



**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**SCHOOL OF MANAGEMENT SCIENCES**

**COURSE CODE: ACC 313**

**COURSE TITLE: MANAGEMENT ACCOUNTING**

ACC 313  
MANAGEMENT ACCOUNTING  
COURSE GUIDE

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**CONTENT**

## **1.0 INTRODUCTION**

ACC 313-Management Accounting is designed to give you self instruction to you as you study Bachelor of Science (B. Sc) in Accounting. It is adapted from the Institute of Chartered Accountants of Nigeria study materials to prepare you for your B. Sc Accounting examination of School of Management Sciences of the National Open University of Nigeria .

## **2.0 COURSE AIM**

The aim of this course is to introduce you to Management Accounting approaches and processes.

## **3.0 COURSE OBJECTIVES**

By the end of this course, you should be able to:

- (i) Provide relevant information to assist management of organization in various sectors; And at operational and strategic levels in planning, decision making and in controlling operations;
- (ii) Analyzing problem situations, purpose and/ or evaluate alternative courses of action ;
- (iii) Know relevant quantitative techniques in solving problems;
- (iv) Assist management in identifying and applying appropriate measurement techniques;
- (v) Use information and communication technology to solve problems and preparation of reports.

### **COURSE CONTENT**

Nature and purpose, Decision making, Planning, Control, Divisional performance evaluation, application of quantitative methods, Contemporary issues in Management accounting

## **4.0 WORKING THROUGH THIS COURSE**

This course, ACC 313-Management accounting, expects you to do a lot of reading and practicing, in order to cover the materials in the course material. This means that you should devote much time to this course by reading through this material and getting more information from numerous texts and journals. These abound in every library and from the internet. The course material has been made easy to read and user-friendly. You will need to work in groups with other students in order to discuss, compare notes and thoughts as well as to exchange and share ideas. Below are the lists of all the components of the course:

## **5.0 COURSE MATERIALS**

The National Open University of Nigeria will provide you with the following items:

- Course Guide
- Study Units- Course material

- TMA Assignments

In addition, at the end of every unit, is a list of texts for your references and for further reading. It is not compulsory for you to read all of them. They are only essential supplements to this course material.

## 6.0 STUDY UNITS

The study units in this course are as follows:

### **MODULE I: MANAGEMENT ACCOUNTING-INTRODUCTION**

- Unit 1: Introduction and Scope of Management Accounting
- Unit 2: Management Accounting and Management Information System
- Unit 3: Cost Accounting Concepts and Principle
- Unit 4: Costing Methods
- Unit 5: Planning and Management Control System

### **MODULE II: COST, BUDGET AND DECISION MAKIN**

- Unit 6: Cost Estimation and Behaviour
- Unit 7: Decision making under Uncertainty
- Unit 8: Budgeting and Budgeting Control
- Unit 9: Standard Costing
- Unit 10: Cost of Capital

### **MODULE III: QUANTATIVE METHODS AND MANAGEMENT ACCOUNTING**

- Unit 11: The Application of Quantative Methods to Management Accounting
- Unit 12: Working Capital Management
- Unit 13: Capital Investment Decision
- Unit 14: Decision Making under Risk and Uncertainty
- Unit 15: Divisional Performance Evaluation

### **MODULE IV: PRICING, RATIO, COST AND CURRENT TREND IN MANAGEMENT ACCOUNTING**

- Unit 16: Transfer Pricing Systems
- Unit 17: Pricing Decisions
- Unit 18: Ratio Analysis
- Unit 19: Cost Control and Cost Reduction
- Unit 20: Current Trends in Management Accounting

#### **Module 1:**

Unit 1- discusses the introduction and scope of management accounting- definition, as it relates cost to accounting, financial accounting, techniques used in management accounting for planning, controlling and decision making. It also deals with roles of management accounting in an organization and basic

management accounting issues such as business objectives and goal congruence.

Unit 2- deals with management information system role in relation to management accounting information attributes, management report and feedback

Unit 3- treats definition of basic cost accounting, principles of accounting-material costing, labour costing and overhead costing, It discusses concept of activity based costing as well,

Unit 4- covers a detailed description of costing methods, job costing, batch costing and contract costing. It also explains process costing, joint – product, by-product and service costing.

Unit 5- treats short-term and long-term planning. It discusses strategic, tactical and operational planning: control system and the basic knowledge of closed loop and open loop systems and decisions are also treated

## **Module 2:**

Unit 6- treats you to the importance of cost behavior: definition of variable cost in linear and non-linear form and techniques used in estimation and prediction of all cost are discussed. It also treats the effect of inflation in costing.

Unit 7- covers a comprehensive discussion on marginal technique and the preparation of operative statements under marginal and absorption costing techniques. It deals also with cost-volume-profit analysis for decision making, break-even charts and project analysis including limiting factors and its affects decision making. Application of relevant cost, opportunity cost, incremental cost and differential cost to decision making are also discussed.

Unit 8- presents objective of budgeting. Stages in developing budget and their interrelationships, cash budget and its importance in an organizational functional budgets and master budget, control limits, activity and efficient ratio: need for budgetary control and vital importance of the human of human aspect of budgeting is treated. The major techniques used in budgeting such as flexible budgets, zero-based budgeting, activity based budgeting, continuous budgeting, and programme planning and budgetary systems are also covered.

Unit 9- discusses the difference between cost and standard costing: types of standard and capacity levels. It also covers standard costing techniques and the associated objectives, how to apply the various principles required for the computation of variances; the concept of standard hour and computation of capacity, efficiency and activity ratio: and how to apply the principle of marginal costing in standard costing.

Unit 10- treats cost of capital and source of capital funds to an enterprise, the different cost of funds and their computations, various cost models, various

cost concepts as they relate to cost of capital-and the relationship between cost of capital and gearing. It also covers contributions for the cost of capital as well as acceptability of projects.

### **Module 3:**

Unit 11 discusses the application of quantitative methods of learning curve theory and the situation where it may be applied; computation of average and incremental labour for different output levels, advantages and limitations of the learning curve theory: various ways of classifying stock: various stock control techniques and their applications: weakness of the various stock control methods and the situations when it will be appropriate to adopt linear programme techniques. It also discusses the various linear programming techniques and their applications, the meaning and usefulness of the term 'shadow price'.

Unit 12- explains working capital management in the following areas: definition and its component: the need for managing current assets and current liabilities; the proper mix of short term and long term financing for current assets; factor that affect credit policies: techniques of inventory management; technique used in cash management and the preparation of cash flow statement.

Unit 13- discusses opportunity cost of an investment, concept of payback period, accounting rate of returns, net present value: the limitations of the various concepts, how to calculate PBP, ARR, NPV and IRR; superiority of NPV over the IRR; exclusive project with unequal lives, capital rationing; the concept of profitability index, and the treatment of inflation in capital investment appraisal.

Unit 14- issues relating to decision making under risk and uncertainty are discussed. It covers such matters as risk and uncertainty. Payback risk premium and finite horizon methods; the application of probability in project appraisal; the calculation and explanation of expected value: standard deviation and coefficient of variation as measures of risk and their limitations; the construction of decision tree when there is a range of alternatives and possible outcomes; the description and calculation of the value of perfect and imperfect information; the maximum, maxima regret decision rules; sensitivity analysis and its application to project analysis; portfolio analysis and its implication for project appraisal.

Unit 15- discusses the concept of decentralization, responsibility accounting and the various divisional performance evaluation techniques. It also discusses the concept of value for money audit.

### **Module 4:**

Unit 16- discusses the objectives and methods of transfer pricing system. The merits and demerits of the methods are discussed. It also discussed the factors to be considered when setting transfer prices for multinational transactions and the nature and meaning of dual transfer pricing system.

Unit 17- discusses the objective of price decision and factors affecting it. It also discusses the relationship between selling price, various pricing methods and their application; the use of differential calculus to find optimum price and the different pricing policies.

Unit 18- discusses the concept of ratio analysis and explains the benefits and limitations of ratio analysis. The computation of various ratios including value added ratio.

Unit 19- discusses the concept of cost control and cost reduction. It also discusses the main differences and limitations between cost control and cost reduction; the scope and factors of cost reduction. The various cost techniques are also discussed.

Unit 20- discusses current trend in management accounting involving the following: advanced management technology, total quality management, throughput accounting, back-flush accounting, target costing, lifecycle costing, teardown accounting analysis and strategic management accounting

## **7.0 ASSESSMENT**

There are two aspects to the assessment of the course: first is the tutor-marked assignment; and secondly, the examination. Within each unit are self-assessment exercises, which are aimed at helping you to check your assimilation as you proceed. Try to attempt each of the exercises before finding out the expected answers from lecture.

## **8.0 TUTOR-MARKED ASSIGNMENT (TMAS)**

This is your continuous assessment and accounts for 30% of your total score. You are expected to answer at least four TMA's, three of which must be answered and submitted before you sit for the end of course examination.

## **9.0 FINAL EXAMINATION AND GRADING**

With this examination written successfully, you have completed your course in Basic research and one believes you would apply your knowledge (new or up-graded) in your project. The 'end of course examinations' would earn you 70% which would be added to your TMA score (30%). The time for this examination would be communicated to you.

## **10.0 HOW TO GET THE BEST FROM THIS COURSE**

In distance learning, the study units are specially developed and designed to replace the conventional lectures. Hence, you can work through these materials at your own pace, and at a time and place that suits you best. Visualize it as reading the lecture.

This is one of the great advantages of distance learning. You can read and work through specially designed study materials at your own pace, and at a time and place that suits you best. Think of it as reading the lecture that a lecturer might set you some readings to do, the study unit will tell you when to read other materials. Just as a lecturer might give you an in-class exercise, your study units provide exercises for you to do at appropriate points.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit, and how a particular unit is integrated with the other units and the course as a whole.

Next is a set of learning objectives. These objectives allow you to know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the unit, you must go back and check whether you have achieved the objectives. If you make a habit of doing this, you will significantly improve your chances of passing the course.

The main body of the unit guides you through the required reading from other sources. This will usually be either from a **Reading Section** of some other sources.

Self-tests are interspersed throughout the end of units. Working through these tests will help you to achieve the objectives of the unit and prepare you for the assignments and the examination. You should do each self-test as you come to it in the study unit. There will also be numerous examples given in the study units, work through these when you come to them too.

The following is a practical strategy for working through the course.

- (1) Read this course guide thoroughly.
- (2) Organize a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignments relate to the units. Important information e.g. details of your tutorials, and the date of the first day of the semester will be made available. You need to gather all this information in one place, such as your diary or a wall calendar. Whatever method you choose to use, you should decide on and write in your own dates for working on each unit.
- (3) Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their coursework. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.
- (4) Turn to unit 1 and read the introduction and the objectives for the unit.



- (5) Assemble the study materials. Information about what you need for a unit is given in the 'Overview' at the beginning of each unit. You will always need both the study unit you are working on and one of your references, on your desk at the same time.
- (6) Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the units, you will be instructed to read sections from your set books or other articles. Use the unit to guide your reading.
- (7) Review of the objectives for each study unit and confirm that you have achieved them. If you feel you are not clear about any of the objectives, review the study material or consult your tutor.
- (8) When you are confident that you have achieved a unit's objectives, you can then start on the next unit. Proceed unit by unit through the course and try to face your study so that you keep yourself on schedule. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in the Course Guide).
- (9) You now take the e-TMA online
- (10) After completing the last unit, review the course and prepare yourself for the final examination.

## **11.0 SUMMARY**

This course ACC 313 is designed to give you some knowledge which would help you to understand management accounting. After going through this course successfully, you would be in a good position to pass your examination at the end of the semester and use the knowledge gained to function in accounting and help you to contribute to the development of scholarly thoughts in management accounting.

We wish you success in this interesting course and hope you will use what you have learnt in this Bachelor of Science in Accounting in contributing to your organization and the society at large.

We also hope you would appreciate the unique role and opportunity you have to make a difference in using the knowledge derived from this course in solving problems.

We, therefore, sincerely wish you the best as you enjoy the course.  
**GOOD LUCK.**

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### **UNIT 1 INTRODUCTION AND SCOPE OF MANAGEMENT ACCOUNTING**

#### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
  - 3.1 Definition of Management Accounting
  - 3.2 Comparison of Management Accounting, Cost Accounting and Financial Accounting
  - 3.3 Management Accounting Techniques
  - 3.4 The Roles of the Management Accountant
  - 3.5 Business Objectives
  - 3.6 Alternative Goals
  - 3.7 Goal Congruence
- 4.0 Summary
- 5.0 Conclusions
- 6.0 Tutor Marked Assignment
- 7.0 References/Further Readings

#### **1.0 INTRODUCTION**

This unit will delve into the introductory aspect of management accounting. Its relationship to other accounting areas and the role it plays in various organisation

#### **2.0 OBJECTIVES**

In this unit, the readers will be able to understand:

- The scope and principles of management accounting
- Management accounting as it relates to cost accounting and financial accounting
- The techniques used in management accounting for planning, controlling, and decision-making
- The roles of management accounting in an organization
- The basic management accounting issues, such as business objectives, goal

congruence.

### **3.0 MAIN CONTENT**

#### **3.1 DEFINITION OF MANAGEMENT ACCOUNTING**

There are many definitions of Management Accounting by various organizations. However, that of the Chartered institute of Management Accountants (CIMA) had gained general acceptance:

"Management Accounting - An integral part of management is concerned with identifying, presenting and interpreting information used for:

- (a) Formulating strategy;
- (b) Planning and controlling activities;
- (c) Decision-making;
- (d) Optimizing the use of resources;
- (e) Disclosure to shareholders and other external parties to the entity;
- (f) Disclosure to employees; and
- (g) Safeguarding assets".

The above ensures that there is effective:

- (a) formulation of plans to meet objectives (strategic planning)
- (b) formulation of short-term operations plans (budgeting/profit planning,)
- (b) acquisition and use of finance (financial management),
- (c) recording of transactions (financial accounting and cost accounting),
- (d) communication of financial and operating information,
- (f) corrective action to bring plans and results into line (financial control), and
- (g) reviewing and reporting on systems and operations (internal audit, management audit) (CIMA Terminology).

The Management Accounting Practices Committee (MAPC) of the National Accounting Association (NAA) in the United States defined Management Accounting as *"the process of identification, measurement accumulation, analysis, preparation, interpretation and communication of financial information used by management to plan, evaluate, and control within an organisation and to ensure appropriate use of and accountability for its resources"*:

Management accounting may also be defined as "the application of professional skills in the preparation and presentation of accounting information in such a way as to assist management in the formulation of policies and in the planning, and control of the operations of the undertaking" (Sizer 1996).

Management accounting also comprises the preparation of financial reports for non-management groups such as shareholders, creditors, regulatory agencies and tax authorities.

In the above definitions, we could see that policy-making, planning and control are generally descriptions of all the functions of management. It means that any information which could be useful to managers and which was evaluated in monetary terms could be a management accounting responsibility.

In order to carry out this task efficiently, the management accountant will:

- (a) use data from the financial and cost accounting systems,
- (b) conduct special investigations to gather required data,
- (c) use accounting techniques and other appropriate techniques from statistics and operational research,
- (d) take account of the human element in all activities,
- (e) be aware of the underlying economic logic.

All of these will be done in order to produce information which is relevant for the intended purpose. From all the above, it would appear as if all accounting are management accounting!

Management accounting assists the management to plan, control and make decisions. The elements involved in the decision making, planning and control processes are as follows:

- (a) identifying the objectives that will guide the business;
- (b) search for a range of possible courses of action that might enable the objectives to be achieved;
- (c) gather data about the objectives;
- (d) select appropriate alternatives courses of action that will enable the objectives to be achieved;
- (e) implement the decisions as part of the planning and budgeting process;
- (f) compare actual and planned outcomes; and
- (g) respond to divergences from plan by taking corrective action. This will enable actual outcomes conform to planned outcomes or modify the plans, if the comparison indicate that the plans are no longer attainable.

### **3.2 COMPARISON OF MANAGEMENT ACCOUNTING, COST ACCOUNTING AND FINANCIAL ACCOUNTING**

Cost Accounting (commonly termed, costing) may be defined as:

*"The establishment of budgets, standard costs and actual costs of operations, processes, activities, or products and the analysis of variances, profitability or the social use of funds".*

Financial accounting is defined as:

*"The classification and recording of the monetary transactions of an entity in accordance with established concepts, principles, accounting standards and legal requirements and their presentation by means of profit and loss account, balance sheet and cash flow statements during and at the end of an accounting period," (CIMA).*

The main differences between management accounting and financial accounting are as follows:

- (a) **Rules and regulations** - Financial accounting reports adhere strictly to statutory (legal) requirements, for example, Companies and Allied Matters Act, 1990 (CAMA), professional pronouncements (ICAN) and accounting standards (IAS, SAS). On the other hand, management accounting reports need not adhere strictly to these rules and regulations.
- (b) **Degree of details** - Management accounting reports are much more detailed than Financial accounting reports. Whereas financial accounting report, for instance, may show the total profit made by an organisation, while management accounting report lays more emphasis as to the department, branch, division or segment that contributed to the profit.
- (c) **Time focus** - Management accounting reports are futuristic and predictive in nature, while financial accounting reports are historical, that is, past.
- (d) **Period of preparation of reports** - Financial accounting reports are usually rigidly prepared for periods such as monthly, quarterly, semi-annually or annually. On the other hand, management accounting reports can be prepared anytime the management of the organisation needs it. Hence, its reports are flexible.
- (e) **Estimates and approximations** - Since management accounting reports are futuristic, it entails usage of estimates and approximations while financial accounting reports are historical, the use of estimates and approximations are reduced to the barest minimum.
- (f) **Objectives** - The objective of financial accounting report is stewardship while management accounting reports are used for planning, controlling and decision-making.
- (g) **Inter-disciplinary relationship** - Management accounting spills over to other courses, such as Economics, Statistics, Psychology, Quantitative Techniques, Production Management, etc. On the other hand, financial accounting reports are strictly restricted to pure financial accounting issues.
- (h) **Dual Concept** - Financial accounting is based on the dual concept of debit and credit while in management accounting, this is not necessary.
- (i) **Taxation** - Management accounting is not prepared for taxation purposes while financial accounting is prepared for taxation purposes.
- (j) **Monetary and non-monetary concept:** Financial accounting reports are expressed in monetary terms while management accounting reports are

expressed in monetary and non-monetary terms.

### **3.3 MANAGEMENT ACCOUNTING TECHNIQUES**

#### **Planning**

The management accountant's main contribution to planning lies in the preparation of budgets.

#### **Control**

Control in the management sense has been defined as “the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization’s goals”. As involves the setting of goals and objectives, control may be viewed as its counterpart in the management process.

#### **Cost Control**

The book keeping aspect of management accounting is also a useful tool for cost control in small businesses. It facilitates a permanent record of costs incurred in conducting the business. It cannot be over-emphasised that the adequacy and reliability of accounting information contained in the records of the business concern are essential for successful planning and control. For instance, the record-keeping function may be viewed as necessity for effective pricing decisions. If prices are set on the basis of full-cost plus mark-up, it is imperative that one has accurate information on the actual cost of the product to be sold. Similarly even if market prices or market-adjusted prices are adopted, it is still essential to have a record of actual costs in order to determine the firm's profit margin. Clearly, the importance of accurate data for marginal pricing decisions is evident.

#### **Standard Costing**

The use of standard costs has the added advantage of encouraging a greater degree of cost-consciousness within the organisation. Standards are set against which actual costs are compared, in order to determine variances from the standard. Unfavourable variances can then be investigated in order to determine possible explanation for the deviation. In this manner, problem areas may be detected and dealt with expediently.

However, the benefit to be derived from a standard costing system must always be weighed against the cost of establishing it. Hence, one may discover that while standard costs may be effectively and efficiently employed within a small manufacturing firm, the relative costs of setting-up and implementing such a system for a local bakery may be prohibitive.

#### **Credit Control**

This is another area of great importance in management accounting. Naturally in the case of the small businesses which operate strictly on a cash basis, this area would appear to be unimportant. However, it is probably not uncommon to find that small retailer or manufacturer who supplies several regular customers will provide credit facilities as a normal part of trading activities.



In such instances, proper credit control is essential for ensuring that cash proceeds are realized on a timely basis. Appropriate credit terms, supplemented with accurate record keeping and skilful ratio analysis, can enable the owner-manager to identify “bad-risk” customers and appropriate action.

### **Decision Making**

Management accounting techniques are useful for effective decision making. An understanding of the concepts of relevant costs, cost-volume-profit relationships and the contribution approach to decision making may facilitate more efficient and effective decision by enabling the immediate determination of relevant factors that have to be considered. Guidelines, such as the need to cover fixed costs or the concept of a positive contribution margin, are very helpful in making certain decisions such as whether to discontinue a product line, make-or-buy decisions, etc.

### **Financial Management**

When the management accountant becomes a financial manager, he is very much a line manager and not many financial management techniques are in effect, only management techniques. His cash and credit control are akin to production control, his internal audit, a form of inspection; while his cashier, wage and invoice clerks make up his work force.

### **Book-Keeping and Management Accounting**

Book-keeping has become so much associated with accounting thinking. In the popular usage, many people use it to measure the worth of "accounting" in a book such as this. The fact is that management accounting is much more concerned with the economics of business than with the recording of past monetary accounting.

### **Uncertainty and Management Accounting**

Management is concerned with the future and the only thing certain about the future is that it is uncertain. Management accountants then should incorporate this uncertainty into their works, preferably in the form of probability assessment. Strangely enough, this has hardly been done up to the present time, perhaps because accountants are used to handling the exactly known figures that arose in the past. However, this trend is changing and as the emphasis in management accounting swings away from accounting, towards management, probability concepts will certainly become another feature of management accounting.

### **New Techniques in Management Accounting**

Indeed, it should be observed that a whole group of techniques has recently emerged in the world of management accounting. Many of these emerged as 'a result of using a mathematical approach to the measurement of economic performance and efficiency, and were developed in the field of operations research. These techniques include linear programming, and a range of probability-based techniques that embrace topics such as decision theory and queuing. Increasingly, statistics are also playing important part in the work of the management accountants.

### **3.4 THE ROLES OF THE MANAGEMENT ACCOUNTANT**

It is the duty of the management accountant to:

- (a) To plan a profitable future for the business;
- (b) To install and maintain an accounting system to monitor the performance of the business;
- (c) To record transactions by producing accounting statements; and
- (d) Generate information to meet the following requirements;
  - (i) To allocate costs between cost of goods sold and inventories for internal and external profit reporting;
  - (ii) To help managers make better decisions; and
  - (iii) For planning, control and performance measurement.

### **3.5 BUSINESS OBJECTIVES**

In order to assist management by providing information that aid decision-making and control, the management accountant must be aware of the firm's objectives.

#### **Profit Maximisation**

Profit maximisation means maximising the naira income of firms. The reasons for identifying the maximisation of the present value of future cash flows as a major objective are:

- (a) it is equivalent to maximising shareholders value;
- (b) it is unlikely that any other objective is as widely applicable in measuring the ability of the organisation to survive in the future;
- (c) although it is unlikely that maximising the present value of future cash flow that can be realised in practice, it is still important to establish the principles necessary to achieve this objective; and
- (d) it enables shareholders as a group in the bargaining coalition to know how much the pursuit of other goals is costing them by indicating the amount of cash required to achieve their objectives.

### **3.6 ALTERNATIVE GOALS**

Although, profit maximisation may be a primary goal, proprietors may have secondary objectives which may include:

- (a) maximisation of sales revenue or achieving a target level of sales, subject to a minimum profit constraint,
- (b) long run growth,
- (c) long run survival,
- (d) maintaining or increasing market value,
- (e) increasing the status of the firm, and
- (f) earning satisfactory (as opposed to maximum profit). This is known as profit 'satisficing'.

### **3.7 GOAL CONGRUENCE**

One of the most important functions of management is to harmonise as far as is practicable the goals of the participants and sub-units with those of the organisation as a whole. This function is known as 'Goal Congruence'.

The management accounting system should encourage all employees, including management to act in a manner which contributes to the overall objectives of the organisation, that is, the employees' objectives and the company's objectives would in, ideal circumstances, coincide. The system and the approach adopted by the management accountant should motivate staff by means of genuine participation, good communication, and rapid feedback.

#### **Goals of Groups-other than Owners**

An assumed objective of maximising the wealth of owners, to the exclusion of other groups in a firm has been widely criticised in recent years. It is argued that the firm is a coalition of groups, each pursuing its own objectives, and each of which is in a position to exert influence on those responsible for taking decision within the firm. Groups in the "coalition" might include the proprietors (shareholders in the case of limited liability companies), managers, trade unions, creditors, various employees and government. Groups other than the proprietors are able to exert pressure on the decision makers in the firm.

#### **The Goals of Individuals**

These individuals have their own personal goals. Similarly, group of individuals that form the functional divisions of the business, each group identifying with its own goals. The sales manager will want to have large stocks of all products so that no customer is refused or has to wait long for delivery. The production manager will want to have long production runs to reduce set-up costs and training. The purchasing manager prefers to buy large quantities of materials, to take advantage of bulk discount and lower transport costs. The financial manager will want to maintain records of the working capital tied up in raw materials or finished goods stocks.

### **4.0 CONCLUSIONS**

Management accounting has to do with provision and interpretation of information, which help management in planning, controlling, decision-making and assessing performance.

The management accountant must be aware of the behavioural implications of his activities and information without losing sight of goal congruency.

### **5.0 SUMMARY**

Management accounting system is multi-disciplinary in nature in that statistics and operational research techniques may be utilised in the design process.

The Management accountant must reflect all uncertainties and variability of the

situation because of the unpredictable nature of activities in the business environment. The Management accountant should take into consideration the changing value of money due to the effects of inflation.

## **6.0 TUTOR MARKED ASSIGNMENT**

1. The application of professional skills in the preparation and presentation of accounting information in such a way as to assist the management to plan, control and make decision is known as\_\_\_\_\_
2. State two major roles of management accounting in an organisation.
3. The classification and recording of the monetary transactions of an entity in accordance with established concepts, principles, accounting standards, balance sheets and cash flow statements, during and at the end of an accounting period is called\_\_\_\_\_
4. “The establishment of budgets, standard costs and actual costs of operations, processes, activities or products and the analysis of variances, profitability or the social use of funds” is called\_\_\_\_\_
5. Mention two ways in which management accounting differs from financial accounting.
6. Identify and describe two different users of accounting information.
7. Describe two different functions of management accounting.
8. What is Goal Congruence?
9. Mention two techniques used by management accountants.
10. Mention two main sub-objectives of a profit-making organization.

## **7.0 REFERENCES/FURTHER READINGS**

ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.  
Faruonbi K. (2006) Management Accounting, Lagos: EL-Toda Ventures Ltd.  
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## **UNIT 2: MANAGEMENT ACCOUNTING AND MANAGEMENT INFORMATION SYSTEM**

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  - 3.5 Risk and Information Presentation
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### **1.0 INTRODUCTION**

There exist a thin line between management accounting and management information system. Information is of utmost important to any organisation, therefore, managers have need for an effective information system to be able to execute its work well and achieve a given goal.

### **2.0 OBJECTIVES**

In this unit, the readers will be able to understand:

- Management information system role in relation to management accounting
- Management reports and feedback
- Information attributes.

### **3.0 MAIN CONTENT**

#### **3.1 MANAGEMENT INFORMATION SYSTEMS (MIS) AND CONTROL**

A management information system as the term may imply, is a system of providing

and communicating information, which will enable managers do their job. The management accountant plays a vital role in assisting management to carry out the responsibilities of planning, controlling, communicating, decision-making, directing and organising through the provision of management information. Thus, management information is vital to the role of management. Our concern, however, is with how good or bad such systems are, and whether there are any theoretical 'rules', 'laws', or 'principles' which can be applied to improve the quality of information provided at an acceptable cost.

One aim of the management accounting syllabus is to examine the ability of readers to design and evaluate systems for planning and control, that is, to understand MIS concept.

These are relevant to the work of management accountants since their job is to provide information. It is important to state as follows:

- (a) Managers must have information in order to do their work. Every organisation with managers must have an MIS:
  - (i) the MIS might be a good one, or it might provide poor-quality information. In the long run, a poor MIS will result in poor management decisions: and
  - (ii) the MIS might be a formally designed and planned system or it might have grown up in any fashion. Whenever computers are used to provide information, there will probably have been some attempt at a formal design of; at least, part of the organisation's MIS.
  
- (b) The aim of management accounting should be to provide a carefully designed, good-quality MIS. There are many ways, however, in which management accounting can be misleading. For example, is using full costs for decision making, or charging uncontrollable costs to a manager's performance report. The awareness of the possible pitfalls is important.

## **3.2 MANAGEMENT ACCOUNTING REPORTS AND FEEDBACK**

By providing information that is relevant to planning and control decisions, for example, budgetary control information, budgeting information, relevant costs for one-off decisions, profitability reports for profit monitoring such as, management accounting, like any other MIS, should help managers to plan and control the resources of their organisation. Much of management accounting is concerned with the recording of actual costs for comparison with expectation or budget. This control information is known as "feedback".

### **3.2.1 The Qualities required for a good MIS**

A good MIS needs to tell managers about the consumption of the organization's resources and the revenues or other benefits from the use of those resources. It should provide quality information to managers at all levels in the management hierarchy.

### **3.2.2 Managers use information:**

- (a) By relating them to other knowledge they already have; and
- (b) By asking for other information before making a decision. Using information with reference to experience and knowledge is a quality of a good management.

### **3.2.3 Types of Information Necessary**

A manager needs to know the types of information necessary for its intended purpose:

- (a) What are his resources? Stock of raw materials, spare machine capacity, labour availability, the balance of expenditure remaining for a certain budget, target date for completion of a job.
- (b) At what rate are his resources being consumed? For example, how fast is his labour force working; how quickly are his raw materials being used up; how quickly are other expenses being included?
- (c) How well are the resources being used? How well are his objectives being met? A manager uses resources based on the information given to him. The board of a company decides how much of available funds should be allocated to any particular activity and the same problem faces the manager of a factory or department, or even a foreman, that is, which machines should he use, which men should be put on certain jobs, etc. Having used information to decide what should be done, a manager then needs feedback (or control information from environment) to decide how well it is being done.

### **3.3 COMPARISON BETWEEN DATA AND INFORMATION**

The terms 'data' and 'information' are often used interchangeably. Technically, data differs from information.

Data is defined as groups of non-random symbols which represent quantities, events, actions and things. Data are made up of characters which may be special symbols, alphabetic and numeric.

Information is a form of data that has been processed and which is meaningful to the user. It must be of real or perceived value for its intended purpose. It also follows that what is information for one purpose or level in the organisation may be used as data for further processing into information for a different purpose and level.

Data can be gathered from both internal and external sources which is frequently derived from the day to day operations of the organisation.

It is pertinent to note that data which have been processed using specific identified techniques (planning, decision, controlling, etc.) are compared with alternatives

generated in order to produce the required information which will be communicated to the user.

### 3.4 QUALITIES OF MANAGEMENT INFORMATION

Management information is expected to possess the following attributes:

- (a) **Accuracy** - The information must be communicated with sufficient confidence in its accuracy to enable the manager to make valid decisions.
- (b) **Completeness** - The information to be given to the manager should be complete so that a decision is not made in ignorance of some of the key facts.
- (c) **Timeliness** - Information should be produced at the right time so as to enable useful decisions to be taken.
- (d) **Concise** - The manager should be provided only with the information which is useful for the purpose of his need and of a quantity for which he is capable of absorbing.
- (e) **Clarity** - The information to be provided to manager should be readily intelligible. It must reduce ambiguity to the barest minimum.
- (f) **Cost/benefit analysis** - The cost of the information to be obtained should be less than the benefit to be derived from the information.

### 3.5 RISK AND INFORMATION PRESENTATION

Risk to a greater or lesser degree is present in all planning and decision making situations. It may be as follows:

- (a) the possibility of machine failure,
- (b) the difficulties of forecasting inflation or exchange rates, and
- (c) the effects of competition, changing tastes, government actions, etc.

Therefore, it is important that the preparer of information for planning and decision making purpose presents the information in a manner which helps the manager to understand the effects of risk on the problem being considered, how risks are likely to affect the range of possible outcomes.

The effects of uncertainties can be presented in reports, statements and analyses in the following ways:

- (i) Results and outcomes are presented as ranges of values rather than single point estimates.
- (ii) Three points estimates (high, low and most likely) for analysis and presentation purposes are used.
- (iii) Probabilities are associated with the values and outcomes. This is so because of its subjective nature. However, probability has been tested to provide possible valuable insights to the underlying risks.
- (iv) Sensitivity analysis may be used. This is a process by which the factors involved in the situation, for example, sales volume, cost per unit, selling price per unit and so on are varied one at a time and the effect on the outcome noted.



- (v) Confidence limits may be applied more so when forecasts are involved.

### **3.6 LEVELS OF INFORMATION**

Levels of information within an organisation (as distinct from information provided by an organisation to external users, such as shareholders, the general public, pressure groups, competitors, suppliers, customers, etc.) can be analysed into three:

- (a) Strategic information - This is used by top management to plan organisations' objective. Such information includes future market prospects, the availability and cost of raising new funds, total cash needs, etc. Readers will note that strategic information is orderly used as the management for decision-making, called strategic planning.
- (b) Management control information, also known as tactical information, is used by middle management to ensure that the resources of the business are efficiently and effectively employed, (use monitored) to achieve organisation strategic objectives. Examples are productivity measurements (output per man hour or per machine hour); budgetary control or variance analysis; profit result within a particular department of the organisation; labour turnover statistics within a department; short-term purchasing requirements, etc. Please note that a large proportion of this information will be generated within the organisation, that is, as feedback and is likely to have an accounting emphasis. Tactical information is usually prepared regularly - perhaps weekly, or monthly (whereas strategic information is communicated irregularly). Tactical information is used for the decision-making called management control.
- (c) Operational information is used by 'front-line' managers such as foreman or head clerks to ensure that specific tasks are planned and carried out properly within a factory or office. In the payroll office, for example, operational information relating to day-rate labour will include the hours worked each week by each employee, his rate of pay per hour, details of his deductions and for the purpose of wages analysis, details of the time each man spent on individual jobs during the week. Operational information relates to a level of decision-making called operational control.

#### **Time scale of using Information**

"Historic" information might be used immediately (for operational control) but less frequently for management control and only rarely for strategic planning. Information can be collected and stored for future use, although presumably, there will be a limit to its useful life.

Strategic planning may use information gathered several years previously and associate it with current information from within the organisation and from the environment, so as to analyse past trends in order to predict the future.

Management control may also use information several years old (to compare past and current performance) but historic information is more likely to have a limited useful life.

Operational control information has a short life-span in the design of a management information system. Some thought must be given to how long information (or data) should be stored, and to what uses they will eventually be put. One advantage of computers has been the facility to store large volumes of data for a long period in a manageable volume of space.

### **3.7 REPORTING BY EXCEPTION**

There are physical and mental limitations to what a manager can read, absorb and understand properly before taking action. An enormous mountain of information, even if it is relevant, cannot be handled. Reports to management must, therefore, be clear and concise, and in many systems control action, works basically on the 'exception' principle. This is especially true of tactical information for management control.

Slight variations between actual result and the plan may be considered acceptable, and corrective action is only applied when results exceed established tolerable levels.

#### **Information Flow**

Information should be communicated to the managers who need to use it for control action. The structure of information flow - that is, how information is transmitted, from where to whom - is an important consideration in management information systems.

Information flow may be:

- (a) vertical (down or up), or
- (b) horizontal.

#### **Vertical Communication**

Communicating downwards, that is, from superior to subordinate may be:

- (a) delegation of work, which involves giving information about objectives, job instructions;
- (b) information about procedures and practices in the organisation;
- (c) telling the subordinate what the role of his job is in relation to the objectives of the company as a whole, that is, job rationale;
- (d) informing the subordinate how well or how badly he is doing his job; and
- (e) indoctrination of the company's goals.

In practice, items (c), (d) and (e) are often too much neglected. The size of the downwards communication loop is normally very small between a superior and his immediate subordinate. Some information may come from higher management, for example, statements about the goals of the organisation. But communication from the top are often too general in character and too remote from what the employee thinks of

as practical reality to have any value.

Communicating upwards, that is, from subordinates to superiors may be analysed into five types:

- (a) Information by subordinates about himself, his performance and his problems;
- (b) Information about others and their problems;
- (c) Comments about organisational practices and policies;
- (d) Suggestions about what should be done and how it could be done; and
- (e) Reports on what has been done.

It is normal for communication upwards to be restricted so that a subordinate deals with his immediate superior only

This communication 'loop' will be larger if there is:

- (a) a formal grievances procedure, that is, a channel for official complaints; and
- (b) a formal suggestions procedure, that is, a system of encouraging suggestion for improvement from employees.

Because reporting upwards is usually very restrictive, there are many inherent communication problems (noise). A boss is unlikely to be given information by his subordinates which affects him adversely, and it is also probable that bosses will be told either what they want to hear or what the subordinates want them to hear.

The whole-hearted, well-informed support of all employees involved in producing information is essential to the success of a system. Filling-in time sheets, for example, can be done with widely differing attempts at accuracy by the people concerned.

### **Horizontal Communication**

Horizontal communication is between people at the same hierarchical level in the organisation. It is necessary in two ways:

- (a) **formally:** to co-ordinate the work of several people and perhaps several departments, who have to co-operate to carry out a certain operation. For example, a production department manager or foreman might need to work in co-operation with a service department manager or foreman; and an accountant may require the help of a management scientist or statistician;
- (b) **informally:** to furnish emotional and social support to an individual or a course.

It is important that formal co-operation should not lead to a situation where a manager accuses another of boundary crossing. Horizontal communications should be an organised procedure or should be made only as a request for assistance, or as a response to such a request.

The information requirements of superiors and subordinates do not always coincide, in practice. What a subordinate wants to know is not always what a superior is prepared to tell him and vice versa. The greater this conflict, the more the likelihood of horizontal communication; as an escape value and also perhaps to get some essential work done which would not otherwise be properly performed.

### **3.8 TIMING OF INFORMATION**

Information which is not available until after a decision is made will be useful only for comparisons and longer-term control.

The time value of information may be gauged by:

- (a) the latest event (time) which the information covers: and
- (b) the comparison control stage for which it will be used.

For example, weekly planning meeting in week two requires information about production in week one in order to influence control action by week three at the latest.

The criteria for the time value of information apply to both regular information (daily, weekly, monthly etc.) and ad hoc information (which is gathered on request or at irregular intervals). In planning for the future, for example, what resources will be required, management gives consideration to the 'planning horizon', which is the time at which something will get done if a decision is taken now. Future planning calls for forecasts about the situation at that future date. To make the planning decision, management must have the information it requires first. If the information is late, there will be a delay in implementing the future plan.

Information prepared too frequently can be a serious disadvantage. If for example, a decision is taken at a monthly meeting about a certain aspect of a company's operations, information to make the decision is only required once a month and weekly reports would be a time consuming waste of effort.

If control-information is provided later than it should be, perhaps because control reports are too infrequent, then the consequence would be unnecessary losses that could have been avoided and would thus be a much more difficult job to get actual results back on the course for achieving targets.

#### **Confidence / Risk**

Information must be trusted by the managers who are expected to use it. An important problem is, therefore, how much uncertainty analysis should be incorporated into reporting systems, in order to make the information realistic. In the past, there has been a reliance on historic cost data and a reluctance to recognize uncertainty in estimating.

An important issue in the design of a confidence information system is to decide from

what source data should be collected and to what extent uncertainties in cost estimation and sales demand, etc. should be analyzed. Historic costs provide valuable information for budgetary control but they have restricted value for both routine and once-only planning decisions.

Data generated by routine operations of the organisation can usually be collected easily and cheaply. Special information from non-routine data often requires a lot of planning and involves considerable expense, (much of it must be collected from sources outside the organisation). For this reason, accounting systems are often unable to supply non-routine data. This situation may change as data base information systems are developed with computer technology and non-routine data can be stored and accessed should a special purpose arise. The use of probability distributions (perhaps from an analysis of historic information) and expected values or sensitivity analysis, should feature in management amounting information more regularly than it does in practice at the moment.

A risk decision taker, who wished to minimise his risk, for example, by taking a decision where the standard deviation of expected profit is low or by using the minimax cost or minimax regret criteria may value information more highly than a risk seeker, who may be content to base his decision on expected values only.

Management accountants have the jobs of providing useful information to guide management planning and control decision and 'as the usefulness of quantitative decision models becomes more widely understood by managers' the demand for information as model inputs will grow' (*Source: Report of the American Accounting Association Committee on Managerial Decision Model 1969*).

