1,800	1,650
20X8	1,800	1,125
20X9	1,800	750

It is assumed that the plant will be used from 1 January, 20X4 and both plants have negligible residual value.

Jim is expected to generate a before-tax return on his divisional investment in excess of 14% p.a. which he is currently achieving. As his bonus is linked to his performance, he will not take up a project with a return of less than 14%. For calculating returns, divisional assets are valued at net book values at the beginning of the year. Depreciation is charged on a straight line basis.

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Required:

Evaluate both the plants using Residual Income as well as Return on Investment to arrive at a decision whether to take up the new project or not.

Question 3

Calculate ROI, RI and EVA from the following data:

	Division S (TZS million)	Division M (TZS million)
Total operating assets	100	80
Revenue	107	90
Expenses	87	70

The minimum rate of return on investments for the same firm is 12.5%.

The corporate taxation rate is 35%.

Expenses include interest payable on 10% debentures worth TZS50 million in project S and interest payable on an 11% loan worth TZS10 million in project M.

Question 4

- Briefly discuss any five advantages and any five disadvantages of divisionalization (decentralization)
- You have been given the following information regarding two divisions X and Y of company;

	Division X	Division Y
ROI on proposed project	20%	13%
RIO of the division at the present	25%	9%

The company as whole is ready to accept any project that has a ROI greater than 15%.

Required:

Using the given information, explain how Return on Investment (RIO) as a measure of performance would result into goal incongruence.

Question 5

- Transfer between processes in a manufacturing company can be made at **cost or sales value at the point of transfer**.

Required:

Explain how each of the above methods might be compatible with the operation of a responsibility accounting system.

- Sanilac Ltd has been offered supplies of special ingredient X at a transfer price of TZS. 15,000 per kg by Zodiac Ltd, which is the part of the same group of companies. Zodiac Ltd processes and sells special ingredient X to customers external to the group at TZS. 15,000 per kg. Zodiac Ltd based its transfer price on cost plus 25% profit mark up. Total cost has been estimated as 75% variable and 25% profit mark up. Total cost has been estimated as 75% variable and 25% fixed.

Required:

Discuss the transfer price at which Zodiac Ltd should offer to transfer special ingredient X to Sanilac Ltd in order that group profit maximizing decisions may be taken on financial grounds in each of the following situations:

- Zodiac Ltd has an external market for all its production of special ingredient X at a selling price of TZS. 15,000 per kg. Internal transfers to Sanilac Ltd would enable TZS. 1,500 per kg of variable packing cost to be avoided.
- Conditions are as per (i) above but Zodiac Ltd has production capacity for 3000 kg of special ingredient X for which no external market is available.
- Conditions are as per (ii) above but Zodiac Ltd has alternative use for some of its spare production capacity. This alternative use is equivalent to 2,000 kg of special ingredient X and would earn a contribution of TZS. 6,000,000.

Question 6

Food Co. is a well-established food manufacturing and distribution company, specializing in food production. Currently it has annual turnover in excess of TZS 1,500 million. At present the company has three production and distribution divisions, each responsible for specific product groups.

The summary information of Maaza division relating to the divisional assets and profitability is as follows:

Maaza division produces a wide range of both dried and fresh Maaza products which it sells to both supermarket sector and the restaurant trade.

Last year the divisional figures were as follows:

	TZS millions
Investment in non-current assets	150
Investment in working capital	100
Operating profit	50

The company is keen to ensure that each division operates as an autonomous profit-making unit to ensure that efficiency prevails and motivation and competitiveness are maximized. Managers are given as much freedom as possible to manage their divisions. Divisional budgets are set at the beginning of each year and these are then monitored on a monthly basis. Divisional managers are then rewarded in terms of divisional return on investment.

The company is currently considering expansion into a new but allied product range. This range consists of sauces and canned foods. Projected figures are as follows:

	TZS million
Additional non-current asset required	75
Additional investment in working capital	35
Budgeted additional profit	19.8

The company has a cost of capital of 15%

The manager of Maaza division has produced successful results over the past few years for her division. She and her staff have enjoyed handsome bonuses on the basis of return on investment. The company has traditionally calculated return on investment as operating profit as percentage of return on all net divisional assets, and bonuses are paid as a percentage on this basis. The Board of Directors proposes that the Maaza division will be responsible for expansion into sauces and canned foods.

Required

- (a) Calculate the return on investment for the division both before and after the proposed divisional expansion.
- (b) Calculate the residual income for the division both before and after the proposed divisional expansion.
- (c) (i) Using Return on Investment (ROI) as performance measure, determine whether the divisional manager will be happy to accept the proposed expansion.
(ii) Explain how your answer would alter if residual income was used as a performance measure instead of return on investment.
- (d) Briefly outline the advantages and disadvantages of return on investment and residual income as divisional performance measures

Answers to Self-Examination Questions

Answer to SEQ 1

(a)

Profit statement for product X	TZS'000
Variable costs:	
Direct materials	27
Direct wages	22
Variable overheads (TZS10,000 (W1 x 1 hr))	10
	59
Fixed overheads (TZS8,000 (W2) x 1 hr)	8
Total Cost	67
Add: Profit (66.67% of total cost)	45
Selling Price	112

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If Graceful sells to Stylish at the existing price of TZS112,000 per kg then Stylish makes a profit of TZS135,000 – (TZS112,000 + TZS16,000 + TZS3,000) = TZS4,000 per kg. Therefore, the profit would be TZS12,000 for the total order of 3,000 kg.