### **Sources and Comprehensiveness of Information**

Production of large volume of information is not necessarily an advantage and the principle of exception reporting has already been described. Too much information will confuse rather than help the manager receiving it. Information, however, must not only be relevant and easily understood, but also need be detailed.

All sources from which relevant information may be obtained should be tapped and the sources may either be:

- (a) internal, that is, from within the company; or
- (b) external, that is, from the external environment, including information about competitors.

### **3.9 VALUE OF INFORMATION**

For information to have value, it must lead a decision-maker to take action which results in reducing costs, eliminating losses, increasing sales, better utilisation of resources, prevention of fraud (audit requirements) or providing management with the consequences of alternative courses of action. Information which is provided but not used has no value.

A decision taken on the basis of information received also has no actual value. It is only the action taken as a result of a decision which realize actual value of the information for a company.

Value may, therefore, be considered as:

- (a) **Intrinsic:** information has a value inherent in itself, for example, a company knows there is a new machine which could increase output by 30%
- (b) **Potential:** If a decision is taken to buy the machine in the example above, there is the possibility of making a certain profit and this is the potential values of the information.
- (c) **Actual:** If the machine is bought, the actual extra profit earned will be the actual value of the information.

The expected value of information would be assumed to be the maximum amount, a user would be willing to pay for it. After the event, value measured in retrospect is of little value because it does not help the decision in advance as to whether the information is worth the cost of its collection. The information required for the preparation of statutory reports has a latent value because it prevents the consequences of what would happen if the company failed to produce them. The cost of collecting information bears no relation to its value. An item of information which leads to an actual increase in profit of ₦90 is not worth having if it costs ₦100 to collect it.

The cost of collecting information typically consists of:

- (a) the costs of the MIS designers and installers; the wages and salaries of employee operating the system; professional fees, for example, consultancy fees;
- (b) the costs of equipment used in the information system and supplies, such as, paper consumed; and
- (c) training costs;

### **Value and Frequency**

The value of information must also relate to the frequency of its provision and to the level in the management hierarchy where it is sent and used:

- (a) front-line supervisors need more regular control information perhaps weekly or daily; and
- (b) middle managers and senior managers might need information less frequently, say monthly, half yearly or yearly.

The benefits (value) from feedback of control information are usually a once only gain. Once the fault has been identified and put right, there should be no scope for further improvement, and repeated feedback of control information should be of little value until the system gets out of control again. Arguably, continuous monitoring and reporting may be unnecessarily costly. At the very least, the principle of reporting by exception should be used.

The value of information also relates to:

- (a) the ability of the receiver to understand it and use it;
- (b) the purpose or decision for which it is intended to help; and
- (c) the quality and availability of other information from different sources as complements.

A user will value information more if it changes his decision from what it would otherwise have been to a more optimal decision on the basis of the information provided.

### **3.10 COMPUTERS (INFORMATION TECHNOLOGY)**

Computers enable more data to be processed than would be possible by manual methods, and in most mid-sized companies, a management information system depends, at least to some extent, on their use. The costs of computers are high and it is necessary to decide whether the values of information which would be obtained using them is worth the cost of their installation and operation.

Although, computers often justify their expense, there may always be some areas, where their application will be uneconomical. If a detailed study of costs and value is made, it will be clear where computer could be used to advantage. No company should embark on a programme to develop a major computer information system except to meet a specific properly evaluated need. It is also necessary to remember that although computers can process large volumes of data quickly, the information actually reported to management should be concise and selective. A computer should be a means of boiling a mass of data down to key facts on which action should be taken.

### **3.11 CLASSES OF REPORTS**

#### **Management Report**

This refers to various statements prepared solely for the use of management' for example, the budget, sales reports, etc. Management reports have no set standards and format.

#### **Corporate Report**

- (a) **Objective:** the fundamental objective of corporate reports is to communicate economic measurements or an information about the resources and performance of the reporting entity useful to those having reasonable rights to such information.
- (b) **Users of corporate reports:**
  - (i) The management;
  - (ii) Existing and potential shareholders;
  - (iii) Existing and potential holders of debentures and loan, providers of short-term loans and finance;
  - (iv) labour unions and employees, including existing, potential and past employees;
  - (v) Financial and investment analysts;

- (vi) The government and government agencies;
  - (vii) The auditors;
  - (viii) The public at large;
  - (ix) The competitors.
- (c) **Corporate Reporting in Nigeria:** Under The Companies and Allied Matters Act, 1990 the directors of a company are required to prepare annually and to lay before the shareholders in general meeting, audited accounts, together with a report by the directors.
- (d) **Contents of the Annual Report:** The contents of the annual report and accounts of a company can broadly be categorised as those complying with the requirements of professional bodies or industry associations, standards and other regulatory framework or laws.

In addition to information falling under broad categories, it is common to find, in a company's annual report and accounts, certain information which is published, not because it is required by law or by any professional organisation but as a matter of commercial convention and prudence. An example of this is the chairman's statement.

The annual report and accounts of companies published usually consist the following:

- (a) The Chairman's statement
- (b) The Director' s report
- (c) Basic financial statements, that is:
  - (i) the statement of accounting policies;
  - (ii) the balance sheet;
  - (iii) the profit and loss account; and
  - (iv) the notes on the accounts;
- (d) A statement of cash flow;
- (e) The auditors' report;
- (f) The Audit Committee's report;
- (g) A statement of value added. In some cases, this is presented in the form of pictorial illustration;
- (h) A five year financial summary;
- (i) Some other information such as directors shareholdings and shareholders with more than 10% of the equity shares;
- (j) An employment report;
- (k) A statement of transactions in foreign currencies; and
- (l) A statement of the future prospect.

#### 4.0 CONCLUSIONS

Various packages are utilized for the purpose of managing information and they include: executive information system which permits rapid information retrieval and work by exception reporting and 'drilling down' the data and sensitivity analysis which ensures the assessment of the effects of uncertainty.



## **5.0 SUMMARY**

Management accounting is but one facet of the general information system of a firm. Information is managed in order to ensure speed, accuracy, filing and retrieval abilities, and decision making capabilities.

## **6.0 TUTOR MARKED ASSIGNMENT**

1. Distinguish between data and information
2. State three qualities of information
3. What is a Management Information System?
4. Describe Tactical Information?
5. That information used by “front-line managers” such as head clerks is known as\_\_\_\_\_
6. That information used by senior managers to plan the objectives of their organizations and to assess whether the objectives are being met in practice is called\_\_\_\_\_

## **7.0 REFERENCES/FURTHER READINGS**

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## **UNIT 3      COST ACCOUNTING CONCEPTS AND PRINCIPLES**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Basic Definitions and Cost Concepts
- 3.2 Installation of a Costing System
- 3.3 Material Costing - Purchasing, Receipt and storage
  - 3.3.1 Materials Control
  - 3.3.2 Just-In-Time (JIT) Systems
  - 3.3.3 Materials Requirement Planning (MRP)
- 3.4 Inventory Control
  - 3.4.1 Carrying Costs or Holding Costs
  - 3.4.2 Costs of Obtaining or Ordering Stock
  - 3.4.3 Costs of being without Stock (Stock-out Costs)
  - 3.4.4 Benefits of a good Inventory Control System
  - 3.4.5 Economic Order Quantity
- 3.5 Material Costing - Pricing Issues and Stocks
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  - 3.6.1 Personnel Engagement
  - 3.6.2 Time Keeping for Control
  - 3.6.3 Time Keeping for Accounting
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  - 3.7.1 Just-In-Time (JIT)
  - 3.7.2 Time Based Systems
- 3.8 Direct Expenses
- 3.9 Overheads
- 3.10 Activity Based Costing (ABC)
- 3.11 Cost Pools and Drivers
- 3.12 Activity Based Accounting (ABA)
- 4.0 Conclusions
- 5.0 Summary
- 6.0 Tutor Marked Assignment
- 7.0 References/Further Readings

### **1.0 INTRODUCTION**

This unit will be treating the definition of cost accounting, principles of costing and the concept of activity based accounting.

### **2.0 OBJECTIVES**

In this unit, the readers will be to understand:

- The definition of basic cost accounting
- The principles of costing – material costing, labour costing and overhead

- costing
- The concepts of activity based costing.

### 3.0 MAIN CONTENT

#### 3.1 BASIC DEFINITIONS AND COST CONCEPTS

- (a) **Cost:** A cost may be defined as 'the amount of expenditure (actual or notional) incurred on or attributable to a specified thing or activity.
- (b) **Cost Unit:** This is a unit of product or service in relation to which costs are ascertained. The unit chosen is most relevant for the activities of the organisation.

Examples:

Units of production    Tables, TV sets, litres of paint, a job, a contract, a crate of beer, tonnes of cement.

Units of service        Consulting hours, guest-nights, kilowatt hours, passenger-mile.

The primary classification of cost unit is as follows:

- (a) direct cost; and
- (b) indirect cost
- (c) **Direct Costs:** These costs consist of direct materials, direct labour, and direct expenses which can be directly identified with a job, a product or a service.

Examples:

Direct materials        Raw materials used in the product; part and assemblies incorporated into the finished product; bricks, timber, cement, used on a contract

Director labour         Wages paid to factory workers for work that are directly related to production; salary paid to foreman.

Direct expenses        Expenses incurred directly for a specific job, project or saleable service, for example, royalties paid on barrel of crude oil produced, tonnage of lime stone, etc.

The total of:            Direct materials + direct labour + direct expenses = Prime cost

- (d) **Indirect Costs:** These are materials, labour and expenses which cannot be directly identified with the product. These are also called overheads and can be classified into administration, finance, selling, distribution and production.

Note

$$\text{Prime cost} + \text{overheads} = \text{Total cost}$$

- (e) **Cost Centre:** This is a production or service location, function, activity or item of equipment for which costs are accumulated (CIMA). Thus, in the cost centre coding system, costs are gathered together according to their incidence. The gathering together of the indirect costs results in the establishment of the overheads relating to each cost centre which is an essential preliminary to spreading the overheads over cost units.
- (f) **Cost Allocation:** To assign a whole item of cost, or of revenue, to a single cost unit, cost centre, account or time period (CIMA). It can also be defined as the allotment of costs that are directly identifiable with, incurred by a production or service cost centre.
- (g) **Apportionment:** This process involves the sharing of indirect cost between two or more cost centres or units on the basis of benefit derived by them using relevant bases of apportionment. "To spread revenues or costs over two or more cost units, cost centers accounts or time periods", (CIMA). This process, which is common for indirect costs, involves the splitting or sharing of a common cost over the receiving cost centre on some basis which is deemed to reflect the benefits received. The following table gives examples of typical bases of apportionment.

Basis of Apportionment	Costs which may be apportioned on this basis
Floor Area	Rates, Rent, Cooling, Cleaning, Lighting, Building, Depreciation
Volume or space occupied	Cooling, Lighting, Building Depreciation
Number of employees in each cost centre	Canteen, Welfare, Personnel, General Administration, Industrial Relations Safety
Book or Replacement value of plant, equipment, premises, etc.	Insurance, Depreciation
Store Requisition	Store-keeping
Weight of materials	Store-keeping, material handling

- (h) **Overhead Absorption:** "A means of attributing overhead to a product or service based, for example, on direct labour hours, direct labour costs or machine hours" (CIMA). This is calculated thus:

$$\frac{\text{Total cost centre overhead}}{\text{Total units of base to be used}}$$

- (i) **Conversion Cost:** This is the term used to described the costs of

converting materials purchased into finished or semi finished products. It is thus total production cost minus initial material input cost, that is, the sum of direct wages, direct expenses and absorbed production overhead. Economists define conversion cost as total cost less material costs, that is, all overhead are included not just production overheads.

- (j) **Added Value Or Value Added:** This can be defined as "Sales value less the cost of purchased materials and services. This represents the value of an alteration in form, location, or availability of a product or service", (CIMA).
- (k) **Marginal Costing:** Marginal costing can be defined as: "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. Marginal costing is also known as 'contribution approach', and 'direct costing'. Its special value is in recognising cost behavior and, hence, assisting in decision making" (CIMA).

Arithmetically, Marginal cost is:

Direct material + Direct labour + Direct expense + Direct variable expense + Indirect variable expense.

The term marginal cost, at times, refers to the marginal cost per unit and also to the total marginal costs of a department or batch or operation. One can deduce its meaning from its context.

- (l) **Cost Objects:** A cost object is any activity for which a separate measurement of costs is desired. In essence, if the user of accounting information wants to know the cost of product/service, that service/product is called a "cost object". Examples are 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.
- (m) **Avoidable Costs:** These are savings in costs as a result of not altering or adopting a given alternative, for example, advert, insurance, donation, etc. Readers must note that only avoidable cost are relevant for decision making purposes. The decision rule is to accept those alternatives that generate revenues in excess of the unavoidable costs.
- (n) **Unavoidable Cost:** Are those costs that cannot be saved. Therefore unavoidable costs are irrelevant for decision making, for example, depreciation, security cost, etc.
- (o) **Sunk Cost:** This is a cost already incurred and therefore irrelevant to decision making. It is synonymous with historical or past cost, for example, salaries and wages paid, cost of machines already bought.

- (p) **Relevant Cost:** A relevant cost is a future cash flow arising as direct consequences of a decision.
- (q) **Opportunity Cost:** This is referred to as foregone alternative cost.
- (r) **Incremental Cost (also known as differential cost)** is the difference between costs and revenue for the corresponding items under which each alternative being considered.
- (s) **Target Costing:** "A product cost estimate derived by subtracting a desired profit margin from a competitive market price. It may be less than the planned initial product cost, but will be expected to be achieved by the time the product reaches the mature production stage" (CIMA). Target costing is a market driven approach where market research establishes the performance requirements and target selling price required to gain the desired market share for a proposed product. The required profit margin subtracted from the target selling price to arrive at the target cost for the product is cost which in the long run must be met. Thus, accounting is driven by the requirements of the market place.
- (t) **Costing System:** This refers to a collection of procedures used in assigning cost to cost object. Typically, costing systems are classified as: direct costing system, traditional absorption costing system and activity output based costing systems.

### 3.2 INSTALLATION OF A COSTING SYSTEM

A costing system is not an arrangement which should be imposed on a business, rather it should be developed from a careful consideration of the business itself, and its special needs. It should, therefore, evolve out of the business and be adapted to it. The aim should be to make the costing system as simple as possible and acceptable to the accounting staff. Obviously, to be of any value, it must produce helpful results promptly.

The following are essential to its success:

- (a) There must be an efficient system of stores and stock control;
- (b) There must be a well-designed wages procedure including the method of allocating labour cost to production;
- (c) There must be a sound plan for the collection of all indirect expense (overhead) under suitable headings, and for its absorption to products or service departments on a predetermined basis;
- (d) The cost and financial accounts should preferably be one integrated system. If not, the separate systems must allow for ease of reconciliation;
- (e) Standard printed forms should be introduced wherever possible, giving the name and containing instructions as to what use is to be made of it; and
- (f) The status of the cost accountant should be defined and his responsibilities and duties made clear. Adequate authority should be given to allow him access to

all relevant records.

### **3.3 MATERIAL COSTING - PURCHASING, RECEIPT AND STORAGE**

#### **3.3.1 Materials Control**

Materials control involves the following procedures:

- (a) Stock control;
- (b) Purchasing;
- (c) Reception;
- (d) Storage; and
- (e) Issue to production.

#### **Stock Control**

Management must give careful consideration to the stock levels to be maintained. This applies to:

- (a) Raw materials;
- (b) Bought-in components;
- (c) work-in-progress; and
- (d) Finished goods.

Decisions on stock holding will be influenced by:

- (a) Cash available;
- (b) Storage space available;
- (c) Storage costs such as premises costs, insurance of stocks and possibly interest on capital invested in stocks;
- (c) Delivery delays;
- (d) Risks of stock losses, that is, wastage, pilferage, and obsolescence;
- (e) Minimum ordering quantities imposed by purchasing policy;
- (f) Purchase ordering (procurement); and
- (g) Required service level to works or customer (whether it is essential that the stores shall be able to meet every requirement on demand, and if not what percentage of failure to meet demand can be tolerated).

#### **Centralised Buying**

In large businesses, buying is usually decentralised. In essence, each department is responsible for its own purchasing. However, most businesses operate a buying department, that is, centralised buying, which is usually a very satisfactory arrangement.

Advantages of centralised buying are;

- (a) A firm policy can be initiated with regard to conditions of purchasing e.g. terms of payment;
- (b) Standardisation of articles is facilitated;
- (c) Expert buying staff are concentrated in one department;
- (d) The number of people authorised to make purchase commitments is reduced; and

- (e) Combined purchasing power may result in reduced prices of commodities.

Disadvantages of centralised buying are:

- (a) The creation of a special department may lead to high administration costs;
- (b) The purchasing procedure is much less flexible than that geared to special departments; and
- (c) Bureaucracy may lead to sub-optimal decisions.

### **Store Records**

Two records are usually kept on materials received, issued or transferred, namely:

- (a) on the Bin cards, and
- (b) in the stores ledger. The Bin cards are written up in the stores, but the stores ledger is usually kept in the profit centres or in the accounts office.

The advantages in this procedure are:

- (a) The Storekeeper is required to do the minimum amount of clerical work;
- (b) The accounting records are maintained more accurately and in a better condition by an experienced stores clerk than by an assistant in the stores; and
- (c) The balances on the bin cards in the stores can be easily compared with the balances in the ledger.

### **Centralised Storage**

The advantages of operating central stores as compared with sub-stores are as follows:

- (a) Economy in staff and concentration of experts in one department;
- (b) Reduced clerical costs and economy in records and stationery.
- (c) Better supervision is possible;
- (d) Staff become acquainted with different types of stores which is very useful. If anyone is absent from work;
- (e) Better lay-out of stores;
- (f) Stocks are kept to minimum, thus reducing storage space;
- (g) Inventory checks facilitated;
- (h) Fewer obsolete articles; and
- (i) The amount of capital invested in stock is reduced.

The disadvantages are:

- (a) Increased transportation costs;
- (b) The stores may be situated at some distances from many departments, thus causing inconveniences and delay;
- (c) Breakdowns in transport or hold-ups in central stores may cause production stoppages in departments; and
- (d) Possible loss of local knowledge.

### **Periodic Stocktaking**

Periodic stocktaking main objective is to find out the physical quantities of all types of



materials, that is, raw materials, finished goods, work-in-progress, etc. at a given date.

Factors to be considered are:

- (a) Staff should be adequately available to receive clear and precise instructions on the procedures.
- (b) The stocktaking should be organised into clearly defined physical areas and the checkers should count or estimate all materials in the area.
- (c) Technical assistance should be available to identify materials, etc. in order to avoid far greater errors that are possible because of wrong classification rather than wrong counting.
- (d) Effort should be made to ensure that only valid stock items are included and that invalid items are identified and excluded.
- (e) Stock sheets should be given random independent checks to verify their incorrectness.
- (f) The quantities of each type of materials counted should be compared against the stock record to expose any gross errors which may be due to stocktaking errors or faults or errors in the recording system.
- (g) The pricing and extension of the stock sheets, where done manually, should be properly checked. Where the pricing and value calculations are done by computer, the only action necessary would be to input quantities and stock and part numbers.

### **Continuous Stocktaking**

In order to avoid some of the disruptions caused by periodic stocktaking and to be able to use competent and reliable staff, many organisations operate a system whereby a proportion of stock is checked daily so that over the year, all stock is checked at least once. Where continuous stocktaking is adopted, it is invariably carried out by staff independent from the store officers.

Continuous stocktaking is essential when an organisation uses the *Perpetual Inventory* system. This is a stock recording system whereby the stock balance is shown on the record after every stock movement' either issue or receipt. Continuous stocktaking is important to ensure that the perpetual inventory system is functioning correctly and that minor stock mistakes are corrected.

### **Changes in Production and Purchasing Systems**

There are a number of changes that takes place in industry which alters dramatically the way products are made and the organisation of production. These changes naturally influence supporting activities such as purchasing and storage.

#### **3.3.2 Just-In-Time (JIT) Systems**

JIT systems aim at producing the required items, of high quality, at the time they are required. JIT systems are characterised by the pursuit of excellence at all stages with a climate of continuous improvement.

JIT systems were developed and considered as one of the main contributions to the success recorded by the Japanese manufacturing outfit.

Attributes of JIT are as follows:

- (a) a move towards zero inventory,
- (b) elimination of non-value added activities,
- (c) an emphasis on perfect quality, that is, zero defects,
- (d) short set-ups,
- (e) a move towards a batch size of one,
- (f) 100% on-time deliveries,
- (g) a constant drive for improvement, and
- (h) demand-pull manufacture.

It is these latter attributes which gave rise to the name of Just-in-Time. It is also relevant to say that production only takes place when there is actual customer demand for the product so JIT works on a pull-through basis which means that products are not made to go to stock.

Exception to this is the traditional manufacturing approach of production-push where products are made in large batches and moved into stock.

There are two aspects to JIT systems, JIT purchasing and JIT Production.

### **JIT Purchasing**

This should match the usage of materials with the delivery of materials from external suppliers. This means that material stocks can be kept at near-zero levels. For JIT purchasing to work, it requires the following:

- (a) Assurance that suppliers will deliver exactly on time.
- (b) That suppliers will deliver materials of 100% quality and quantity so that there will be no rejects, returns and consequent production delays.

The assurance of suppliers is all important and JIT purchasing means that the company must have good working relationships with her suppliers. This is usually achieved by doing more business with fewer suppliers and placing long term purchasing orders in order that the suppliers have assured sales and can plan to meet the demand.

### **JIT Production**

JIT production, as earlier mentioned, works on a demand-pull basis and seeks to eliminate all wastes and activities which do not add value to products. It considers the lead times associated with making and selling a product. These include:

- (a) Inspection time
- (b) Transport time
- (c) Queuing time
- (d) Storage time
- (e) Processing time.

Of these, lead times, only processing time adds value to product whereas all others add

cost.

The aim of ET systems is to convert materials to finished products with a lead time equal to processing time in order to eliminate all activities which do not add value. Away of emphasising the importance of reducing throughput time is to express the above lead times as follows:

$$\text{Throughput time} = \text{Value-added time} + \text{Non-valued added time}$$

In using activity based system to identify and prioritise the need for cost reduction, many organisations have found it convenient to categorise activities as either value added or non value added.

Value added activity may be as an activity which customers perceive as adding usefulness to the product or service they purchase.

Non-value added activity relates to an activity where there is an opportunity to reduce cost (cost reduction) without necessarily reducing the product's service need to the customer.

Under the JIT pull system, components are not made until requested by preceding process. Consequent upon this, there may be idle time at certain work station but this is considered preferable to adding to work-in-progress inventory.

### **Implementation of JIT Production System**

The following implementation stages are essential to achieve the targets of low inventories and on time deliveries.

- (a) The production processes must be simplified and reduced to the barest minimum.
- (b) JIT systems require quality awareness programmes, statistical checks on output quality and continual staff training.
- (c) The layout of the factory must be rearranged so that the production process is separated away from a batch production functional lay-out. Conventionally, factory machines are grouped by function. Their movement from one area of the factory to another often stopping along the way in a storage area constitutes non-value adding activities.
- (d) The employees must be fully involved. It is relevant to state that one of the most important behavioral implications of JIT is that the status quo is continually challenged and there is a never ending search for improvements.

### **Benefits of JIT**

- (a) It reduces the investment on inventory.
- (b) Due to low-inventory storage, there will be savings in the space required.
- (c) Higher quality would result in customer satisfaction due to better deliveries.
- (d) Elimination of waste and inefficiency improves performance.

- (e) Due to the flexibility of JIT and the ability to supply small batches, companies are able to respond more quickly to market changes and satisfy market needs.

### **3.3.3 Materials Requirement Planning (MRP)**

Materials requirement planning is a computerised approach for coordinating the planning of materials acquisition, information and production in enhancing smooth production flow.

MRP main feature are:

- (a) Estimation of the quantity and timing of finished goods demanded by the customers.
- (b) The system determines the requirements for each product into its various components for efficient scheduling.

The operation of an MRP system requires the following:

- (a) A master production schedule specifying both the timings and quantities demanded.
- (b) A Bill of Material file (BOM) which shows the breakdown of each finished product into sub-assemblies components and raw materials.
- (c) An inventory file containing the balance on hand, scheduled receipts and numbers already allocated for each sub-assembly, component and type of raw material.
- (d) A master parts file containing planned lead times of all items to be purchased and internally produced components.

MRP has evolved into MRP II which integrates material resources planning, factory capacity planning and labour scheduling into a single manufacturing control system.

## **3.4 INVENTORY CONTROL**

Inventory control is the system used in a firm to control its investment in stock. This includes:

- (a) the recording and monitoring of stock levels;
- (b) forecasting future demands; and
- (c) deciding when and how many to order.

The objective of inventory control is to minimise, in total, the costs associated with stock. These costs can be categorised into three groups:

### **3.4.1 Carrying Costs or Holding Costs:**

- (a) Interest on capital invested in stocks.
- (b) Storage charges (rent, lighting, heating, refrigeration, and air conditioning).
- (c) Stores staffing, equipment, maintenance and running costs.
- (d) Material handling costs.

- (e) Audit, stocktaking, stock recording costs.
- (f) Insurance and security.
- (g) Deterioration and obsolescence.
- (h) Pilferage, evaporation and vermin damage.

### **3.4.2 Costs of Obtaining or Ordering Stock**

- (a) Clerical and administrative costs of purchasing, accounting and goods reception
- (b) Transportation costs
- (c) Where goods are manufactured internally, the set-up and tooling costs associated with each production run plus the planning, production control costs associated with the internal order.

### **3.4.3 Costs of Being Without Stock (Stock - out Costs)**

- (a) Lost contribution through the lost sale caused by the stock out.
- (b) Loss of future sales because customers may go elsewhere.
- (c) Cost of production stoppages caused by stock-outs of work-in-progress and raw materials.
- (d) Extra costs associated with urgent, often small quantity, replenishment orders.

The basic reason why stocks are held in the first instance is to avoid stock out costs.

### **3.4.4 Benefits of a Good Inventory Control System**

Benefits of a good inventory control system are:

- (a) Ensures proper execution of policies covering procurement and use of materials and make possible rapid shifts in business to meet changes in market conditions
- (b) Obtains economies through a reduction in needless variety of items carried in stock.
- (c) Eliminates delays in production caused by non-availability of required materials and tools.
- (d) Avoids over accumulation of inventories and tools and thereby maintain the minimum investment consistent with production needs and procurement policies.
- (e) Reduces inventory losses caused by inadequate inspection of incoming materials, damage, deterioration, obsolescence, waste or theft.
- (f) Provides "balanced - stores" records to serve as a reliable basis for effective production planning, economical procurement, cost accounting and preparation of financial reports.

Over-stocking are stocks which are excess to current needs and it results in capital being tied up unnecessarily and increased costs of storage and obsolescence. Under-stocking may result in costly production holdups, which may mean increased costs of

goods. It also interrupts production, making machines and men idle and causing sales loss.

### 3.4.5 Economic Order Quantity

In economic order quantity a formula is applied to incorporate relationships between ordering/obtaining and holding costs and order quantities. It is the quantity to be ordered that would minimize both ordering cost and holding cost

Assumptions in Economic Order Quantity (EOQ) Model

- (a) The rates of demand are known,
- (b) Ordering cost is known and constant,
- (c) Stockholding cost is known and constant,
- (d) There is instantaneous replenishment, that is, the delivery is done once.

Nevertheless, the EOQ calculation is a useful starting point in establishing an appropriate reorder quantity.

The EOQ formula is given below and its derivation given in 'Quantitative Techniques', continuum.

$$EOQ = \sqrt{\frac{2DC_o}{C_c}}$$

Where            D = Demand per annum  
                    C<sub>o</sub> = Ordering cost per order  
                    C<sub>c</sub> = Carrying cost per unit per annum

Readers are advised to have a look once again at ICAN Study Pack Intermediate paper 4, Cost Accounting and Foundation paper 2 - Q/A for more in depth discussion. Refer also to chapter 11 of this study pack.

### ILLUSTRATION 3 – 1

Typical methods of calculating the major control levels: Reorder level. Minimum level and Maximum level are illustrated below using the following data:

Average usage	200 units per day
Minimum usage	120 units per day
Maximum usage	260 units per day
Lead time	20 – 26 days
EOQ (previously calculated)	6,000 units

### SUGGESTED SOLUTION 3 – 1

Reorder level            =        Maximum usage x maximum lead time  
                                  =        260 x 26

$$\begin{aligned}
&= \underline{6,760 \text{ units}} \\
\text{Minimum level} &= \text{Reorder level} - (\text{average usage in average} \\
&\quad \text{Lead time}) \\
&= 6,760 - (200 \times 23) \\
&= 6,760 - 4,600 \\
&= \underline{2,160 \text{ units}} \\
\text{Maximum level} &= (\text{Reorder level} + \text{EOQ}) - (\text{minimum} \\
&\quad \text{Anticipated usage in minimum lead time}) \\
&= 6,760 + 6,000 - (120 \times 20) = \underline{10,360 \text{ units}}
\end{aligned}$$

### ILLUSTRATION 3 – 2

The forecast demand for XYZ Limited is 2,500 units per month, the ordering cost is N450 per order, the units cost is N10 each and it is estimated that carrying costs are 15% per annum. Calculate EOQ for XYZ Company Limited.

### SUGGESTED SOLUTION 3 – 2

$$\begin{aligned}
C_0 &= \text{N}450 \\
D &= 2,500 \times 12 \\
C_c &= \text{N}10 \times 15\% \\
&= \text{N}1.5 \text{ per item per annum} \\
\text{Thus EOQ} &= \sqrt{\frac{2 \times 30,000 \times 450}{1.5}} = \underline{4,243 \text{ units}}
\end{aligned}$$

#### Notes:

- (a) It will be seen that it is necessary to bring the factors involved to the correct time scale. The EOQ formula given above is for replenishment in one batch. Where replenishment takes place gradually, for example, they are made, the formula changes slightly as follows:

$$\text{EOQ (with gradual replenishment)} = \sqrt{\frac{2DC_0}{C_c(1-D/R)}}$$

Where: R = Replenishment rate per annum.

### ILLUSTRATION 3 – 3

The following information has been gathered with regard to material X of BODE Ltd.

	<b>Units</b>
Normal month usage	24,600
Maximum anticipated monthly usage	27,000
Minimum anticipated monthly usage	6,400
Delivery period from suppliers:	
Maximum	3 months
Normal	2 months

Minimum	1.2 month
Re-order quantity (EOQ)	10,000 units

**Required:**

- (a) Calculate:
- (i) Re-order level
  - (ii) Minimum stock level
  - (iii) Maximum stock level.
- (b) Comment on four factors, which may have to be taken into accounts in setting the maximum stock level
- (c) The company required 80,000 units per year which will be used at a constant rate. The purchasing manager is considering what size to be used. The holding cost is 20% of the purchase price. The cost per order is ₦2,500 while the purchase price is ₦24 per unit. Calculate Economic Order Quantity, using the formula.

**SUGGESTED SOLUTION 3 – 3**

- (a) (i) Re-order level  
Maximum usage x maximum re-order period  
= 27,000 x 3 = 81,000 units
- (ii) Minimum stock level  
= Re-order level – (normal usage x normal re-order period)  
= 81,000 – (24,600 x 2) = 31,800 units
- (iii) Maximum stock level  
= Re-order level + Re-order quantity – (minimum usage x minimum re-order period)  
= 81,000 + 10,000 – (6,400 x 1.5)  
= 81,400 units
- (b) Factors to be considered in setting maximum level include:
- (i) The availability of storage space
  - (ii) The nature of the stock material
  - (iii) Seasonal nature of the material
  - (iv) Lead time, that is length of period between placing and receiving orders.
  - (v) Rate of consumption of the material.
- (c) Annual demand = D = 80,000  
Holding cost = 20% x ₦24 = ₦4.8 = cc  
Ordering cost = C = ₦2,500



$$EOQ = \sqrt{\frac{2DCo}{CC}}$$

$$EOQ = \sqrt{\frac{2 \times 80,000 \times 2,500}{4.8}}$$

$$= 9,129 \text{ units}$$

### 3.5 MATERIAL COSTING – PRICING ISSUES AND STOCKS

There is no point in detailed analysis of pricing systems for charging purposes unless the basic records are accurate and up to date. The system of issues, job recording, scrap records, material returns, material transfers, defective material returns, inspection records etc. must be continually monitored to ensure its relevance and accuracy.

#### Objectives of Material Pricing

There are two main objectives of material pricing:

- (a) To charge to production on a consistent and realistic basis the cost of materials used; and
- (b) To provide a satisfactory basis of valuation for inventory on hand.

#### Factors that affect Materials Pricing

Factors that affect materials pricing are:

- (a) Frequent changes in prices for bought-in materials and components;
- (b) The stock of any given material is usually made up of several deliveries which may have been purchased at different prices;
- (c) The frequent impossibility (and undesirability from a costing view point) of identifying items with their delivery consignment; and
- (d) The sensitivity of profit computations to the adopted pricing method where materials form a large part of total cost.

#### General Features of Pricing Systems

When an issue is made from Stores, the Materials Requisition would be passed to the cost department for pricing and an extension of appropriate ledger entries made:

Dr:            Work-in-progress control A/C  
                  (direct material issues)

Or

                  Overhead control A/C  
                  (indirect material issues)

Cr:    Store Ledger control A/C

To be able to use some of the pricing systems described below (For example, the FIFO and LIFO methods) the stock recording system has to be comprehensive enough not

only to record overall quantities and prices, but also the number or quantity received in any one batch. This is so that issues can be nominally identified against batches which is necessary to establish the appropriate price to be charged.

### **Methods of Pricing Store Issues**

**(a) First in First out (FIFO)**

Under this method, issues are valued at the price of the oldest batch in stock until all units of the batch have been issued when the price of the next oldest is used. In essence, as the issues are received, they are charged out to production.

**(b) Last in First out (LIFO)**

Under this method, issues are charged out at the price of the most recent batch received and continue to be charged until a new batch is received, that is, the last issues received are charged out first to production.

**(c) Average price method**

The average price method is a perpetual weighted average system where the issue price is recalculated after each receipt taking into account both quantities and value.

**(d) Specific or unit price**

The item issued can be identified with the relevant invoice where the actual cost can be charged. This is usually only possible with special purpose items bought for a particular job.

**(e) Standard price**

This is defined as:

"A predetermined price fixed on the basis of a specification of a product or service and of all factors affecting that price" (CIMA). A standard or planned price is an average price predicted for a future period and all issues/returns would be made at the standard price for the period concerned. It uses the expected purchase price as a standard.

**(f) Replacement price**

Under this method, issues are charged out at the buying price on the day of issue. There are many variants to this approach. For example, buying prices may be established by means of a price index or actual prices updated on a monthly basis.

**(g) Base stock method**

This is not strictly a method of valuing issues, it assumes that initial purchases were to provide a buffer or base stock and that this base stock should appear in all subsequent stock valuations at its original cost.

A disadvantage of the base stock method is that the resultant stock values could

be totally unrealistic.

## **3.6 LABOUR COSTING**

### **3.6.1 Personnel Engagement**

Management will determine the optimum number of workers for each department. Adequate communication must exist between the personnel department, the factory and the wages office. The personnel department will maintain records of past and present employees and, in particular, should obtain reasons for all terminations of employment.

### **3.6.2 Time Keeping for Control**

It is important that good time keeping is enforced. This is usually affected by time clocks at the entrance to the factory or the individual departments.

### **3.6.3 Time Keeping for Accounting**

It is essential to relate labour costs to individual jobs and processes and to achieve this, it is necessary for each worker to record the time he spends on each individual activity. The methods of time booking in existence are:

- (a) Daily time sheet,
- (b) Weekly time sheet,
- (c) Job tickets,
- (d) Job cards attached to each job, and
- (e) Mechanical time booking.

The daily and weekly time sheets are prepared by the worker and should account for all working hours.

The job ticket may be completed by the worker or the cost office relating to one activity forming part of a job. As the activity is finished, the ticket is submitted to the cost office which summarises all the tickets relating to a particular job in order to ascertain the total costs thereof.

The job card actually circulates with the job and so it is not possible to ascertain labour costs until the job is completed and the card returned to the cost office. In some systems, the job card is returned weekly for cost control and is replaced by a 'balance card' for subsequent time records. There are a number of mechanical devices available today with which workers can 'clock' their time to specific jobs.

An analysis of labour is required for costing purposes for the following categories of costs:

- (a) production jobs, analysed by the numbers,
- (b) indirect labour such as idle time or cleaning up,

- (c) time taken setting up machinery analysed by job numbers.

## **3.7 LABOUR REMUNERATION**

### **3.7.1 Just-In-Time (JIT)**

The modern forms of production organisation, such as Just-In-Time systems mean more and more workers will be paid time rates and will not have their pay dependent on individual output levels.

### **3.7.2 Time Based Systems**

#### **Basic System**

Workers would be paid for the number of hours worked at a basic rate per hour up to say, 40 hours in a week. Time worked in addition to 40 hours would be treated as overtime and is usually paid at a higher rate, for example 'time and a quarter' (that is  $1\frac{1}{4}$  x basic rate per hour) depending on the number of extra hours worked and when the overtime was worked.

It is important to say here that although workers' pay is not related to output, this does not mean that output performance is not relevant and fundamental. It is normal practice to monitor output and performance closely by factory floor supervision and managerial control systems so that workers are paid for actually working and not merely attending or hanging around.

Advantages of time based system are:

- (a) Easy to understand and administer
- (b) Simplifies wage negotiations in that only one rate needs to be determined unlike the continuous complex negotiations over individual rates.

Disadvantages:

- (a) There is no incentive to increase output.
- (b) All employees in the grade are paid the same rate regardless of performance.
- (c) It requires effective supervision.

#### **High Day Rate System**

This system is designed to provide a strong incentive by paying rates higher than the normal rates in exchange for above average output and performance. For the application of the rate system to be successful, it is necessary to ensure that the output levels are the result of detailed work studies and that there is agreement with the labour force and the unions involved on the required production level.

**Merits of the High Day Rate System are:**

- (a) It attracts higher grade workers.
- (b) It provides a direct incentive without the complications of individual

piecework rates.

- (c) It is simple to understand and administer.

**Demerits of High Day Rate System are:**

- (a) It encourages agitation for better remuneration to attract the best workers.
- (b) It brings about problems when the original target production figures are not met.

The system is also called 'Measured Day Work'.

**Common Bonuses in Time-Based Systems**

In addition to the time rates outlined above, bonuses or extra payments are frequently made.

Example of bonuses are:

- (a) Shift bonus: A worker agrees to work shifts particularly where rotating shifts are used, he receives an extra amount.
- (b) Timekeeping bonus: A person's timekeeping has been good over the week, a bonus may be paid.
- (c) Continuous working bonus: The plant achieves continuous production without strikes, go slows or stoppages, necessitating a weekly bonus payment.

**INCENTIVE SCHEMES**

**General Features of Incentive Schemes**

Under this scheme, payments are related to output in some way or another. There are lots of variations. Some schemes apply to individuals while others apply to groups of workers. Some have a direct and immediate relationship to output whilst others are indirect. In an organised and well planned system, both the firm and the employees can benefit. The employee from the extra income arising from increased production, and the firm from the reduced overheads per unit of the increased production. Regrettably, not all schemes achieve this objectives. The following factors should be considered:

- (a) Workers efforts should be taken into consideration and payment should be made without delay.
- (b) Employees should be able to calculate their own bonus, hence, simple scheme should be introduced.
- (c) Performance levels should be demonstrably fair, that is, they should be in reach of the average worker, working reasonably hard.
- (d) There should be no artificial limit on earnings and earnings should be safeguarded when problems arise outside the employee's control.
- (e) The scheme should not be introduced until there has been full consultation and agreement with employees and unions.
- (d) Performance levels, rates, etc must be considered, so that it will be on for a reasonable length of life. Rapid changes especially artificial one curtail earnings and therefore, destroy trust and cause problems.

- (g) Employees should be consulted and agreement reached before the implementation.

## **ADVANTAGES AND DISADVANTAGES OF INCENTIVE SCHEMES**

### **Advantages**

- (a) It increases production, thereby increasing wages but also reducing overheads per unit, particularly where there are substantial fixed overheads.
- (b) It enables a firm to remain competitive in inflationary periods.
- (c) It improves morale by ensuring that extra effort is rewarded.
- (d) It attracts efficient workers towards the opportunity of earning higher wages.

### **Disadvantages**

- (a) There are problems in establishing performance levels and rates with frequent and continuing disputes.
- (b) Some incentive schemes are expensive to administer and complex.
- (c) Some group of workers, although relatively unskilled, may earn high wages through incentive schemes whilst others engaged on skilled work may become resentful when differentials are eroded.

### **Types of Incentive Scheme**

#### **(a) Individual Incentive Schemes**

Incentive schemes which relate to an individual worker seem to be the more usual and successful, probably because of the immediate and direct relationship between effort and reward.

#### **(b) Straight Piecework**

The worker would be paid an agreed rate per unit for the number of units produced. On occasions, the number of operations would be the basis of payment, or where various types of articles are produced, a piecework time allowance per article would be set and the worker paid for the piecework hours produced.

#### **(d) Group Incentive Schemes**

It has been observed that individual based incentive schemes are common and successful but using group scheme will be much ideal in some type of business. Such businesses are:

- (i) Road surfacing or local mining
- (ii) Cars or domestic appliances.

Any of the incentive methods (piecework, differential piecework, premium bonus systems, etc.) can be used, with appropriate adoption, for group scheme. In addition, because of the wider scope of a group scheme, incentives based on cost savings, delivery dates, quality norms are used.

## **MERITS AND DEMERITS OF GROUP SCHEMES**

### **Merits**

- (a) It engenders closer co-operation in the group and a team spirit.
- (b) It is simple to administer, especially with recording of labour times, production rates etc.
- (c) Support-workers, not directly associated with production, can easily be included in the scheme.
- (d) It reduces the number of rates to be negotiated.
- (e) It encourages more flexible working arrangements within the group.

### **Demerits**

- (a) It is less direct than individual schemes. Provision of some incentive is difficult.
- (b) It causes friction as it rewards both efficient and less hardworking members of a group with same bonus.
- (c) It is difficult to obtain agreement on proportions of the bonus which group members will receive.

### **Trends in Labour Costing**

Labour costs were a major proportion of total cost in the past. This means that it was worthwhile carrying out a thorough analysis of labour costs and making the necessary detailed accounting entries. The position today is very different. Factories are highly automated and labour is a small (and reducing) proportion of total cost. In these circumstances simpler costing systems are being used for labour with some companies eliminating direct labour accounting completely, and treating labour as part of overhead.

It is important to note that:

- (a) Incentive scheme may increase the labour cost per unit but as long as the reduction in overhead cost per unit is sufficient, the scheme should be worthwhile.
- (b) Incentive schemes are not only applicable to manufacturing. The Federal government is attempting to introduce 'Performance Related Pay' across the public sector and civil servants, local government officials, teachers and others are being targeted.
- (c) It is a common costing practice to charge overtime wages above basic rate to overheads rather than direct wages. For example, if the basic rate is ~~₦4~~ per hour and overtime is paid at 'time and a quarter', then ~~₦4~~ per hour would be charged to direct wages and ~~₦1~~ per hour charged to overheads.

An incentive scheme is any method of remuneration based on labour performance. Such incentive schemes may relate to individuals or groups.

- (a) Profit sharing
- (b) Co-partnership
- (c) Benefits-in-kind

## **Labour Reports**

Regular reports should be prepared to indicate the efficiency (or otherwise) of labour. These will include:

- (a) Labour turnover report
- (b) Comparison of labour time and costs with output
- (c) Lateness reports
- (d) Idle time reports
- (e) Overtime reports.

## **Labour Cost Accounting**

A brief description of the system is as follows:

- (a) Clock cards (attendance records) are reconciled with time sheets (record of work done),
- (b) The employee's total 'gross' pay is credited to the payroll control account and debited either to the work-in-progress control account for the amount allocated to productive jobs, or to an overhead control for total non-productive time. Readers are referred to the general accounting entries under general features of Pricing Systems. The amount attributed to each individual job or overhead code will be charged to the appropriate job card or overhead analysis account - these being subsidiary records supporting the work-in-progress and overhead control accounts. There are a number of alternative methods of making these bookings in practice.
- (c) Deductions from gross pay such as national insurance contributions, loan refund and taxation will be debited to the payroll control account and credited to control or suspense accounts pending disbursements to the relevant authorities.
- (d) The net wage paid to each employee will be credited to the cash account and debited to the payroll control account which is thus cleared,

## **Labour Turnover**

### **(a) Ratio Calculation**

The labour turnover ratio is calculated using the standard formula:

$$\frac{\text{Number of Employees that left and Replaced} \times 100\%}{\text{Average Number of Employees}}$$

This formula is one of several which could be used but is chosen because it is not affected by those leaving for whom no replacement is intended, for example, redundancy, natural wastage. The average number of employees thus remains fairly constant over the year, indicating quite clearly changes in the rate at which personnel are leaving.

### **(b) Costs of Labour Turnover**

These include:

- (i) Costs of filling the vacancy, such as advertising, interviewing costs;
- (ii) Costs of training, for example, induction courses, supervisor time;



- (iii) Loss of production due to the difference in skill between the trained employee and the trainee;
- (iv) Higher scrap and wastage costs during initial training.

**(c) Possible Remedies**

Naturally, there is little that can be done to prevent employees leaving. Events such as illness or pregnancy are outside the immediate control of the company and can be classed as unavoidable. In order to reduce the avoidance loss to manageable proportions, possible courses of action are as follows:

**(i) Personnel Selection Deployment Procedures**

These should be reviewed in order to ensure that not only are suitable employees taken into the firm, but that every effort is made to fit them into the right job.

**(ii) Training and Development**

Revision of the training and development programmes are advised to ensure that employees have sufficient scope for promotion and personal betterment.

**(iii) Remuneration**

The number of firms paying highly competitive wages is on the increase. An investigation into the effect of possible wage increase is indicated.

**(iv) Working Conditions and Welfare Facilities**

A gradual decrease in the level of personnel can be traced in part to a lack of consideration on the part of management to the social needs of the employees.

Improvements in working conditions; welfare facilities and leisure activities can assist in the development of a more stable work force.

**ILLUSTRATION 3 – 4**

From data below, you are required to compute the total earnings of the three employees of Sangodiya Industries Limited for the month of July 2005.

Employee	Units produced	Rate per hour	Time allowed per hour
Gemila	80	4.00	2.50 hrs
Chuks	100	3.00	3.00 hrs
Ahmed	60	3.50	4.00 hrs

Hours spent by employees

Gemila	100 hours
Chuks	250 hours
Ahmed	120 hours

**Required:** Calculate the gross pay for each of the employees based on the following methods:

- (i) Halsey using 50% of time saved
- (ii) Halsey – Weir
- (iii) Rowan

### SUGGESTED SOLUTION 3 – 9

Calculation of Time Saved

	Gemila	Chuks	Ahmed
Time Allowed (TA)	200 hrs	300 hrs	240 hrs
Time Taken (TT)	<u>100 hrs</u>	<u>250 hrs</u>	<u>120 hrs</u>
Time Saved (TS)	<u>100 hrs</u>	<u>50 hrs</u>	<u>120 hrs</u>

Time Allowed (TA)	<u>(80 x 2.50)</u>	<u>(100 x 3.00)</u>	<u>(60 x 4.00)</u>
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Halsey Scheme – (50% of Time Saved)

	Gamila	Chuks	Ahmed
	₦	₦	₦
Normal pay (100 x 4)	400	(250 x 3) 750	(120 x 3.50) 420
Bonus (50% of TS) x ₦4 =	<u>200</u>	<u>75</u>	<u>210</u>
Total Earning	<u>600</u>	<u>825</u>	<u>630</u>

Halsey – Weir System – ( $33\frac{1}{3}$  of TS)

Normal pay	400	750	420
Bonus $\frac{1}{3}$ of 100 x ₦4	<u>133.33</u>	<u>50</u>	<u>140</u>
	<u>533.33</u>	<u>800</u>	<u>560</u>

$$\text{Rowan System} = \left\{ \frac{\text{TS}}{\text{TA}} \times \frac{\text{TT}}{1} \right\}$$

	Gamila	Chuks	Ahmed
Normal pay	400	750	420
Bonus ( $\frac{100}{200} \times \frac{100}{1} \times 4$ )	<u>200</u>	<u>125</u>	<u>210</u>
	<u>600</u>	<u>875</u>	<u>630</u>

### 3.8 DIRECT EXPENSES

Direct expenses are those costs other than materials or labour which can be identified directly with a particular cost unit. In many types of businesses, direct expenses will be insignificant and as a matter of convenience, all expenses will be treated as indirect. In other instances, particularly where work is carried out at a number of sites, such as civil engineering, it will be possible to allocate the majority of the expenses directly to a particular cost unit.

### **Examples**

- (a) Plant hire, if the plant is hired to manufacture a specific cost unit.
- (b) Sub-contracting, where the jobs are sent out for special work
- (c) Travelling expenses to sites, particularly for contractors.
- (d) Royalty payments as royalties are charged as a rate per unit.
- (e) Salesmen's commission as this is often based on the sales value of units.

### **3.9 OVERHEADS**

Overheads are those costs which cannot be related to an individual cost unit. They are identified, therefore, in the first instance with:

- (a) Classification of cost in the ledger.
  - (b) Departments or cost centres where they can be controlled.
- Overhead Charges

These can arise from the following:

- (a) Material requisitions for small tools, consumable stores and other stock items which are not customarily identified with production jobs.
- (b) Time sheets for labour bookings to non-productive work, idle time etc.
- (c) Supplier: invoices for goods such as stationery and for service such as electricity, rent telephone charges etc.
- (d) Petty cash vouchers for small disbursements.

#### **Overhead Analysis**

- (a) Overheads are collected and analysed.
- (b) Overheads are allocated to (identified with) production and service cost centres.
- (c) Overheads are apportioned to (shared among) production and service centres.
- (d) Service cost centre overheads are re-apportioned to productive cost centres.
- (e) Cost units are charged according to the benefits they have received from each cost centre. This means that they are allocated on an equitable basis.

#### **Allocation and Apportionment**

Some overheads arise solely because of the existence of a particular cost centre. These overheads are direct, in view of the fact that, cost centre is concerned and can be allocated to it.

The majority of overheads are not caused solely by one cost centre and it is, therefore, not possible to allocate costs directly to individual cost centres. In these cases, it is only possible to apportion costs on a reasonable basis.

#### **Bases of Apportionment**

There are many bases for apportioning overheads and the choice of a suitable basis is largely a matter of common sense. Examples of overheads together with the manner in which they might be apportioned are:

- (a) Cooling and heating costs - number of compressors and radiators in each cost

- center
- (b) Rent-relative floor area in each cost centre
  - (c) Depreciation of machinery - capital values of machines.
  - (d) Canteen, Supervision, personnel - number of employees.
  - (e) Telephone costs- number of extensions
  - (f) Power- technical estimate.

### **Re-apportionment of Service Cost Centre Costs**

Having charged all overheads to individual cost centers (production and service), it is necessary to re-apportion all service costs center costs to the production. The following are examples of the service cost centres to be found in a typical engineering factory:

- (a) Maintenance room
- (b) Inspection
- (c) Stores
- (d) Canteen
- (e) First aid
- (f) Production.

The cost of the various departments will be apportioned to the productive cost centres on the basis of the benefit received by each cost centre.

### **Reciprocal Service Cost**

Where there are a number of service departments, they may supply their services to one another as well as to productive departments. Finding an equitable basis of apportionment may prove difficult because of the number of variable factors involved. One of the following methods can be applied:

- (a) Simultaneous equation
- (b) Repeated distribution
- (c) Apportioning the costs of the service centre which received least benefits from other service centres first and then repeating the process until all service department costs are apportioned.

## **OVERHEAD ABSORPTION**

### **Definition:**

“A means of attributing overheads to a production service based, for example, on direct labour hours, direct labour cost or machine hours” (CIMA).

Having analysed overheads to productive cost centers, a fair share of these overheads is charged to each of the cost units passing through a cost centre. This process is termed 'overhead absorption'. In order to absorb overheads into cost units, the process entails the computation of an overhead absorption rate. This is computed by the following formula:

$$\frac{\text{Total cost centre overheads}}{\text{Total units of base to be used}}$$

There are many bases for absorption. Some of them are as follows:

- (a) % of Direct materials cost
- (b) Direct labour hours
- (c) % of Direct labour cost
- (d) % of Prime cost
- (e) Machine hours
- (f) Units of output/production.

The absorption rate is normally based on budget cost and output figures.

Budgeted output [units]	30,000	25,000
Total budgeted overheads	₦400,000	

Calculate the overheads absorbed by production according to:

- (a) % of Direct materials cost
- (b) Direct labour hours
- (c) % of Direct labour cost
- (d) Machine hours

### **Argument for Absorption Overheads**

- (a) The main argument for absorbing overheads costs is that they must be recovered if the firm is to make profit and the best way to recover overheads costs is to charge each department and ultimately, each product with a share of them,
- (b) Another problem is the nature of the overheads which are charged to products. They will usually be combination of two different classifications:
  - (i) Those which vary with the level of output (variable overheads)
  - (ii) Those which remain at a constant level, regardless of the level of production (fixed overheads)

### **Pre-determined Overheads Absorption Rates**

To obtain accurate costs, it is necessary to wait until the end of the accounting period to obtain the total costs and the total units of the base of absorption. In seasonal types of business, it will be necessary to wait for the end of an accounting cycle in order to obtain the necessary information.

In practice, it is not usually possible to wait until the end of an accounting period before preparing costing information and it is necessary to use estimated figures. Such estimates are termed "pre-determined overhead absorption rates" and are calculated in the following way:

$$\frac{\text{Budgeted overheads for future period}}{\text{Budgeted units of base for future period.}}$$

### **Over And Under Absorption**

With pre-determined overhead rates, it will almost always be found that actual overheads incurred differ from the amount of overheads absorbed. This over-or under-absorption may be caused by two factors:

- (a) Difference between actual and budgeted overheads
- (b) Difference between actual and budgeted units of base.

### **Blanket Absorption Rate**

A blanket absorption rate is one which is applied to a whole factory. Such a rate fails to distinguish between cost units which incur a large amount of overhead in mechanised processes and those which incur a smaller amount of overhead in manual processes. A blanket absorption rate can produce completely erroneous results.

### **Non-Production Overheads**

The same principle with respect to production overheads shall also apply to non-production overheads.

- (a) Selling overheads should not be absorbed into the cost of goods produced since the selling cost is part of administration overheads. The source documents for these entries are material requisitions [indirect materials], time sheet [non-productive time], the invoice analysis for purchase on credit and possibly, an analysis of petty cash payments. There will also be some overheads derived from internal calculation such as depreciation charges.
- (b) The total factory overheads are analysed to cost centres on sheets sometimes called standing order numbers. This is a two way analysis, each standing order number containing a particular type of cost and analysing it across productive and service cost centres.
- (c) Non-productive overheads are analysed on similar sheets called cost account numbers.
- (d) The total of the standing order numbers are summarised into a departmental distribution summary and this in turn forms the basis for the computation of the overhead absorption rate of the department concerned.
- (e) Overhead absorbed [applied] is entered on the individual job or process record and debited in total to the work-in-progress account. The corresponding credit can be made to the overhead control account.
- (f) The individual job or process records may show only works cost, or percentage additions may be made for the non-productive overheads.

### **Depreciation**

Depreciation charges are intended to represent the diminution in the value of a fixed asset due to use or lapse of time. Provision for depreciation may be calculated by any of the following methods:

- (a) ***Straight-line:*** Under which the cost of an asset, possibly after deducting its forecast residual value, is written off by equal annual installments over its useful life. For example, an asset may have cost 5,000 and is expected to be

used for five years after which it will be sold as scrap for 200. The annual depreciation charge will be:

$$\frac{\text{N}5,000 - \text{N}200}{5} = \text{N}960$$

- (b) **Reducing Installment:** Under which depreciation is calculated each year at a fixed percentage of the residual asset value. For example, you are to depreciate the asset costing  $\text{N}5,000$  at 15% per annum. In this case, the first year's depreciation would be  $15\% \times \text{N}5,000 = \text{N}750$ . The second year's charge would be  $15\% \times [\text{N}5,000 - 750] = \text{N}637.5$  and so on.
- (c) **Production unit:** This is a method entirely based on use. An estimate is made of the number of units to be processed by a machine during its lifetime, and the cost of the machine is divided by that number of units to give a unit rate of depreciation. The depreciation charge for any year will be found by multiplying the number of units produced by the unit rate.
- (d) **Production hour:** This is similar to the production unit method, but using the forecast number of working hours in the effective life of the machine instead of the number of units it will produce.

The maintenance of an asset register will facilitate the calculation of depreciation, provide continuous record of residual values, and enable depreciation charges to be allocated to cost centres.

**Interest:** This is usually omitted from costing records. It is advisable to bring interest into account in special report for decision making where it is significant.

**Taxation:** This should be considered in decision making when comparing alternative courses of action especially under investment appraisal.

### 3.10 ACTIVITY BASED COSTING [ABC]

This has developed to resolve the defects that conventional absorption costing absorbs support overheads into product costs. Traditionally all overheads were absorbed on production volume [measured as labour or machine hours] although, many support overheads vary, not with production volume, but with the range and complexity of production.

ABC is a recent approach to product costing, pioneered by Professors Kaplan and Cooper of Harvard University. ABC is aimed at using only cause and effect cost allocations. It is an attempt to reflect more accurately in product costs, those activities which influence the level of support overheads.

This includes such items as inspection, production planning, set-up tooling and other costs. Traditionally, all overheads were absorbed in production volume as measured by labour or machine hour.

Traditional volume related overhead absorption tends to over-cost products made in the long run and under cost products made in the short run. ABC seeks to overcome this problem in the following ways:

- (a) short-term variable costs
- (b) Long-term variable costs

**(a) Short-term variable costs**

ABC recognises that there could be several costs drivers wherever labour hours, machine hours and material costs are used in different proportions by products. In most organisations, there will only be a small proportion of overheads that can be classed as short-term variable costs.

**(b) Long-term variable costs**

These are overhead costs which do not vary with production volume but vary with other measures of activity, for example, costs for support activities such as stock handling, production scheduling to the range and complexity of the products manufactured.

ABC requires that these costs be traced to products by transaction based cost drivers. Most support overhead can be classified as longterm variable costs and thus traced to products using appropriate cost drivers such as making procurement order. In the traditional system, most of these would be classified as fixed.

**(c) Fixed costs Using**

ABC, these are classified as costs which do not vary, for a given time period with any activity indicator. An example would be the salary of the Managing Director. Research conducted by Kaplan and Cooper (1992) suggests that these are a relatively small proportion of the total costs.

### **3.11 COST POOLS AND DRIVERS**

#### **Cost Pools**

Cost pools can be defined as *"The point of focus for the cost relating to a particular activity in an activity-based costing system"* (CIMA).

There are difficulties in choosing realistic cost drivers Kaplan and Cooper (1992) warns:

*"There are no simple rules that pertain to the selection of cost drivers. The best approach is to identify the resources that constitute a significant proportion of the products and determine their cost behaviour If several are long-term variable costs, a transaction based system should be considered"*



## **Cost Drivers**

*"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" (CIMA).*

It may be decided that an activity based system is required then the appropriate cost drivers are chosen and the costs associated with each activity are gathered together in cost pools.

Cost pools are similar in principle to cost centres in traditional system. Costs are pooled, or collected, on the basis of the activity that drives the costs regardless of conventional departmental boundaries. For example, if the cost driver is a number of set-ups, then all costs relating to activity of setting-up will be pooled together.

Cost pools are not necessarily related to departmental boundaries nor do they include all the activity of a single department as the cost drivers may differ for the various activities carried out within the same department.

## **Selecting Cost Drivers**

Basically, there should be a direct cause relationship between the consumption of overheads and the chosen cost driver. There should be a causal relationship between the amount of resource use, and therefore, the level of cost, and the volume of the selected cost driver. The relationship is not necessarily a short-term one. This is because salaries and related personnel costs make up a significant proportion of most support overheads and these costs are not easily adjusted in the short-run, hence; Kaplan (2001) defines it as 'long-run variable costs'.

## **Factors that affect Cost Drivers**

The factors that most likely affect cost drivers are;

### **(a) Accuracy**

The greater the level of accuracy required of product costing, the more the cost drivers.

### **(b) Correlation**

The more closely a cost driver correlates with activity use, the fewer distortions in products cost and the fewer cost drivers.

### **(c) Homogeneity**

The cost pool should be homogenous. It can fairly be represented by one cost driver. Where this is not possible, the pool may need to be sub-divided and numerous cost drivers used and the resultant effect make the system more complex and costly to administer.

### **(d) Inspection**

This is the extent that one cost can be fairly applied to diverse products. If the

cost driver, 'number of inspections' was used to trace Inspection costs to products, distortions will be introduced. If inspections take varying amounts of time for different products, inspection hours may be a better cost driver or there may be a need for several cost drivers to trace cost fairly.

### **Cost Drivers used in Practice**

Conventionally, the cost pools and cost drivers chosen must suit the organisation, the products or services and the objectives of the ABC system. As a consequence, they will vary from organisation to organisation and there are, no universally applicable examples.

### **Example of Cost Driver Calculation and Use**

An organisation introduced ABC and has separated its main activities into reasonably homogenous cost pools. Cost drivers have been selected for each pool.

- (a) It provides realistic product costs most especially in Advanced Manufacturing Technology [AMT] factories where support overheads are a significant proportion of total costs.
- (b) It enhances the tracing of overheads to the product. In modern factories, there are a growing number of non-factory floor activities. ABC is concerned with all activities.
- (c) It recognises activities which cause cost, and not products.
- (d) It focuses attention on the real nature of cost behaviour and helps in reducing costs and identifying activities which do not add value to the product.
- (e) It also recognises the complexity and diversity of modern production by the use of multiple cost drivers, many of which are transaction based rather than based solely on production volume.
- (f) It provides a 'reliable indication of long-run variable product cost which is relevant to strategic decision making.
- (g) It is flexible to trace costs to processes, customers, areas of managerial responsibility, as well as products costs.
- (h) It also provides useful financial measures, for example, cost driver rates and non-financial measures - transaction volumes.

### **Demerits of ABC**

These include:

- (a) the preference for particular cost drivers - it is a simplistic assumption that a chosen cost driver is an adequate summary measure of complex activities.
- (b) the assumption of a direct linear relationship between the usage of a cost driver and the amount of overheads. It is widely known that very few costs are truly variable, whether in the short or long term.
- (c) the issue of common costs - it is difficult to attribute costs to single activities; hence, some costs support several activities.
- (d) tracing difficulties - It is not always apparent which product should carry the traced overhead.
- (e) Complexity - A full system having numerous cost pools and cost drivers is

more complex and consequently more expensive to operate. This need not be a problem provided that the benefits outweigh the costs.

### **3.12 ACTIVITY BASED ACCOUNTING [ABA]**

Activity Based Accounting is a new approach to internal accounting. It focuses on analyzing, recording, controlling and reporting on the costs and wider performance of activities rather than the conventional emphasis on merely the costs of departments and cost centres.

Activity based accounting includes:

- (a) Activity Based Costing [for product costing],
- (b) Activity Based Budgeting or Activity Cost Management [for cost planning and control] and
- (c) Activity Performance Measurement [for performance monitoring using both financial and non-financial indicators]. All these approaches are covered in detail later in the study pack. It has strong behavioural influences and is widely used to promote cost reduction and increase efficiency

## **4.0 CONCLUSIONS**

Cost accounting system largely focuses on the analysis of past costs and operations. The prime cost is the addition of the total direct material plus direct labour plus direct expenses while the total indirect costs is referred to as overhead.

Overheads are determined by defining cost centres and then allocating and apportioning costs to the cost centres using bases of apportionment which are deemed to reflect the benefits received. These overheads are spread over cost units by adopting overhead absorption rates usually based on labour or machine hours.

Where all costs whether variable or fixed are included in production costs, the system is "absorption costing" and where fixed costs are excluded from production costs and charged as period costs, the system is referred to as "marginal costing".

The major material pricing systems are FIFO, LIFO, replacement price, weighted average price and standard price.

ABC collects overheads into cost pools and traces these to products using cost drivers with overhead being long term variable costs that vary more with product complexity and diversity than production volume.

Cost pools are homogeneous and are single cost drivers that relate directly to the amount of resources used.

ABC has strong behavioral influences and is widely used to promote cost reduction and increase efficiency.

## 5.0 SUMMARY

This unit has attempted to a large extent to discuss the various principles, concepts and elements of cost accounting. And also show their relationship.

## 6.0 TUTOR MARKED ASSIGNMENTS

1. Peju Limited had an opening stock value of 300 units valued at N8.80 each on 1 April, 2005. The following receipts and issues were recorded during the month  
10 April      Receipt 1000 units              N8.60 per unit  
23 April      Receipt 600 units                      N9.00 per unit  
29 April      Issue 1700 units.

Using the LIFO method, what was the total value of the issue on 29 April 2005?

- A    N14,840
  - B    N14,880
  - C    N14,888
  - D    N15,300
  - E    N15,960
2. Prime cost is:  
A    all costs incurred in manufacturing a product  
B    the total of direct costs  
C    the material cost of a product  
D    the cost of operating a department  
E    the cost of administrative and direct expenses.
  3. Femi Limited has a component with a safety stock of 1000, a re-order quantity of 6000 and a rate of demand which varies between 400 and 1400 per week. The average stock is approximately:  
A    4000  
B    4600  
C    5000  
D    7000  
E    6500
  4. The process cost apportionment is carried out so that  
A    cost may be controlled  
B    cost units gather overheads as they pass through cost centre  
C    whole items of cost can be charged to cost centres  
D    common costs are shared among cost centres  
E    costs are shared equally.
  5. Over-absorption overheads occurs when  
A    absorbed overheads exceed actual overheads  
B    absorbed overheads exceed budgeted overheads

- C actual overheads exceed absorbed overheads
- D budgeted overheads exceed absorbed overheads
- E over-absorbed overheads exceed budgeted overheads.

6. Give three examples of absorption rate.
7. What is Activity Based Costing?
8. What is labour turnover?
9. What is the formula for pre-determined absorption rate?
10. What is blanket absorption rate?

## **7.0 REFERENCES/FURTHER READINGS**

ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.  
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## **UNIT 4 COSTING METHODS**

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## **1.0 INTRODUCTION**

In this unit, It must be clearly understood that whatever costing method is employed, the basic principles relating to analysis, allocation and apportionment of costs will be used.

## **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- Costing methods
- Job costing, batch costing and contract costing
- Process costing, joint-product and by-product; and
- Service costing.

## **3.0 MAIN CONTENT**

### 3.1 COSTING METHOD DEFINED

This is a method that is used to determine the amount or value of the economic resources used in producing a product or providing a service.

Costing method should be designed to suit the objective of a business enterprise. The objective could be to determine the unit cost of a product from the manufacturing process; the contract cost in a construction outfit; the cost of executing specific jobs, etc.

### 3.2 CATEGORIES OF COSTING METHODS

A costing method is designed to suit the way goods are processed or manufactured or the way that services are provided. It follows, therefore, that each firm will have costing methods which have unique features. Nevertheless, there will be recognizably common features of the costing systems of firms which are broadly in the same line of business.

Conversely, firms employing substantially different manufacturing methods, for example, a food processor and a jobbing engineering factory, will have distinctly different costing methods.

#### Categories of Costing Methods

There are two broad categories of product costing methods, namely: specific order costing and continuous operation/process costing.

(a) Specific order costing

This is defined as: *The basic cost accounting method applicable where work consists of separately identifiable contracts, jobs, or batches.* (CIMA).

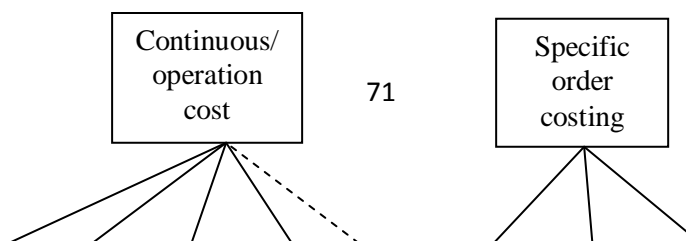
The main sub-divisions of specific order costing are:

- (i) Job costing
- (ii) Contract costing
- (iii) Batch costing

Specific order costing is employed where each cost unit is different from any other cost units and where certain job re-occur from time to time and it is desirable to determine their costs afresh each time they occur.

- (b) Continuous operation/ process costing (sometimes called unit costing). This is defined as; *"The costing methods applicable where goods and services result from a sequence of continuous or repetitive operations processes, Costs are averaged over the units produced during the period, being initially charged to the operation or process,"* (CIMA).

#### COSTING METHODS CHART



### **Fig. 4.1 Costing Methods depicted by categories.**

The dotted line indicates an area of overlap between the two major categories. Although each batch is separated and identifiable and may be different from any other batch, within a given batch there will be a number of identical cost units over which the total batch costs will be averaged.

#### **3.2.1 Costing Methods and Costing Principles**

A unique difference between the principles of costing with regard to specific order costing and operation costing, is that, with operation costing, all costs, that is, labour, materials and overheads are allocated or apportioned to a cost centre from which these costs are shared out over the cost units produced. This differs from specific order costing,

### **3.3 JOB COSTING**

Job costing is defined as: *"A form of specific order costing in which costs are attributed to individual jobs."* (CIMA).

#### **Requirements of Job Costing**

The main purposes of job costing are to establish the total cost of a job, the profit or loss on each job, and to provide a valuation of work-in-progress.

A successful job costing system. requires:

- (a) A good and reliable system of production control.
- (b) Effective works documentation.
- (c) An adequate and efficient time booking system using either time cards or piecework cards.
- (d) A clearly defined costing system that ensures costs incurred are captured accurately.

#### **ILLUSTRATION 4 - 1**



The data below relate to a single accounting period in a jobbing engineering works of Uoroho Engineering Limited.

Extracts from Job Cost Cards

	Opening W-I-P	Charged during Period	Closing W-I-P
	₦	₦	₦
Materials	5,310	16,420	6,315
Labour	7,625	26,630	8,085
Production overhead	5,415	16,760	4,630

The financial accountant supplied the following information relating to the same period:

	₦
Materials purchased	19,575
Marketing and admin. overheads	6,390
Production overheads	15,310
Sales	73,165

The opening stock of material was ₦9,200. All completed jobs are invoice immediately to customers. Please note that the Cost Department recovers selling and administrative overheads at the rate of 10% of the cost of completed jobs.

Using the above information, you are required to write up the Cost ledger and prepare a Costing Profit and Loss Account for the period, assuming that the firm operates an interlocking system with separate financial and cost accounts. Financial control balance brought forward and work-in-progress were ₦22,950 and ₦18,350 respectively.

**SUGGESTED SOLUTION 4 – 1**

**Cost Ledger**

<b>Cost Control Ledger Account</b>			
	₦		₦
		Balance b/f	22,950
Sales	73,165	Purchases	19,575
		Marketing + Admin.	6,390
Balance c/d	26,785	Prod. Overheads	15,310
		73	

	Wages	26,630
	Profit	9,095
99,950		99,950
	Balance b/d	26,785

### W.I.P Control

	₦		₦
Balance b/f	18,350	Cost of Sales Balance c/d	59,130 19,030
Material	16,420		
Wages	26,630		
Prod. Overhead	16,760		
	78,160		
Balance b/d	19,030		

### Stores Control

	₦		₦
Balance	4,600	W.I.P Balance c/d	16,420 7,755 24,175
Cost Control Ledger	19,575		
	24,175		
Balance b/d	7,755		

### Production Overhead Control

	₦		₦
Cost Control Ledger	15,310	W.I.P	16,760
Overhead Adjustment	1,450		
	16,760		

### Wages Control

	₦		₦
Cost Control Ledger	26,630	W.I.P	26,630

### Marketing and Admin. Overhead Control

	₦		₦	
Cost Control Ledger	6,390	Cost of Sales Overhead Adjustment	5,913 477	
	6,300			6,390

### Cost of Sales

	₦		₦
W.I.P	59,130		

--	--	--	--

Marketing + Admin.	5,913	Profit and Loss	65,043
	65,043		65,043

#### Overhead Adjustment

	₦		₦
S & D	477	Production Overhead	1,450
Profit and Loss	973		
	1,450		1,450

#### Costing Profit and Loss Account

	₦		₦
Cost of Sales	65,043	Sales	73,165
Profit c/d	9,095	Overhead Adjustment	973
	74,138		74,138
		Profit b/f	9,095

### 3.4 BATCH COSTING

Batch costing is the application of the principle of cost accumulation in circumstances where a quantity of identical articles are manufactured as a batch.

Generally, the procedures for costing batches are similar to costing jobs. The batch would be treated as a job during manufacture and the costs collected. It is significant to state that on completion of the batch, the cost per unit is calculated by dividing the total batch cost by the number of good units produced. In like manner, the cost of the bad units are absorbed by the good units. Batch costing is prominent in the engineering component industry footwear and clothing manufacture.

$$\text{In essence, cost per unit} = \frac{\text{Total batch cost}}{\text{No. of good units produced}}$$

#### ILLUSTRATION 4 – 2

Yetunde Company Ltd. manufactures Footwear and Clothing materials and has the following budgeted overheads for the year, based on normal activity levels.

Department	Budgeted Overhead	Overhead Absorbed Base
Leathering	₦36,000	3,000 labour hours
Machining	₦86,000	5,000 machine hours
Welding	₦40,000	3,600 labour hours

Sewing                      ₦30,000                      2,000 labour hours

Marketing and Administrative overheads are 20% of factory cost. An order for 500 footwear, made as batch 1202, incurred the following costs:

Materials:    ₦6,214

Labour:        256 hours Blanking Shop at ₦10.50/hour

850 hours Machining Shop at ₦11.00/hour

180 hours Welding Shop at ₦10.50/hour

350 hours Assembly Shop at ₦9.60/hour

₦1,050 was paid for a hire of an equipment. The time booking in the machine shop was 1,286 machine hours.

You are required to calculate the total cost of the batch, the unit cost and the profit per assembly if the selling price was ₦200.

**SUGGESTED SOLUTION 4 – 2**

The first step is to calculate the overhead absorption rates (OAR) for the production departments.

Leathering	=	$\frac{₦36,000}{3,000}$	=	₦12.0 OAR per labour hour
Machining	=	$\frac{₦86,000}{5,000}$	=	₦17.2 OAR per machine hour
Welding	=	$\frac{₦40,000}{3,600}$	=	₦11.1 OAR per labour hour
Sewing	=	$\frac{₦30,000}{2,000}$	=	₦15.0 OAR per labour hour

Total cost – Batch No. 1202		₦
Direct Material		6,214
Direct Expense (Equipment hired)		1,050
Direct Labour	256 x 10.50 = 2,688	
	850 x 11.00 = 9,350	
	180 x 10.50 = 1,890	
	350 x 9.60 = 3,360	<u>17,288</u>
	Prime Cost	24,552

Production Overhead Absorption		₦
Leathering	256 x 12.0 =	3,072

Machining	850 x 17.2	= 14,620	
Welding	180 x 11.1	= 1,998	
Sewing	350 x 15.0	= 5,250	<u>24,940</u>
Factory Cost			49,492
Marketing and Administrative Overhead (20% of factory cost) ( <del>₦</del> 49,492 x 0.20)		=	<u>9,898</u>
Total Cost			59,390
Total Cost/Unit	=	<u>59,390</u>	
		500	
			₦
	=		118.78
Profit/Unit	=		<u>81.22</u>
Selling Price	=		200.00

### 3.5 CONTRACT COSTING

Contract costing has many similarities to job costing and is usually applied to work which is:

- (a) Undertaken according to customer's specification
- (b) Relatively long duration
- (c) Site based, out of main office
- (d) Frequently of a construction nature

In view of the long time scale and size of construction contracts, the necessity arises for periodic or intervals valuations to be made of work done and for progress payments to be received from the client.

#### 3.5.1 Contract Plant

One of the characteristic of most contract work is the amount of plant used. This includes cranes, trucks, excavators, mixers, and lorries. The usual ways in which plant costs are dealt in the accounts are:

- (a) *Lease plant.* The lease rental is charged directly to the contract.
- (b) *Plant purchases.* Two methods may be used.
  - (i) The plant depreciation.
  - (ii) Contract account concerned are charged when plant are transferred to the company.

#### Architect's Certificate in Relation to Construction Contracts

A contract provides for the client to make progress payments at specific intervals, for example, when foundation are completed, first floor completion, etc.

You are to assume that a contract has been completed up to 90%, a certificate will be issued by the Architect. This certificate is called Architect certificate. The unpaid balance of 10% will be retained after the successful completion of the work. This fee is called retention fee.

### Profit contract

The purpose of contract costing is to show the profit and loss on each completed contract. When a contract is still in progress at the end of the financial year, a portion of the profit earned is provided in the financial statement (that is part of the total contract profit) in order to avoid excessive fluctuations in company results from year to year. Also, it is relevant to provide a realistic figure of the value of work-in-progress for balance sheet purposes.

Provision should be made for anticipated losses.

A format of the contract income calculation is as follows:

	₦	₦
Total Contract Value		XX
Less: Costs incurred to date	XX	
Estimated costs to completion	XX	
Rectification and guarantee work	<u>XX</u>	
Total estimated contract costs		<u>XX</u>
Estimated contract profit or (loss)		<u>XX</u>

### Guidelines on Calculating Interim Profits

There exists various guideline for calculating interim profit on incomplete contracts. However, profit taken contract should reflect the degree of completion. If the contract is at early stage (say, less than 40% complete) no profit should be taken. Interim profits, however calculated, should only be taken when the final contract outcome can be assessed with reasonable confidence.

There are many ways of calculating interim profit.

(i) Profit taken:  
$$= \frac{2}{3} \text{ or } \frac{3}{4} \text{ of the Notional profit} \times \frac{\text{cash received from progress payments}}{\text{Value of work certified}}$$

where the Notional Profit is:  
value of work Certified Less Cost of work Certified.

(ii) Profit taken  
$$= \frac{\text{Process payments to date}}{\text{Contract price}} \times \text{estimated total profit on completion}$$

(iii) Profit taken =  $\frac{\text{Value of work certified}}{\text{Contract price}} \times \text{estimated total profit}$

(iv) Profit taken = Value of work certified — cost of work certified  
 Or  
 Profit taken =  $\frac{\text{Cost of work done}}{\text{Estimated total cost of contract}} \times \text{Estimated total profit}$

**Profit and Loss Account for Interim Profits**

Having calculated an appropriate interim profit, the necessary turnover and cost of sales figures must be derived, for insertion in the published profit and loss account of the firm. The turnover and cost of sales figures are based on the formulae used for the interim profit calculations and must obviously produce the agreed profit.

**ILLUSTRATION 4 – 4**

OWOJORI Nigerian Limited began work on 1 January 2000 on a contract for the building of an extension to new Lagos Polytechnic amounting ₦1,800,000. The retention on contract is agreed at 10%. On November 2000 the certificate of work approved amounted to ₦1,200,000. The following information is available.

	₦
Materials sent to site	450,000
Labour engaged on site	360,000
Plant installed at cost	180,000
Direct expenditure	72,000
Establishment charges	150,000
Materials returned to stores	15,000
Cost of work not yet certified	90,000
Materials on site at 31 December 2000	45,000
Wages accrued at 31 December 2000	15,000
Direct expenses accrued at 31 December 2000	3,000
Value of plant at 31 December 2000	120,000

You are required to complete the Contract Account, showing the amount of profit likely to be taken into annual accounts to 31 December 2000 and to calculate the value of work in progress.