Workings

W1 TZS105 million variable overheads for 10,500 production hours; therefore absorption rate is TZS10,000 per hour for Graceful division.

W2 Remaining TZS84 million fixed overheads for 10,500 production hours; therefore absorption rate is TZS8,000 per hour for Graceful division.

(b) The main point to be considered is whether or not product Z is a one-off order. As Graceful division is working at full capacity, if Product Z is a one-off contract, this transfer of 3,000 kg from Graceful to Stylish may lead to loss of external market. However, if product Z has viability, this transfer will not cause any harm to Elegant Ltd.

Answer to SEQ 2

The annual ROI and residual income calculations for each plant are as follows

	20X6	20X7	20X8	20X9	Total
Newcastle	TZS million	TZS million	TZS million	TZS million	TZS million
I. Net cash flow	1,800	1,800	1,800	1,800	7,200
II. Depreciation	(1,200)	(1,200)	(1,200)	(1,200)	
III. Profit	600	600	600	600	2,400
IV. Cost of capital 14% of (VI)	(672)	(504)	(336)	(168)	
V. Residual income (W1)	(720)	96	264	432	
VI. Opening WDV of asset	4,800	3,600	2,400	1,200	
VII. ROI (W2)	12,50%	16,67%	25%	50%	
Sheffield					
I. Net cash flow	1,950	1,650	1,125	750	5,475
II. Depreciation	(975)	(975)	(975)	(975)	
III. Profit	975	675	150	(225)	1,575
IV. Cost of capital 14% of (VI)	(546)	(410)	(273)	(137)	
V. Residual income (W1)	429	265	(123)	(362)	
VI. Opening WDV of asset	3,900	2,925	1,950	975	
VII. ROI (W2)	25%	23%	7,7%	-23%	

Workings

W1 Residual income (RI) for Newcastle and Sheffield

RI = Income – Charged on investment

Charged on investment = Investment x Rate of return

W2 Return on investment (ROI) for Newcastle and Sheffield

ROI = Return on sales x Assets turnover i.e. Profit/Opening WDV of assets

From the above calculations it is found that the Newcastle plant will give a higher return in the later period and the Sheffield plant will provide higher return in the earlier period during the life of the plant.

As shown by the calculations, accepting Newcastle is a better option as it will give a higher return than the Sheffield, but this will involve Jim having to part with his performance bonus. As bonus is linked to performance, there is the chance that managers may devise sub-optimal plans.

Therefore, in this case, it is possible that Jim will choose to go for Sheffield. This will mean that the organisation as a whole will fail to achieve goal congruence.

Answer to SEQ 3

Income statement

Details	Project S TZS million	Project M TZS million
Revenue	107.00	90.00
Less: Operating expenses (without interest)	82.00	68.90
EBIT	25.00	21.10
Less: Interest on debentures	5.00	1.10
EBT	20.00	20.00
Less: Taxation @35%	7.00	7.00
Net operating profit	13.00	13.00

$$ROI = \frac{\text{Net operating profit}}{\text{Total assets employed}} \times 100$$

For division S

$$= \frac{\text{TZS13 million}}{\text{TZS100 million}} \times 100$$

$$= 13\%$$

For division M

$$= \frac{\text{TZS13 million}}{\text{TZS80 million}} \times 100$$

$$= 16.25\%$$

$$RI = \text{Net operating income} - \text{Charge on investment}$$

For division S

$$= \text{TZS13 million} - (\text{TZS100 million} \times 12.5\%)$$

$$= \text{TZS13 million} - \text{TZS12.5 million}$$

$$= \text{TZS0.5 million}$$

For division Ms

$$= \text{TZS13 million} - (\text{TZS80 million} \times 12.5\%)$$

$$= \text{TZS13 million} - \text{TZS10 million}$$

$$= \text{TZS3 million}$$

EVA

For division S

$$\begin{aligned} \text{EVA} &= \text{NOPAT} - \text{Charge on investment} \\ &= (\text{TZS25 million} \times 65\%) - (\text{TZS100 million} \times 12.5\%) \\ &= \text{TZS16.25 million} - \text{TZS12.50 million} \\ &= \text{TZS3.75 million} \end{aligned}$$

For division M

$$\begin{aligned} \text{EVA} &= \text{NOPAT} - \text{Charge on investment} \\ &= (\text{TZS21.10 million} \times 65\%) - (\text{TZS80 million} \times 12.5\%) \\ &= \text{TZS13.715 million} - \text{TZS10.000 million} \\ &= \text{TZS3.715 million} \end{aligned}$$

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Adjusted NOPAT

Details	Project S Amount TZS million	Project M Amount TZS million
Revenue	107.000	90.000
Less: Operating expenses	82.000	68.900
EBT	25.000	21.100
Less: Taxation @35%	8.750	7.385
Net operating profit	16.250	13.715

Conclusion

According to ROI and RI, division M is more profitable. However, according to EVA, division S is performing better.

Answer to SEQ 4

- (a) Advantages and disadvantages of divisionalization (decentralization)

Advantages (any five of the following)

- (i) Quality decision making since the decision makers are familiar with and well informed about the situations they are dealing with.
- (ii) Speedy decision making since there is no chain of command.
- (iii) Efficient productions since heads are familiar with the production lines and processes.
- (iv) Divisional heads are given opportunity to achieve self-fulfilment. This brings motivation and efficiency throughout the organisation.
- (v) The top management is freed from detailed involvement in the day-to-day operations and devotes more efforts to strategic planning.
- (vi) Divisions provide excellent training grounds for future members of the top management by enabling divisional managers to acquire basic managerial skills and experience in an environment that is less complex than that of the company as a whole.

Disadvantages

- (i) Competition between divisions may arise and divisional heads may strive to increase profits at the expense of profits of other divisions.
- (ii) There may arise 'goal incongruence' i.e. lack of harmony in achieving the overall organisational goals as each division strives to achieve its own goals.
- (iii) Total company profits may decrease because of 'goal incongruence'.
- (iv) Costs of operations may be high e.g. each division will have its own accounting department instead of having one centralized accounting department.
- (v) Top management loses some control by delegating decision making to divisional heads.

- (b) How return on investment (ROI) can lead to goal incongruence

	Division X	Division Y
Return on proposed project	20%	13%
ROI of the division at present	25%	9%

There is 'goal incongruence' if the individual divisional goals do not lead to the achievement of the goals of the company as a whole.

If the company as whole is ready to accept any project that has a return greater than 15%:

- (i) The company as a whole is ready to accept Division X project proposal since it gives a return which is greater than 15%, but, Division X will reject this proposal since it gives a return which is less than 25%.
- (ii) The company as a whole will reject Division Y project proposal since it gives a return which is less than 15%, but, Division Y will accept this proposal since it gives a return which is greater than 9%.

Answer SEQ 5**Discussion:**

Responsibility accounting is a system whereby costs and revenues are traced to the individuals who are responsible for incurring them. Under this system managers are held responsible for their performance.

With cost based transfer price systems, transfer are made either at actual cost or standard cost. Where actual costs are used there is no incentive for supplying centre to control costs because any inefficiencies arising in supplying centre will be passed on to receiving centre. Consequently, the receiving centre will be held accountable for the inefficiencies of the supplying division. Transfers at actual costs are therefore inappropriate for responsibility accounting.

Where cost based transfer pricing system is used, transfer should be at standard cost and not actual cost. This will result in the supplying centre being held accountable for the variances arising from the difference between standard and the actual cost of transfer.

Where there is a competitive market price for intermediate product, current market price is the most suitable basis for setting the transfer price. When transfers are recorded at represent the real economic contribution of the profit centre to total company profits.

Therefore transfers based on selling prices will represent a more appropriate basis for meeting the requirement of a responsibility accounting system.

b) Discussion:

The proposed transfer price of TZS 15,000 is based on cost plus 25% implying that the cost is TZS 12,000 this comprises TZS 9,000 ($12,000 \times 75\%$) variable costs and 3,000 ($12,000 \times 25\%$) fixed costs. Zodiac will lose TZS 6,000 ($15,000 - 9,000$) if it transfer to Sanilac instead of selling directly. Therefore, transfer price will be set at marginal cost plus opportunity cost. But the marginal cost of transfer is TZS 7,500 (9,000 less packaging cost) and opportunity cost is TZS 6,000 making a transfer price of TZS 13,500. Alternatively, Market price of TZS 15,000 less packing costs avoided TZS 1,500 which is equal to TZS 13,500.

- (i) For the 3,000 kg where no external market is available the opportunity cost will not apply and transfer should be at the variable cost of TZS 7,500. The remaining output should be transferred at TZS 13,500 as describe above.

The lost contribution for the 2,000 kg is TZS 3,000 ($6,000,000/2,000$) giving a transfer price of TZS 10,500 (7,500 variable cost + 3,000 opportunity cost). The remaining 1,000 kg for which there is not external market should be transferred at TZS 7,500 variable cost and the remainder for which there is external market transferred at TZS 13,500.

Answer SEQ 6

(a) Computation of Return in Investment (ROI) Before and after expansion

	Before expansion TZS Mil	Additions TZS. Mil	After proposed expansion TZS. Mil
Investment in	150	+75	225
Non-current assets			
Investment in working capital	100	+35	135
Net divisional assets	250		360
Operating profit	50	+19.8	69.8
Return on Investment	20.0%		19.4%

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(b) Computation of Residual Income (RI) before and after expansion

	Before expansion	After proposed expansion
	TZS Million	TZS Million
Operating profit	50.0	69.8
Imputed interest on net	37.5	54.0
Divisional assets	(TZS 360m x 15%)	(TZS 250m x 15%)
Residual Income	12.5	15.8

(c) Using Return on Investment (ROI) as a performance measure, the divisional manager would not be happy to accept the proposed expansion. The ROI would reduce if the expansion went ahead, indicating a deterioration in the division's performance, and because bonuses are paid as a percentage on this basis, the manager would receive a lower bonus.

If Residual Income (RI) was used as a performance measure, the manager would be happy to accept the proposed expansion. This is because the RI would increase as the result of expansion. This indicates an improvement in the division's performance and so the manager would receive a higher bonus.

(d) ROI has the obvious advantages of being compatible with the accounting reports and is easier to understand.

There are a number of disadvantages associated with both ROI and RI, however,

- Both methods suffer from disadvantages in measuring profits (how should inventory be valued, how should arbitrary allocations of head office charges be dealt with) and investment (What basis to use)
- It is questionable whether a single measure is appropriate for measuring the complexity of divisional performance.
- If the division maintains the same annual profit, keeps the same assets without a policy of regularly non-current assets replacement, and values assets at net book value, older, even though the profits may be static. This can give a false impression of improving performance over time and acts to discourage managers from undertaking new investment.