## SUGGESTED SOLUTION 4 – 4

### OWOJORI NIGERIA LIMITED CONTRACT ACCOUNT

	₦	₦		₦
Direct Materials		450,000	Materials returned to store	15,000
Direct Wages	360,000		Stock c/d	45,000
Accrued c/d	<u>15,000</u>	375,000	Plant c/d	120,000
Plant installed		180,000	Cost to date	1,050,000
Direct expenses	72,000			
Accrued c/d	<u>3,000</u>	75,000		
Establishment charges		<u>150,000</u>		
		<u>1,230,000</u>		<u>1,230,000</u>
Cost brought down		1,050,000	Contract work certified	1,200,000
Notional Profit c/d		<u>240,000</u>	Cost of work not yet certified	<u>90,000</u>
		<u>1,290,000</u>		<u>1,290,000</u>
P&L a/c (profit taken)	144,000		Notional profit b/d	240,000
Profit provision c/d		<u>96,000</u>		<u>240,000</u>
		<u>240,000</u>		
Stock b/d		45,000	Direct wages accrued b/d	15,000
Plant b/d		20,000	Direct expenses b/d	3,000
Cost of work not yet certified		90,000	Profit provision b/d	96,000

### CONTRACTEE ACCOUNT – LAGOS POLYTECHNIC

Work Certified	1,200,000	Cash	1,080,000
		Balance C/D (retention 10%)	<u>120,000</u>
	<u>1,200,000</u>		<u>1,200,000</u>

### CALCULATION OF WORK-IN-PROGRESS

	₦
Contractee	120,000
Cost of work no yet certified	<u>90,000</u>
	210,000
Less: Profit provision	<u>96,000</u>
WIP	<u>114,000</u>

OR

	₦
Cost up to date	1,050,000
Profit taken	<u>144,000</u>
	1,194,000
Less cash received	<u>1,080,000</u>
WIP	<u>114,000</u>



## CALCULATED OF PROFIT TAKEN

$$\text{Notional Profit} \times \frac{2}{3} \times \frac{\text{Cash Received}}{\text{work certified}}$$

$$\frac{240,000}{1} \times \frac{2}{3} \times \frac{1,080,000}{1,200,000}$$

$$= \text{N}144,000$$

### 3.6 PROCESS COSTING

Process costing is a costing method where manufacturing activities are continuous and the units of output are substantially uniform. Process follows a chain of sequential order. It is used in a various companies including: soap, beverage, paper making, paints and pharmaceutical, beverage processing and others. The characteristics of process costing systems include:

- (a) There must be a clearly defined process cost centres and all costs accumulated (material, labour and overheads) by the cost centres.
- (b) There must be accurate records of units produced and the cost incurred by each process.
- (c) The total costs of each process over the total production of that process, including partly completed units must be averaged.
- (d) The charging of the cost of the output of one process as the raw materials input cost of the following process.
- (e) There must be clearly defined procedures for separating costs where the process produces two or more products, that is, joint products or where by-products arise during production.

It must be noted that output costing describes the costing of a simple process, whereas, process costing describes the costing of a chain of sequential processes.

#### 3.6.1 Determination of Cost Unit

It must be emphasised that, the cost unit to be determined should be relevant to the organisation and its product. The appropriate unit arises having regard to the process and the cost and selling price of the product. Examples include:

Industry	Possible Cost Units
Brewing	Litre, gallon, barrel
Beverages	Litre, gallon
Food processing	Can, case, Kilogram, tonne, litre, etc.
Soap	Bar, tablet.

### 3.6.2 Process Losses

With varied forms of production, the quantity weight or volume of the product emerging at the end of a process may be less than the expected output considering the quantity weight or volume of the materials introduced. This may be due to various reasons:

- (a) The quality of materials introduced.
- (b) Losses inherent in the materials or the method of processing.
- (c) Withdrawal for testing and inspection.

It is important to keep records of input and output quantities and to check for losses that occur due to expectation or formula application.

### 3.6.3 Normal Process Losses

These are expected losses arising from the nature of the production process. Provision is always made for such issues and must be included as part of the cost of good production. The accounting entries are:

- (a) To credit the process account with any realised value of the scrap items.
- (b) To relate the net process cost to the achieved good output; that is, normal process loss without scrap value with the cost of good production.

### 3.6.4 Abnormal Process Losses

Abnormal losses are losses which are in excess of normal losses and so not expected from the production. Some of the causes of abnormal losses are as follows:

- (a) insufficient working losses,
- (b) regular plant breakdown, in any circumstance which could not be foreseen.
- (c) Unexpected defects in materials.
- (d) Unforeseen events or circumstances.

#### Accounting entries

The abnormal losses are valued in like manner with the finished goods.

Entries include

- (a) To locate an abnormal loss account from which will be debited the value of the abnormal quantity(ies).
- (b) To write off the abnormal loss account to costing profit and loss account.
  - (a) Cr Process Account  
Dr Abnormal loss Account (with the value of abnormal loss quantity.)
  - (b) Cr Abnormal Loss account  
Dr Profit and Loss account

(to write off the abnormal loss value.)

### **3.6.5 Valuation of Opening Work in Progress (WIP)**

This relates to units that are partly completed at the end of a period or partly processed in the current period. Opening work in progress can be subdivided into raw materials or finished goods, labour and overheads.

There are two methods of calculating the cost per unit.

These are:

- (a) Average Method
- (b) First In First Out (FIFO) Method

#### **(a) Average Method**

Under this method, the unit cost is calculated by adding the total opening work-in-progress with current period costs.

This method ignores the fact that the opening WIP units were partly completed in the previous period. The effect is the loss of identify of WIP.

#### **(b) FIFO Method**

Under this method, the units are dealt with on the basis of first in first out to the extent that the first work done in a period is the completion of the opening work-in-progress. The FIFO method treats the opening work-in-progress as if it were a separate batch. In order words, the opening work-in-progress keeps its identity.

### **3.6.6 Valuation of Closing Work - In- Progress (WIP)**

Where there is partly completed work in progress at the end of a period, it is necessary to ascertain how much of the process costs relate to the work in progress. This is achieved by expressing partly completed work in terms of equivalent completed units. Thus 200 units which are considered to be three-quarters completed are equivalent to 150 completed units.

### **3.6.7 The Concept of Equivalent Units**

At the end of any given period, there is likelihood that some units are partly completed. From the completed units, it is possible to determine the costs of the period attributable to the partly completed units. In order to equitably distribute costs over partly completed and fully completed units, the concept of equivalent units is required. To arrive at the number of equivalent units for costing purposes is the number of equivalent fully complete units which the partly completed units represent. This is denoted by the formula:

- (a)  $TEP = CU + \text{Eq. units in WIP}$   
 Where  
 $TEP = \text{Total Equivalent Production}$   
 $CU = \text{Completed Units}$   
 $\text{Eq. in WIP} = \text{Equivalent Units in Work in Progress}$
- (b)  $\text{Cost Per Unit} = \frac{\text{Total Costs}}{\text{Total Equivalent Production Units}}$

### 3.7 JOINT PRODUCT

A *joint product* is the term used to describe a process where two or more products arise simultaneously in the course of production, each of which has a significant sales value in relation to each other. Joint products occur in the following industries:

- (a) *Oil Refining*  
 Diesel fuel, petrol, paraffin, lubricants, kerosene.
- (b) *Meat Processing* The various grades of meat and hides.
- (c) *Mining* The recovery of several metals from the same crushing.

#### 3.7.1 Joint Product Costing

Joint products occur due to the inherent nature of the production process and therefore, follows that none of the products can be produced separately. The various products are identical at a point known as the '*split-off point*' to that stage, all costs are joint costs. Subsequent to the split-off point, any costs incurred can be identified with specific products and they are known as 'subsequent' or 'additional processing costs'.

It follows that subsequent costs after the split-off point do not pose any particular costing problem because they are readily identifiable with a specific product and these are coded, and charged accordingly. For product costing purposes, the major problem in joint-product costing is to apportion the joint costs, that is, those costs incurred prior to the split-off point, on an equitable basis.

#### 3.7.2 Apportioning Joint Costs

The methods that are universal in apportioning joint costs are:

- (a) The physical unit basis:  
 The joint costs are apportioned over the joint products in proportion to the physical weight or volume of the products.
- (b) The sales value basis:

Here the joint costs are apportioned in proportion to the relative sales value of the products.

### 3.7.3 The Notional Sales Value Method

At times, the products which emerge from the split-off point are not saleable without further processing. It assumes, therefore, that at the split-off point, sales values are not known and joint costs cannot be apportioned until an estimate is made of a notional sales value at the split-off point.

In order to calculate the notional sales value at split-off point subsequent processing costs are deducted from the final sales value.

This is illustrated below:

### 3.7.4 Joint Products in Service Organisations

It is instructive to point out that joint products or joint services also arise in service organisations. Wherever facilities such as buildings, staff and equipment — are used in common to provide a variety of products or services, then joint products may occur as in manufacturing.

Let us illustrate the above using the banking industry. Banks provide a range of financial services using, largely, a common pool of facilities. The services include: current and deposit accounts, foreign exchange, investments, insurance, trustees and taxation and consultancy. Readers will observe that there are some identifiable costs specific to particular services however, most of the costs are incurred in common for all the services and that the cost accounting system in a bank has to deal with precisely the same problems characterised in industries such as oil refining, near processing and mining.

## 3.8 BY-PRODUCT COSTING

*By-products are defined as "products recovered incidentally from the materials used in the manufacture of recognised main products having either a net realisable value or a usable value which is relatively unimportant in comparison with the saleable value of the main products"(CIMA).*

Examples of by-products are:

*Iron and steel manufacture*

- furnace slag is sold for use in cement and brick manufacture and for road construction.

*Meat trade*

- bones, grease and certain offal are regarded as by-products.

### *Timber trade and Carpentry Workshop*

- sawdust, small offcuts and bark are usually regarded as by-products.

After the point of separation, both joint and by-products may need further processing before they are saleable.

For the purposes of clarity, we shall revisit waste and scrap as defined by CIMA:

Waste: 'Discarded substances having no value'.

Scrap: 'Discarded material, having some recovery value, which is usually either disposed of without further treatment (other than reclamation and handling), or re-introduced into the production process in place of raw material.' (CIMA)

## **3.9 MISCELLANEOUS REVENUE**

If the company considers that the value of the by-product is relatively insignificant, it may decide that all of the previous methods are too detailed. In this situation, all of the common costs will be borne by the main product and any revenue received from the disposal of the by-product will be credited to the Profit and Loss Account and merely shown as miscellaneous revenue.

### **3.9.1 Comparative Value**

In some situations, the by-product may be usable elsewhere in the company or factory, therein for example, wood shavings which can be used to heat the factory. A realistic value to put on the by-product in this situation would be cost of the product replaced by the by-product.

Let us assume that the by-product replaces a product for which we currently pay N4 per kg. and which is used in another process, Process I.

This process account would look like this:

#### **Process I – Oil Account**

	Quantity	₦		Quantity	₦
Materials	3,000	30,000	Main product	2,400	41,400
Labour		9,000	a/c		
Overheads		6,000	By-product a/c	600	3,600
	3,000	45,000		3,000	45,000

#### **By-product Account**

	N		N
Process Y A/c	2400	Process C A/c	2400
	2400		2400

### Process C Account

By-product a/c	2400	
----------------	------	--

### 3.9.2 Standard Price

In order to save time, a company may decide to value any by-product output at a standard price. This standard price is set after due consideration of historical records. Any difference between the price actually obtained and the standard price would be reflected as a difference in the By-product Account. This difference "variance" would then be written off to Profit and Loss Account.

If the standard price were N4.50 per kg, the accounting entries would be as follows:

#### Process Oil Account

	Quantity	₦		Quantity	₦
Materials	3,000	30,000	Main product	2,400	41,400
Labour		9,000	a/c		
Overheads		6,000	By-product a/c	600	3,600
	3,000	45,000		3,000	45,000

#### By-product Account

	₦		₦
Process Oil A/c	2,700	Sales Income	4,200
Profit & Loss A/c	1,500		
	4,200		4,200

By applying the selling price of ₦7.00 per litre on the income, the profit and loss account is ₦1,500.

### 3.9.3 Service / Function Costing

This is defined as:

*'Cost accounting for specific services or functions, e.g. canteens, maintenance, personnel These may be referred to as service centres, departments or functions.'*  
(CIMA)

The services provided may be for sale, such as. public transport, hotel accommodation, restaurants, power generation etc, or they may be provided within the organisation, for example, maintenance, library, stores.

A particular difficulty is to define a realistic cost unit that represents a suitable measure of the service provided. Frequently a composite cost unit is deemed the more

relevant. For example, the hotel industry may use the 'occupied bed-night' as an appropriate unit for cost ascertainment and cost control. Typical cost units used in service costing are shown below:

Service	Possible Cost Units
Transport	Tonne-Mile, passenger-Mile, Miles traveled
Hospital	Patient-days, number of operations
Electricity	Kilowatt-hours
Hotels	Occupied bed-nights
Restaurants	Meals served
Colleges	Full time equivalent student

Each organisation will have to determine what cost unit is most appropriate for its own purposes. Frequently, if a common cost unit is agreed, valuable cost comparisons can be made between similar establishments, such as Law Chamber, Audit firm, etc.

Whatever cost unit is decided upon, the calculation of the cost per unit is done in a similar fashion to output costing, that is.

$$\text{Cost per service unit} = \frac{\text{Total costs per period}}{\text{Number of service units supplied in the period}}$$

Readers will notice the similarities in the cost per unit calculation of cost drivers using ABC.

#### 4.0 CONCLUSIONS

Process costing which entails the averaging of total cost over the total throughput costs of the process, including any partly completed units was also treated. Process losses may be normal, and/or abnormal while gain may also be involved. The valuation methods in process costing which are FIFO and weighted average methods while joint products or by — products costs are apportioned using either physical unit basis or the sales value basis have also been well explained.

#### 5.0 SUMMARY

The major costing methods which are job costing, batch costing, contract costing process costing and service costing have been considered in this chapter.

#### 6.0 TUTOR MARKED ASSIGNMENT

1. Polaru Construction Company has the following data concerning one of its contracts

Contract Price	₦4,000,000
Value Certified	₦2,600,000
Cost incurred	₦2,100,000
Cash received	₦2,400,000



Cost of work certified      ₦2,000,000

The profit (to the nearest N'000) to be attributed to the contract is

- A    ₦500,000
- B    ₦554,000
- C    ₦600,000
- D    ₦1,900,000
- E    ₦1,850,000.

2. Which of the following are characteristics of job costing?
- (i) homogeneous products
  - (ii) customer-driven production
  - (iii) complete production possible within a single accounting period.
- A    i only
  - B    i and ii only
  - C    ii and iii only
  - D    i and iii only
  - E    i, ii and iii.
3. A chemical process has a normal wastage of 10% of input. In a period, 2500 kgs of materials were input and there was an abnormal loss of 75kgs. What quantity of good production was achieved?
- A    2175 kg
  - B    2250 kg
  - C    2325 kg
  - D    2474 kg
  - E    2480 kg.
4. Which of the following are characteristics of service costing?
- (i) high levels of indirect costs as a proportion of total costs
  - (ii) use of composite cost units
  - (iii) use of equivalent units
- A    i only
  - B    i and ii only
  - C    ii only
  - D    ii and iii only
  - E    i, ii and iii.
5. Process J had no opening stock, 13,500 units of raw material were transferred in at ₦4.50 per unit. Additional material at ₦1.25 per unit was added in process. Labour and overheads were ₦6.25 per completed unit and ₦2.50 per unit incomplete. If, 11,750 completed units were transferred out. What was the closing stock in process J?
- A    ₦77,625.00

- B     ₦14,437.50
- C     ₦141,000.00
- D     ₦21,000.00
- E     ₦131,000.00

6.     What are the normal process losses and how are they dealt with in the costing method?
7.     What is an equivalent unit?
8.     What is joint product?
9.     What is split-off point?
10.    “Discarded-substances having no value” is known as\_\_\_\_\_

#### **7.0     REFERENCES/FURTHER READINGS**

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## **UNIT 5      PLANNING AND MANAGEMENT CONTROL SYSTEM**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Long-term Strategic Planning (Corporate Planning)
  - 3.1.1 Importance of Corporate Planning (CP)
  - 3.1.2 Stages in Corporate Planning (CP)
  - 3.1.3 Advantages of Corporate Planning
  - 3.1.4 Disadvantages of Corporate Planning
- 3.2 Control concepts
  - 3.2.1 Types of Control Systems
  - 3.2.2 The Process of Control
  - 3.2.3 Open and Closed Loop Systems
- 3.3 The Decision Process
  - 3.3.1 Stages in Decision Making Process
  - 3.3.2 Types of Decisions
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor Marked Assignments
- 7.0 References/Further Readings

### **1.0 INTRODUCTION**

Planning is one of the functions of management and is concerned with the future. Planning relies upon information from many sources, both external and internal to the company for it to be successful. Information for planning includes cost and financial data and also information relating to personnel, markets, competitors, production capacities and constraints, and material supplies.

#### *Definition of planning*

‘The establishment of objectives and the formulation, evaluation and selection of the policies, strategies, tactics and actions required to achieve these objectives, Planning comprises long term/strategic planning and short-term operational planning’ The later usually refers to a period of one year’ (CIMA). The overall planning process covers both the long and short term. Planning is thinking before doing.

### **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- Short-term and long-term planning;
- The differences between strategic, tactical and operational planning;

- Control systems and the basic knowledge of closed loop and open loop system
- The decision process.

### **3.0 MAIN CONTENT**

#### **3.1 LONG-TERM STRATEGIC PLANNING (CORPORATE PLANNING)**

This is defined as '*the formulation, evaluation and selection of strategies for the purpose of preparing a long-term plan of action to attain objectives. Also known as planning and long range planning*' (CIMA).

Long-term strategic planning denotes planning with a long-term span in economic and business affairs. It can further be explained as the total resources of a company for the achievement of quantifiable objectives within a specified period of time. It signifies a comprehensive and organised but flexible approach to planning. There is a need for a routine monitoring of the organisation's internal and external environment to keep plan relevant.

##### **3.1.1 Importance of Corporate Planning (CP)**

Corporate Planning is essential for the following reasons:

- (a) It is a means by which a company gives itself the desire to construct its own future;
  - (b) Wages and prices of materials are usually rising and the organisations are, therefore, under pressure to make profit;
  - (c) Capital formation needs to be planned as a unit, because the implication of investment decisions are more widespread nowadays;
  - (d) Business diversification is spreading presently with a resulting complexity of operations; and
  - (e) The increased sophistication of products and production processes make decision-making difficult for top executives.
- Hence, long-term planning will assist in solving the problem.

##### **3.1.2 Stages in Corporate Planning (CP)**

Corporate planning involves six stages. These are:

###### **Stage I: Determine the objective**

This is the first stage in corporate planning process and it is the key stage. It seeks to answer the question: what is the business attempting to achieve? A set of objectives need to be established, which express in quantitative terms, what the organisation is trying to accomplish. There are difficulties in establishing corporate objectives because of the nature of the modern business which are now sophisticated. We have the following areas in which objectives of performance and results have to be set, namely:

- (a) Productivity
- (b) Innovation
- (c) Market standing
- (d) Physical and financial resources
- (e) Manager performance and development
- (f) Employee performance and attitude
- (g) Public responsibility

### **Stage 2: Establish the Current Position (Assessment Stage)**

This is called a "position audit" which seeks to provide detailed answers to the following questions:

How is the business at the present time and the environment in which it operates? In what environment will the company operate in future?

The four aspects of the current position stage are:

- (a) The external environment includes an assessment of economic, political, social and technological factors, detailed analysis of competitive activity for established product affecting the organisation.

The external investigation exposes the threats and opportunities that exist by identifying changes within the environment.

- (b) The organisation - This is a process of looking from the outside into the company to assess its present strengths and weaknesses. It also involves the appraisal of each part of the company's objective, identifying the key profit-making factors. The following should be established: "How much can present profits be increased from present resources?", "What serious weaknesses are apparent?" etc.
- (c) The future - The future is very difficult to predict. That notwithstanding, the following factors have to be considered to be able to predict properly: economic forecast, inflation, taxation, political problems, and social trend in taste and trend in government policy thrust.
- (d) The expectation - The expectations of the stakeholders are to influence the corporate objectives: stakeholders are employees, customers, shareholders, government, the general public, etc.

### **Stage 3: Develop a strategy (also known as Appraisal Stage)**

In this stage, SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats) needs to be carried out in order to be able to determine the next line of action. The question

to be asked is: "How can the gap between objectives and current position be closed?"

Primary considerations are:

- (a) Product development expenditure;
- (b) Improved cash flow;
- (c) Greater share of the existing markets;
- (d) New market expansion;
- (e) Alternative products lines;
- (f) Production capacity;
- (g) Manpower planning; and
- (h) Control systems.

All the above represent the strengths, weaknesses, opportunity and threats which the planning team must take into consideration when embarking on long-term planning.

A policy document showing the major decision to be taken, the time span for the change and the supporting evidence necessary will be produced.

#### **Stage 4: Preparation of the Plan.**

The chosen strategy is being worked out. The critical problem that would have to be resolved is getting a commitment from the whole of the management team and an undertaking to make the strategy a success. Each aspect of the plan will be produced by the department concerned while the whole exercise is being co-ordinated by the corporate planning team.

#### **Stage 5: Implementation of the Plan**

The strategy is translated into action.

The preparation stage leads on to implementation stage. The plans will contain targets and will be sufficient in details so that tactical level management know the task they have to plan and execute. The strategic plan will be used by tactical management to prepare operational plans, budgets etc. Each member of management must be informed about all details of the plan together with the contribution each will make towards its realisation.

#### **Stage 6: Continuous Re-appraisal**

This is monitoring and control stage. Reappraisal of the plan will occur in the following ways: There will be an in going system by the corporate planning department to improve the information in which the plan is based. This should be helpful to the long-term forecast in closing the forecast gap. Specific re-appraisal or monitoring will be required:

- (a) At each end of the year, when current performance is measured against trends and
- (b) When any significant event occurs that would materially affect the plan, for example, a merger of competitors.

### **3.1.3 Advantages of Corporate Planning**

The benefits that can accrue from corporate planning include the following:

- (a) It clarifies policies and strategies and provides the essential framework for realistic operational budgeting and planning.
- (b) It helps to avoid sub-optimality as the operational planning helps to co-ordinate the different aspects of the organisation.
- (c) It assists in greater job security.
- (d) It is scientifically based on diversification and expansion policy.
- (e) It improves management team because executives are forced to think ahead of time.
- (f) It exposes weaknesses in the company's information flow and assists to improve the system.
- (g) It improves the goal-congruence of the organisation and assists in the motivational programme of the company.

### **3.1.4 Disadvantages of Corporate Planning**

- (a) The process may absorb a considerable amount of management time and involve a lot of bureaucracy.
- (b) It may lead to the formulation of unrealistic objectives, which may act as a disincentive to the employees.
- (c) It may make the organisation inflexible and less capable of responding to changes.

## **3.2 CONTROL CONCEPTS**

Control is the process of compelling events to conform to plan.

Control is concerned with the efficient use of resources to achieve determined objective, or a set of objectives, contained within a plan. In an organisation, control is exercised by the *feedback of information on performance compared with plan*. Control regulates performance so that results conform to plans. Control is dependent upon planning and cannot exist in isolation. In practice, planning and control overlap so much that it is sometimes extremely difficult to separate them. Planning is a pre-requisite for control. Control does not end when deviations from plans are produced neither is it merely the correction of past mistakes. Control information is produced so that decisions can be made in order to ensure that objectives are achieved.

### **3.2.1 Types of Control Systems**

The quantitative control systems include budgetary control, standard costing, production control and inventory control. We also have quantitative systems for monitoring product quality and scheme of staff appraisal. In addition to the quantitative systems. There are also control systems that are concerned with qualitative factors.

### **3.2.2 The Process of Control**

The control process or the elements of control cycle are:

- (a) **The setting of standard of performance** - Targets and plans are established and standards of performance are determined in order to achieve those targets. The standards must be carefully set in order to ensure that they are realistic and can be achieved.
- (b) **The operation of the system** - The information of the standard of performance and operation results are communicated to those operating the system. There is need for good communication and motivation in order to ensure that output is achieved in accordance with plans. It is important that managers must know their objectives and the limits of their responsibility and authority.
- (c) **Feedback** - Deviation is determined after the actual performance has been compared with the standard expected. The decisions are reported to the appropriate authority in a clear and useful way to ensure that corrective action is taken. It may involve the adjustment of the original plans or current operation to ensure the realisation of objectives.

### **3.2.3 Open and closed loop systems**

- (a) The closed loop system. In a closed loop system, the feedback remains within the control system itself and passes to a control unit or correcting unit. This unit will automatically correct the operating performance in response to any deviation from standard. It is referred to as a closed loop system because it operates without outside control, for example, problems are solved internally and automatic machines such as numerically controlled machines, which are capable of self adjustment are examples of closed loop systems.
- (b) The open loop system. In an open loop system, feedback is directed to a higher level for action. The system is capable of adjustment for external factors, and control, usually human, is external to the system. It is usually recognised that the original plans and standards of performance may have to be changed in the light of actual results. Most business systems are open systems because control is exercised by managers using skill and judgement to evaluate information and initiate appropriate action.

## **3.3 THE DECISION PROCESS**

### **3.3.1 Stages in decision making process.**

Decision making is one of the major functions of management. A decision is a commitment to action. Decision making is an important aspect of management because the quality of decisions made can affect the long-term planning success of a whole business as well as the day to day effectiveness of its operations. The following



stages form part of the decision making process.

- (a) Identify that there is a problem.
- (b) Collect all necessary information on all aspects of the problem.
- (c) Evaluate the relevance of the information obtained.
- (d) Define the objective.
- (e) Find out the alternative courses of action.
- (f) Evaluate these alternatives.
- (g) Make decision with regard to the course of action to be adopted.
- (h) Mobilise the resources required.
- (i) Implement the objective.
- (j) Find out if the problem has been solved.

However, it must be emphasised that many other factors may be of critical importance in a decision situation. Examples include; markets, the environment, legal factors, personal and psychological characteristics, production or service quality, reliability and so on.

Therefore, decision making is not just a consideration of financial factors alone.

### **3.3.2 Types of Decisions**

Decisions can be classified into *programmed and non-programmed* categories.

- (a) Programmed decisions. These are decisions that can be clearly defined and tailored through computer based management information system e.g.se-order level decision and inventory control techniques incorporated into computer based management information systems. A typical example is a reorder decision based on usage and reorder levels in an inventory control system.
- (b) Non-programmed decisions. These are decisions with decisions, rules and procedures that cannot be defined. These decisions will therefore involve many external and internal factors, frequently with high levels of risk that require information from various sources.

## **4.0 CONCLUSIONS**

Planning could be strategic — covering periods longer than one year but within 10 years. It is made up of several stages such as assessment, objective, approval and evaluation.

The corporate plan gives birth to the detailed short term or operational planning spanning a period of one year.

The advantages of corporate planning include: the classification of policies and strategies, the avoidance of sub—optimality, taking a long-term view, the exposure of

weaknesses and motivational effects.

The shortcomings are: time costing, inflexibility and possible bureaucratic procedures.

Part of the planning process includes consideration of an appropriate control system, which is concerned, with the efficient use of resources to achieve a plan.

The major quantitative control systems are budgetary control, standard costing, inventory control, production control etc.

Control in organisations is carried out using information feedback loops. Control action must be correctly phased otherwise the action may become the opposite of that intended.

Open systems interact with the environment whereas close systems are self-contained.

## **5.0 SUMMARY**

Planning is an important part of business activity and can be defined as the act of setting objectives and deciding upon the manner that these will be achieved.

## **6.0 TUTOR MARKED ASSIGNMENT**

1. Define planning
2. What are the stages in decision making process?
3. Mention two short-term tactical planning
4. Define short-term tactical planning
5. Distinguish between programmed decision and non-programmed decision
6. What is "SWOT ANALYSIS"?
7. A depiction of the interrelationship among recognized factors in real situation called \_\_\_\_\_
8. What is the difference between an open and closed loop systems?
9. The formulation, evaluation, and selection of strategies for the purpose of preparing a long term plan of action to attain objectives is known as \_\_\_\_\_
10. Mention two advantages of Corporate Planning?

## **7.0 REFERENCES/FURTHER READINGS**

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## **MODULE II: COST, BUDGET AND DECISION MAKING**

Unit 6:	Cost Estimation and Behaviour
Unit 7:	Decision making under uncertainty
Unit 8:	Budgeting and Budgeting Control
Unit 9:	Standard Costing
Unit 10:	Cost of Capital

### **UNIT 6: COST ESTIMATION AND BEHAVIOUR**

#### **CONTENTS**

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Importance of cost behaviour
	3.1.1 The level of activity
	3.1.2 Cost behaviour and range of activity level
3.2	Variable Cost
3.3	Fixed Cost
3.4	Semi-Variable Costs
3.5	Cost estimation
	3.5.1 Techniques used in Prediction / Estimation
4.0	Conclusions
5.0	Summary
6.0	Tutor Marked Assignment
7.0	References/Further Readings

#### **1.0 INTRODUCTION**

In this unit, we shall look at the presentation of financial information for decision making and cost control. We shall be considering how the management accountant can be of assistance in providing answers to question about the consequences of following a particular action.

#### **2.0 OBJECTIVES**

In this unit, readers would be able to understand:

- The importance of studying cost behavior.
- The definition of a variable cost in linear and non-linear forms.
- The techniques used in estimation and prediction
- How inflation affects costs.

### 3.0 MAIN CONTENT

#### 3.1 IMPORTANCE OF COST BEHAVIOUR

The study of the behaviour of costs has to do with the classification of costs which form the basis for the prediction of the future level of activity. Costs can be categorised into: Variable costs, fixed costs and semi-variable costs.

##### 3.1.1 The Level of Activity.

The volume or level of activity constitutes the main basis for forecasting costs especially where changes or future changes are to be measured. The level of activity can be viewed severally, for example, tonnage produced, standard or predetermined hours required, bed space occupied, grammage of stock used, kilometres covered per hour, passenger per bus, etc.

#### 3.2 VARIABLE COST

A variable cost (VC) is defined as:

"A cost which varies with the measure of activity". (CIMA)

##### Variable Cost Behaviour

Variable cost can be analysed into two main groups: Linear and non-linear or curvilinear.

##### (a) Linear Variable Cost

This is the easiest way of showing the relationship between total variable cost and output as a straight line graph thus:

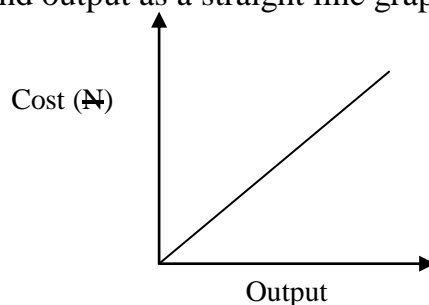


Fig. 6.1 Linear variable cost

In order to ensure easy computation and analysis, the linearity is expressed algebraically as:

$$\text{cost} = b(x)$$

where:  $x$  = volume of output in units/hours

$b$  = a constant representing the variable cost per unit.

#### ILLUSTRATION 6 – 1

The materials contained in each Assembly Z110 are

6kgs of material A at ₦2.50 each

30kgs of material B at ₦4.00 each

16kgs of material C at ₦3.00 each

What is the expected variable cost of materials for producing 80 Assemblies?

**SUGGESTED SOLUTION 6 – 1**

	<b>₦</b>
6kgs of material A at ₦2.50	= 15.00
30kgs of material B at ₦4.00	= 120.00
16kgs of material C at ₦3.00	= <u>48.00</u>
VC per Assembly	= <u>183.00</u>

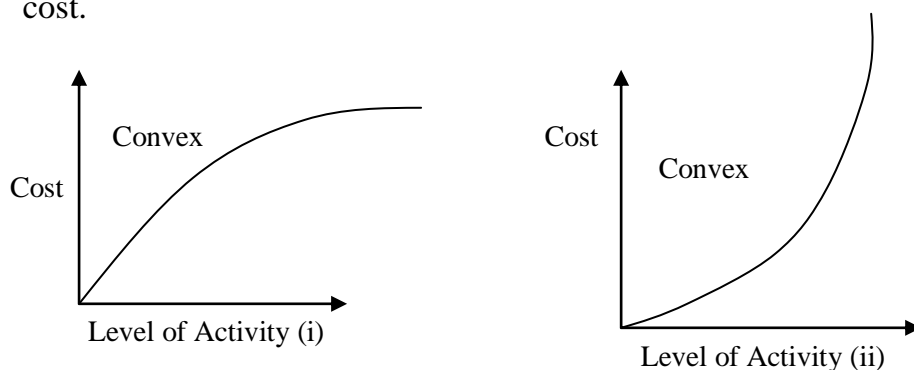
Total VC = ₦183 x 80 = ₦14,640

**(b) Non-Linear or Curvilinear Variable Costs**

The non-linear cost curve establishes the relationship between output and variable cost as that of a curved line on a graph. This can be shown in two ways, thus:

*convex* - where each extra unit of output causes a less than proportionate increase in cost

*concave* - where each extra unit of output causes a more than proportionate increase in cost.



**Fig. 6.2 Non-linear variable cost**

A situation whereby there is an additional increase in the input of raw materials in the production process, brings about a proportionate decrease in output will result in a convex cost function.

**Non-Linear Variable Costs - the Parabola**

A curve is referred to as a parabola in a situation whereby changes in the level of output brings about a uniform change in the gradient of the cost function. It can be shown algebraically thus:

$$\text{Cost} = bx + cx^2 + dx^3 + \dots px^n$$

Where  $x$  = volume of output in units  
 $b, c, d, \dots, p$  = constants representing the variable cost per unit.

### ILLUSTRATION 6 – 2

Analysis of cost and activity records for a project show that the variable cost can be accurately represented by the function:

$$\text{Cost} = N(bx + cx^2 + dx^3)$$

Where  $b = 10$ ,  $c = 0.7$  and  $d = 0.8$ .

Calculate:

- (i) Variable cost when production is 20 units.
- (ii) Variable cost when production is 25 units

Is the function convex or concave?

### SUGGESTED SOLUTION 6 – 2

- (i)  $\text{Cost} = \text{N}(10 \times 20) + (0.7 \times 20^2) + (0.08 \times 20^3)$   
 $= \text{N}1,120$
- (ii)  $\text{Cost} = \text{N}(10 \times 25) + (0.7 \times 25^2) + (0.08 \times 25^3)$   
 $= \text{N}1,937.35$

It will be seen that a slight increase in activity from 20 to 25 units results in almost doubling of variable cost. This shows that there is a more than proportionate increase in the unit cost of extra production. Therefore, the function is concave.

### 3.3 FIXED COST

A fixed cost is defined as:

“A cost which is incurred for an accounting period, and which, within certain output or turnover limits tends to be unaffected by fluctuations in the level of activity (output or turnover)”(CIMA)'.

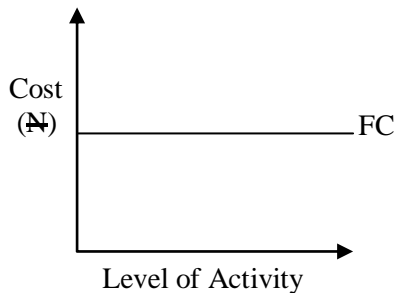
A fixed cost can also be referred to as a period cost.

Since fixed costs are a function of time, they do not respond to changes in activity levels. Therefore, changes in cost is not related to changes in the volume of activity within a given range of activity Fixed cost increased or stepped up only after a range of activity and not at every level of activity.

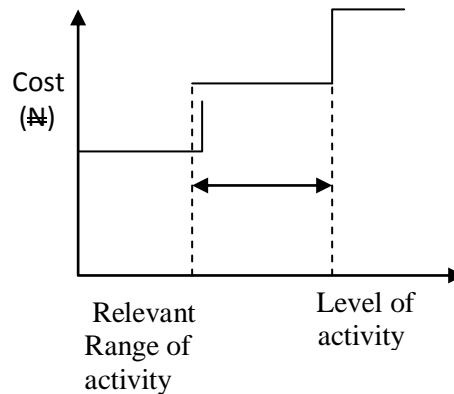
Even though, fixed costs can be depicted on a graph, it can also be shown algebraically as: = 'a'

Where 'a' is fixed.

(a) Fixed Cost



(b) Stepped fixed Cost



**Fig 6.4 Fixed cost and Stepped fixed cost**

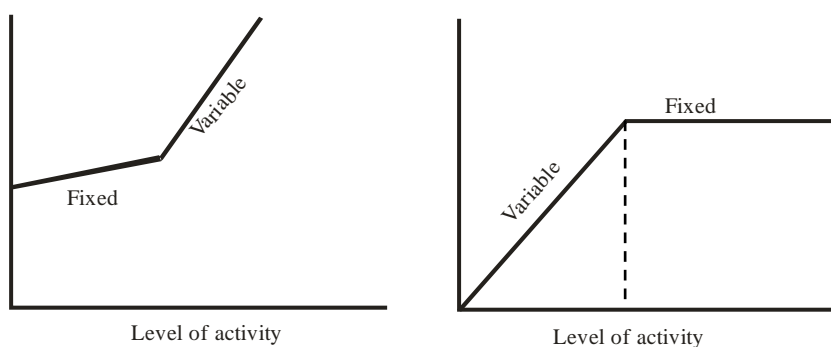
It means that at any level of activity, the fixed cost remained the same.

### 3.4 SEMI-VARIABLE COSTS

This type of cost can be defined as;

“A cost containing both fixed and variable components and which is thus partly affected by a change in the level of activity”, (CIMA).

Examples of semi-variable cost are: NEPA bill, NITEL telephone bills, Water rate, and some GSM operators bills.



**Fig 6.5 Semi-variable cost**

Semi-variable costs can also be expressed algebraically by bringing together the expressions for variable cost and fixed cost thus:

Linear Semi-variable cost =  $a + bx$ :

where 'a' represents fixed cost, b represent the unit variable cost and x represents the level of activity.



Non-linear semi variable cost =  $a + bx + cx^2 + dx^3 + \dots + px^n$  is expressed in 6.1.2 (b)

### ILLUSTRATION 6 – 3

A breakdown of maintenance packaging department of Uzuh Limited costs shows that there is a fixed element of ₦5,000 per month and a variable element related to hours amounting to ₦6.00 per machine hour.

What is the expected cost for a month when the planned activity level is

- (i) 2,500 machine hours,
- (ii) 3,000 machine hours?

### SUGGESTED SOLUTION 6 – 3

$$\begin{aligned} \text{(i) Total cost} &= a + bx \\ &= \text{₦}5,000 + (\text{₦}6.00 \times 2500) \\ &= \text{₦}20,000 \end{aligned}$$

$$\begin{aligned} \text{(ii) Total cost} &= \text{₦}5,000 + (\text{₦}6 \times 3000) \\ &= \text{₦}23,000 \end{aligned}$$

(Alternatively, since the variable costs will change between 2,500 and 3,000 hours, then the total cost can be computed as follows):

$$\text{₦}20,000 + 500 (6) = \text{₦}23,000$$

#### Note:

In another way, the semi-variable costs can be referred to as semi-fixed and mixed costs.

## 3.5 COST ESTIMATION

Cost estimation is a term used to describe the measurement of historical cost with a view to helping in the prediction of future costs for management decision making, i.e. historic information is analysed to provide estimates on which to base future expectations.

Mixed costs can be separated into their fixed and variable elements, using a variety of techniques. Some techniques are more sophisticated than others, and, therefore, likely to be more reliable, but in practice, the simpler techniques are more commonly found.

### 6.5.1 Techniques Used in Prediction / Estimation

- (a) The account classification method / account analysis techniques
- (b) The high - low method or the Range method.

- (c) Scatter graph.
- (d) Regression Analysis.

**(a) Account Classification Method**

This is the examination of each item of expenses which involves classifying them into variable, and fixed cost using the subjective judgement of the Accountant.

**Advantages of Accounts Classification Method**

- (i) It is fast and inexpensive.
- (ii) It is simple and easy to understand.
- (iii) It can be revised regularly to account for changes in cost structure or cost classification.

**Disadvantages of Accounts Classification Method**

- (i) The initial classification has considerable subjective element.
- (ii) It relies on a single observation to determine the cost function.
- (iii) It is based on past costs.
- (iv) Separation of semi-variable cost into its fixed and variable component is arbitrary.

**(b) High-Low Method/Range Method**

By this method, a check is made of historic costs in previous accounting periods, and the costs in the two particular periods are selected for cost estimation, namely:

- (i) the period with the highest volume of output;
- (ii) the period with the lowest volume of output (Note: the periods with highest/lowest output may not be the periods of highest or lowest cost).

Where inflation makes the costs in each period uncomparable, costs should be adjusted to the same level by means of a price level index.

The difference between the total cost of the high output and the total cost of the low output will be the variable cost of the difference in output level.

**ILLUSTRATION 6 – 4**

The costs of operating the maintenance department of a computer manufacturer, for the last five months have been as follows:

		N	Production volume (standard hours)
Month:	Jan	120,000	6,000
	Feb	125,000	7,000
	Mar	104,000	5,000

Apr	121,000	8,000
May	125,000	8,500

What cost should be expected in month 6 when output is expected to be 10,000 standard hours? Ignore inflation.

#### SUGGESTED SOLUTION 6 – 4

	Output		₤
(i)	High output	8,500 hours: total cost	125,000
	Low output	<u>5,000</u> hours: total cost	<u>104,000</u>
	Total variable cost of	<u>3,500</u> =	<u>21,000</u>

Variable cost per standard hour	$\frac{21,000}{3,500}$	=	6.00
---------------------------------	------------------------	---	------

(ii)	Substituting in either the high or low volume cost:		
	High (8,500)	Low (5,000)	
	₤	₤	
	Total cost	125,000	104,000
	Variable costs (8,500 x 6)	<u>51,000</u>	(5,000 x 6) <u>30,000</u>
	Fixed costs	<u>74,000</u>	<u>74,000</u>

(iii) Estimated total cost of 10,000 standard hours of output:

	₤
Fixed costs	74,000
Variable costs (10,000 x 6)	<u>60,000</u>
	<u>134,000</u>

#### Advantages of High and Low Method

- It is relatively simple to operate.
- It is a quick and an inexpensive method of determining the underlying relationship of cost and level of activity.
- It is not subjective.

#### Disadvantages of High and Low Method

- It ignores any information between the two extreme observations.
- When the extreme points are not typical, the function calculated will reflect an abnormal rather than normal cost function (i.e. a situation whereby there is no relationship between the level of activity and the costs).
- It is not fully represented, because it does not make use of the whole of the available data.

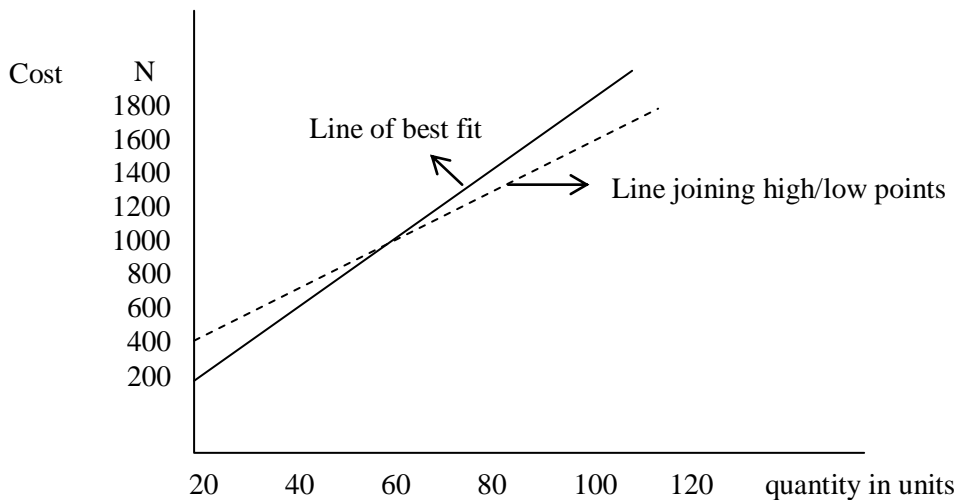
#### The Effect of Inflation

When two or more years are compared to determine the variable cost and fixed cost

for estimation, it is likely that the price -index might have changed hence there is need to adjust for the effect of inflation before arriving at the variable cost and fixed cost for prediction purposes.

**(c) Scatter Graph Technique**

This is a visual technique which co-ordinates the cost and the level of activity of historical records for a period of time and are plotted on a graph. At the point of interception with the cost axis, the fixed cost emerges, the shape of the line represents the rate of change of cost with activity level which is variable cost.



Thus: variable element = N8.50

Therefore, the estimated cost function using the line of best fit = 100 + 8.5x, where x = units of output.

The scatter graph technique is simple and convenient but clearly no claims can be made for its accuracy.

**(d) Regression Analysis Technique**

This is a statistical technique that is based on historical data. If it involves one independent variable, it is called "Simple Regression; whereas when the use of more than one independent variables is involved, it is referred to as "Multiple Regression". However, the least square regression analysis is determined by the formulae as follows;

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

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

$x$  = independent variable  
 $y$  = dependent variable  
= Summation  
 $n$  = is the number of pairs of data for  $x$  and  $y$

### **Advantages of Regression Analysis**

- (i) Line of best fit can be easily recognized and could be extended through the use of multiple regression analysis.
- (ii) It uses the whole data, unlike the accounts classification and high and low methods.
- (iii) It assists in the use of computers and electronic calculation.

### **Disadvantages**

- (i) A reasonable number of observation is required.
- (ii) The elimination of non-random variables can reduce the available data and frustrate any attempt to fix the curve statistically to the observation.
- (iii) A true relationship may not be linear, it may be curve-linear.

## **4.0 CONCLUSIONS**

Costs frequently do not behave in regular manner and a cost function may be linear, curve-linear or stepped at different activity levels. Therefore, the ability to forecast costs is a vital part of supplying information for planning and decision making.

There are basically four ways to cost prediction or estimation. These are account analysis, scatter-graph, high and low (range method) and linear regression analysis method.

## **5.0 SUMMARY**

The usage of any statistical technique requires a confirmation of its applicability and usefulness.

Costs can generally be separated into either fixed or variable. However, cost classification has its own drawbacks since variable costs are not always variable, fixed costs can and do change and thus many costs are semi fixed or semi — variable.

When long term forecasting is required, extrapolation from historical data become less relevant and judgement and qualitative factors become increasingly relevant.

## **6.0 TUTOR MARKED ASSIGNMENTS**

1. Mokuolu Plc uses time series analysis and regression techniques to estimate future sales demand. Using these techniques, it has derived the following trend  
 $y = 10,000 + 4200x$

where y is the total sales mix and x is the time period. It has also derived the following seasonal variation index values for each of the quarters using multiplicative (proportional) seasonal variation model:

Quarter	Index Value
1	120
2	80
3	95
4	105

The total sales units that will be forecast for time period 33, which is the first quarter of year 2004 is

- A 138720
- B 148720
- C 176320
- D 178320
- E 180320

2. Eze Limited has found that its total overheads are dependent on labour hours, machine hours and unit produced. Analysis has produced the following multiple regression formula.

$$y = \text{N}25,000 + 7.3x_1 + 4.8x_2 + 3.1x_3$$

where y = total overhead

$x_1$  = Labour hours

$x_2$  = Machine hours

$x_3$  = Units produced

What is the predicted overheads in a period when there were 16500 labour hours, 7300 machine hours and 13400 units were produced?

- A 232,030
- B 222,030
- C 322,030
- D 422,030
- E 248,070.

3. Analysis of cost and activity data shows that the variable costs of part No 430 can be represented by the function:

$$\text{Variable cost of Part No 430} = \text{N}bx + cx^2 + dx^3$$

where b = material cost per unit = ~~N~~3

c = labour cost per unit = ~~N~~0.8

d = variable overheads per unit = N0.06

Calculate:

Variable cost when production is 15 units.

- A N437.50
- A N467.50

- A N427.50
- A N417.50
- A N407.50.

4. Peter Limited has recorded the following distribution costs during the last three months.

Month	Volume Units	Total Cost (₦)
1	32,000	100,000
2	40,000	120,000
3	50,000	145,000

What will be the distribution costs in month 4 when the expected activity level is 42500 units?

- A ₦126,250
  - B ₦127,500
  - C ₦129,861
  - D ₦132,813
  - E ₦140,813.
5. Define variable cost
6. Explain what is meant by cost function.
7. What is the major limitation of the high and low method?
8. Identify and explain three requirements which should be observed when using statistical regression analysis.
9. Describe the least square method.

## 7.0 REFERENCES/FURTHER READINGS

- ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.
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## **UNIT 7: DECISION MAKING UNDER CERTAINTY**

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- 1.0 Introduction
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  - 3.5.4 Applications of the C-V-P model
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### **1.0 INTRODUCTION**

The concept of marginal costing is based on the behavior of costs that vary with the volume of output. Sometimes marginal costing and direct costing are treated as interchangeable terms.



## 2.0 OBJECTIVES

In this unit, the readers will be able to understand:

- Marginal costing techniques and the preparation of operating statements using marginal and absorption costing techniques;
- The principles of carrying out the cost-volume-profit (CVP) analysis for decision making;
- Break-even charts and profit graphs;
- The limiting factor and its effect on decision process;
- The applications of the concepts of relevant cost, opportunity cost, incremental cost, and differential cost to decision making.

## 3.0 MAIN CONTENT

### 3.1 DEFINITION OF MARGINAL COSTING

CIMA defines marginal costing "as a decision making technique used to determine the effect of cost on changes in the volume of time and output in a multi — product firm especially in the short run". Thus, it is a technique which emphasizes the variable cost of a product, that is, the direct material, direct labour, direct expenses and other variable overheads. It demands that fixed cost of the relevant period are written off in full against the contribution. The contribution is the difference between the sales value and the variable or marginal cost of a product in a given period of time.

#### 3.1.1 Marginal Costing Statement Format

The format showing the components of a marginal costing statement is as shown below:

	N	N
Sales (a)		x
Direct material	x	
Direct labour	<u>x</u>	
Direct expenses	<u>x</u>	
Prime cost	<u>x</u>	
Production variable costs	<u>x</u>	
Production marginal cost (b)		<u>x</u>
Contribution - (a-b)		<u>x</u>

Fixed cost are excluded from the cost structure and therefore written off in the period.

#### 3.1.2 Merits of marginal costing

Marginal costing is a technique which is of utmost importance to management decision making efforts. The following reasons are pertinent to this assertion:

- (a) Profit volume ratio helps management to decide which products

- are most profitable.
- (b) Contribution margin helps to decide whether:
    - (i) To accept or reject a special order;
    - (ii) To close down a line of product or business;
    - (iii) To determine product profitability;
    - (iv) To determine product mix using linear programming technique;
    - (v) To make or buy or lease decisions on an item of plant and equipment; and
    - (vi) To decide further processing decision particularly in relation to joint product cost.
  - (c) It assists in the pricing decision making process.
  - (d) Contribution approach can be used to forecast the units to be produced and sold.
  - (e) It facilitates the stock valuation for final accounts purposes.

### **3.1.3 Demerits of marginal costing**

The difficulties associated with marginal costing are as follows:

- (a) The analysis of costs into fixed and variable costs may be subjective for the purpose of costs classification.
- (b) It places emphasis on the short run effects of costs, whereas, fixed costs will vary in the medium and long term.
- (c) It is impossible to determine strategic or long term decision in that, giving a product total cost data, it needs to be noted that in the final analysis (long run) fixed costs must be recovered.
- (d) It focuses attention on the contribution level and the tendency to exclude fixed costs by the management may be disastrous.

## **3.2 ABSORPTION COSTING**

Absorption costing is a method of costing stocks in which all production costs such as variable and fixed are included as part of the cost of items'. (Statement of Accounting Standard ES.A.SI No. 4 in stocks).

Absorption costing, therefore, is a technique in which all costs are absorbed into production cost, hence operating statements, prepared using this approach, does not distinguish between fixed and variable cost. It is an approach which allocates all production costs into individual products. Fixed production overhead are absorbed into products by establishing overhead absorption rate. This may result to over or under absorbed overhead, which is less or more than recovery of fixed overheads at planned or predetermined activity level.

**3.2.1 (a)** Absorption costing standard cost (where there is no opening and closing stock) card-format

	PER UNIT	
	<del>₦</del>	<del>₦</del>
Sales		x
Direct Materials	x	
Direct Labour	x	
Direct Expenses	<u>x</u>	
Prime Cost	x	
Production Variable Overhead	<u>x</u>	
 (i) Marginal Cost	x	
Fixed Production overhead cost	x	
(ii) Total production cost of sales		
(Absorption cost)		<u>(x)</u>
Gross Profit		<u>xx</u>

**(b)** Absorption Costing Operating Statement (with opening & closing stocks).

	<del>₦</del>	<del>₦</del>
Sales		x
Opening Stock (valued at Absorption cost)	x	
Cost of Production (“ “ “)	<u>x</u>	
		x
Less: Closing Stock (valued at absorption cost)	<u>x</u>	
Total Cost of sales		<u>x</u>
Gross Profit		<u>x</u>

**3.2.2 Advantages of absorption costing**

- (a) It does not undermine the importance of fixed cost.
- (b) It avoids fictitious losses being reported by representing product cost at full factory cost to bring the product to a point that its ready for use.
- (c) It assists in arriving at total cost of production which is a basis for selling price decision process.
- (d) It matches costs with revenues since fixed production cost are considered in the product cost.
- (e) It represents current market trends and, therefore, it is widely accepted especially for tax purposes.

**3.2.3 Disadvantages of absorption costing**

- (a) It does not help in decision-making.
- (b) Production may be very difficult since there is element of fixed cost in the product cost.

- (c) Calculation of under or over absorbed overhead may be problematic.
- (d) It overbears the product cost with management administrative inefficiency which may partly be represented in fixed cost.
- (e) It does not conform with the matching principle which stipulates that all costs (fixed and variable) must be matched against revenue in the period concerned for determination of profit.

### 3.3 MARGINAL AND ABSORPTION COSTING COMPARED

#### 3.3.1 Marginal Costing

Marginal Costing is a useful technique for studying the effects of changes in volume and type of output in a multi-product business. It is an accounting technique which determines the marginal cost by distinguishing between fixed and variable costs. The primary purpose of marginal costing is to provide information to management on the effects on costs and revenues of changes in the volume and type of output in the short run.

It can also be used in the system for recording and collecting costs. In this case, stocks are valued at variable cost and fixed costs are treated as period costs in profit statements.

#### 3.3.2 Absorption costing

Absorption costing is the approach used in all published accounts, and all financial accounting statements. It emphasizes a functional classification of costs, for example manufacturing, selling and distribution and financial costs.

In contrast marginal costing, or the contribution approach, highlights the behaviour of costs and classifies them accordingly, by identifying variable costs and fixed costs.

**3.3.3** Further distinctions between the two techniques are presented in tabular form below:

Marginal Costing and Absorption Costing Techniques:

Marginal Costing	Absorption Costing
a. Fixed overheads are written off in a period. Treated as period costs	Fixed overhead are: a. Absorbed into production, such that part of fixed cost is carried to subsequent year by way of its inclusion in closing stock.
(b) Only variable costs are regarded as product cost	(b) Fixed production overheads form part of the product cost.
(c) Contribution is the main feature of the operating	(c) Contribution are treated as funds in which fixed cost are

statement (sales less marginal cost = Contribution	absorbed to arrive at profit.
(d) Distinction is made between fixed and variable costs.	(d) No distinction is made between fixed and variable costs.
(e) Stocks are valued at variable costs which exclude fixed costs.	(e) Stocks are valued at total production cost including fixed production overhead costs.
(f) It is used for decision making purposes.	(f) It is used for routine purposes.

It is imperative to say that the marginal costing approach (also known as the contribution approach) highlights the total contribution which forms a fund out of which fixed costs must be paid. The contribution per unit will be the same irrespective of the level of output. This approach does not attempt to imply a fixed overhead rate per unit rather fixed overheads do not change with the level of output, and therefore, should only be stated in total.

### ILLUSTRATION 7-1

(1)	Absorption Costing Statement	₦'000	₦'000
	Sales		75
	Less: manufacturing cost of goods sold		45
	Gross profit		30
	Less: Selling costs		<u>18.75</u>
	Net profit		<u>11.25</u>
(2)	Marginal Costing Statement		
	Sales		75
	Less: Variable costs		30
	Contribution		45
	Less: Fixed Cost – manufacturing	15	
	- Selling	<u>18.75</u>	<u>33.75</u>
	Net Profit		<u>11.25</u>

The conventional absorption costing statement fails to differentiate between fixed and variable costs and, therefore, cannot be used for cost-volume-profit analysis. In addition, it is normal procedure to calculate the cost and profit per unit, based on absorption costing as illustrated below using the level of activity of 7,500 units:

	₦	₦
Selling price		10.00
Manufacturing cost	6.00	
Selling cost	<u>2.50</u>	<u>8.50</u>
Profit per unit		<u>1.50</u>

Assuming the level of activity increased to 9,000 units, the following results would be expected.

	Total N'000	Per Unit N'000
Sales		
Less: Manufacturing cost of goods sold	90	10,00
Gross profit	<u>54</u>	<u>6,00</u>
Less: Selling costs	36	4,00
Net profit	<u>22.5</u>	<u>2,50</u>
	<u>13.5</u>	<u>1,50</u>

### ILLUSTRATION 7 – 2

Kike Nigeria Limited produces “Pomade” in 2004, and made the following data available. As Management Accountant, you are required to present to the management of Kike Nigeria Limited the profit based on marginal costing and absorption costing.

Selling price	₦20.00 per unit
Variable manufacturing cost	₦8.00 per unit
Fixed manufacturing cost	₦20,000.00
Selling and administrative cost	Fixed ₦10,000 Variable ₦4.00 per unit
Units produced	20,000 units
Units sold	19,000 units

### SUGGESTED SOLUTION 7 – 2

#### (a) Absorption Costing Statement

Sales			₦	380,000
Less: Cost of goods sold	Per Unit		₦	
			₦	
Variable manufacturing costs 20,000 units	8	160,000		
Fixed manufacturing cost	1	<u>20,000</u>		
	9	180,000		
Less: closing stock (500 units)	9	<u>4,500</u>		<u>175,500</u>
Gross profit				204,500
Less: Selling and administrative costs				<u>86,000</u>
Net profit				<u>118,500</u>

#### (b) Marginal Costing Statement

Sales		₦	380,000
Variable manufacturing costs of production- (20,000 units at N8)	160,000		
Less: closing stock (500 units N8)	<u>4,000</u>		

Variable manufacturing cost of goods sold	156,000	
Add: Variable selling and administrative costs	<u>76,000</u>	
Variable cost of goods sold		<u>232,000</u>
Contribution		148,000
Less: fixed costs:		
Manufacturing cost	20,000	
Selling and administrative cost	<u>10,000</u>	<u>30,000</u>
Profit		<u>118,000</u>

The difference in the operating statement of both techniques of N500, relates to the valuation of the closing stock (N4,500 – 4,000).

### 3.4 MARGINAL COSTING AND DECISION MAKING

Decision making is defined as making choices between future, uncertain alternatives. It must be emphasized that all decision making relate to the future and that a decision is a choice between alternatives in pursuit of an objective. Where no alternatives exist, no decision can be made and nothing can be done now that will alter the past. These fundamentals of decision making are of critical importance in determining what information the management accountant should supply to the decision maker.

#### 3.4.1 The decision process

The overall decision process can be subdivided into stages:

- (a) definition of objective(s);
- (b) consideration of alternatives;
- (c) evaluation of alternatives in the light of the objective(s); and
- (d) selection of the course of action.

#### 3.4.2 Types of decisions

Decision making is concerned with 'cost and revenues' or costs/benefits analysis. The assumption that level of activity will remain constant within the relevant range of output will not be maintained. However, variation in unit variable costs or fixed costs might occur. Various types of decisions are:

- (a) Routine planning decisions - These relate to budgeting decisions whereby fixed and variable costs are analysed together with revenues over a period.
- (b) Short-run problem decisions - These refer to unforeseen decisions of a non-recurring nature, so that revenue and costs are obtained within a relatively short time.
- (c) Investment or disinvestments decisions - These refer to decision of long-term consequences. It allows for the concept of time value of money and the appreciation of discounted cash flow techniques.
- (d) long-range decisions - These relate to an infrequently reviewed decisions. They are decisions made once, meant to provide a continuing solution to a recurring

problem, for example, deciding, or reviewing the channel of distribution of the company's products.

- (e) Control decisions - That is, these are cautious decisions with a view to evaluate the benefits expected such that they exceed the costs of investigation. It is more like "think before you act" circumstances.

### 3.4.3 Relevant cost

Any cost that is useful for decision making is often referred to as a relevant cost. A cost is said to be relevant provided there is a future cash flow arising from a direct consequence of a decision.

#### (a) Relevant cost are future costs:

- (i) A decision is about the future; it cannot alter what has been done already  
*In a famous passage, the economist Jevons( 1871) wrote 'the fact that labour once spent has no influence on the future of any article; It is gone and lost forever In commerce, bygones are forever bygones, and we are always starting clear at each moment judging the values of things with a view to future utility*
- (ii) The concept that bygones are bygones refers not only to labour, but also to all historic costs of materials, machinery and other items.
- (iii) Costs that have been incurred include:
- cost that have already been paid; and
  - costs that are the subject of legally binding contracts, even if payments due under the contract have not yet been made.

It is necessary to advise the readers that past costs are only useful as long as they provide information for forecasting.

#### (b) Relevant costs are cash flows:

- (i) Decisions are most often taken which will maximize the 'satisfaction' of a company's shareholders. Readers will realise that the time value of money affects the worth of cash flows from project over a longer period, and all short - run decisions are assumed to improve the shareholders' satisfaction if they increase net cash inflows. *'The decision rule will be to accept opportunities that increase the value of future cash resources and to reject those that decrease it.'* (Arnold 1963)
- (ii) Only cash flow information is required. In essence, any cost or charge that fails to reflect additional cash spending should be excluded. These include:
- Depreciation as a fixed overhead incurred.
  - Notional rent or interest, as fixed overhead incurred.
  - All overheads absorbed. Fixed overhead absorption is always irrelevant, since it is overheads to be incurred which affect decisions. (Confusingly variable overhead cost are usually relevant, because they should be incurred at the same rate that they are absorbed).



- (c) A relevant cost is one which arises as a direct consequence of a decision. Thus, only costs which will differ under some or all of the available opportunities should be considered; relevant costs are, therefore, sometimes referred to as incremental costs or differential costs.

Thus, if an employee is expected to have no other work to do during the next week, but will be paid a basic wage (of ₦100 per week) for attending work and doing nothing, his manager might decide to give him a job which earns only ₦40. The net gain is ₦40, and the ₦100 is irrelevant to the decision, because although it is a future cash flow, it will be incurred anyway whether the employee is given work or not. Relevant costs were slow to be accepted by the accounting profession, and did not properly feature in accounting textbooks until the early 1960's. Economists have been aware of them for a much longer time; and they are simply the application of common sense and economic wisdom. Parker(1963), (Topics in Management Accounting ) wrote that *intelligent business men at an early date were aware intuitively of the notions of a avoidable cost and opportunity cost, and of irrelevance of cost which are the same under all alternatives,*

### **3.4.3 Differential costing**

This is a term used in the preparation of adhoc information when all the cost and income differences between the various options being considered are highlighted so that clear comparisons can be made of all the financial consequences. In one sense, differential costing is a wider concept than marginal costing because all cost changes are considered, both fixed and variable, whereas the presumption when marginal cost is used is that only variable cost changes.

### **3.4.4 Differential and incremental costs**

A differential cost is the difference in the cost of alternative choices. If option A will cost an extra N300 and option B will cost an extra N360, the differential cost is N60, with option B being more expensive.

A differential cost is the difference between the incremental cost of each option.

### **3.4.6 Historical cost information**

Although historical costs (also called past cost, sunk costs, irrevocable cost and including committed costs) are irrelevant for decision making, historical cost data can be useful for decision making. [*Historical costs are themselves irrelevant to the decision, although they may be the best available basis for predicting future costs.*] (Horngren, 2004).]

### 3.4.7 Opportunity Costs

Relevant cost may also be expressed as opportunity costs.

An opportunity cost is the benefit of the next best alternative that is forgone:

- (a) If the choice is between choosing option A or doing nothing, the opportunity cost of A is the extra cash expenditure incurred, for choosing option A, Arnold(1963), calls this an *external opportunity cost* but it is, quite simply, incremental cost.
- (b) If the choice is between choosing option B or C, the opportunity cost of A would be described as the benefit forgone from the more profitable of the two other choices, B or C. Arnold calls this an *internal opportunity cost*, which arises whenever there are mutually exclusive options, or limiting factors/scare resources for production. It is this type of opportunity cost which is more widely known by the general term; opportunity cost, for example. see quotation in the above paragraph incremental or differential costs.

### 3.4.8 Acceptance or rejection of a special order

By this is meant the acceptance or rejection of an order which utilizes spare capacity but which is only available if a lower than normal price is quoted. The procedure is illustrated by the following example.

#### ILLUSTRATION 7 – 3

Babariga Company which manufactures rubber soles for use in its production cycle, has the following unit cost for production of 40,000 units.

	₦
Director labour	30
Direct material	8
Manufacturing overheads	<u>36</u>
	74

75% of the manufacturing overhead is fixed. Buba Ltd has offered to sell 40,000 units of the rubber soles to Babariga Ltd for ₦55 per unit. If Babariga accepts the offer, part of the facilities presently used to manufacture the rubber shoes could be rented to Kaftan Ltd at a rent of ₦72,000. Also, per unit of the fixed overhead costs applied to the rubber shoes would be avoided.

The Managing Director, Mallam Danbaba has called you to advise him on whether or not to accept the offer. You are also required to state other matters that should be noted before taking the decision.

#### SUGGESTED SOLUTION 7-3

## EVALUATION OF BUBA LTD'S OFFER

	₦	₦
Buba Ltd's Quotation (₦55 x 40,000)		2,200,000
Less incremental outlay		
Direct Materials (₦8 x 40,000)	320,000	
Direct Labour (₦30 x 40,000)	1,200,000	
Valuable manufacturing overhead (25% of N36 x 40,000)	<u>360,000</u>	
	1,880,000	
Applicable fixed overhead (₦10 x 40,000)	<u>400,000</u>	
	2,280,000	
Opportunity cost - rent to Kaftan Ltd.	<u>72,000</u>	<u>2,352,000</u>
		<u>(152,000)</u>

**Decision:** Since Buba Ltd's quotation of ₦2,200,000 is less than the cost of producing within (₦2,352,000), it is hereby recommended that the offer should be accepted from Buba Ltd. Subject to other qualitative factors.

However, there are several other factors which would need to be considered before a final decision is taken. These include:

- (a) Will the acceptance of one order at a lowered price lead other customers to demand lower prices as well?
- (b) Is this special order the most profitable way of using the spare capacity?
- (c) Will the special order lock up capacity which could be used for future full price business?
- (d) Is it absolutely certain that fixed costs will not alter?

### 3.4.9 Discontinuance of a product line

If a company has a range of products, one of which is deemed to be unprofitable, it may consider discontinuing with the item from its range.

#### ILLUSTRATION 7 – 4

Aseye Ltd. Igbogbo produces three products for which the following operating statement has been produced:

	Product A	Product B	Product C	Total
	₦	₦	₦	₦
Sales	128,000	200,000	180,000	508,000
Total Costs	<u>144,000</u>	<u>152,000</u>	<u>136,000</u>	<u>432,000</u>
Profit/(Loss)	<u>(16,000)</u>	<u>48,000</u>	<u>44,000</u>	<u>76,000</u>

The total cost comprises 2/3 variable and 1/3 fixed.

The directors consider that as product A shows a loss it should be discontinued.

Based on the above cost data, should Product A be dropped? What other factors should be considered?

## SUGGESTED SOLUTION 7 – 4

### ASEYE LTD, IGBOGBO

Product A

	₦
Sales	128,000
Less Total Variable Cost	
(2/3 x ₦144,000)	<u>96,000</u>
Total Contribution	<u>32,000</u>

#### Decision:

Product A is showing a positive total contribution of ₦32,000, hence it should not be dropped. If product A is mistakenly dropped, the total profit of the business (₦76,000) will go down by the positive contribution of A (₦32,000) to ₦44,000.

Other factors that should be considered are:

- (i) Is product A jointly demanded with any of the other products? If so, then sales of other products will be affected. This will also lead to loss of profit.
- (ii) Loss of goodwill will result if customers of product A cannot see the product in the market.
- (iii) What will be the fate of workers that manufacture product A? Are they going to be re-trained or retrenched?
- (iv) What would happen to the plant and equipment used in manufacturing Product A, particularly if it is of a specialized nature and not readily marketable.

### 3.4.10 Key Budget Factor / Limiting Factor

Key budget factors sometimes known as a limiting factor or principal budget factor. This is a factor which is a binding constraint upon the organization, that is, the factor which restricts indefinite expansion or unlimited profits. It may be sales, availability of finance, skilled labour, supplies of material or lack of space. Where a single binding constraint can be identified, then the general objective of maximizing contribution can be achieved by selecting the alternative which maximizes the contribution per unit of key factor. It will be apparent that from time to time, the key factor in an organization will change. For example, a firm may have a shortage of orders. It overcomes this by appointing salesmen and then finds that there is a shortage of machinery capacity. The expansion of the productive capacity may introduce a problem of lack of space and so on.

The 'maximizing contribution per unit of the limiting factor' rule can be of value, but

can only be used where there is a single binding constraint and where the constraint is continuously divisible, that is, it can be altered one unit at a time. Where several constraints apply simultaneously, the simple maximizing rule given above cannot be applied because of the interaction between constraints.

In such circumstances mathematical techniques can be used to establish the optimal position. One of the more important mathematical techniques that can be used for such problems is known as Linear programming (LP). This is explained in chapter eleven (11) of this study pack.

Rules governing the limiting factor(s):

- (a) When there is no key limiting factor, use contribution margin
- (b) If there's only one key limiting factor, use contribution per key limiting factor.
- (c) If there is more than one limiting factor, use linear programming.

### **3.4.11 Make or buy decisions**

Frequently, management is faced with the decision on whether to make a component part within or to buy from outside supplier. A decision is relevant particularly in a situation whereby the company has the capacity to produce/make such component.

In general, the relevant cost comparison is between the marginal cost of manufacture and the buying-in price. However, when manufacturing the component displaces existing production, the lost contribution must be added to the marginal cost of production of the component before comparison with the buying-in price. The two situations are illustrated below.

## **3.5 COST-VOLUME-PROFIT (CVP) ANALYSIS**

Cost-Volume-Profit Analysis otherwise known as Break-Even Analysis refers to a technique that assists in decision making by employing the marginal costing concept and is used to measure the effect on profit as a result of changes in volume of activities, cost and prices. It also facilitates planning in the sense that CVP analysis could assist to predict future cost levels and sales as related to a range of level of activity. It demonstrates how the profit will be affected as a result of changes in any of the variables that make up the profit function. Its use requires the separation of the total cost function into their, variable and fixed portion, as required in the application of marginal costing principles.

The profit-volume ratio is a very useful figure which indicates the relationship of contribution to turnover. The formula used to calculate it is:

$$\frac{\text{Contribution}}{\text{Sales}} \quad \times \quad \frac{100}{1}$$

It is common practice to express this measurement in percentage form, so the usual version is:

$$\frac{S - V}{S} \times 100$$

The profit-volume ratio may be used to measure the relative contribution of a product or a company for various periods. It is popularly called P/V Ratio.

### 3.5.1 Application of the P/V ratio

Management may request information towards solving a variety of problems which require calculations and involving profit-volume ratios, for example:

- (a) What is the company's break-even point?
- (b) What would be the profit on sales volume  $\text{₹}X$ ?
- (c) What volume of sales would be required to achieve a planned level of profit?
- (d) What volume of sales would be required to maintain the present level of output if selling price were reduced, let's say, by 10%

The use of P/V ratio and graphs can provide answers to such problems although it is again assumed that these answers are guides only and may not be accurate. However, they do at least provide a measuring tool which can form the basis of decision making.

### 3.5.2 Basic assumptions of C-V-P-Analysis

The basic assumptions associated with C - V - P technique are:

- (a) All costs could be categorized as either variable cost or fixed cost.
- (b) Semi-Variable cost can be segregated into both the variable and its fixed component.
- (c) Selling price per unit is constant.
- (d) Variable cost per unit is constant.
- (e) Total fixed cost remains unchanged regardless of output.
- (f) Parity of production and sales. That is, there is no closing stock of goods since production equals sales.
- (g) Only one product is involved and in case of a multi-product organization, there is a constant sales mix.
- (h) Level of technology and efficiency remains the same.
- (i) Volume is the only independent variable that affects cost.
- (j) Risk and uncertainty are non-existent.
- (k) There is a relevant range.

### 3.5.3 Limitations of the basic assumptions

In a true life situation, the basic assumptions of C-V-P analysis as discussed above tend only to be valid over a limited range of activity. As a result of this reason, care must be exercised when using break even analysis as a basis for decision making or the presentation of information.

The basic assumptions of C-V-P have the following deficiencies:

- (a) It might be difficult to separate some costs into their fixed and variable cost portions.
- (b) The selling price per unit is assumed to be constant. This is not realistic because of possibility of discounts.
- (c) The variable cost per unit is assumed to be constant. This is not realistic because quantity discount could result in decrease in material cost and labour cost per unit could fall whenever the learning curve theory becomes applicable.
- (d) Fixed cost is assumed to remain unchanged. This is not true because in reality, fixed cost moves in a step-like manner. Also in the long run all costs are variable.
- (e) It is assumed that production is equal to sale, hence no closing stock. This assumption looks unrealistic because a business is a going concern and invariably stocks are carried from one period to the other.
- (f) The assumption of one product or constant mix of product is not realistic because most organizations produce variety of products and invariably actual mix turn out to be radically different from the expected level of activity. This may be due to a host of factors such as the tastes of the customers and the economic realities of the day,
- (g) The assumption that there is no change in level of technology and efficiency is untenable since innovations are taking place every day in all spheres of business endeavours.

### 3.5.4 Applications of the C-V-P model

- (a) To determine the breakeven point in units

$$= \frac{\text{Total fixed cost}}{\text{Contribution per unit or contribution margin}}$$

$$= \frac{\text{TFC}}{\text{CM}}$$

- (b) Break even point in sales value (₦)

$$= \frac{\text{Total fixed cost}}{\text{Contribution margin ratio}}$$

- (c) Number of units to sell to make a targeted profit (₦)

$$= \frac{\text{TFC} + \text{Targeted profit}}{\text{CM}}$$

- (d) The sales value in N required to achieve a targeted profit

$$= \frac{\text{TFC} + \text{Targeted profit}}{\text{CMR}}$$

Note: Targeted profit is assumed to be profit before tax (PBT). However, if the targeted profit is profit after tax, there is need to gross-up the profit after tax to profit before tax, using the formula below:

$$\text{Profit before tax} = \frac{\text{Profit after tax}}{1 - \text{tax rate}}$$

$$\text{That is, if tax rate is 30\%, PBT} = \frac{\text{Profit tax}}{1 - 0.30} = \frac{\text{PAT}}{0.7}$$

### ILLUSTRATION 7 – 5

Yinka Limited is considering a reduction in the price of its product by 10% because it is felt that such a step may lead to a greater volume of sales. It is thought that there is no prospect of a change in fixed costs or variable cost per unit. The director wishes to maintain profit at the present level, so the loss which will be incurred by reducing the selling price must be offset by a gain due to increased volume of sales. You are given the following information:

Sales (10,000 units)	₦200,000
Variable costs	₦15 per unit
Fixed costs	₦40,000

State the volume of sales required to maintain the existing profit.

### SUGGESTED SOLUTION 7 – 5

$$\begin{aligned} \text{The present level of profit} &= \text{N}200,000 - (150,000 + 40,000) \\ &= \text{N}10,000 \end{aligned}$$

$$\text{and the P/V Ratio is} = \frac{\text{S} - \text{V}}{\text{S}} = \frac{50,000}{200,000} = 25\%$$

If the selling price were reduced with no corresponding increase in sales volume, the profit-volume ratio would be:

$$\begin{aligned} \text{Sales} &= 180,000 \\ \text{VC} &= 150,000 \\ \text{Total Contribution} &= 30,000 \\ \text{CMR} &= \frac{\text{S} - \text{V}}{\text{S}} = \frac{30,000}{180,000} \times 100 = 16.67\% \end{aligned}$$

It is not expected that fixed costs will change. The Director wishes profit to remain at its present level. So, the volume of sale required is

$$= \frac{\text{TFC} + \text{Profit}}{\text{CMR}} = \frac{\text{N}40,000 + 10,000}{16.67\%}$$



$$\begin{aligned} \text{P/V or CM Ratio} & \qquad 16\frac{2}{3}\% \\ & = \text{N}300,000 \end{aligned}$$

### The P/V Graph

The profit volume graph - This graph is a development of the break - even chart and portrays the relationship of profit to volume. It requires the same basic data as the Break - Even Chart (BEC) and suffers from the same limitations with BEP chart. But if these limitations are borne in mind, they provide a valuable aid to management in making decisions concerning volumes of output. Construction of profit - volume chart will involve the following processes:

- (a) Draw a vertical line and select a point in between it to represent point 0, that is, the point at which neither profit nor loss is made.
- (b) From point 0, draw the horizontal line to the right and scale appropriately for sales.
- (c) Also scale the upper vertical line for profit and the lower line for losses.
- (d) On the vertical axis, the area below the sales line represents fixed cost and that above it represents profit.
- (e) Profits are plotted for the required fixed costs and for profit and a line is drawn to connect the two points.

The P/V graph, or profit/volume graph is similar to the break - even chart, and records the profit or loss at each level of sales. It is a straight line graph, drawn most simply by recording:

- (i) The loss at zero sales, which is full amount of fixed cost and
- (ii) The profit (loss) at the budgeted level of sales; and joining up the two points.

## 4.0 CONCLUSIONS

Marginal costing is a decision making technique used to determine the effect on profit due to cost changes and volume changes from time to time in a multi-product firm especially in the short run. Emphasis is on the variable cost of a product and the fixed cost is written off in full against the contribution and treated as period cost.

The various areas where the marginal costing technique is applicable are in: make or buy, accept or reject situations, deleting a segment, special pricing decisions etc.

Cost-Volume-Profit analysis, also known as Break-even analysis, is used to measure the effect on profit as a result of changes in both revenue and cost parameters,

## 5.0 SUMMARY

This unit treated in a greater depth the concept of marginal costing and its contribution towards the provision of information for managerial decision making.

## 6.0 TUTOR MARKED ASSIGNMENT

1. Ade Limited has fixed costs of ₦60,000 per annum. It manufactures a single product which it sells for ₦20 per unit. Its Contribution margin ratio is 40%. Ade Limited's break-even point is:  
A 1,200  
B 1,800  
C 3,000  
D 5,000  
E 7,500.
2. Zaria Plc. makes a single Product which it sells for ₦16 per unit. Fixed costs are ₦76,800 per month and the product has a contribution to sales of 40%. In a period when sales were ₦224,000, Zaria Plc's margin of safety in units was:  
A 2,000  
B 6,000  
C 8,000  
D 12,000  
E 14,000.
3. Ariara Plc produces a single service to its customers. An analysis of its budget for the year ending 31, December 2002 shows that in period 4, when the budgeted activity was 5,220 service units with a sales value of ₦42 each, the margin of safety was 19.575%. The budgeted fixed contribution to sales ratio of the service is 40%. Budgeted fixed costs in period 4 were nearest to  
A ₦1,700  
B ₦71,000  
C ₦70,500  
D ₦176,000  
E ₦96,000.
4. The following extract is taken from the production cost budget of Sunday Ebang Limited:

Production Units	2,000	3,000
Production Cost	₦11,100	₦12,900

The budget cost allowance for an activity level of 4,000 units is
5. The make-up of a company's cost structure changes so that the contribution per unit increases, but the total cost remains exactly the same. The operational gearing (also referred to as operational leverage) would:  
A Increase  
B Decrease

- C Stay the same
- D Probably decrease
- E Probably increase.

6. What is differential cost?
7. What are the formulae for: break-even point (units); break-even point (sales value)?
8. Define relevant cost.
9. A company fixed cost is N100,000 and has two products. The sales and contribution sales Ratio are”

Product	Sales	P/V Ratio	Variable
A	N300,000	20%	_____
B	N 80,000	50%	_____

Determine the variable cost for products A and B.

10. Explain the term “Opportunity Cost”

## 7.0 REFERNCES/FUTHER READINGS

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## **UNIT 8      BUDGETING AND BUDGETARY CONTROL**

### **CONTENTS**

- 1.0 Introduction
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  - 3.6 Behavioural aspects of budgeting
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  - 3.8 Forecast
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    - 3.9.2 Organization for budgetary control
- 4.0 Conclusions
- 5.0 Summary
- 6.0 Tutor Marked Assignments
- 7.0 References/Further Readings

### **1.0 INTRODUCTION**

Every organization makes plans, Some plans are more formal than others and some organization's plan more formally than others but all makes same attempt to consider the risk and opportunities, which lie ahead, and how to confront them. In most businesses, this process is formalized at least in short-term, with considerable effort put into preparing annual budgets and monitoring performance against those budgets. Traditionally, budgets have been employed as devices to limit expenditure, but a much more useful and constructive view is to treat the budgeting process as a means for obtaining the most effective and profitable use of the company's resources via planning and control.

## 2.0 OBJECTIVES

At the end of this unit, readers would be able to understand:

- The objectives of budgeting.
- The stages in developing budgets and their inter-relationships.
- Cash budget and its importance in an organisation.
- Functional budgets and master budget
- Control limits, activity and efficiency ratios.
- The major techniques used in budgeting such as Flexible budgets, Zero based budgeting, Activity-based budgeting, Continuous budgeting, and Programme Planning and Budgeting systems.
- The need for budgetary control.
- The Vital importance of the human aspects of budgeting.