In addition, ROI suffers from the following disadvantages:

- The need to maintain ROI in the short-term can discourage managers from investing in new assets (since the average ROI of a division tends to fall in the early stages of a new investment) even if the new investment is beneficial to the group as a whole (because the investment in ROI is greater than the group's target rate of return). This focuses attention on the short-run performance whereas investment decisions should be evaluated over their full life. RI can help to overcome this problem of sub-optimally and lack of goal congruence by highlighting projects which return more than the cost of capital.
- It can be difficult to compare percentage ROI results of divisions if their activities are very different. RI can overcome the problem through the use of different interest rates for different divisions.

There are also a number of disadvantages associated with RI: it does not facilitate comparisons between divisions: neither does it relate the size of the division's income to the size of investment: In these respects ROI is a better measure.

The disadvantages of the two methods have a number of behaviour implications. Managers tend to favour proposals that produce excellent results in the short term proposals that produce excellent results in the short term to ensure their performance appears favourable) but which, because they have little regard for latter life of their division's projects, are possibly unacceptable in the longer term. They will therefore, disregard proposal that area in the best interest of the group as a whole. ROI and RI can therefore produce dysfunctional decision making.

SECTION E3: PERFORMANCE MANAGEMENT SYSTEMS

Get Through Intro

The management information needs of the various management levels in an organisation are different. The information needs of the different management levels of an organisation planning to launch a new watch model would be as follows:

Strategic level: to help decide the branch where the new model can be launched.

Tactical level: to help decide the features that can be included in the watches depending upon the consumer preferences and economic conditions of target customer.

Operational level: to help decide whether the target production and sale requirements can be achieved.

Management accountants use both internal and external sources of information to provide the data required by managers, which help them to run effective operational and strategic performance management systems.

Learning Outcomes

- a) Evaluate and advise management on suitable information technology and information systems support that may enable them to operate effective operational and strategic performance management systems.
- b) Evaluate and advise management on suitable approaches that may be used to manage people issues and change when implementing performance management systems.

1. Evaluate and advise management on suitable information technology and information systems support that may enable them to operate effective operational and strategic performance management systems.

[Learning Outcome a]

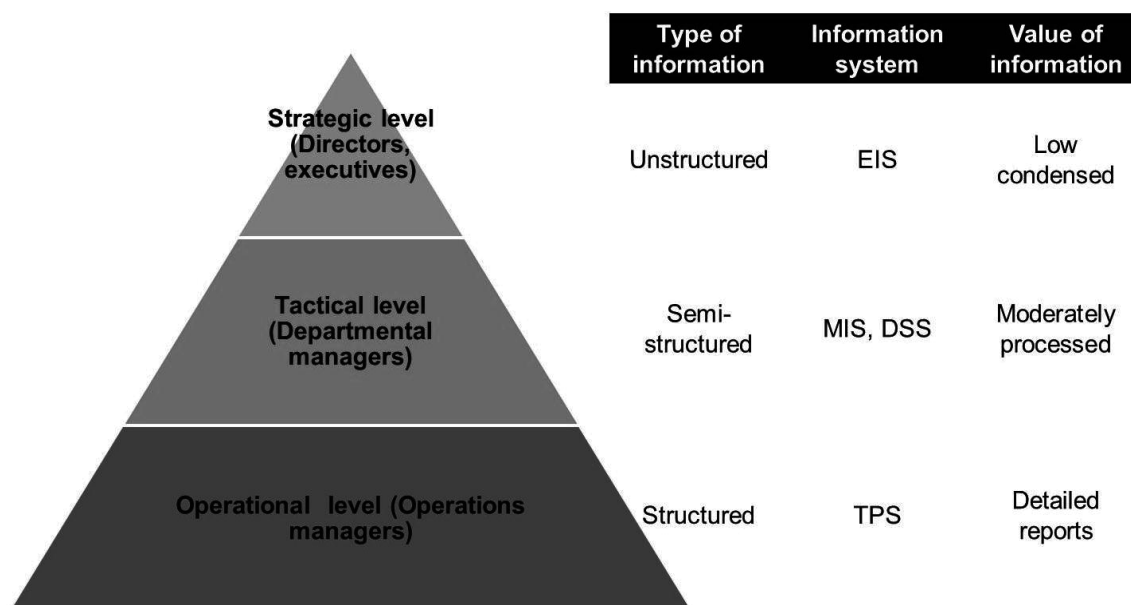
The monitoring of business performance requires an arrangement for collecting and monitoring business performance data. This arrangement is known as an information system. In most of the organisations, Information Systems (IS) is the name of the department responsible for computers, networking and data management. Many organisations refer to the same department as IT (Information Technology) or MIS (Management Information Services).

An information system may be designed to collect information regarding actual performance against functional goals in the form of quantity produced, wastages of material, idle labour, labour efficiency, quantity sold by divisions, inventory levels, delay in receiving payments from customers, delay in paying suppliers, wastage of power, product failures, customer complaints, customer satisfaction etc.

Information systems support different types of decisions at strategic, tactical and operational levels of the organisational hierarchy. Major types of information systems include structural databases and information management software that can include the following;

- Transaction process systems (TPS)
- Management information systems (MIS)
- Decision support systems (DSS)
- Executive information systems (ESS)

Diagram 1: Information systems



1.1 Transaction processing systems

Transaction processing systems (TPS) were the first type of information systems. As their names suggests the purpose of TPS is to **record and process the routine transactions** of an organisation.