### 3.1 DEFINITION OF BUDGET

A budget is defined as "a quantitative statement for a defined time which may include, planned revenues, expenses, assets, liabilities and cash flow. A budget provides a focus for the organisation, aids the coordination 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).

Budget is a financial and/or quantitative plan of operations for a forthcoming accounting period.

Many functional budgets [a budget of income or expenditure for individual functions of a business such as the sales budget, production budget, direct labour budgets, etc] are incorporated into a master budget.

"Budgets are designed to carry out various functions such as planning, evaluating performance, co-ordinating activities, implementing plans, communicating, motivating and authorizing actions. The last-named role seems to predominate in government budgeting and not-for-profit budgeting, where budget appropriations serve as an authorisation and ceiling for management actions" [Horngren (2004).]

The purpose of a budget is to:

- (i) Communicate ideas and plans to everyone affected by them. A formal system is necessary to ensure that each person is aware of what he or she is supposed to be doing. Communication might be one-way, that is, with managers giving order to subordinates; or there might be a two-way dialogue and exchange of ideas, this is between managers and subordinates.
- (ii) Coordinate the activities of different departments or sub-units of the

organization. This concept of coordination implies, for example, that the purchasing department should base its budget on production requirements, and that the production budget [that is, direct labour budget and machinery utilization budgets etc] should in turn be based on sales expectations. Although straight forward in concept, coordination, in practice, is remarkably difficult to achieve, and this often leads to 'sub-optimality' and conflict among departmental managers.

- (iii) Establish a system of control by having a plan against which actual results can be progressively compared and variance analysed for prompt attention and action.
- (iv) Motivate employees to improve their performances. The level of attainment usually incorporated in the budget is a realistic figure for the budget period. [Thornton: [1978].  
Thornton, (1978) suggests that two levels of attainment could be fixed:
  - (i) a 'minimum expectations' budget, and
  - (ii) a 'desired standards' budget.

A budget is a means to an end, and not an end in itself. It is a short term plan that depicts the focus of a long term objective of the organisation. It covers area of responsibility of one specified person, so that his performance can be measured at the end of a budget period. It follows that the budget should be prepared in conjunction with those who are to be responsible for achieving the budgeted performance. In this way, a head of department translates his goal in the budgets. This approach offers motivation to the managers. This technique, with its stress on personality, differs from standard costing, for the latter is concerned with standards for products or services.

### **3.2 TYPES OF BUDGET**

#### **(a) Functional budgets**

Functional budgets are prepared by the departmental heads. The order of importance in preparation of the budget depends on the budget limiting factor of the organisation. Where sales are considered critical to the success of the objectives, the sales budget is prepared first. Similarly, where source of raw material is restricted and in limited supply the raw material budget is prepared first.

The order of presentation suggests that the sales are critical and so sales budget is prepared before other budgets:

- (i) Sales budget. This will incorporate decisions about selling prices and expected sales volume for each item of product (or service) for all segments of the company's product or service;
- (ii) The departmental budgets for marketing, sales and distribution would also be made at an early stage, because estimates of spending on sales

promotion, advertising and salesmen, etc will be necessary to gauge the expected volume of sales;

- (iii) Having prepared the sales budget, it should be possible to estimate production requirements in terms of quantity of raw materials, labour hours, machine hours etc. However, decision must first be taken about stocks of finished goods. A decision to increase stocks would mean that production for the period must exceed sales volume. On the other hand, a decision to reduce stock levels (so as to improve the organisation's cash position) would mean that production volume would be less than sales volume by the amount of the run-down in stocks. The level of stock to hold would depend on the variability in demand, leadtime for raw materials, etc.;
- (iv) The production budget is then prepared, specifying the expected quantities of each product to be made, in each factory or manufacturing department, followed by the budgets of resources for production, that is,
  - Materials usage budget for all types of materials, direct and indirect;
  - Machine utilization budget for the operating hours required on each machine or group of machines;
  - Labour budget ( all grades of labour, direct and indirect in hours and cost);
  - Overhead cost centres budgets for production, administration, and research and development cost centres.
- (v) A materials purchasing budget is also required, specifying the expected quantities and price of each stores item for raw materials bought-in components, stationery, etc. In order to prepare the purchases budget a decision must first be taken about stock level. Purchase requirements (in quantity) are the usage requirements, plus any increase in raw material stocks, or less any decrease in stocks;
- (v) A capital expenditure budget, updated each year, covering a period of the next three to five years.
- (vi) A working capital budget, specifying the changes in debtors and creditors during the year. Turnover periods would be estimated and the effect of any proposed decision on discounts or credit period allowances considered.
- (vii) The cash budget cannot be prepared until the functional budgets in (i) to (vi) have been decided, prepared and agreed.

(b) **Master budget**

The master budget consolidates the position of all the functional budgets in the form of a budgeted trading and profit and loss account and a budgeted balance sheet. Budgetary control relates expenditure to the person responsible for each function, thus affording an effective method of control. It is an important

principle of the system that an executive is held responsible only for expenditure within his control.

### **3.3 BUDGET PREPARATION AND APPROVAL PROCEDURES**

#### **3.3.1 Budgets Preparation Procedures**

The business of any organisation must be conducted in an organised and orderly manner to achieve the desired results.

Budget preparation is a serious activity of management and some time should be expended on it. In practice, top management may constitute a budget committee which could comprise:

- (a) The Managing Director/ Chief Executive Officer as the Chairman
- (b) Chief Accountant (or Director of finance) as the budget officer. He coordinates the preparation and readiness of other budgets and prepares the cash budget as well as the master budget. His knowledge of the interrelationship of these other functional budgets puts him in an advantageous position to be the budget officer.
- (c) The head of department or the line and service managers who prepares the functional budgets of the department.

It is good management policy to have a pre-budgeting meeting where the guidelines for the new budget period are drafted, discussed and approved. This would include the requirements that the new budgets must meet the standard parameters.

#### **3.3.2 Approval of the master budget**

The budget committee will submit the master budget to the top management (usually the board of directors) for approval. If it is approved, the master budget will then become the blueprint for the activities of the budgeted period. If approval is not received, sections of the budget will have to be amended to incorporate any change or review in emphasis so as to meet the requirements of top management. However, these requirements should be realistic. There are limits to the success which can be achieved. Some improvements may be possible for the following reasons:

- managers may have been too pessimistic in their estimates.
- padding or slack variables may have been built into the budget - that is estimates of costs may be overstated and activity understated so that the budget can be easily achieved.
- improvements in efficiency may be possible.
- additional sales promotion may yield positive results.
- it may be possible to increase productive capacity — although in many industries this could take considerable time.

### **3.4 PREPARATION OF BUDGETS**



### 3.4.1 Cash Budget

A cash budget is a summary of the company's expected cash inflows and outflows over a given period of time.

Cash is required in order to facilitate the achievement of a company's plans and intentions. Inadequate flow of liquidity will hamper efficiency and level of profitability of the firm. A company may be profitable but, still faces liquidity problems. Cash is a resource which should be effectively utilised in order to generate benefits for the company. Cash budget shows the timing of expected cash flows. The benefits to be derived from the preparation of detailed cash budget are as follows:

- (i) It provides early signals of potential deficit or surplus in order to take appropriate action,
- (ii) It enables financial feasibility of plans to be ascertained.
- (iii) It indicates the financial effects of policies within a firm.
- (iv) It provides a base for monitoring actual activity. The frequent comparison of actual cash flow with budgeted cash flow will enable up to date information to be incorporated into budget revisions.

#### ILLUSTRATION 8.1

From the following data, prepare a cash budget for the first six months of 2005 for Super Industries Ltd:

- (i) Budgeted Profit and Loss Accounts for the period ended 30 June, 2005.

	Jan N'000	Feb N'000	Mar N'000	April N'000	May N'000	June N'000
Sales	90	92	88	95	90	94
Less Purchases	<u>54</u>	<u>56</u>	<u>50</u>	<u>60</u>	<u>52</u>	<u>55</u>
Gross Profit	36	36	38	35	38	39
Less operating expenses:						
Selling expenses	(10)	(12)	(13)	(13)	(16)	(15)
Distribution expenses	(6)	(4)	(5)	(7)	(4)	(5)
Admin. expenses	<u>(3)</u>	<u>(4)</u>	<u>(4)</u>	<u>(2)</u>	<u>(5)</u>	<u>(3)</u>
Net profit	<u>17</u>	<u>16</u>	<u>16</u>	<u>13</u>	<u>13</u>	<u>16</u>

- (ii) Sales for November and December 2004 were N85,000 and N90,000 respectively.
- (iii) 40% of sales would be in cash, 30% each would be paid in 30 days and 60 days.
- (iv) Purchases for November and December 2004 were N48,000 and N50,000 respectively
- (v) 75% of purchases would be paid for immediately and the balance in two months time.

- (vi) Selling expenses are to be settled in two equal installments in 30 and 60 days. December 2004 expenses are ₦15,000.
- (vii) Distribution, expenses are payable one month in arrears while administration expenses are payable immediately.
- (viii) Distribution expenses for December 2004 would be ₦5,000 while selling expenses would be ₦8,000 for November 2004 and ₦9,000 in December 2004.
- (ix) Balance in the bank on 31 December, 2004 is expected to be ₦28,000 overdrawn.
- (x) The company intends to pay for the following:
- Company tax of ₦12,000 in February 2005
  - A new generator costing ₦6,500 in March 2005
  - Dividends of ₦20,000 in April 2005.
- (xi) Some unserviceable vehicles would be sold in January 2005 for ₦8,000. Show all workings.

### SUGGESTED SOLUTION 8 – 1

#### SUPER INDUSTRIES LIMITED

	Jan	Feb	March	April	May	June	Total
<b>RECEIPT</b>							
(N'000)	88.5	90.8	89.8	92	90.9	93.1	545.1
Sales	<u>8.0</u>	—	—	—	—	—	<u>8</u>
Asset disposal	<u>96.5</u>	<u>90.8</u>	<u>89.8</u>	<u>92</u>	<u>90.9</u>	<u>93.1</u>	<u>553.1</u>
<b>TOTAL</b>							
<b>PAYMENT</b>	52.5	54.5	51.0	59.0	51.5	56.25	324.75
(N'000)	7.5	12.5	11.0	12.5	13.0	14.5	71.0
Purchases	5.0	6.0	4.0	5.0	7.0	4.0	31.0
Selling expenses	3.0	4.0	4.0	2.0	5.0	3.0	21.0
Distribution exp.	—	—	6.5	—	—	—	6.5
Admin. expenses	<u>68.0</u>	<u>89.0</u>	<u>76.5</u>	<u>98.5</u>	<u>76.5</u>	<u>77.75</u>	<u>486.25</u>
Corporation tax	28.5	1.8	13.3	(6.5)	14.4	15.35	66.85
Generator	(28.0)	5.0	2.3	15.6	9.1	23.5	(28.0)
Dividends	5.0	2.3	15.6	9.1	23.5	38.85	38.85
<b>TOTAL</b>							
Net Cashflow							
Opening balance							
Closing balance							

## WORKINGS

	Nov. 2004	Dec. 2004	Jan. 2005	Feb. 2005	Mar. 2005	Apr. 2005	May 2005	June 2005
Sales								
Actual	<u>85.0</u>	<u>90.0</u>	<u>90.0</u>	<u>92.0</u>	<u>88.0</u>	<u>95.0</u>	<u>90.0</u>	<u>94.0</u>
40%	34.0	36.0	36.0	36.8	35.2	38.0	36.0	37.6
30%		<u>25.5</u>	27.0	27.0	27.6	26.4	28.5	27.0
30%	—	—	<u>25.5</u>	<u>27.0</u>	<u>27.0</u>	<u>27.6</u>	<u>26.4</u>	<u>28.5</u>
Total	<u>34.0</u>	<u>61.5</u>	<u>88.5</u>	<u>90.8</u>	<u>89.8</u>	<u>92.0</u>	<u>90.0</u>	<u>93.1</u>

	Nov. 2004	Dec. 2004	Jan. 2005	Feb. 2005	Mar. 2005	Apr. 2005	May 2005	June 2005
Purchase								
Actual	<u>48.0</u>	<u>50.0</u>	<u>54.0</u>	<u>56.0</u>	<u>50.0</u>	<u>60.0</u>	<u>32.0</u>	<u>55.0</u>
75%	36.0	37.5	40.5	42.0	37.5	45.0	39.0	41.25
25%			<u>12.0</u>	<u>12.5</u>	<u>13.5</u>	<u>14.0</u>	<u>12.5</u>	<u>15.0</u>
Total	<u>36.0</u>	<u>37.5</u>	<u>52.5</u>	<u>54.5</u>	<u>51.0</u>	<u>59.0</u>	<u>51.5</u>	<u>56.25</u>

Selling Expenses	Nov. 2004	Dec. 2004	Jan. 2005	Feb. 2005	Mar. 2005	Apr. 2005	May 2005	June 2005
Actual	-	<u>15.0</u>	<u>10.0</u>	<u>12.0</u>	<u>13.0</u>	<u>13.0</u>	<u>16.0</u>	<u>15.0</u>
50%	-	-	7.5	5.0	6.0	6.5	6.5	8.0
50%	-	-	-	<u>7.5</u>	<u>5.0</u>	<u>6.0</u>	<u>6.5</u>	<u>6.5</u>
			<u>7.5</u>	<u>12.5</u>	<u>11.0</u>	<u>12.5</u>	<u>13.0</u>	<u>14.5</u>

## ILLUSTRATION 8 – 2

GSMA Limited expects sales of its airtime to amount to N800 million in January, N850 million in February and N950 million in March, 2004.

Prepare an estimate of cash budget from these information for the three (3) months ended 31 March 2004 assuming the following:

- 10% of sales are cash sales with 5% discount
- 3% discount is also given for credit sales when payment is received within 10 days, 25% of credit sales are paid within 10days.
- Half of the remaining debtors paid in the month following sales.
- The remainder paid two months following sale with the exception of bad debtors, who amount to 1% of total sales.
- The following expenses were incurred during the period:

	JAN N'000	FEB N'000	MARCH N'000
Salaries and wages	14,500	15,200	16,000

Printing of cards	2,300	4,200	4,500
Loan (Principal due)	80,000	185,000	220,000
Interest on loan	8,500	9,000	10,000

The following notes relate to these expenses:

- 10% of salaries are paid one month in arrears, 10% salaries and wages due as at the end of December 2003 not yet paid amounted to ₦1,200,000.
- Loan is paid as at when due while interest on loan is paid one month in arrears. Loan interest for the month of December 2003 is ₦7,900,000.
- Royalties are also paid one month in arrears. Royalties are 5% of total cash receipts and total receipts for December 2003 is ₦210,500,000.
- Administrative expenses are 5% of total sales and are paid in the month of sales.

### SUGGESTED SOLUTION 8 – 2

#### GSMA LIMITED

<b>WORKINGS</b>	<b>JAN ₦'000</b>	<b>FEB ₦'000</b>	<b>MARCH ₦'000</b>
Total sales	800,000	850,000	950,000
10% cash sales	<u>(80,000)</u>	<u>(85,000)</u>	<u>(95,000)</u>
Credit sales	720,000	765,000	855,000
Payment within 10 days (25%)	<u>(180,000)</u>	<u>(191,250)</u>	<u>(213,750)</u>
	540,000	573,750	641,250
50% month following 10days	<u>270,000</u>	<u>286,875</u>	<u>320,625</u>
	270,000	286,875	320,625
Bad debt – 1% of sales	<u>8,000</u>	<u>8,500</u>	<u>9,500</u>
Payment 2 month after sales	<u>262,000</u>	<u>278,375</u>	<u>311,125</u>
10% cash sales without discount	80,000	85,000	95,000
Less 5% discount	<u>4,000</u>	<u>4,250</u>	<u>4,750</u>
	<u>76,000</u>	<u>80,750</u>	<u>90,250</u>
Credit sales within 10 days	180,000	191,250	213,750
Less 3% discount	<u>5,400</u>	<u>5,738</u>	<u>6,413</u>
	<u>174,600</u>	<u>185,512</u>	<u>207,337</u>
Admin expenses – 5% of sales	<u>40,000</u>	<u>42,500</u>	<u>47,400</u>
Salaries & wages 90%	13,050	13,680	14,400
10% arrears	<u>1,200</u>	<u>1,450</u>	<u>1,520</u>
Salaries & wages paid	<u>14,250</u>	<u>15,130</u>	<u>15,920</u>

#### GSMA LTD.

#### CASH BUDGET FOR THE PERIOD ENDED 31 MARCH 2004

<b>RECEIPTS</b>	<b>JAN ₦'000</b>	<b>FEB ₦'000</b>	<b>MARCH ₦'000</b>
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Cash sales less discount	76,000	80,750	90,250
Credit sales less discount	174,600	185,512	207,337
Payment in the following month	-	270,000	286,875
Payments – 2 months after sale	-	-	<u>262,000</u>
Total cash receipts	<u>250,600</u>	<u>536,262</u>	<u>846,462</u>
<b>PAYMENTS</b>			
Salaries and wages	14,250	15,130	15,920
Printing of cards	2,300	4,200	4,500
Loan repayment	80,000	185,000	220,000
Interest repayment	7,900	8,500	9,000
Admin. expenses	40,000	42,500	47,500
Royalties	10,525	12,530	26,813
Total payment	<u>154,975</u>	<u>267,860</u>	<u>323,733</u>
Net Cash Flow	95,625	268,402	522,729
Opening Balance	-	<u>95,625</u>	<u>364,027</u>
Closing Balance	<u>95,625</u>	<u>364,027</u>	<u>886,756</u>

### 3.5 TECHNIQUES USED IN BUDGETING

#### 3.5.1 Flexible budget

The CIMA defines a flexible budget as "a budget which is designed to change in accordance with the level of activity attained".

A flexible budget recognises the existence of fixed, variable and semi-variable costs, and it is designed to change in relation to the actual volume of output or level of activity in a period. The principles underlying the flexible budget are:

- (i) to prepare 'contingency plans' in advance. Flexible budgets are prepared for a range of activity rather than for a single level of activity (although the most probable activity level becomes unavoidable/desirable during the course of the year, management automatically adapts itself to the change by switching to a more appropriate flexible budget as the new budget master plan;
- (ii) budgetary control. Flexible budgeting is fundamental to budgetary control. Control is not achievable with a fixed budget. In fixed budgets control, the budgets prepared are based on one level of output, a level which has been carefully planned to equate sales and production at the most profitable rate. If the level of output actually achieved differs considerably from that budgeted, large variances will arise. Basically the idea of a flexible budget is that there shall be some standard of expenditure from varying levels of output.

The concept of flexible budget was to focus on how control could be achieved over the operations. In a flexible budget, overheads are analysed into three, namely:

- (a) fixed;
- (b) variable; and

(c) semi variable.

### ILLUSTRATION 8-3

Sales director of Tayo Box Fabricators has become aware of the disadvantages of static budget. The director asks you as the Management Accountant to prepare a flexible budget for October 2005 for its main brand of boxes.

The following data are available for the actual operation in September 2005:

Boxes produced and sold	4,500 units
Direct Materials costs	₦180,000
Direct Manufacturing Labour Costs	₦135,000
Depreciation and other fixed	

Manufacturing costs	₦101,400
Average selling price per box	₦ 140
Fixed marketing costs	₦ 62,700

Assume no stock of boxes at the beginning or end of the period. A 10% increase in the selling price is expected in October. The only variable marketing cost is a commission of N0.50k per unit paid to the manufacturer's representatives, who bear all their own costs of traveling, entertaining customers, etc. A patent royalty of N2 per box manufactured is paid to an independent design firm. Salary increases that will become effective in October are N12,000 per year for the production supervisor and N15,000 per year for Sales Manager. A 10% increase in direct materials prices is expected to become effective in October. No changes are expected in direct manufacturing labour wage rates or in the productivity of the direct manufacturing labour personnel standard costs for any of its inputs.

You are required to:

Prepare a flexible budget for October 2005 showing budgeted amounts at each of these output levels of boxes, 4,000 units, 5,000 units and 6,000 units.

### SUGGESTED SOLUTION 8 –3

#### TAYO BOX FABRICATIONS LIMITED FLEXIBLE BUDGET FOR THE MONTH OF OCTOBER, 2006

Activity Level	4,000 units ₦	5,000 units ₦	6,000 units ₦
Sales	<u>616,000</u>	<u>770,000</u>	<u>924,000</u>
Less			
Direct material	(176,000)	(220,000)	(264,000)
cost	(120,000)	(150,000)	(180,000)
Direct labour	(2,000)	(2,500)	(3,000)

cost	(8,000)	(10,000)	(12,000)
Marketing	(306,000)	(382,500)	(459,000)
variable			
Royalties	310,000	387,500	465,000
Variable costs	<u>(266,350)</u>	<u>(266,350)</u>	<u>(266,350)</u>
	<u>43,650</u>	<u>121,150</u>	<u>198,650</u>
Contribution			
Less: Fixed			
Costs			
NET PROFIT			

## WORKINGS

### STATEMENT OF COST

	SEPTEMBER	OCTOBER
	₦	₦
Direct material cost	40.00	44.00
Direct labour cost	30.00	30.00
Marketing variable cost	0.50	0.50
Royalties	<u>2.00</u>	<u>2.00</u>
Total variable cost	<u>72.50</u>	<u>76.50</u>
Fixed Cost-Depreciation	101,400	101,400
Marketing	162,700	162,700
Increase in salary – production	-	1,000
Increase in salary – marketing	-	<u>1,250</u>
	<u>264,100</u>	<u>266,350</u>
Selling Price	140	154

### 3.5.2 Zero-based budget (ZBB) or "priority based budgeting"

ZBB is a budgeting technique which seeks to eliminate the draw backs of traditional incremental budgeting by taking the budgets for service or overhead centres back to a minimal operating level and then requiring increments above this level to be quantified and justified.

'A method of budgeting which requires each cost element to be specifically justified, as though, the budget related were being undertaken for the first time, without approval, the budget allowance is zero" CIMA

ZBB was introduced in the early 1970s in the United States by O. Phyrr. It gained prominence because of the fact that it is based on common sense. President Carter, the President of the United States, directed all US government departments to adopt this technique.

ZBB is concerned with the evaluation of the costs and benefits of alternatives and, implicit in the technique, is the concept of opportunity cost.

### **ZBB is applied in three stages**

- (i) The decision unit: This means subdividing the organisation to discrete sub-units where operations can be meaningfully and individually identified and evaluated.
- (ii) The decision packages: Each decision unit manager submits no less than three budget packages namely (a) the lowest level of expenditure, (b) the expenditure required to maintain levels of activity. (c) the expenditure required to provide an additional level of service or activity.
- (iii) Agreed packages will form the budget.

### **Advantages of ZBB**

- (i) Results in a more efficient allocation of resources to activities and departments.
- (ii) It focuses attention on value for money
- (iii) ZBB develops a questioning attitude which enables management to determine inefficiency.
- (iv) It may lead to cost reduction.
- (v) Managers performance can be monitored.

### **Disadvantages of ZBB**

- (i) ZBB is a time consuming process and generates volume of paperwork especially for the decision packages.
- (ii) It requires management skill in both drawing decision packages and for the ranking process.
- (iii) It encourages the wrong impression that all decisions have to be made in the budget.
- (iv) Trade Union always go against ZBB, who prefer status quo to remain.
- (v) Co-ordination of all activities may be difficult.

### **3.5.3 Activity based budgeting (ABB)**

Activity based budgeting (ABB) which is also known as Activity Cost Management is defined as "method of budgeting based on an activity framework and utilizing cost driver data in the budget-setting and variance feedback processes" (ICMA).

It is a part of planning and control system which tends to support the objectives of continuous improvement. ABB is a form of development of conventional budgeting system. It is also based on activity analysis techniques.

### **ABB FEATURES**

- (a) It recognises activities that drive costs with the aim of controlling the causes of cost directly rather than the costs themselves. It enables costs to be managed



and understood in the long run.

- (b) ABB differentiates and examines activities for their value adding potentials.
- (c) The department activities are driven by demands and decisions which are beyond the control of the budget holder.
- (d) It encourages immediate and relevant performance measures required than are found in conventional budgeting systems.

### **Advantages of ABB**

- (i) It provides stronger links between an organisations strategic objectives.
- (ii) It has ability to tackle cross organisational issues through a participating approach.
- (iii) It also uses activity analysis techniques which promotes continuous improvement.

### **3.5.4 Planning, Programming, Budgeting System (PPBS)**

PPBS analyses the output of a given programme and also seeks for the alternatives to find the most effective means of reaching basic programme activities.

PPBS involves the preparation of a long-term corporate plan that clearly establishes the objectives that the organization have to achieve.

PPBS is the counter part of the long-term process for profit-oriented organisations.

### **Aims and Objectives of PPBS**

- (i) The aim of PPBS is to enable the management of a non-profit making organisation to make more informed decision about the allocation, of resources to meet the overall objectives of the organisation.
- (ii) It enables the management to identify the activities, functions or programmes to be provided thereby establishing a basis for evaluation of their worthiness,
- (iii) PPBS provides information that will enable management to assess the effectivenesses of its plans.

### **Stages In PPBS**

- (i) Calls for a careful specification and overall objectives are determined.
- (ii) identify programmes that will achieve these objectives and those programmes which are normally related to the major activities undertaken by government establishments.
- (iii) The costs and benefits of each programme are determined, so that budget allocations can be made on the basis of the cost-benefit of the programme.
- (iii) Analyses the alternatives to find the most effective means of reaching basic programme objectives.
- (iv) This analytical procedures will be established as to systematically form part of budgetary control.

### 3.5.5 Continuous Budget/Rolling Budget

Continuous budget which is known as rolling budget is a system of budgeting that involves continuously updating budgets by reviewing the actual results of a specific period in the budget and determining a budget for the corresponding time period. It has been described as an attempt to prepare targets and plans which are more realistic and certain by shortening the period of budget preparations. Under this method, instead of preparing a budget annually, there would be budget every three or six months so that as the current period ends, the budget is extended by an extra period; for example, if a continuous budget is prepared every three months, the first three months would be planned in great details and the nine months in lesser details, because of the greater uncertainty above the longer term future. This means that, if a first continuous budget is prepared for April to June, in details to March, in less detail a new budget will be prepared towards the end of June to cover June to September in details and October of the following year in lesser details.

#### Advantages

- i. Management is made to be continuously aware of the budgetary process since the figures for the next 12 months are made always available.
- ii. It allows for more frequent assessment and revision of the budgets in the light of current trends particularly during the period of inflation, thus, the budget does not become quickly obsolete or outdated.

#### Disadvantages

- i. Higher costs and efforts are required for continuous budgeting.
- ii. It is time consuming in that, in each period, the whole procedures of preparing budgets have to be undertaken.

### 3.6 BEHAVIOURAL ASPECTS OF BUDGETING

Despite all the benefits/objectives already narrated on the budgetary control system and in spite of the management accounting control techniques, the operations of budgetary control techniques have met with little success. Many scholars have done research on these, in order to detect what should have been responsible for the failure. Such researchers are Hopwood (1974), Argris (1952), Horgren (1960) and a host of others.

The main causes of the level of low success in practice have been attributed to lack of co-operation and negative attitude of the operating managers to the control techniques. Managers' personal objectives also override the goal congruence of the organisation. This negative and dysfunctional attitude of managers manifest at both the planning stage and implementation stage.

- (a) **Planning Stage:** Assuming the operating managers are involved in preparing a budget; they may:

- (i) Intentionally build in slack in the budget.
- (ii) Express the opinion that budget is time wasting and that they are always busy to prepare the budget.
- (iii) Argue that formalising a budget on paper is too restrictive and that they should be granted some flexibility in making their operational decisions.
- (iv) Always prefer incremental system of budgeting to considering alternative options and new ideas.
- (v) Have in mind that the budget is unattainable, that is, having negative idea about the achievement of the budget.

**(b) Implementation Stage**

- i. Lack of co-operation and co-ordination with other budget centres.
- ii. Putting in less effort to achieve budget targets without putting all efforts to achieve more than budgeted.
- iii. Managers may disregard control reports which show negative variances.
- iv. Lack of controlling cost to achieve their own selfish end.
- v. Having much interest in short-term factors to the detriment of more important longer term consequences.
- vi. Blaming budgeting systems for any problems which may occur.

**8.7 SOLVING BEHAVIOURAL PROBLEMS IN BUDGETING**

**(a) Motivation**

Hornrgren (1996) defined motivation as the "need, some selected goal and the resulting drive that influence action towards the goal", He suggested that motivation has two aspects:

- (i) Direction or goal congruence exists when managers working in their own best interest also are in harmony with the goals of top management (that is, the organisation as a whole). It is very difficult to obtain the goal congruence in an organisation. This is one of the essentially behavioural problems in budgeting.
- (ii) Strength with getting subordinates to run rather than work towards the desired goal. Incentive improves the performance of employee and helps to reduce personal or departmental objective.

Motivation helps to improve business results and eliminate misdirected or dysfunctional operation. Hornrgren argues that accounting system must be designed in such a way as to achieve a motivational response from its use, provided that the costs of providing such a system do not outweigh the expected results. He also acknowledges that human behavior is inclined to damage the usefulness of format accounting system.

**(b) Participation**

Participation by employees in budget setting and the encouragement of a human

approach, and man-management would remove the drawbacks to effective budgeting. All the operators of the budget should be fully involved in the preparation of the budget.

Participation leads to more positive attitude and higher performance.

Kenis (1979) reported a positive correlation of attitude and performance with participation, while other scholars such as Bryan and Locke, Stedry and others showed a negative relationship between participation and performance.

Argyris (1952) on the other hand cautioned against the level of participation, as different organisations use the word participation to describe quite different activities. He suggested that the involvement of managers should be total, otherwise pseudo-participation could lead to counter-productive results.

**(c) Goal Congruence**

Goal congruence means the overall objective of an organisation. This overall objective should not conflict with the individual or group objectives entirely but recognition must be given to the fact that organisational objectives cannot be set and implemented through budgeting without consideration of the interaction of individual group and departmental objectives.

Hopwood's (1976) emphasised that there are many problems in achieving goal congruence because:

- (i) There may be numerous objectives in one organisation, some of which may conflict.
- (ii) Different managers may perceive their objectives differently.
- (iii) Departmental rivalries.
- (iv) Different and conflicting reward structures. Other practical realities make perfect goal congruence extremely unlikely.

Efforts should be made to educate both top management and middle management on the importance of goal congruence.

**(d) Management Support**

Top management should be interested in the budgetary system in order to ensure that operating managers give the necessary co-operation.

**(e) Reporting System**

Efforts should be made to isolate uncontrollable cost from controllable ones in order to have meaningful-variances reporting system.

**(f) Communicating**

Communication should be adequate with the operating managers at all stages of the budgetary system.

### **3.8 FORECAST**

"The technique of business forecasting has been developed to give a logical and

comprehensive means of providing management with information to determine the most advantageous plans which can be made within the anticipated resources of the business." (MA).

Despite the uncertainty that exists about the future, business plans are prepared to resolve some of this uncertainty.

### **3.8.1 Distinction between forecast and budgets**

A forecast states the events which are likely to occur in the future. A budget states the plans which the managers will endeavour to turn into actual events. It is a statutory executive order.

### **3.8.2 Forecasting procedures**

There is more than one way of arriving at the sales forecasts. Probably the most satisfactory approach is to use all available methods; each result then provides a check on the others.

Three possible approaches are:

- (a) **Assessments by staff of sales department:** *Estimates* should be made by the individual salesmen and passed upwards to the sales manager. The advantage of this method is that individual salesmen can give consideration to the particular factors which are relevant in their areas.
- (b) **Mathematical analysis of past sales:** *Such* analyses should indicate trends and seasonal variations. This information can be adjusted for known factors, such as increase advertising, to give a forecast of future sales.
- (c) **Senior management judgement:** The senior management team, including production manager, administrative manager etc., will meet to discuss sales prospects. The approach brings a variety of skills and experience to the forecasting exercise.

The sales budget will be determined by reference to the sales forecast. However, the budget should be prepared in the light of any constraints on the amount that can be produced.

## **3.9 BUDGETARY CONTROL**

There is a difference between a budget and budgetary control/budgeting. A budget is just an integral part of budgetary control/budgeting.

Budgetary control is defined thus: "a system of controlling costs which includes the preparation of budgets, coordinating the departments and establishing responsibilities, comparing actual performance with that budgeted and acting upon results, to achieve maximum profitability" (CIMA).

Budgetary control is also defined as 'the establishment of budgets relating the responsibilities of executive to the requirements of a policy, and the continuous comparison of actual with budgeted results either to secure by individual action the objective of that policy or to provide a basis for its revision.

Certain fundamental principles can be outlined from the above definitions of budgetary control:

- (a) Establish a plan or target of performance which co-ordinates all the activities of the business;
- (b) Record the actual performance;
- (c) Compare the actual performance with that planned;
- (d) Calculate the differences or variances, and analyse the reasons for them; and
- (e) Act immediately, if necessary, to remedy the situation.

### **3.9.1 The objectives of budgetary control**

These are:

- (a) To combine the ideas of all levels of management in the preparation of the budget;
- (b) To co-ordinate all activities of the business;
- (c) To centralize control;
- (d) To decentralize responsibility of each of the manager involved;
- (e) To act as a guide for management decisions, when unforeseeable conditions affect the budget;
- (f) To plan and control income and expenditure so that maximum profitability is achieved;
- (g) To direct capital expenditure in the most profitable direction;
- (h) To ensure that sufficient working capital is available for the efficient operation of the business;
- (i) To provide a yardstick against which actual results can be compared;
- (h) To show management which action is needed to remedy a situation.

### **3.9.2 Organisation for budgetary control**

These include:

- (a) *The Preparation of an Organization Chart:* This defines the functional responsibilities of each member of management and ensures that he knows his position in the company and his relationship to other members.
- (b) The *Budget Period* is the time to which the plan of action relates. Period budgets cover a fixed period of time, most commonly one year. They will be divided into shorter time periods, known as: control periods, for purposes of reporting control. With a one-year period budget, control periods may be 4 weeks [13 periods each year] or one month [12 periods each year]. Long-term budgets [for example, capital expenditure budgets] may be for periods of up to

five or ten years, or even longer.

- (c) *Budget manual*-The organization for budgeting [and budgetary control] should be documented in a budget manual, which has been described as a "procedure or rule book which 'sets out standing instructions governing the responsibilities of persons, and the procedures, forms and records relating to the preparation and use of budgets". (CIMA)

Even though organisations are different, the content of a manual are:

- (a) Description of budgetary planning and control;
  - (b) Goals of each level of the budgetary process;
  - (c) Association with long term planning;
  - (d) Nature of organogram depicting duties and level of budget officers;
  - (e) Analysis of relevant budgets and association with accounting activities;
  - (f) Description of principal budgets;
  - (g) Composition of budget committee and mode of operation;
  - (h) Modalities for the preparation and publication of budget;
  - (i) Designation and responsibility of the budget manager;
  - (j) Chart for codes;
  - (k) Design and nature of form; and
  - (l) Mode of operation especially where they concern procedures for accounting, preparation of reports and dead line for the submission of such reports/budgets.
- (d) *Budget Committee*: The overall responsibility for budget preparation and administration should be given to a Budget Committee, normally chaired by the chief executive of the organization, with departmental heads or senior managers as members. The purpose of the committee is to:
- (i) ensure the active co-operation of departmental managers, and to act as a forum in which differences of opinion can be argued out and reconciled;
  - (ii) ensure that managers in the organization understand what other departments are trying to do;
  - (iii) establish long-term plans around which the budgets should be built, and then to identify budget objectives;
  - (iv) review departmental budgets;
  - (v) during the year, examine reports showing actual performance compared with budget and expectations.
- (e) *The Budget Officer*: He controls the budget administration on a day to day basis. He will be responsible to the budget committee and should ensure that its decisions are transmitted to the appropriate people and relevant data and opinions are presented for its consideration. He will normally also have the vital job of educating and selling the budget idea. Since the master budget is summarized in cost statements and financial reports the budget officer is

usually an accountant.

- (f) *The Introduction of Adequate Accounting & Records:* It is imperative that the accounting system should be able to record and analyse the information required. A chart of accounts should be maintained which corresponds with the budget centres.
- (g) *The General Instruction on Techniques to all concerned in Operating the System:* Each person must feel that he is capable of carrying out the budgeted programme.
- (h) *Budget Centres:* An organisation's planned activities are divided into separate areas known as budget centres or cost centres. Each area selected as a budget centre must be clearly definable, and should be the natural responsibility of one particular manager [or supervisor]. A separate budget is prepared for each budget [or cost] centre. The 'budget centre budgets are known as departmental budgets. Departmental budgets are often used to build up budgets for overhead costs, that is:
  - (i) the production overhead budget will be compiled from separate budgets for the production departments, maintenance, production planning, quality control, etc
  - (ii) the administration budget will be compiled from separate budgets for personnel, finance, management services, data processing etc;
  - (iii) the selling and distribution budget will be the amalgamation of budgets prepared by sales office managers, marketing managers, warehouse and transport managers.
  - (iv) the research and development budget.
- (i) *Principal Budget Factor:* This is also known as the key budgeting factor or limiting budget factor. The first task in budgeting is to identify the factors which impose limitation or ceilings on the level of activity. It is usually sales demand; but it may also be limitations on any resource-materials, labour, machine time, working capital, etc. Once this factor is defined, the rest of the budget can be prepared. It determines priorities functional budgets, for example, it may be material, labour or plant.

Management may not know in advance which is the principal budget factor. One method to identify this factor is to prepare a draft sales budget, and then consider whether any resource shortage prevents this level of sales from being met.

- (j) *Level of Activity:* it will be necessary to establish the normal level of activity, that is, the level the company can reasonably be expected to achieve: quantity to produce, quantity to be sold, etc.



## 4.0 CONCLUSIONS

Budgeting or short term planning is the process by which the long term corporate plan is converted into action or activities.

A budgetary system ensures co-ordination, assignment of responsibilities, communication, control, motivation, direction and goal congruency. This will help to avoid sub - optimality.

A budgetary system must fulfill the following conditions for it to be successful: support of the top management, clear definition, full involvement of everyone at all levels, appropriate accounting system put in place and administration in a flexible manner.

Of importance to any budgeting activity is the availability of budget manual, budget committee and budget officer. All the various budgets are related and composite to form the master budget.

The various methods adopted in budgeting are zero based budgeting (ZBB), programme planning and budgeting systems (PPBS), Incremental budgeting method, rolling budget etc.

## 5.0 SUMMARY

Every organization needs to plan and consider how to confront future potential risks and opportunities. In most organisations, this process is formalized by preparing annual budgets and monitoring performance against the budgets. Budgets are mainly a collection of plans and forecasts. They reflect the financial implications of business plans, identifying, the amount, quality and timing of resources needed.

## 6.0 TUTOR MARKED ASSIGNMENT

1. When preparing a production budget, the quantity to be produced equals
  - A sales quantity + opening stock + closing stock
  - B sales quantity - opening stock + closing stock
  - C sales quantity - opening stock - closing Stock
  - D sales quantity + opening stock - closing stock
  - F sales quantity.
2. ABIBATU Limited is currently preparing its production budget for product Z for the forth coming year. The sales director has confirmed that he requires 60,000 units of product Z. Opening stock is estimated to be 6,500 units and the company wishes to reduce stock at the end of the year by 50%. How many units of product Z will need to be produced?
  - A 56,750 units
  - B 60,000 units

- C 63.250 units
  - D 66.500 units
  - E 67.250 units
3. The budgeting process is
    - A Purely a marketing function
    - B Purely a production function to forestall products deficiency
    - C Purely a purchasing function
    - D An overall company function moderated by the Accountant
    - E Purely an accounting function.
  4. A zero-based budget
    - A is prepared up without regard to historical records
    - B figures are rounded up to the nearest thousand
    - C uniform incremental percentage of past performances
    - D is also known as flexible budget
    - E is the budget for not profit organizations.
  5. In the context of budget preparation the term “goal congruence” is
    - A the alignment of budget with objectives using feed-forward control
    - B the setting of a budget which does not include budget bias
    - C the alignment of corporate objectives with the personnel objectives of a manager
    - D the use of aspiration levels to set efficiency
    - E fixed in nature.
  6. What is a master budget?
  7. Describe three stages in the budgeting process in chronological order.
  8. Mention three function/purpose of budgets.
  9. Explain what is meant by the term “planning, programming, budgeting systems”.
  10. What is a Discretionary cost?

## **7.0 REFERENCES/FURTHER READINGS**

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## UNIT 9      STANDARD COSTING

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### 1.0 INTRODUCTION

In this unit, we shall look at a financial control system that enables the deviations from budget to be analyzed in detail, thus enabling costs to be controlled more effectively. This system of control is called standard costing. We shall consider how a standard costing operates and how the variances are calculated.