Definition

A transaction is a business activity or exchange that occurs between an organisation and an external party. Transactions can also occur between the different divisions of an organisation

The transactions were recorded on paper before the time of computers. Today many TPS are on-line, meaning that the transaction is actually recorded as it happens. TPS for organisations not only keep an official record of transactions they also serve as the **data source for other systems** of the organisation such as:

- Customer billing systems;
- Vendor payment systems and
- Inventory control



Example

One Tree is an organisation that specialises in selling different types of lumber to construction companies. Whenever an order of lumber leaves the organisation's premises, its TPS records the payment details such as the amount / type of lumber bought. This information is then used to automatically update the organisation's record of inventory (amount of stock physically at the premises).

Characteristics of transaction processing systems

1. A TPS records internal and external transactions for a company. It is a warehouse of data that is frequently accessed by other systems.
2. A TPS performs routine and repetitive tasks. It is mostly used by lower-level managers to make operational decisions.
3. Transactions can be recorded in batch mode or online. In a batch mode, the files are updated periodically, whereas in an online mode, each transaction is recorded as it occurs.
4. There are six steps in processing a transaction. They are: data entry, data validation, data processing and revalidation, storage, output generation, and query support.
5. A TPS supports different tasks by imposing a set of rules and guidelines that specify how to record, process, and store a given transaction. There are many uses of transaction processing systems in our everyday lives, such as for making a purchase at a retail store, depositing or withdrawing money at a bank, or registering for classes at a university. Almost all organisations, regardless of the industry in which they operate, have a manual or automated TPS.
6. A TPS is the data life-line for a company because it is the source of data for other information systems, such as MIS and DSS (Decision Support Systems). Hence, if the TPS shuts down, the consequences can be serious for the organisation.
7. A TPS is also the main link between the organisation and external parties, such as customers, suppliers, distributors, and regulatory agencies.
8. TPS exists for the various functional areas in an organisation, such as finance, accounting, manufacturing, production, human resources, marketing, quality control, engineering, and research and development.

Transaction processing systems (TPS) are basic business systems that serve the operational level of the organisation by recording the daily routine transactions required to conduct business, such as payroll and sales receipts.

There are two types of TPS:

1. **Batch processing:** data is stored and processed in batch jobs



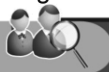
Example

Examples include:

Clearing of presented cheques
Generation of bills

Credit card transactions (systems that show real time computerized transactions as they occur, but actual updating is processed in batches)

2. **Real time processing:** i.e. a continual input, process and output of data. Here, data has to be processed in a small stipulated time period (real time). In many organisations, batch processing is replaced by real time processing.



Example

Examples include:

Reservation system
Point of sale termination
ATM

Application of TPS in performance management: by using a TPS, the chances of errors are minimised due to automation, thus, helping in improving overall performance. Then, since this is the basic level (operational) of the entire system of an organisation and involves elaborate data relating to various departments, the performance of various departments (Production, HR, Sales, etc.) can be monitored on a more regular basis.

1.2 Management information systems

The term management information system (MIS) made its first appearance in the US navy in a report on the use of computers to construct a single integrated system to manage all navy's resources. Today, MIS is taken to mean computer-based systems. Used broadly, an MIS is considered to be a system which satisfies all the information needs of managers. An MIS is the system of providing information to people who make choices about the allocation of valuable resources in a timely, accurate and complete manner at a minimum of cognitive and economic cost for acquisition, processing, storage and retrieval.



Definition

Management information system is a system that provides data and information to the managers in the form of reports, including exception reports of matters requiring action, analysis and other information to support the functions of planning and control as well as decision making and its various aspects such as analysis and modelling.

Historically, accounting systems have been the most organised and developed part of any information system, but an MIS extends beyond accounting information. It is used to pull together all the organisation's resources to equip all levels of management from every part of the organisation with the necessary information. This enables timely and effective decision making at all three levels of planning for which management is responsible, thus, also paving way for effective performance management



Example

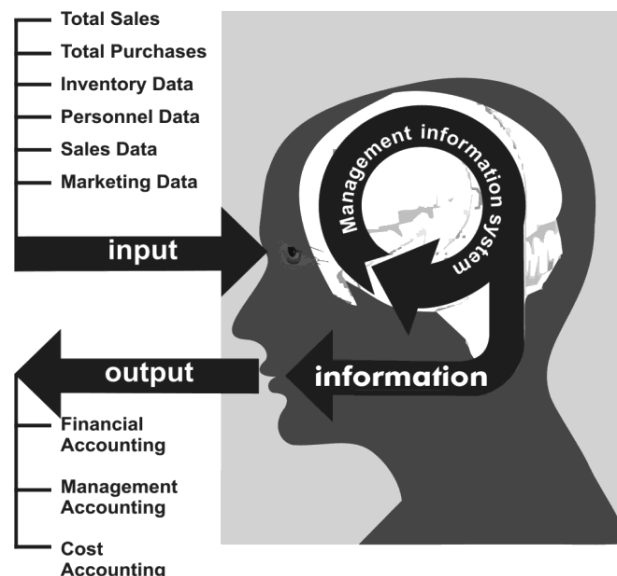
The employee details in an organisation are recorded in a number of different files. Organisations today increasingly follow the system of creating a database of information which will practically fulfil any information request. MIS of an organisation is equipped with abilities to extract any information pertaining to an employee from the database thus prepared.

In case the management wants the information of an employee relating to his age, remaining years of service, date of joining, his salary structure or his leave record then the MIS has the capability to extract all this information from the different locations in the database.

The role of management information systems (MIS) is **to generate a regular series of reports** for the managers and executives of an organisation. These reports will contain the necessary information that this group requires to make **strategic / managerial decisions** and **monitor the performance** of an organisation.

MIS will typically take raw data from TPS as their inputs. MIS will then perform **calculations and / or data comparisons** on this information to generate its outputs (reports). The reports generated will fall into one of three broad categories: summary, detailed and exception. Summary records provide a summarisation of all of an organisation's various transactions.

Diagram 2: Functioning of an MIS



An MIS may include

Accounting records: bill books, purchase order book, cash book.

Financial statements: statement of comprehensive income, statement of financial position

Inventory data: stores ledger, dispatch notes

Production schedules: specifying the daily and weekly output targets to be achieved

HR (Personnel) records: employees' personnel files, time sheets

Marketing data: including market trends and customer expectations

Processed information: to be used by management in the attainment of the organisational objectives, usually, MIS generated reports (possible to be formatted as: tabular / textual / graphical) can be classified into two categories, routine reports and ad-hoc reports. Routine reports are the reports that are generated from within the organisation's interface as and when required whereas ad-hoc reports are custom built and generated on organisational demand.

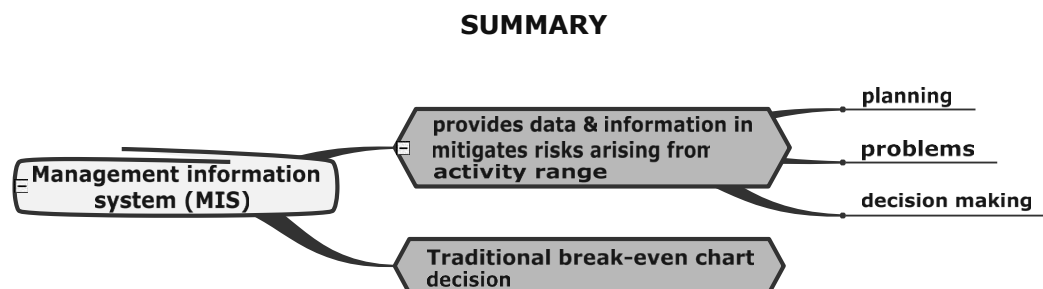
The following example illustrates how various types of MIS reports helps in performance management.

Summary reports: consolidate information in a format that provides ease and comfort to managers in reviewing and analysing scenarios. For example, sales summary report provides information on daily sale; sales by product category, sales by region, etc.

Trend reports: help managers to compare the performance of business units or product types and to assess historical results. For example, a sales trend report displays the sales of different product types over a year, split down by weeks or months.

Exception reports: cumulate the unusual conditions and present them distinctly. A timely reporting of exception conditions makes it easier for a manager to separate situations that require immediate attention.

On-demand reports: content of these reports depends on the circumstances and the requesting manager's requirements. For example, a small coaching class might want to know how its batches are selling around certain months, in specific geographic areas or a combination.



1.3 Decision support systems

DSS is a computer-based information system that supports organisational decision-making activities. DSSs serve the management, operations, and planning levels of an organisation and help to make decisions.

A sales manager, for example, might need to determine the level of yearly sales quotas to be set, based on increased sales and lowered product costs. Decision supports systems help provide information to support such decisions. A decision support system (DSS) is a computer-based information system that supports business or organizational decision-making activities. Decision support systems can be either fully computerized, human or a combination of both.

Typical information that a decision support application might gather and present includes:

- Comparative sales figures between one period and the next
- Projected revenue figures based on product sales assumptions

A decision support system uses data from internal and/or external sources. Internal sources of data might include sales, manufacturing, inventory, or financial data from an organization's database. Data from external sources could include interest rates, population trends and costs of new housing construction or raw material pricing.

Typical characteristics of DSS

1. These systems assist senior management to make long term decisions.
2. They provide information for unstructured or semi structured decisions. A decision is considered unstructured if there are no clear procedures for making the decision and when not all the factors to be considered in the decision can be readily identified in advance.
3. A decision support system must be very flexible. The user should be able to produce customized reports by giving particular data and format specific to particular situations.

The objective of decision support systems (DSS) is to help management / executives make decisions in situations with high levels of uncertainty. DSS comprise of a set of tools and techniques that will allow the decision makers of an organisation to run various “what if” scenarios. It is particularly helpful for decision makers who would like to compare what the potential outcomes of a number of different strategies would be. A common example of a very basic DSS is a spreadsheet.

1.4 Executive information systems

An executive information system (EIS) is one of the types of management information system, which is intended to **enable and support the information and decision-making needs** of higher level management (senior executives) **by providing easy access** to internal and external information which is **relevant for meeting the strategic goals** of the organisation.

EIS provides a variety of internal and external information to top managers in a highly summarised and convenient form. Nowadays, these systems are becoming an important tool for top-level control in many organisations. As the name suggests, EIS helps an executive to spot a problem, an opportunity, or a trend.

The emphasis of EIS is on graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities.

Usually, it is considered to be a specific form of decision support system (DSS). The only difference between DSS and EIS is that DSS are primarily used by middle and lower level managers to plan future operations, whereas EIS mostly serve the control needs of higher level management.