## 2.0 OBJECTIVES

At the end of this chapter, readers will be able to understand:

- The difference between standard cost and standard costing;
- The different types of standards and capacity levels;
- The standard costing techniques and the associated objectives;
- How to apply the various principles required for the computation of variances;
- The concept of standard hour and computation of the capacity, efficiency and activity ratios.
- How to apply the principles of marginal costing in standard costing.

## 3.0 MAIN CONTENT

### 3.1 A STANDARD COST

This is defined as "*the planned unit cost of the products, components or services produced in a period. The standard cost may be determined on a number of bases. The main uses of standard costs are in performance measurement control, stock valuation and in the establishment of selling prices*". (CIMA)

A standard cost, apart from being related to production costs, may also be looked at from the view point of selling and distribution costs, administration costs, etc.

A standard cost can be meaningful if based on good production systems, work methods and measurement, labour and material rate forecasts as well as peculiarities of materials required.

Standard costs can be applied to both absorption and marginal costing techniques, in that:

- (a) Fixed costs, under absorption costing, are determined on total basis and the machine hour or direct labour hour basis can be adopted to absorb them into the standard unit costs;
- (b) The basis for determining the variable cost content of the direct materials and labour is the unit basis;
- (c) Even though the variable overhead costs can be budgeted in total, they can be identified on a unit basis, thus ensuring the determination of hourly cost and unit cost.

### 3.2 STANDARD COSTING

This is a useful control technique based on the feedback control concept which ensures the determination of standard costs of products or services and compares them with the actual results and costs with the difference being referred to as a variance. This difference can be further explained by a process called variance analysis.

The standard costing technique can be of use in a number of circumstances such as: where there is repetition of jobs and large production activities (process); service industries (hospital, merchandising) etc.

### **Reasons for adopting a standard costing techniques**

Some of the basic reasons for adopting a standard costing technique are:

- (a) To encourage management and employees, since it ensures that they have to plan ahead;
- (b) To serve as the basis for quoting for jobs or fixing prices;
- (c) To ensure that performance improvement measures are adequately guided;
- (d) To provide the basis for setting budgets;
- (e) To ensure that standards are put in place and variances properly analysed in order to control costs;
- (f) To provide the basis for allocating duties in order to check inefficiencies or take advantage of opportunities;
- (g) To serve as basis for determining unprofitable ventures; and
- (h) To ensure that stocks and work-in-progress are Properly valued.

### **Drawbacks/Disadvantages of the technique:**

The following are the disadvantages of standard costing;

- (a) Lack of understanding of its application could bring about resistance from the employees.
- (b) Confidence of the users may be eroded, especially where they become outdated.
- (c) The technique may be very expensive to operate especially where technicalities are involved and set-up time is elongated.
- (d) It may not be appropriate for business use, if standard costs are not properly determined.

## **3.3 SETTING OF STANDARDS**

### **3.3.1 Types of Standards**

Performance standards setting are a function of four basic standards:

- (a) **Ideal Standards:** These are based on perfect operating conditions whereby there are no wastages, inefficiencies, idle-time, breakdown of machines etc. Variances relating to ideal standards are beneficial in showing aspects requiring verification, thus, bringing about some savings. Ideal standards are not necessarily of encouraging status in that staff may be of the opinion that the objectives are not achievable, therefore, resulting in less efforts being put into the work by the labour force.
- (b) **Basic Standards:** These are standards which remained unaltered over a long span of time and they may become outdated as a result of changes in technology, laws, norms etc. They can only be used to express changes in the level of efficiency or performance over a period of time and as well as the trend of prices from period to period.  
Nonetheless, the drawbacks are:
  - (i) The standard may become useless as a result of the changes in price and

- efficiency levels;
  - (ii) After the first year, the fixed overhead aspect of basic standard cost computed on annual basis from the budget, may have little or no impact.
- (c) **Current Standards:** They are based on current conditions of service or production, for example, current losses, inadequacies etc. However, they do not seem to bring about a higher current level of performance.
- (d) **Attainable/Expected Standards:** They are a function of normal operating circumstances, thus ensuring that some allowances are available for losses, wastages, inadequacies, etc. They make for a challenging situation for employees in as much as psychological awareness is created.

### 3.3.2 Capacity Levels

Since standards cannot be set on their own, it is therefore necessary for capacity levels that give meaning to standards set to be discussed here. The capacity levels include:

- (a) **Full Capacity:** It is the "production volume expressed in standard hours that could be achieved if sales order, supplier and work force were available for all installed work places" (CIMA).

Under this circumstance, full capacity can be related to ideal standards with the assumption that labour shortages, shortfall in supplies, equipment breakdown will not affect the smooth running of the production processes.

- (b) **Practical Capacity:** This is "full capacity less an allowance for known unavoidable volume losses" (CIMA). Some examples of unavoidable losses are: repair time for equipment and plants, job resetting times, machine breakdown etc.

Therefore, since full capacity is more than the practical capacity, the latter can be related to attainable standards.

- (c) **Budgeted Capacity:** It is the "standard hours planned for the period, taking into account budgeted sales, suppliers and work force availability " (CIMA).

In effect, it is the labour hours and machine hours required to have the budgeted units and can be a function of current standards that are not peculiar to normal practical capacity over an extended period of time.

- (d) **Idle Capacity:** This is the difference between the practical capacity and the budgeted capacity based on standard hours of output. This is the unutilized capacity that is not required, in that, the budgeted volume is less than the practical volume that could be achieved.

### **3.3.3 Need for Revising Standards**

The unexpected change(s) in the economy as a result of change(s) in economic and socio-political situations could make for the unreasonableness of standard costs. It should be noted that the said change(s) could bring about inconsistency in the application of the standard costs which may eventually lead to a high cost of operation especially when inflation constitutes a determining factor. Therefore, in practice, the revision of standard cost should be done on a yearly basis, with the action being taken at the beginning of every accounting year.

### **3.3.4 Shortcomings of Setting Standard Costs**

The shortcomings that can be associated with the setting of standard costs may include:

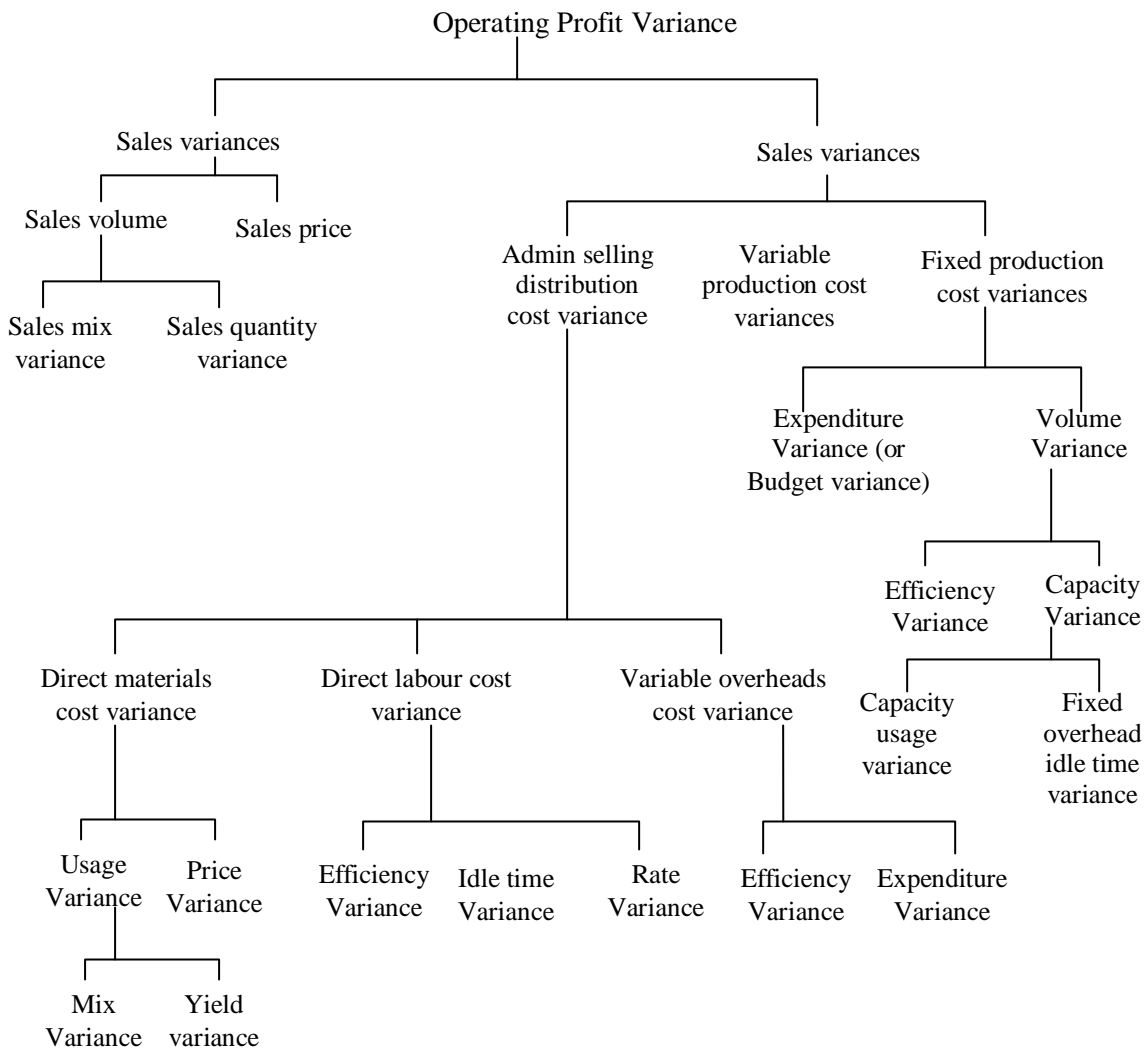
- (a) The significant influence of quantity discounts and cyclical price changes that may make it difficult to determine the prices of materials.
- (b) If is desired to have a mix of the constituents parts of materials, it may be difficult to determine the proportion of the mix of the constituent parts of the materials.
- (c) It may not be easy to come up with the appropriate wage efficiency standard.
- (d) The manner of introducing the issue of inflation into predetermined unit costs is also a matter of concern.
- (e) Even though good materials may be expensive to obtain, the issue is how to determine the quality to be utilized per time may not be easy especially when there is the need to reduce material losses and spoilage





### 3.4 VARIANCE ANALYSIS

The process of further explaining the difference(s) between the actual costs or results and the predetermined costs or results is referred to as variance analysis. The various variances can be depicted in the form of a diagram in order to have an effective picture of what they look like. See figure 9.1 below



**Figure 9.1: Summary of Variances**

#### 3.4.1 Basic Variances

The basic variances can be categorised under four main headings:

- Sales volume variance.
- Sales price variance.
- Variable cost variances, that is, direct materials; direct labour and variable overheads (which can also be sub-divided into spending and efficiency variances).
- Fixed overhead cost variances, that is, expenditure and volume variances (which can be further categorised into efficiency and capacity variances (which

can also be sub-divided into capacity usage and fixed overhead idle-time variance).

- I **Sales Margin Variance** - is the difference between the predetermined margin from turnover and the actual margin derived when the cost of goods sold is based on the standard cost of manufacturing goods or products.

This can be further analysed into sales margin price variance and sales margin quantity variance with the objective of being able to control the profit from sales whereby all the products are expressed at standard production costs in order to carry out the sales margin variance analysis.

## II **Variable Cost Variances**

Variable cost variances, in case of materials, labour or overheads, are all determined in the same manner. The total cost variance for each type of variable costs is classified as:

- (a) Price, rate or expenditure variance, whereby:
- (i) The actual price of a unit of raw material is different from the predetermined or standard price.
  - (ii) The actual rate per direct labour hour is different from the standard labour rate.
  - (iii) The actual rate per hour of expenditure on variable production overhead is not the same with the standard rate of spending.
- (b) Efficiency or usage variance; that is,
- Material usage variance:**
- (i) The quantity of materials put in to have the output is different from the standard or required usage.
  - (ii) Labour efficiency variance/variable overhead efficiency variance: The actual time of spending the output is different from the standard time allowed, with effects on both direct labour and variable production overhead costs.
- Direct labour efficiency variance and variable production overhead variance require the same number of hours.
- (iii) Labour idle time variance; This involves the actual hours for which no productive efforts were made. Thus, the direct labour costs are affected without any effect on variable overhead expenditure, since they are not incurred when idle time are being accounted for in term of the variance element.

It is important to note that price or expenditure variances are measured in money terms, for example, Naira, Cedis, etc. while

efficiency variances are measured in quantities (hours, kilograms, litres etc) after which they are expressed in monetary terms at the standard cost per unit of labour, material or variable overheads.

### **III Fixed Cost Variance**

The fixed cost variance is a function of the magnitude of fixed overhead over-absorbed in the production process. Thus:

- (a) The manufacturing fixed cost volume variance, is the difference between predetermined and actual production volumes multiplied by the absorption rate in order to have the monetary values of the volume so involved.
- (b) The difference between the actual and predetermined production volumes can be expressed in two ways:
  - (i) Since the efforts put in by the labour force will determine the degree of output, then, the fixed production overhead efficiency variance is the same as the direct labour efficiency variance.
  - (ii) If the actual hours involved is greater or less than the predetermined hours, thus resulting in more or less output and the predetermined hours put in represent normal capacity, then the capacity variance will be measured in standard hours and expressed in monetary terms at the standard absorption rate per hour.

#### **3.4.2 Why Cost Variances?**

Expected standards of performance are set for a firm's operations taking into account wastage and lost time. The standards try to be realistic by setting levels of attainable performance which do not necessarily correspond with current levels of performance, if management considers that any particular operation for which standards are set is not meeting its capability.

Variances show those situations where actual results are not as budgeted. They depict the difference between standard and actual for each element of cost and sometimes for sales. If actual operations outweighed the planned, a favourable variance is arrived at, (F) and where the reverse is the case, an adverse variance arises (A).

#### **Computation of Variances**

Variances may be computed as follows:

##### **(a) Material cost variances**

The material cost variance shows the difference between the actual costs incurred and the standard costs. It is calculated as Standard cost less actual cost, that is, (SC - AC).

These variances can be sub-analysed into price and usage variances so that the variance is attributed to the manager who has the responsibility for controlling it. Usage Variance can further be analysed into mix and yield. The standard cost is determined by multiplying the standard specified actual quantity of output by the standard cost per unit of output.

**(i) Material price variance**

This is derived by multiplying the difference between the standard price and actual price by the actual quantity of materials purchased. It is calculated as:  $AQ (SP - AP)$ . This variance may occur because of:

- Material price changes.
- Reduction in supply of materials.
- Ineffective purchasing policy.
- Non-availability of storage space.
- Insufficient funds.
- Purchasing mistakes.
- Reversal of specification standards.

**(ii) Material usage variance**

This is determined by multiplying the difference between the standard quantity and the actual quantity by the standard price of quantity used. **The** standard quantity is expressed as a function of the actual quantity produced at the standard specifications. It is calculated as  $SP (SQ - AQ)$ .

The material usage variance can be sub-divided into mix and yield variances:

- **Material Mix Variance** — This can be computed by multiplying the difference between the standard specification of the material input and the actual mix used by the standard price. That is,  $SP (SM - AM)$ .
- **Material Yield Variance** — This can be expressed as the difference between the standard yield and the actual yield from the materials used in production. That is,  $SC (AQSM - SQSM)$ .

**(b) Wages cost variance**

Wage cost variance is the difference between the standard wage cost of actual output and the labour cost paid for. It is commonly separated into wage rate variance, an idle time variance and efficiency variance.

Standard cost is the actual quantities produced at standard hours specified multiplied by standard rate per hour. It is calculated as the difference between standard cost and actual cost, that is,  $SC - AC$ .

- **Wage Rate Variance** —

This is the difference between the standard wage rate and the wage rate

actually paid, multiplied by the actual hours worked, that is, AH (SR - AR).

The foreman is to ensure that the machines are operated by the employees with the requisite skills as the wage negotiation is a national policy and not that of an individual.

- **Wage Usage Variance**

This is as a result of the difference between standard labour hours of actual output and the labour hours actually paid for multiplied by the standard rate per hour, that is, SR (SH - AH). The wage usage variance can be sub-divided into an idle time and efficiency variance. Standard hour (SH) is the actual quantity of output based on specific standard hour.

- **Idle Time Variance** — This is the difference resulting from hours lost through unexpected situations, such as machine breakdown, lack of materials or tools, etc. (unexpected idle time multiplied by standard hour).
- **Efficiency Variance** – This is the variance resulting from the difference between the standard labour hours of actual output and the useful labour hours actually worked. This is represented by Standard Labour Cost of Actual output and standard cost of useful hours worked multiplied by the standard rate of pay; that is, SR (SH – AUH). Therefore, hours paid for less idle time equals Actual Useful Hours (AUH).

(c) **Variable Overhead Variance**

Variable overhead can be absorbed into production on the basis of units of output produced or standard hours used in production. Where standard hours are adopted as the strength for determining the level of activity, the variable overhead absorption rate can be computed as:

$$\text{OAR} = \frac{\text{Predetermined Variable Overhead}}{\text{Predetermined Standard Hours}}$$

Where the OAR = Overhead Absorption Rate

Therefore, the difference between the variable overhead absorbed for actual production and the actual variable overhead expenditure is termed the *total variable overhead variance*.

The variable overhead variance can be sub-divided into expenditure variance and efficiency variance.

- **Expenditure Variance:** This is as a result of the difference between actual cost and standard cost for the actual level of activity. It is to be taken that where the determination of level of activity is a function of the actual activity labour hours, the actual activity is the number of labour

hours for which the work was performed. It is calculated as the difference between standard rate and actual rate multiplied by the actual hour.

- **Efficiency Variance:** This is as a result of the difference in the labour hours worked and the standard hours equivalent of actual production, multiplied by the standard cost or rate. It is expected that the activity level will be measured in labour hours for the purpose of determining the variable overhead absorption rate. Its formula is  $SR (SH - AH)$ .

**(d) Fixed Overhead Variance**

Fixed Overhead cost is a cost that will not change within a given level of activity, but overhead absorption rate per unit will be charged to products, Nonetheless, it is normal to compute a budgeted fixed overhead absorption rate whenever product cost and valuation of stock are required.

Fixed Overhead Absorption Rate (FOAR)

$$= \frac{\text{Predetermined Fixed Overhead}}{\text{Predetermined Standard Hours}}$$

Therefore, the difference between the fixed overhead absorbed by the actual production and the actual fixed overhead for the period is referred to as *total fixed overhead variance*. Its formula is given as  $(SC - AC)$ .

- (i) Fixed Overhead Expenditure Variance** - This is the difference between the actual and predetermined cost of overhead. The degree of spending on the fixed overhead is not affected by the volume of activity. Therefore, the difference between the standard overhead stated in the budget and the actual overhead incurred is referred to as expenditure variance. Budgeted Fixed Overhead (BFO) is the budgeted quantities at standard hours specified multiplied by standard rate per hour. Its formula is  $BFO - AFO$ .
- (ii) Fixed Overhead Volume Variance** — This is the difference between the standard fixed overhead elements of actual output and the standard fixed overhead in the budget. Its formulae is given as  $SR (BR - SH)$ .

The fixed overhead volume variance can be further analysed into efficiency and capacity variances.

- **Efficiency Variance** - This is the difference in the standard efficiency and the efficiency actually attained. Its formulae is  $SR (SH - AUH)$  (Standard hours - Useful hours) x Standard Absorption Rate (SH - Actual Hours worked (AH)).
- **Capacity Variance** - This is the difference in the budgeted activity and the level of activity actually attained. That is, Standard Rate (Budgeted Hours - Actual Useful Hours).

**(e) Sales Variance**

A sales variance is used to give effect to the difference between budgeted sales and actual sales and can be further sub-divided into a sales price variance and sales volume variance.

These variances may be related to sales profit or sales contribution, with the assertion that those related to profit or contribution ensure the provision of effective information.

- (i) **Sales Price Variance** - This variance is used to determine the effect of selling output above or below the predetermined selling price. Its formulae is:  $AQ (SSP - ASP)$ .
- (ii) **Sales Volume Variances** - This variance is used to determine the effect on profit or contribution on selling more or less than the predetermined quantity. Its formulae is  $SP (BQ - A QS)$ , where, BQ = budgeted quantity and AQS = actual quantity sold.

Where the valuation of the variance is based on the standard profit per unit, it shows the difference between budgeted standard profit and the standard profit earned on actual sales. On the other hand, if it is at standard selling price, it shows the difference between budgeted sales revenue and actual sales at a standard price.

Where the standard marginal costing is used, all final products are valued at a standard marginal cost, therefore, ensuring that all fixed overheads are treated as period costs against the contribution made in the budgeted period, thus making it impossible to absorb them into product costs.

The variances under the standard marginal costing approach are the same as those of the budgetary control where the standard costs are not existence:

- (a) Since fixed overheads are not absorbed into product cost, then, there exists fixed overhead expenditure variance and no fixed volume variance.
- (b) Sales volume variance can be computed, thus: volume variance in units multiplied by standard contribution per unit.

**ILLUSTRATION 9-1**

Dapo Ltd produces thatched roofs for houses. The budget for 2006 was as follows:

	N	
Number of houses to be thatched		140 roofs
		N
Revenue		6,000
Standard cost per roof:		
Direct materials:		
Thatch: 2 tons @ N400 per ton	800	
Other materials	300	

Direct labour 300 hours @N5	1,500	
Variable production overhead 300 hours @N1.0	300	
Fixed production overhead: 300 hours @N7.0	<u>2,100</u>	
Standard cost		<u>5,000</u>
Standard profit.		<u>1,000</u>

**Note:**

- (a) The budgeted fixed production overhead was N147,000, from which the standard absorption rate of  $\frac{294,000}{(140 \times 300 \text{ hours})} = \text{N}7.00$  per standard hour was derived
- (b) Since one thatched roof equals 300 standard hours = N2,100.
- (c) There is additional budgeted overhead for selling and administration of N30,000. This expenditure is regarded as a fixed cost.

Actual results in 2006 were as follows

Number of roofs thatched	150 roofs
Revenue (Selling price per roof 5,760)	N864,000
Thatch:	
Purchase 360 tons, cost	N133,200
Used 340 tons	
Other direct material, cost	N48,000
Direct labour:	52,000 hours
Hours worked (active time)	44,000 hours
Hours of idle time	8,000 hours
Cost of hours paid for	N288,000
Variable production overhead	N46,000
Fixed production overhead	N304,000
Sales and administration overhead	N32,000

*Required:*

- (a) Prepare an operating statement reconciling the budgeted profit with the actual profit. All closing stock are valued at standard cost.
- (b) An explanation of the possible interdependence between variances.

**SUGGESTED SOLUTION 9-1**

**DAPO LTD**

- (a) The budgeted profit, before deducting sales and administration costs was  $(140 \times \text{N}1,000) = \text{N}140,000$ .



(b) The calculation of actual profit begins with:

	N	
<b>Actual Sales</b>		864,000
Less: Actual standard production		
Cost of sales (150 x N5,000)		<u>750,000</u>
Unadjusted profit		<u>114,000</u>

(c) From this unadjusted profit, adjustments are made for cost variances. All cost variances reported are written as an adjustment to the profit and loss account at the end of the accounting period.

### Direct Materials

(i) *Direct material price variance*

This variance measures the actual purchase price for materials against the expected price:

	N	
360 tons of Thatch purchased should cost (360 x N400)		114,000
but did cost		<u>133,200</u>
Material price variance		<u>10,800(F)</u>

(ii) *Direct material usage variance*

This variance measures the efficiency in the usage or consumption of a material. Because it is a measure of efficiency (i.e. quantity) it must be measured in quantities –i.e. tons-and then valued in money terms by applying the standard cost per unit (ton) of material.

150 roofs were made and should be use (x2)	300 tons of thatch
they did use	340 tons
material usage variance – (Thatch)	40 tons (A)
Valued at standard price	<u>N400 per ton</u>
That is,	<u>N16,000(A)</u>

### *Other Direct Materials Variance*

Since we are not given the quantity of other materials per roof, nor the purchase price per unit of these other materials, the only variance we can calculate is the materials cost variance.

	N
Actual cost of 150 roofs (other materials)	48,000
Standard (expected) cost of 150 roofs (x N300)	<u>45,000</u>
Other direct materials cost variance	<u>3,000(A)</u>

### *Direct Labour Variances*

(a) The total cost variance for direct labour is:

	N
Actual labour cost of 150 roofs	288,000
Standard labour cost of 150 roofs (x N1,500)	<u>225,000</u>
Direct labour cost variance	<u>63,000(A)</u>

This variance need not be calculated, because we can analyse it in greater depth as the sum of the rate, idle time and efficiency variances.

- (b) *Direct labour rate variance* – This is the same type of variance as the materials price variance. It measures the actual price or rate paid per hour for labour against the actual rate per hour.

	N
52,000 hours were paid for and cost	288,000
They should cost (x N5 per hour x 52,000)	<u>260,000</u>
Direct labour rate variance	<u>28,000(A)</u>

- (c) *Idle time variance* – This is an inefficiency variance which is recorded in hours. It is valued in naira by applying the standard per hour; i.e.

$$8,000 \text{ hours (A)} \times \text{N}5 \text{ per hour} = \text{N}40,000(\text{A})$$

- (d) *Direct Labour efficiency variance* – This variance measures the efficiency (or inefficiency) of labour. Since idle time is measured separately, we are concerned with efficiency in active hours worked. It is calculated in the same way as the materials which is costed in N by applying the standard rate per hour.

150 roofs were made and should take (x 300)	45,000 hours
They did take (active hours)	<u>44,000</u> hours
Direct labour efficiency variances	<u>1,000</u> hours(F)
Valued at standard rate	N5 per hour
i.e.	N5,000 (F)

(e) <u>Summary</u>		N
Rate variance	(b)	28,000(A)
Idle time variance	(c)	40,000(A)
Efficiency variance	(d)	<u>5,000(F)</u>
Total labour cost variance	(a)	<u>63,000(A)</u>

### Variable Production overhead

- (a) The total cost variance for variable production overhead is:

	N
Actual cost of 150 roofs	46,000
Standard (expected) cost of 150 roofs (x N300)	<u>45,000</u>
Variable production overhead cost variance	<u>1,000(A)</u>

(b) It is usually assumed that variable overheads are incurred during **Active Working Hours**, but are not incurred during idle time. This means that the company, in our example, has had to pay for 44,000 hours of variable overhead expenditure, and not 52,000 hours.

(c) Variable production Overhead Expenditure variance – following on from (b) the expenditure variance may now be calculated in the same way as the materials price and labour rate variances.

44,000 hours of variable overhead expenditure	N
should cost (N1.00)	44,000
they cost	<u>46,000</u>
Variable overhead expenditure variance	<u>2,000(A)</u>

In other words, during 44,000 active hours of work, the expected spending at the standard hourly rate would be N44,000. The actual hourly rate was in excess of this and the total excess amounted to N2,000.

(d) Variable Production Overhead Efficiency Variance – This is exactly the same, in hours, as the direct efficiency variance. This is 1,000 hours (F) and is valued in N1 at the standard rate per hour for variable overhead (N1.00).

1,000 hours (F) x N1.00 per hour

Variable production overhead efficiency variance = N250(F)

(e) Summary		N
Expenditure variance	(c)	2,000(A)
Efficiency variance	(d)	1,000(F)
Total variable production overhead cost variance (a)		1,000(A)

### Fixed Production overheads

(a) In standard absorption costing, fixed overheads are absorbed into production costs at a standard cost per unit. For each roof that is thatched, a standard cost of N2,100 (300 standard hours of production) is applied to the cost of production.

(b) The standard cost of 150 roofs is therefore is 150 x N2,100 = N315,000. The actual cost of fixed production overhead was N304,000

	N
Absorbed (Standard) fixed overhead	315,000
Actual fixed overhead	<u>304,000</u>
	<u>11,000(F)</u>

This over-absorbed overhead is the fixed production overhead total cost variance.

(c) Fixed production overhead expenditure variance:

	N
Budgeted expenditure	294,000

Actual expenditure	<u>304,000</u>
Fixed production overhead volume variance	<u>10,000(A)</u>

- (d) Fixed production overhead volume variance;
- |                                    |                    |
|------------------------------------|--------------------|
| Budgeted production volume         | 140 roofs          |
| Actual production volume           | <u>150 roofs</u>   |
| Volume variance                    | <u>10 roofs(F)</u> |
| X Absorption rate (=standard rate) | N2,100 per roof    |
|                                    | N21,000 (F)        |
- (e) Fixed production overhead efficiency variance – This is exactly the same as the labour efficiency variance (in hours) but is valued at the standard fixed overhead absorption rate per hour
- |   |                |
|---|----------------|
| Efficiency variance                           | 1,000 hours(F) |
| Absorption rate per hour                      | N7.00per hour  |
| Fixed production overhead efficiency variance | N7,000(F)      |

- (f) Fixed production overhead capacity variance
- |  |                      |
|--|----------------------|
|  | Hours                |
| Budgeted hours of work (140 roofs x 300 hours) | 42,000               |
| Actual hours of work (active hour only)        | <u>44,000</u>        |
| Capacity variance                              | <u>2,000hours(F)</u> |

2,000 hours more work was done than budgeted. The expected over-absorption of overhead as a result of this capacity variance = 2,000hours (F) x N7.00 per hour = N14,000 (F)

- (g) Summary
- |  |                  |
|--|------------------|
|  | N                |
| Capacity variance (g)                        | 14,000(F)        |
| Efficiency variance (f)                      | <u>7,000(F)</u>  |
| Volume variance (d)                          | 21,000(F)        |
| Expenditure variance (c)                     | <u>10,000(A)</u> |
| Total fixed production overhead variance (b) | <u>11,000(F)</u> |

### Sales variance

- (a) Sales Price Variance
- |   |                  |
|---|------------------|
|   | N                |
| 150 thatched roofs should sell for x N6,000 | 900,000          |
| They did sell for                           | <u>864,000</u>   |
| Sales price variance                        | <u>36,000(A)</u> |

- (b) Sales Volume Variance
- (i) In standard absorption costing, fixed overhead costs increase with output, and the standard cost of sales increases by the full standard cost for each extra unit sold. The sales volume (margin) variance is calculated by applying the Standard Profit per unit and not the contribution per unit.

(ii) Standard profit used because a fixed production overhead volume variance is calculated. This is a further difference, therefore, from the calculation of variances in other types of budgetary control.

- if a fixed production overhead volume variance is calculated, the sales volume variance is based on standard profit.
- where a fixed production overhead volume variance is calculated, the sales volume variance is based on standard contribution.

(iii) In our example:

Budgeted sales volume	140 roofs
Actual sales volume	<u>150</u> roofs
Sales volume variances	<u>10</u> roofs(F)
X Standard profit per unit	<u>x 1,000</u>
Sales volume (margin) variance	<u>N10,000(F)</u>

Sales and administration overheads are not absorbed into standard units costs. They are fixed costs, and the only variance is an expenditure variances.

	N
Budgeted expenditure	30,000
Actual expenditure	<u>32,000</u>
Expenditure variance	<u>2,000 (A)</u>

### Reconciliation of Operating Statement for 2006

	N	N
Budgeted profit, before sales and admin. O/H(140 roofs x N1,000)		
140,000		
Overhead		
Sales variance		
Sales price	36,000 (A)	
Sales volume	<u>10,000 (F)</u>	
<u>26,000(A)</u>		
Actual sales minus standard production		
Costs of sales		114,000
Cost variance	(F)	(A)
Direct materials:		
Thatch price	10,800	
Thatch usage		16,000
Other materials cost		3,000
Direct labour:		
Rate		28,000
Idle time		40,000
Efficiency	5,000	
Variable Production overheads:		
Expenditure		2,000
Efficiency	1,000	
Fixed production overheads:		10,000

Expenditure	7,000		
Efficiency	<u>14,000</u>		
Capacity	<u>37,800</u>	<u>99,000</u>	61,200(A)
			52,800
Less: increase in closing stock (20 x N400)			<u>8,000</u>
Actual profit before sales and admin overhead			<u>44,800</u>
Costs:			
Budgeted sales & admin costs	30,000		
Expenditure variance (30,000 – 32,000)	<u>2,000</u>		
			<u>(32,000)</u>
Actual profit			<u>12,800</u>

Confirmation of Actual Result:	N	N
Revenue		864,000
Less Costs:		
Thatch	133,200	
Other materials	48,000	
Labour	288,000	
Variable production overhead	46,000	
Fixed production overhead	<u>304,000</u>	<u>819,200</u>
		44,800
Sales and admin. Overhead		(32,000)
	<u>12,800</u>	

### 3.4.3 Interdependence between variances

Interdependence between variances is a term adopted to describe the way in which the reason for one variance may be wholly or partly stated by the reason for another variance. In the example above:

- the material price variance for thatch was N10,800(F) and the usage variance N16,000(A). It is possible that by buying a cheaper type of thatch (and earning a favourable purchasing variance) the purchasing manager has obtained lower quality materials, which explains the adverse usage in production;
- the sales volume variance is favourable (by roofs), but in order to obtain the extra business, the selling price per roof may have been reduced. The favourable sales volume variance and the adverse sales price variance may, therefore be, to a certain extent, interdependent;
- the favourable efficiency variances (labour, variable and fixed production costs) may be the result of using more highly skilled labour which is paid higher rate per hour. The favourable efficiency variances and the adverse labour rate variance may be interdependent.

### 3.4.4 Cost Accounting Entries

Variances are written to a variance account. There may be separate variance accounts for materials price, materials usage, labour rate etc. or there may be one single account for all the variances.

You should check the following T accounts, carefully, but the basic principles are:

- (a) material price variance is usually recorded in the stores account;
- (b) labour rate variance is usually recorded in the wages account;
- (c) material usage, labour efficiency and the idle time variances are recorded in the work in progress (WIP) account;
- (d) the cost ledger control account, in a system where cost accounts and financial accounts are not integrated, represents all those items which appear in the financial accounts but which are excluded from the cost accounts (e.g. debtors, creditors, cash, reserves etc.)

### SUGGESTED SOLUTION 9-2

(a) **Cost Ledger Control Account (CLC)**

	N		N
Sales account	95,600	Stores account	9,800
		Direct wages account	16,800
		Variable production overhead account	2,600
		Fixed production overhead a/c	42,300
		Sales admin. costs a/c	18,000
		P & L a/c (profit)	<u>6,100</u>
	<u>95,600</u>		<u>95,600</u>

(b) **Stores Ledger Control Account**

		N			N
Purchases (CLC)		9,800	WIP (2,300kg x N4)		9,200
			Material Price variance (Variance a/c)		<u>600</u>
		<u>9,800</u>			<u>9,800</u>

(c) **Direct Wages Control Account**

		—N			N
CLC		16,800	WIP (8,500hrs x N2)		17,000
Ratevariance (variance a/c)					
		<u>200</u>			
		<u>17,000</u>			<u>17,000</u>

(d) **Variable Production Overhead Control A/C**

		N			N
CLC		2,600	WIP (8,000 hrs @ N0.3)		2,400
			Expenditure		<u>200</u>
		<u>2,600</u>			<u>2,600</u>

(e) **Fixed Production Overhead Control Account**

		N			N
CLC		42,300	WIP(8,000hrs at N3.70)		29,600
			Expenditure variance		4,560
			Capacity variance		<u>8,140</u>
		<u>42,300</u>			<u>42,300</u>

(f) **Sales And Administration Costs Account**

		N			N
CLC		18,300	Cost of sales a/c		18,000

(g) **Work in Progress Control Account**

		—N			—N
Stores account		9,200	Finishedgoods account (4,850 x N14)		67,900
Direct wages account		17,000	Idle time variance		1,000



Variable overhead a/c	production	2,400	
Fixed overhead a/c	production	29,600	
Labour variance	efficiency	3,400	
Material usage variance		500	
Variable o'hd variance	efficiency	510	
Fixed o'hd variance	efficiency	<u>6,290</u>	
		<u>68,900</u>	<u>68,900</u>

(h) **Finished Goods Control Account**

	N		N
WIP a/c	<u>67,900</u>	Cost of sales a/c	<u>67,900</u>

(i) **Cost of Sales Control Account**

	N		N
Finished goods a/c	67,900	P & L a/c	85,900
Sales and admin	<u>18,000</u>		<u>85,900</u>
	<u>85,900</u>		<u>85,900</u>

(j) **Sales Account**

	N		N
P & L Account	<u>95,600</u>	CLC	<u>95,600</u>

(k) **Variations Account**

Stores a/c (Material price)	Direct wages (rate)
Variable overhead expenditure	Variable overhead efficiency (WIP)
Fixed overhead expenditure	Fixed overhead efficiency (WIP)
Fixed overhead capacity	Labour efficiency (WIP)

Idle time (WIP a/c)

Material usage (WIP)

P & L a/c

(1) **Profit and Loss Account**

	N		N
Cost of sales account	85,900	Sales account	95,600
Variance account	3,600		
Profit (CLC)	<u>6,100</u>		
	<u>95,600</u>		<u>95,600</u>

Note: That sales are recorded at the actual amount invoiced and that there are no sales variances at all in the accounts.

### 3.5 ADVANCED VARIANCES

#### 3.5.1 Material Variances – Mix and Yield

In Section 3.4.1 of this unit, the basic material variances were explained. In some situations, it may be necessary to further analyse the materials usage variances into direct material mix variance and direct material yield variance. This may be possible in situations where the manufacturing process require a mix of various material inputs in order to achieve the expected output such as: production of paints, textiles, roofing sheets etc. As in a normal process, losses could be caused by pilferage, machine break downs, power failure, evaporation etc.

There are basically two approaches to analysing material usage variance into mix and yield variances. The first is the individual price method under which individual standard prices are adopted for the components and the second is that which involves the usage of weighted average price for all components.

### 3.5.2 Individual Price Method – (Direct materials mix variance)

“A subset of the direct usage variance, applicable when materials are applied in a standard proportion showing the effect on cost of variations from the standard proportions.” (CIMA)

#### Direct Material yield variance

“A subset of the direct materials usage variance applicable when materials are combined in standard proportion.” (CIMA)

#### Mix and yield formulae (individual price method)

	<b>Budgeted Cost</b>			<b>Budgeted Cost</b>
Direct Materials	= of the actual quantity	minus		of the actual quantity of
Mixture Variance	of the actual mixture			the Budgeted mixture

	<b>Budgeted Cost</b>			<b>Budgeted Cost</b>
Direct Materials	= of the actual quantity	minus		of the Budgeted
	of the Budgeted			Quantity of the
	Mixture			Budgeted Mixture

#### Notes:

- (a) The mix and yield variances use only budgeted prices.
- (b) The change of expressions from actual to budgeted values
- (c) The yield variance measures abnormal process losses or gains

### 3.5.3 Weighted Average Price Method (Alternative Method)

Direct materials mix variance is “the difference between standard quantity of inputs for the output achieved and the actual quantity used priced at the difference between individual standard prices and weighted average standard price.” (CIMA)

Direct materials yield variance is the difference between the standard quantity of inputs for the output achieved and the actual quantity used priced at the weighted average standard price.

### 3.5.4 Sales Margin Variances

Apart from the cost variance analysis carried out from control reasons, other factors required for the realisation of planned profit is the effect of the sales margin whether

as profit margin in the case of absorption costing or the contribution margin where the marginal costing technique is applied. Under this circumstance, all products are valued at the standard factory cost in order to give effect to sales margin variance analysis. Therefore, the standard sales margin is actually the difference the budgeted selling price of a product and the related standard cost which could also be referred to as the budgeted profit for a product.

### **Total Sales margin variance**

This is the difference between the standard margin from sales and the actual margin when the cost of sales is treated at the standard cost of production. This can be sub-analysed into the sales margin price and quantity variances.

### **Sales margin price variance**

This is the difference between the standard margin per unit and the actual margin per unit for the quantity of units on sales in the period (CIMA).