Characteristics of executive information systems

The characteristics can be summarised as how EIS is helpful in performance management are as below:

1. EIS provides access to a variety of databases, both internal and external, through a uniform interface.
2. It provides prompt and easy access to information reflecting the key success factors of the company and of its units.
3. These systems primarily assist top management in revealing either a problem or an opportunity. Forecasters and middle managers can consequently use a DSS to suggest a solution to a problem.
4. EIS allows executives to see both summarised and detailed level data. One can display summarised data reflecting the overall status of their enterprise. EIS offers the capability to drill down into the data. It means it can display highly summarised data, then drill down to the detail level. Drill-down capabilities provide users with the flexibility to trace problem areas directly to the source.
5. Presentation of information through colour graphics or video allows an EIS user to understand key factors and performance trends in the areas of sales, purchasing, production, and finance at a glance.
6. Through EIS, both current status and projections can be made available.
7. An EIS allows easy modification and tailoring to the preferences of the particular users or group of users. One can search, sort, and filter information using pre-programmed controls.
8. Access to the data lies at the core of an EIS. EIS may work on the data mining principle, as DSS do, or they may be given access to the actual corporate databases / data warehouses.
9. EIS can exist either on individual workplaces or on servers.

1.5 Enterprise resource systems

ERP is an enterprise-wide software system which is a transaction processing and reporting mechanism through an integrated approach. ERP enables the organisation to use a unified database so that the transactions are recorded and processed in an integrated manner. The different business intelligence tools like EIS enable managers to access dash board reports almost on an online basis. The facility is usually access-controlled so managers can access only relevant data. In the previous versions of IT systems, managers did not have a direct access to the required data and had to depend on IT or the accounts department for information.

Performance measures such as budgets, standards or any other benchmarking parameters can be fed into the system. According to the defined time frequency (which can be real time online!), the system processes the comparison of actual vs. benchmarks and updates variance reports for managers. These reports are useful in measuring the performance and controlling the activity by initiating actions in time.

Enterprise resource planning (ERP) system accumulates, organises and combines huge amounts of data, which can be used to help in decision making. ERP is an advanced method of using computer technology. This software is used to link different functions like customer order management, accounting, inventory control, manufacturing, sales, marketing and human resources — across an entire company. An ERP system improves operational efficiency and reduces waste as it allows various departments and their functions across the company to use resources through a single computer system.

ERP is intended to ease:

information sharing;
business planning; and
decision making on an enterprise-wide basis.

Characteristics of ERP systems

Usually, ERP systems have the following characteristics:

- (i) It is a common database which supports all applications.
- (ii) ERP systems can be installed without elaborate application or data integration by the IT department.
- (iii) It is an integrated system which operates in real time, without relying on periodic updates.
- (iv) ERP systems can be used for a variety of functions such as:
 - to forecast demand for a product
 - to order the necessary raw materials
 - to establish production schedules
 - to track inventory
 - to allocate costs
 - to project key financial measures

ERP systems attempt to integrate all departments and their functions across a company into a single unified computer system, which can serve specific needs of all those different departments.

Conclusion

A sound information system support and information technology enables management to fulfil its control function and to conduct business effectively. Management evaluates and reviews the business information available through different types of information systems in order to make managerial decisions and operate effectively at all levels – strategic, tactical and operational.



Test Yourself 1

Taste Aspiration is a seven star hotel offering a wide variety of seafood. Its management wants to reduce 5% of the menu offerings to limit density in operations.

Taste Aspiration wants to implement a system which can provide timely and the most accurate data possible stating which of the variety is performing poorly, which is most likely to lead to sales, and which has the maximum distinctive ingredients in the recipe.

Required:

Suggest the most appropriate information system support for Taste Aspiration and list its benefits.

2. Evaluate and advise management on suitable approaches that may be used to manage people issues and change when implementing performance management systems.
[Learning Outcome b]

Performance management is a process that considerably affects organisational success by having managers and employees work together to set expectations, review results, and reward performance.

An effective performance management system includes the following components: performance planning, performance review, feedback on performance, rewarding good performance, implementing performance improvement plans and potential appraisal. It is an on-going process in any managed organisation.

2.1 Organisational challenges and people issues when implementing performance management systems

1. Organisational challenges

Implementing a performance management system in any organisation is not always easy. Most organisations have to face the **resultant challenges**. If these issues are not addressed, they can cause the performance management system to fail.

The resultant challenges are briefly discussed below:

- (a) **Difficult performance management:** performance management is not as easy as it seems. It is a time-consuming and complex process, and requires significant efforts in the given resource limitations. Organisational culture may also oppose the motivation to support implementation.
- (b) **Restrictions on financial systems:** in many organisations, existing financial systems have their limitations and are not capable enough to report or sort data which can support performance reporting. Usually, the available data cannot directly support the linkage between financial and operational data to determine cost per unit / service, the output per hour / labour, the productivity and other useful metrics. It has to be converted into meaningful information.
- (c) **Regular assessment and practice:** under performance management system, often, various data from various departments is gathered for decision making purpose. If that collected data is not being used for decision-making at the relevant time, it loses its value to the organisation and may lead to subsequent interrogations of why the information is being collected or reported.
- (d) **Organisational objections:** some departments in organisations may be apprehensive of implementing performance management systems because of fears on how the results will be interpreted, what it may reveal about the department's performance, and/or a lack of clarity of how it will affect the department and its employees.

2. People issues

Developing a performance management system is a challenge for most human resources departments, because there are so many elements critical to the process.

When we are talking about changes within an organisation, we are actually talking about changing the people-related systems and practices – and changing the attitudes and behaviours of people. People don't resist all changes – many changes are welcomed.

People resist change for a number of reasons; some of them are listed below:

- Fear of unfamiliar environment and unknown outcomes
- Negative sways from peers and leaders
- Lack of support, training, and guidance – the feeling that “nobody cares”
- The opinion that the change is unfair – some people appear to be protected, while others are threatened by the change
- Mistrust that is an integral part of a “them and us” culture of management and workers
- Insufficient consultation (involvement) to gain “commitment” – people need to understand and appreciate the reason for the change

2.2 Approaches that may be used to manage change and people issues

The following approaches need to be followed to overcome the challenges and manage organisational change and people issues on implementation of performance management system:

1. **Cooperation:** all successful organisational change while implementing a performance management system requires **co-operation**. Managers need to involve people and motivate them to change. This may include a frank conversation about disagreeable realities.
2. **Effective and proactive communication:** communication is an essential tool. Effective communication requires the provision of relevant information. A proactive communication strategy and process must be followed throughout the implementation of the performance management system. It eases fears and anxieties, reduces conflict to change, and generates commitment to the system.
3. **Group formation:** Managers need to establish an influential group, not necessarily senior, that can swiftly share the vision and promote the change process. This group should provide input and advice to the normal management hierarchy, and needs to establish itself as a key source of information and guidance relating to the change process.
4. **Staff motivation:** staff motivation should not be neglected, otherwise it will decline naturally. Various drivers are required to ensure high levels of staff motivation and commitment to the organisational vision, which may include a variety of activities such as team building, strategic planning, family picnics, internal competitions and awards, learning and development opportunities, behavioural change exercises, attitude change activities, sport activities, and so on.
5. **Reward systems:** a reward system that rewards high performance and discourages low and mediocre performance must be put in place. Much greater importance must be given to non-monetary rewards. Mechanisms must be put in place to take corrective action against low performers.
6. **Monitoring performance management system:** performance management system implementation must be continuously monitored. Problems must be spotted at an early stage to enable prompt, corrective action. Monitoring systems must be developed to systematically collect information, analyse and interpret it, and use it for decision-making.

Answer to Test Yourself

Answer to TY 1

Taste Aspiration needs an interactive information system that provides information, models, and data manipulation tools to help make decisions in semi-structured and unstructured situations.

Taste Aspiration should implement a decision supports system (DSS).

This is because DSS provides information, models, and data manipulation tools to help make decisions in semi-structured and unstructured situations. It also supports analytical work and helps in simulation and optimisation.

Simulation model – calculates the simulated outcome of tentative decisions and assumptions

Optimisation model – determines optimal decisions based on criteria supplied by the user, mathematical search techniques, and constraints

Benefits of DSS

- Improves personnel efficiency
- Speeds up the process of decision making
- Increases organizational control
- Encourages exploration and discovery on the part of the decision maker
- Speeds up problem solving in an organization
- Facilitates interpersonal communication
- Promotes learning or training
- Generates new evidence in support of a decision
- Creates a competitive advantage
- Reveals new approaches to thinking about the problem space
- Helps automate managerial processes

574: Performance Measurement and Control

Quick Quiz

1. What is an information system?
2. Name the major types of information systems.
3. Which information system provides data and information to the managers in the form of reports?
4. Define performance management.

Answers to Quick Quiz

1. The monitoring of business performance requires an arrangement for collecting and monitoring business performance data. This arrangement is known as an information system.
2. Major types of information systems include:
 - Transaction process systems (TPS)
 - Management information systems (MIS)
 - Decision support systems (DSS)
 - Executive information systems (ESS)
3. Management information system provides data and information to the managers in the form of reports.
4. Performance management is a process that considerably affects organisational success by having managers and employees work together to set expectations, review results, and reward performance.

Self Examination Question

Question 1

Tele Talk is a call centre handling customer service telephone calls.

These calls are monitored by an information system (IS) that records:

- the number of calls each representative received
- the time frame each representative took to answer each call
- the time frame each representative took to respond to the question / request for service

The management of Tele Talk can easily obtain statistics on almost any part of the process. Apparently, the management's goal is to make sure all calls are answered quickly and those customers are satisfied.

Information generated from IS can then be used in a variety of ways. For example, a senior manager can use the information from the system to compare an employee's output to that of his colleagues, to his own earlier output, or to historical outputs reflecting similar work conditions at other times. He can also evaluate the number and duration of calls, service representatives' response on a given day etc.

Required:

- (a) Explain the different roles that the MIS plays in the control process described for Tele Talk.
- (b) Describe the relationship between TPS, MIS, DSS, and ESS.

Answers to Self Examination Questions

Answer to SEQ 1

(a) Role of MIS

MIS plays a very important role in the organisation; it creates an impact on the organisational functions, performance and productivity. MIS usually:

- aids middle management
- provides reports on the firm's current performance based on data from TPS
- provides responses to routine questions with predefined procedures for replying
- has some analytical capability

(b) Relationship between TPS, MIS, DSS and ESS

Main management groups within a business are operational management (employees, staff), middle management and senior, top-management. Accordingly, there are three major types of information systems – transaction processing system (TPS), management information systems (MIS), decision-support system (DSS), and executive support system (ESS).

The various types of systems in the organisation exchange data with one another.

TPS are typically a major source of data for other systems, especially MIS and DSS. TPS are operational-level systems that collect transaction data. Examples of these are payroll or order processing that track the flow of the daily routine transactions that are necessary to conduct business.

TPS provide data that is required by MIS and DSS, although these systems may also use other data.

DSS not only use data from TPS but also from MIS.

MIS rely heavily on data from TPS.

ESS is primarily a recipient of data from lower-level systems. They obtain most of their internal data from MIS and DSS.

Usually, all four systems use the same basic data. TPS are a major source of internal data for other systems, especially MIS and DSS. Internal data from TPS and MIS combine with external data to provide a source of analysis for DSS and ESS. All four systems are designed to give managers of all organisational levels a complete, consolidated view of the firm.