### **Sales margin quantity variance**

“The difference between the actual total number of units at the actual mix and the actual total number of units at standard mix valued at the standard margin per unit.” (CIMA)

### **Sales margin volume variance**

“That portion of the sales margin quantity variance which is the difference between the actual total quantity of units sold and the budgeted total number of units at the standard mix valued at the standard margin per unit.” (CIMA)

## **ILLUSTRATION 9-3**

Ijaodola Ltd. produces and sells three product brands of lime. In a period, the budgeted and actual results were as follows:

Products	Volume Units	<b>Budget</b>		Total sales (₦)	Total margin (₦)
		Unit price (₦)	Margin (₦)		
Small Jar	500	20	8	10,000	4,000
Medium Jar	250	30	12	7,500	3,000
Large Jar	<u>50</u>	50	20	<u>2,500</u>	<u>1,000</u>
	<u>800</u>			<u>20,000</u>	<u>8,000</u>

Products	Volume Units	<b>Actual</b>		Total sales (₦)	Total margin (₦)
		Unit price (₦)	Margin (₦)		
Small Jar	430	18	6	7,740	2,580
Medium Jar	230	34	15	7,820	3,450

Large Jar	<u>40</u>	48	18	<u>1,920</u>	<u>720</u>
	<u>700</u>			<u>17,480</u>	<u>6,750</u>

Required:

Determine the following variances:

- Sales price
- Sales margin mix
- Sales margin volume
- Sales margin quantity variance

### SUGGESTED SOLUTION 9-3

(a)	Actual units @ Actual mix Actual margin	₦6,750	sales margin price variance ₦250 A	Sales margin Quantity Variance ₦1,000A	Total Sales Margin Variance ₦1,250 A
(b)	Actual usage Actual mix Standard margin	₦7,000	sales margin mix variance ₦8 F		
(c)	Actual usage Standard mix Standard margin	₦6,992	sales margin volume variance ₦1,008A		
(d)	Standard units Standard mix Standard margin	₦8,000			

**Note:**

- This is as given in the question ₦6,750.
- It is the actual units in the actual proportions but at the standard margin, that is,  $₦(430 \times 8) + (230 \times 12) + (40 \times 20) = ₦7,000$ .
- It is the actual number of units sold (700) but as the standard proportions (62.5%, 31.25%, 0.0625%).
- This is as given in the question ₦8,000.

The sales margin variance is derived by comparing the standard state with the actual state, that is,  $₦6,750 - ₦8,000 = ₦1,250A$

### 3.6 STANDARD MARGINAL COST

It is noteworthy to state that the total absorption costing principles form the basis on which standard costing systems operate. However, the marginal costing principles can also be introduced into standard costing operations, hence being referred to as standard marginal costing. It can also be recalled that marginal costing operates on the contribution approach, whereby costs are separated into variable and fixed costs and the latter are not part of product costs but are treated as period costs.

The standard marginal costing technique adopts the following principles and characteristics:

- Standards are evolved in the usual manner on standard cost card, without the inclusion of the fixed costs. The direct materials, direct labour, direct expenses and variable overheads are recorded on it.
- The standard selling price is determined by adding the budgeted contribution for every product to the budgeted marginal cost. Therefore, the budgeted sales margin is the budgeted contribution.
- The budgeted sales levels and fixed overhead cost can be used to come up with the budgeted profit statement for the subsequent operating period. The format would appear as below.

### **Budgeted Profit Statement for the Period ended**

	₦
Budgeted sales	XXX
(Budgeted no of units x budgeted selling price)	
Less: Budgeted cost of goods sold	<u>(XXX)</u>
(Budgeted no. of units x budgeted marginal cost per unit)	
= Budgeted Contribution	XXX
Less Budgeted fixed costs	<u>XXX</u>
Budgeted profit	<u>XXX</u>

With the non-inclusion of the fixed overhead volume variance and the sub-analysed variances (the capacity and efficiency variances), the analysis of variances becomes easier

### **3.7 OPPORTUNITY COST APPROACH TO VARIANCES**

These variances conform to the terminology of the Chartered Institute of Management Accountants. It is not uncommon in practice for additional ‘special’ variances to be included within a reporting system, to reflect the unique characteristics of a company’s operations, that is, a flour or sugar manufacturer might include an item in his standard costs for losses due to damaged or broken packs.

Nevertheless, most variance reporting systems conform on the whole to the conventional type.

A school of theorists, however, has suggested a different approach to the calculation of variances. The leading exponent of this school is Professor Joel Demski.

**Demski (1977)** argues that Existing internal accounting techniques of flexible budgeting and variance analysis are thought to be general purpose in nature, because of their emphasis on comparison between actual and planned results’.

Analysis of differences between actual and planned results, leads to the taking of remedial action as well as learning. Unfortunately, the price of this generality is an accounting model that merely monitors performance relative to the original plan, except as signalled by implication or use of an adjusted budget. Put another way, because of its emphasis on comparison between actual and planned results, and consequent disregard of changes in these planned results, the traditional accounting model does not act as an opportunity cost system.

### **3.7.1 Opportunity Cost Approach**

An opportunity cost approach ‘compares what a firm actually accomplished during some planning period with what it deems on the basis of hindsight, it should have accomplished. It is an opportunity cost approach in the sense that what a firm actually accomplished during some planning period is what it should have accomplished in the ex-post optimum programme’. Demski therefore argues that in order to provide control information which guides managers towards better control decisions, it is necessary to show what realistically could have been achieved during a period, rather than what the possibly-out-of-date budget plan intended to be achieved. ‘Instead of comparing actual results with ex ante standard results, this system compares actual results with revised optimum results.

‘This implies that the proper standard to be used in supplying variance information is a standard based on actual conditions; that is ‘those that would have been incorporated in the original plan if the actual conditions had been known in advance.’ We shall call this an ex-post (currently attainable) standard.’

The opportunity cost approach considers:

- (a) actual results;
- (b) budgeted results; and
- (c) ‘ex-post’ optimum results. Traditional variance analysis does not do this.

### **9.7.2 Marginal Costing and Opportunity Costs**

You may have noticed that in the previous examples, marginal costing variances were calculated, that is, sales volume variances were valued at contribution foregone and there are no fixed cost volume variances. This because contribution foregone, in terms of lost revenue or extra expenditure incurred, is the nearest equivalent to opportunity cost which is readily available to management accountants (who assume linearity of costs and revenues within a relevant range of activity).

### **3.7.3 The Opportunity Cost of Capacity Variances**

**Horngren (1990)** suggested that a ‘contribution foregone’ approach to reporting capacity variances would be preferable to the traditional absorption costing capacity variance.

### ILLUSTRATION 9-4

The Master budget of Jones Ltd for 1988 is to make and sell 100 units of its product each month, at a contribution of N50 per unit. However, at the beginning of May, the scheduled production for the month was reduced to 95 units because of difficulties in making sales to customers. Each unit takes 4 hours to make, and actual production and sales in May amounted to 90 units in 360 hours of work. Calculate the opportunity cost of the capacity variances.

### SUGGESTED SOLUTION 9-4

- (a) Scheduled production for May in the Master Budget 400 hours  
Schedule production at the beginning of the month 380 hours  
Marketing capacity variance 20hours(A)

At N50 per unit (N12.5 per hour), the contribution foregone is N250 by the failure of the sales department to achieve the expected sales.

- (b) Similarly;  
Scheduled production at the beginning of the month 380 hours  
Actual hours worked 360 hours  
Production capacity 20 hours (A)

The contribution foregone is N250 by the failure of the production department to meet its output targets.

(c)		N	N
	Budgeted Contribution		5,000
	Opportunity cost of		
	Marketing Capacity variance	250 (A)	
	Production Capacity variance	<u>250 (A)</u>	<u>500</u>
	Actual Contribution (90 units x N50)		<u>4,500</u>

### 3.7.4 The Opportunity Cost of Efficiency Variances

The same argument might be applied to efficiency variances. If inefficiency, by restricting output below what it should have been, also results in lost sales, the cost of inefficiency will include the contribution foregone by losing the sales.

### ILLUSTRATION 9-5

Ayo Wale Ltd budgets to make and sell 200 units of its product during a period. Unit costs are as follows:

	N	N
Sales		18
Direct materials	6	



Direct labour (5 hours per unit)	10	<u>16</u>
Contribution		<u>2</u>

During the period, the production department works for 1,000 hours and produced 175 units. The actual contribution was

	N	N
Sales (175 units at N18)		3,150
Direct Materials	1,000	
Direct Labour	2,000	<u>3,000</u>
Actual Contribution		<u>150</u>

Analyse the variance from an opportunity cost approach

### SUGGESTED SOLUTION 9-5

175 units should take (x 5 hours)	875 hours
but did take	1,000
Efficiency variance	125 hours (A)
x N2 per hour	N250 (A)

Inefficiency of 125 hours (A) has also cost the company lost production and sales of 25 units, and the contribution foregone from these sales at N2 per unit is N50 (A).

	N	N
Budgeted Contribution		400
Efficiency Variance		
Labour costs	250 (A)	
Lost sales volume	<u>50 (A)</u>	
	300 (A)	
Material cost variance	<u>50 (F)</u>	<u>250 (A)</u>
Actual contribution		<u>150</u>

### 3.8 PLANNING AND OPERATIONAL VARIANCES

Traditional variances imply that actual performance is always at fault, as a result of the method of analysing variances between operational and planning factors, that cause failure to achieve budgeted profit in that faulty standards could be identified separately.

Planning and operational variances provide additional relevant information as they separate the variances into components which are the result of good planning and operation.

When planning, variances may not be separated, some elements which are uncontrollable may work against the planning system. It must however be remembered that the Planning and Operational approach does not make the traditional approach absolute, but rather make the information of things more relevant especially in controlling the operation of the organization.

The main difficulty in this approach is the ability of the management to separate the total variances into their planning as well as operational sources, hence most organisations are slow in modifying their system in this direction.

### 3.8.1 Calculation of Planning and Operational Variances

In calculating planning and operational variances, we have to understand the following terms:

- (a) **Ex-Ante:** this is the first target set.
- (b) **Ex-Post:** this is the later situation during the year or immediately which were not foreseen during the first target (Budget);
- (c) **Actual Result:** this is actual result at the end of the period.

Planning Variances = Ex-Ante – Ex-Post  
Operational Variances = Ex-Post – Actual Result

Planning variances are those variances which are not within the control of management (Uncontrollable).

Operational variances are variances which are controllable by the management.

Planning variances may be due to the following:

- (a) New government policy on importation
- (b) New government policy on taxation
- (c) Inflation

#### ILLUSTRATION 9-6

In January 2004, Jaye Limited set a standard marginal cost for its major product at ₦50 per unit. The standard cost is re-calculated once each year.

Actual production costs during August 2004 were ₦608,000 when 8,500 units were made.

With the benefit of hindsight, the management of Jaye Limited realized that a more realistic standard cost for current conditions would be ₦80 per unit. The planned standard cost of ₦50 is unrealistically low:

#### SUGGESTED SOLUTION 9-6

With the benefits of hindsight, the realistic standard should have been ₦80. The variances caused by favourable or adverse operating performance, that is, the material price and usage, labour rate and efficiency variances etc – should be calculated by comparing actual results against this realistic standard. Since the variance should then

be a true reflection of operating performance, they will be called operational variances, that is, (Ex-post less Actual Result).

	N
8,500 units should (realistically have cost (x N80)	680,000
But did cost	<u>608,000</u>
Total operating variances	<u>72,000 F</u>

The planning variance reveals the extent to which the original standard would be at fault (Ex-Ante less Ex-Post).

	N
The original (ex-ante) standard cost 8,500units x N50 per unit	425,000
The realistic retrospective (ex-post) standard cost	
8,500 units x N80 per unit	<u>680,000</u>
Planning Variance	<u>255,000</u>

(Note: it is an adverse variance because the original standard was too optimistic, that is over-estimating the expecting profits by understating the standard cost).

	N
Planning	255,000
Operating variances	<u>(72,000)</u>
Total	<u>183,000</u>

If traditional variance analysis had been used, the total cost variance would have been the same, but the ‘blame’ would all appear to lie on actual results and operating inefficiencies.

	N
Standard cost (ex-ante) of 8,500 units (x N50)	425,000
Actual cost of 8,500 units	<u>608,000</u>
Total Cost Variance	<u>183,000</u>

Bromwich (1990) would argue that:

- (a) the total cost variance reported by the traditional method would not be helpful for management control purposes;
- (b) planning and operating variances give a better idea of why actual results failed to reach the original budget expectations. Operating variances may or may not be controllable, whereas planning variances tend to be uncontrollable. If the standard is wrong, no amount of control-action to adjust operating resources will reconcile actual results to the faulty budget. Nevertheless, planning variance reveals a severe weakness in a business organization in that failure to budget correctly may lead a company into severe financial difficulties or at best poor financial results for the accounting period. They need to be identified, albeit in hindsight, and eliminated as much as possible in future planning.

## ILLUSTRATION 9 – 7

Ayo limited budgeted to sell 10,000 units of a new product during 2005. The budget sales price was ₦20 per unit, and the variable cost ₦6 per unit. Although actual sales in 2005 were 10,000 units and variable costs of sales were ₦60,000. Sales revenue was only ₦10 per unit.

With the benefit of hindsight, it is realized that the budgeted sales price of N20 was hopelessly optimistic, and a price of N9 per unit would have been much more realistic.

**Required:** Analyse the variances into operating and planning variances.

## SUGGESTED SOLUTION 9 – 7

### AYO LIMITED

Budgeted Contribution	140,000 (₦14 per unit)
Actual contribution	<u>40,000</u> (₦4 per unit)
Total Variances	<u>50,000</u> (A)

The only variances are sales price variances.

Operating (Sales price) variance	₦
10,000 units sold for N10 each	100,000
but should (realistically) have been sold for N9 each	<u>90,000</u>
	<u>10,000</u> (F)

Planning (Sales price) variance:

	Volume	Sales Price	Variable Cost	Total Contribution
		₦	₦	₦
Ex-ante (original) budget	10,000 units	20	6	140,000
Ex-post (realistic) budget	10,000 units	9	6	<u>30,000</u>
Planning Variance		11 A per unit		<u>110,000</u> A

The total difference between budgeted and actual profit of N50,000 (A) can be analysed as:

	₦
Operating variance (sales price)	5,000 (F)
Planning Variance	<u>55,000</u> (A)
	<u>50,000</u> (A)

### 3.8.2 Importance and shortcomings of planning and Operational Variances

Even though, the conventional variances may not be analysed into the planning and operational elements, the importance cannot be underestimated and they include:

- Ensures an orderly manner of reviewing standards as well as the associated basis for setting them up.

- (b) Prompts the realistic nature of standard costing and variance analysis, especially where circumstances change and are drastic.
- (c) Ensures the usage of updated information, especially in the operational variances adopted for determining present levels of efficiency.
- (d) Since standard costing as a technique is realistic and informative, its acceptability will be on the high side and encourage motivation.
- (e) Since the planning efforts are enhanced, problem areas can be easily identified and actions taken as at when due.

Nonetheless, the shortcomings of the variances are:

- (a) The responsibility centres may experience some form of pressure especially where interpretation are involved in terms of controllable and uncontrollable activities or internal or external factors affecting planning and operating duties.
- (b) The determination and updating of additional variances entail many clerical and managerial efforts on a continuous basis.
- (c) The determination of the ex-post element may be subjective, hence resulting in the allotment of the planning and operational causal factors being political in nature.

### **3.9 CONTROL RATIOS**

The units of output can be shown in different variety of forms and for the purpose of standard costing. They are identified as a peculiar element/unit, that is the standard hour which is referred to as the quantity of production that should be produced in an hour.

A standard hour is a measure of the work content in an hour and not that of time involved or taken to produce. For example, if 500 units of a product should be produced in one hour, then output of 2000 units is equivalent to 4 standard hours.

Therefore, the relationship between standard hours and actual production can be expressed as control ratios. These are used to show the degree of efficient or inefficient utilization of resources at the disposal of management.

The following ratios can be computed:

#### **(a) Activity Ratio**

This ratio compares the actual level of production with the planned level of production.

It can be expressed as:

$$\frac{\text{Standard hours equivalent of actual production} \times 100}{\text{Budgeted hours}}$$

It is not a measure of efficiency, but indicates the level of activity which has, in fact, been achieved.

**(b) The Efficiency Ratio**

The ratio measures the efficiency with which production has been achieved. Actual time taken to achieve the actual production is compared with the time such production should have taken.

The efficiency ratio can be expressed as:

$$\frac{\text{Standard hours equivalent of actual production}}{\text{Actual hours worked}} \times 100$$

**(c) The Capacity Ratio**

This ratio assesses the utilization of the available capacity by comparing actual hours worked with budgeted hours.

$$\frac{\text{Actual hours worked}}{\text{Budgeted hours}} \times 100$$

It should be noted that:

Activity ratio = capacity ratio x efficiency ratio.

**ILLUSTRATION 9-8**

One of the departments of Lawal Company Limited produces two products “Gas oil” and “kerosene”. The standard times for the production of the products are 30 minutes for Gas oil and 24 minutes for kerosene. The budget for July is 24,000 units of Gas oil and 10,000 units of kerosene. During the month, 12,000 labour hours were worked and 20,000 units of Gas oil and 8,000 units of kerosene were produced. You are required to compute:

1. The activity ratio;
2. The efficiency ratio;
3. The capacity ratio and interpret your results.

**SUGGESTED SOLUTION 9-8**

**LAWAL LIMITED**

The Standard hours equivalent to actual production for July is:

		Standard Hours
Gas oil	20,000 x 30 =	10,000
	60	
Kerosene	8,000 x 30	

$$60 = \frac{3,200}{13,200}$$

The budget in terms of standard hours is:

			Budgeted Hours
Gas oil	24,000 x 30	=	12,000
	60		
Kerosene	10,000 x 30	=	<u>5,000</u>
	60		<u>17,000</u>

The control ratios are:

$$\begin{aligned}
 1. \quad \text{Activity Ratio} &= \frac{\text{Standard hours}}{\text{Budgeted hours}} \\
 &= \frac{13,200}{17,000} \times \frac{100}{1} = 77.6\%
 \end{aligned}$$

This means that the actual level of production is less than the budgeted level by 22.6%

$$\begin{aligned}
 2. \quad \text{Efficiency Ratio} &= \frac{\text{Standard hours}}{\text{Actual hours}} \\
 &= \frac{13,200}{12,000} \times \frac{100}{1} = 110\%
 \end{aligned}$$

This means that the actual level of production was achieved in less time than standard by working at a rate which was nearly 10% above the normal level of efficiency

$$\begin{aligned}
 3. \quad \text{Capacity Ratio} &= \frac{\text{Actual hours worked}}{\text{Budgeted hours}} \times \frac{100}{1} \\
 &= \frac{12,000}{17,000} \times \frac{100}{1} = 70.5\%
 \end{aligned}$$

This means that the actual hour worked were less than the budgeted hours by 30%.

#### 4.0 CONCLUSIONS

Standard costing involves comparing actual costs with predetermined costs.

The various types of standard are: basic standard, ideal standard, attainable standard and current standard.

Standards are expected to be reviewed on a periodic basis, for example, half yearly, or yearly.

Variance analysis is the process of analysing the total difference planned and actual performance into its components parts. They should not be considered in isolation.

The basic variances are those of material, labour and overhead.

The basic material variances measure the differences between actual and standard wage rates and actual and standard labour efficiency.

A standard hour is a unit measure of production not of time.

If total absorption principles of fixed and variable costs are absorbed into production, variances relating to both fixed and variable overheads will arise while in marginal costing only variable overheads are absorbed into production overheads. Material usage variance can be sub-divided into mix and yield variances.

Sales marginal variances can be sub-divided into price and quantity variances. Traditional variances can be separated into planning and operational variances with the attendant benefits whereby planning variances seek to measure that part of the total variance which is due to planning deficiencies whilst the operating variances seek to measure operating as compared to a realistic current standard.

## 5.0 SUMMARY

In this unit, we have discussed the standard setting process. We then looked at the relationship between budgetary control and standard costing. Finally, we calculated material, labour, overhead and sales margin variance.

## 6.0 TUTOR MARKED ASSIGNMENT

1. During a period, 17,500 hours were worked at a standard cost of ₦6.50 per hour. The labour efficiency variance was ₦7,800 favourable. How many standard hours were produced?
  - A. 1,200
  - B. 16,300
  - C. 17,500
  - D. 18,700
  - E. 18,400
2. Femi Limited has the following budget and actual data:

Budgeted fixed overhead cost	₦100,000
Budget production (units)	20,000
Actual fixed overhead cost	₦110,000
Actual production (units)	19,500

The fixed overhead volume variance is
  - A. ₦500 Adverse
  - B. ₦2,500 Adverse
  - C. ₦10,000 Adverse
  - D. ₦17,500 Adverse
  - E. ₦17,600 Favourable.
3. Lawani Limited uses standard costing system. It purchases a small component for which the following data are available.

Actual purchase quantity	6,800 units
Standard allowance for actual	5,400 units
Standard price	₦0.85



Material price variance (N544) Adverse

What was the actual price per unit?

- A. N0.75K
  - B. N0.77K
  - C. N0.93K
  - D. N0.95K
  - E. N1.00K
4. In a period, 11,280 kgs of materials were used at a total standard cost of N46,248. The material usage variance was N492 adverse. What was the standard allowed weight of material for the period?
- A. 11,520kgs
  - B. 11,280kgs
  - C. 11,394kgs
  - D. 11,160kgs
  - E. 11,180kgs
5. Under what circumstances will a (i) material mix (ii) material yield variance arise?
6. What is the formula for calculating sales mix variance?
7. Explain “Ex-Ante” and “Ex-Post” as planning variances concepts.

Use the below data to answer question 9 and 10.

8. Tayo purchased 19,000kgs raw materials at N11 per unit. The standard price is N10 per unit. What is the material price variance?

## 7.0 REFERENCES/FURTHER READINGS

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Faruonbi K. (2006) Management Accounting, Lagos: EL-Toda Ventures Ltd.  
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## **UNIT 10 COST OF CAPITAL**

### **CONTENTS**

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### **1.0 INTRODUCTION**

For any business venture to operate effectively it must have capital funds, that is, source(s) of financing its operations for example, profits ploughed back, funds brought in by the entrepreneur, shareholders' funds (ordinary and preference), debentures, long term loans and short term loans, overdraft, etc. However, these funds do not come free of charge because their usage in the business has made unavailable for other investments. Therefore, some costs are involved which are referred to as opportunity cost that is, alternative returns forgone in order to achieve a particular objective.

### **2.0 OBJECTIVES**

- In this unit, readers will be able to understand:
- The term 'Cost of Capital.'
- The sources of capital funds to an enterprise
- The different costs of funds and their computations.
- The variance cost models.
- The various cost concepts as they related to cost of capital – WACC and MCC
- The relationship between cost of capital and gearing.

- The various model of capital structure and the contributions for the determination of cost of capital as well as the acceptability of projects.

### **3.0 MAIN CONTENT**

#### **3.1 WHAT IS COST OF CAPITAL?**

Cost of capital can be defined as the minimum return required by providers of finance, over-time, in order to compensate them for not investing their funds in some other alternative businesses available to them. It is calculated on the basis of opportunity cost of different sources of finance, therefore, the most recent market values of such sources will always represent the investment outlay. The concept of cost of capital is a return or yield concept and can be represented in most cases as:

$$\text{Yield or Return} = \frac{\text{Interest}}{\text{Investment}}$$

The calculation of specific cost of the different sources of finance, that is, cost of capital which is synonymous with the cost of finance can therefore be determined from the under-mentioned variables as follows:

- Cost of Equity
- Cost of Retained Earnings or Profit
- Cost of Preference Shares
- Cost of Debentures
- Cost of Short-term funds
- Weighted average cost of capital

##### **3.1.1 Cost of Equity**

This refers to the returns on the investment due to the ordinary shareholders as a result of the capital they have provided for the company's use over a given financial period, that is, what the company has to give up in order to have a use of the shareholders funds. This can be determined based on the following situations namely;

- When there is a constant dividend rate.  
issue cost of transaction or cost of reduction in market per share is involved.
  - When there is a growth in the rate of dividend.
  - Constant dividend rate.
- (a) When the element of constant dividend is involved, the cost of obtaining or using equity funds is determined thus:

$$K_e = \frac{d}{MV_{ex-div}}$$

Where:  $K_e$  = Cost of Equity  
 $d$  = Dividend  
 $MV_{ex-div}$  = Market value excluding dividend

### ILLUSTRATION 10-1

Osimagba Plc has 200,000 25k ordinary shares currently valued at 40k. Cumulative dividend and the dividend which about to be paid is 4k. What is the company's cost of equity?

### SUGGESTED SOLUTION 10-1

Going by the above formulae, the cost of equity can be determined thus:

$$K_e = \frac{d}{MV_{ex-div}} = \frac{0.40}{0.36} = 11.11\%$$

(b) When issue cost of transaction is involved

If transaction costs or issue costs of flotation costs are involved, the cost of equity and in fact, the cost of any other source of finance will be redefined as follows:

$$K_e = \frac{d}{MV_{ex-div} - c}$$

Where:  $c$  = issue/transaction costs or reduction in market value per share

### ILLUSTRATION 10-2

From illustration 10-1 above, let us assume that in addition to the condition therein, the company intends to issue new shares which involves incurring issuing cost of 5k per share and reduction below market value of 10k per share would also be required to be made. Determine the company's cost of equity?

### SUGGESTED SOLUTION 10-2

Cost of equity is determined thus:

$$K_e = \frac{d}{MV_{ex-div} - c} = \frac{0.04}{0.40 - (0.04 + 0.05 + 0.1)}$$

$$= \frac{0.4}{(0.40 - 0.19)} = \frac{0.04}{0.21} = 19.05\%$$

### 3.1.2 Growth in Dividend Rate: Gordon's Growth Model

This is a model that has to do with share price movements which is a function of the fact that the present value of the anticipated future of dividends determines the price of shares.

This model is based on various assumptions, the basic elements of which are:

- (a) Investors act rationally with regard to future returns.
- (b) Investors have the same time preference which can be evaluated by discounting at the investors personal discount rate.
- (c) There is no inflation or taxation and that the future is known with certainty by all investors.

As deficient as the theory may be in practice, the application may be a good takeoff point in the prediction of cost of equity. Nonetheless, two further assumptions made for examination purposes are that: either constant dividend are paid each year to perpetuity or that there is a constant compound growth rate of dividends to perpetuity, that is, the dividend each year increases by the same percentage.

The formulae for the dividend valuation model are as follows:

- (i) Constant dividend to perpetuity

$$K_e = \frac{d}{M_v}$$

- (ii) Constant compound growth rate of dividends to perpetuity

$$K_e = \frac{d(1+g)}{M_v - c} + g$$

Where  $m_v$  = current market value per share

$d$  = dividend per share

$K_e$  = discount rate or personal discount rate

$g$  = growth rate of dividends

$c$  = issued transactions cost or reduction in market value per share.

#### ILLUSTRATION 10 – 3

Otiribe Plc has just paid a dividend of 70k on its ordinary shares which are currently priced at N4 is the investors personal discount rate if:

- (a) There is no growth rate in dividend?
- (b) There is a growth rate of 20% in dividend?

#### SUGGESTED SOLUTION 10 – 3

(a)  $K_e = \frac{d}{M_v} = \frac{0.70}{4} = 0.175$  or 17.5%

$$mv = 4.00$$

$$\begin{aligned} \text{(b) } K_e &= \frac{d(1+g)}{mv - c} + g \\ &= \frac{0.70(1+0.20)}{4.00} + 0.20 \\ &= 41\% \end{aligned}$$

### 3.2 CAPITAL ASSET PRICING MODEL (CAPM) AND COST OF EQUITY

The CAPM is an alternative approach to the problem of measuring the cost of capital, particularly cost of equity. The plan is to determine the linear relationship between risk and return in the capital market. The investor's return is categorized into two:

- (i) a risk free rate of interest; to which is added
- (ii) a premium to cater for the particular level of risk in a given security. The premium is determined by adopting what is required in the  $\beta$ (Beta) coefficient which is the measure of the volatility of the return in a share relative to the market. If a share price were to rise or fall at triple the market rate, it would have beta factor of 3.0. Conversely, if the share price moved at half of the market rate, the beta factor would be 1.5.

The procedures involved in adopting CAPM to estimate the cost of equity capital are as below:

- (i) Estimate the market parameters. This involves the determination of the risk free rate of return, the expected return on the market and the variance of the market return.
- (ii) Estimate the firm's beta co-efficient. This is based on the historical analysis of the share performance, that is, the prices, price changes, dividend yield, variances of return and co-variances with market return over as long a period as possible. Riskless securities have beta co-efficients equal to nil; an average security has a beta value of 1.0; securities have beta value greater than 1.
- (iii) Estimate the cost of equity using the market parameters and the firm's beta co-efficient.

The appropriate equation for establishing the expected returns is as follows:

$$R_a = R_f + (R_m - R_f) \beta$$

Where:  $R_a$  = the expected return on the security

$R_f$  = the risk free interest rate

$R_m$  = the expected return on a market portfolio

$\beta$  = the beta co-efficient which measures the volatility of the security's returns relative to market return.

#### ILLUSTRATION 10.4

If the risk free interest rate is 8%, the market return 12% and the beta co-efficient is 1.2 then:

$$\begin{aligned} R_a &= R_f + (R_m - R_f) \beta \\ &= 8 + (12 - 8) 1.2 \\ &= \underline{12.8\%} \end{aligned}$$

This is the cost of capital estimated according to the Capital Asset Pricing Model.

**Note:**

The  $\beta$  co-efficient is found by dividing the covariance of the return on the new investment and the return on the market folio by the variance of the market return, that is,

$$\beta = \frac{\text{Cov}(R_a, R_m)}{\text{Variance}(R_m)}$$

The cost of equity can be determined as follows, if there is an increase or growth in the rate of dividend involved;

$$K_e = \frac{d_0(1+g)}{MV - c}$$

- Where  $d_0$  = Dividend in Year '0'
- $g$  = Growth rate in dividends annually
- $MV$  = Market value ex-dividend
- $c$  = issue/transaction cost or reduction in market value per share.

**ILLUSTRATION 10 – 5**

Sepele Nig. Plc has in issue 12 million ordinary shares with a market value of N7 per share. N6 million in dividend were paid this year which represented 75% of earnings. The earnings are expected to grow at an annual rate of 5%. The issue of new ordinary shares now will make the company to incur cost which would represent 25k per share and a reduction below market value of 50k per share would also be made. Determine the company's cost of equity?

**SUGGESTED SOLUTION 10 – 5**

$$K_e = \frac{d_0(1+g)}{MV - C} + g$$

$$K_e = \frac{50k(105)}{7 - (0.05 + 0.25)} + 0.05 = 13.4\%$$

The element or rate of dividend was derived by dividing dividend paid by the number of ordinary shares issued and fully paid i.e.

$$\frac{6,000,000}{12,000,000} = \text{N}0.50$$

It is important to note that growth rate in dividend is not given, but there is sufficient information to estimate the growth rate. There is a need to use the growth rate formula as the growth rate exhibited in previous dividend payments, will be expected to continue in the future.

### **3.2.1 Cost of Retained Earnings**

The represented revenue and other reserves accumulated in a company over time. They statutorily and legally belong to the ordinary shareholders. Earlier theories in this area erroneously assumed that retained earnings could be regarded as free source of funds because there were no payments or cash flow to shareholders that will be based on reserves or retained earnings. However, it is now agreed that ordinary shareholders will demand the same rate of return that they are getting from new funds supplied by them to the company in respect of retained earnings. Therefore, the cost of retained earnings will be equal to cost of equity calculated in illustration 10 – 3 above.

Nevertheless, where market values have been used to attach weights for weighted average cost of capital (WACC), the retained earnings in the company cannot be attached with any costs. The reason is that the shareholders would have adjusted for the retained earnings in arriving at the market value of the company's share. Therefore, where book values are used in the calculation of weighted average cost of capital (WACC), the costs to be attached to retained earnings will be equivalent to the prevailing cost of equity.

### **3.2.2 Cost of Preference Shares**

From our knowledge of financial accounting, we know that the preference shareholders are not part of the company, they are only shareholders, therefore a need to pay them fixed dividend as return on their investment. These shares can also be grouped into irredeemable and redeemable preference shares. Irredeemable means that the share remain perpetually in the company unless there is a liquidation whereas the redeemable suggests refund of capital to the shareholders on the expiration of the agreed period of investment in the company. Therefore, the discussion here will be based on the cost or irredeemable and redeemable preference shares as follows:

#### **(a) Cost of Irredeemable Preference shares**

This can be determined by using the formula below:



$$K_{p(i)} = \frac{\text{dividend (d)}}{MV - C}$$

where, d = rate of dividend

MV = market value ex-dividend

C = transaction cost or reduction in market value.

(b) **Cost of Redeemable Preference Shares**

The cost of redeemable preference shares is that rate of return that equates current market value of the preference shares to all future receipts or payment of preference dividend and the market value of preference share at redemption. This can be calculated in the same way as cost of convertible debenture and redeemable debentures which are discussed below.

### 3.2.3 Cost of Debentures

Debentures issued by a company is a means of acquiring long term source of financing projects which is not provided by the owners of the company. The debenture holders are always paid a fixed return on their investment which is called interest. However, debentures can be grouped as follows irredeemable; redeemable and convertible. These groupings will form the basis for the determining the associated cost of securing the capital.

(a) **Cost of Irredeemable Debentures**

This can be calculated by using the formula as follows:

$$K_d = \frac{\text{Interest}}{M_{\text{vex-interest}} - C}$$

However, where the element of taxation is to be incorporated, the cost of irredeemable debentures will then be:

$$K_d = \frac{\text{Interest (1 - t)}}{M_{\text{vex-Interest}} - C}$$

where t = tax rate

This is illustrated in the example below:

(b) **Cost of Redeemable Debentures**

This can also be referred to as the market rate of interest or the implicit cost of debentures. It is that rate of return that equates the current market value of the debentures to all future receipts or payments or interest including market value at redemption. Therefore, to calculate this cost, it is necessary to assume that the redeemable debenture is a project and that the internal rate of return on the project is the cost of redeemable debentures. In this case, the current market value can be regarded as initial outflow while interest received or receipts will

be regarded as cash inflows and market value at redemption will be treated as scrap value.

The cost of redeemable debentures is, therefore, derived through an interpolation method. The example below can be used to illustrate the principles stated above.

(c) **Cost of Convertible Debentures**

The principles and concepts here are the same as in redeemable debentures. The only difference is that we usually substitute the market value of equity into which the debts have been converted for market value at redemption. Hence, the cost of convertible debenture is that rate of return that will equate current market value of the convertible debentures to all future receipts or payment of interest and market value of equity into which the debentures have been converted at the date of conversion.

The following are to be given consideration when the calculation is being made:

- (a) for convertible and redeemable debentures, adjustments for taxation should only be made in the interest element and not the market value.
- (b) where there is no sufficient information to calculate the IRR for the convertible or redeemable debentures, it is better assumed that such debentures are not convertible or redeemable, even if they have been described as such.

### **3.2.4 Cost of Short-Term Funds**

This refers to the interest payment in respect of such fund, for example, interest on bank overdraft or short term loan. However, where the element of taxation is to be incorporated, the cost will then be determined thus:

Interest payment  $(1 - t)$

Where “t” is tax rate

It should be realized that market values are not relevant in this area because short-term funds are not traded in the capital market.

### **3.2.5 Concept of Weighted Average Cost of Capital (WACC)**

There have been considerable arguments as to what constitute the cost of capital of a company that obtains funds from different sources. It has also been argued that the cost of capital for each source of finance, if taken in isolation is irrelevant. However, the theoretically correct view is that the cost of capital relevant to a company is the weighted average of the costs of the various components of the company’s capital structure. The weights attached are based on the proportion that the different components contribute to the total capital structure of the company.

The argument for the relevance of WACC is that in financing a project, it may not be easy to identify the particular sources of finance used to fund the project, since in most cases, projects are financed from a pool of the company's financial resources. Although, a particular source of finance may be used on a specific occasion, that source cannot be used indefinitely. It will be necessary in the future to raise finance from some other sources. Secondly, the costs and the risks associated with the different sources of finance do change from time to time, thereby necessitating an averaging system to recognize differences in the composition of the company's capital structure should be regarded as having a target optimum capital structure. This view is supported by Gordon, a financial management expert thus, *"if projects are evaluated using the WACC, the wealth of the shareholders in the long run will be maximized"*.

This same view is supported by Van Horne (1976) and some other finance authors. Van Horne (1976) said "the rationale behind using the WACC is that by financing projects in the proportion specified and accepting projects yielding more than WACC, the company will be able to, in the long run, increase its market value.

### 3.3 COMPUTATION OF WACC

Theoretically, in calculating the WACC, the market value of equity and debt should be used as the relevant weight to be attached. This is because the returns or costs themselves can be calculated by reference to market value, hence market values are more appropriate. Also in financial management for futuristic models, market values are more relevant than book values. However, if market values are not given, book values may be used on the assumption that the book values are equal to the market values. In particular, with reference to overdraft and other short-term funds that are not quoted, book values should be applied as weight. When book values are used as weight, cost of retained earnings equivalent to cost of equity should be included in the WACC. Nevertheless, where market values are used as weights, no cost and value should be attached to retained earnings.

In effect, the following steps are involved in WACC calculation thus:

- (a) Calculate the specific cost of each source of finance as previously explained in the former part of the chapter.
- (b) Multiply the cost of each source by the market value of that source to arrive at the expected return from that source.
- (c) Add up the total returns from all sources and the total market value of all sources.

$$(a) \quad \text{WACC} \quad = \quad \frac{\text{Total Return}}{\text{Total Market Value}} \quad = \quad \frac{d}{MV}$$

The above principles and concept can be illustrated by the example below:

#### ILLUSTRATION 10 – 6

Oribamise Plc has a capital structure consisting of 100,000 N1 ordinary shares and 50,000 12% loan stock. The ordinary shares are currently valued at 75k each and the loan stock at 80. Annual dividends have been constantly running at 10k per share and a dividend has just been paid. The loan stock interest has just been paid too. Calculate.

- (a) Cost of equity
- (b) Cost of Loan stock
- (c) Weighted average cost of capital.

**SUGGESTED SOLUTION 10 – 11**

$$(a) \quad K_e = \frac{d}{MV} = \frac{0.10}{0.75} = 13.33\%$$

$$(b) \quad K_d = \frac{\text{Interest}}{MV} = \frac{0.12}{0.8} = 15\%$$

(c) Source	Market Value N	Cost	Returns N
Equity	75,000	13.33%	10,000
Debt (Loan)	<u>40,000</u>	15%	<u>6,000</u>
	<u>115,000</u>		<u>16,000</u>

$$\text{WACC} = \frac{16,000}{115,000} \times 100 = 13.913\%$$

**Note:**

$$\begin{aligned} \text{Market value of Equity} &= 100,000 \times 0.75 = 75,000 \\ \text{Market value of Debt (Loan)} &= \frac{50,000 \times 80}{100} = \text{N}40,000 \end{aligned}$$

**ILLUSTRATION 10 – 6**

One of your clients has seen many references to the cost of capital in the financial press and has asked you to give him some guidance on what could be an appropriate figure for this organization. Ononobi Limited.

The following information is available for Ononobi:

Existing Capital Structure	N'000
Issued Ordinary Shares – 12,000,000	12,000
Retained earnings	4,000
6% Preference shares	2,000
9% Debentures repayable	<u>6,000</u>
	<u>24,000</u>

### 9% Debenture

- (a) Issued in 1998 at par;
- (b) Current price ₦92;
- (c) A similar issue, if made now would require to be made at ₦90 of 6%

### Preference Shares

- (a) Preferences shares have a par value of ₦1 and were originally issued at 92k per share;
- (b) Current price is 43%
- (c) A similar issue, if made now would require to be made at 40k per share.

### Ordinary Shares

- (a) The market price of an ordinary share is ₦7
- (b) ₦6 Million in dividends were paid this year which represented 75% of earnings.
- (c) Earnings are expected to grow at an annual rate of 5%
- (d) If new ordinary share, were issued now, costs incurred would represent 25k per share and a reduction below market of 50k per share would also be made.  
The company tax rate can be assumed to be 50%

## SUGGESTED SOLUTION 10 – 6

### WACC

Source	Market Value ₦'000	Cost	Returns ₦'000
Debentures	5,400	5%	270
Preference	800	15%	120
Equity	<u>84,000</u>	13.4%	<u>11,256</u>
	<u>90,200</u>		<u>11,646</u>

$$\text{Therefore, WACC} = \frac{11,646 \times 100}{90,200} = 12.91\%$$

### 3.4 CONCEPT OF MARGINAL COST OF CAPITAL (MCC)

Whenever a company raises new finance, the risk profile of the company's capital structure is likely to change. Therefore, the project which compelled the company to raise additional finance must pay for the increase in risk or benefits from the reduction in risk implicit in the company's new capital structure. This is the reason for preference to marginal cost of capital (MCC) in the evaluation of new projects. The MCC is the cost of new finance or additional fund.

According to Weston and Brigham (1980), new projects ought to be evaluated using MCC in order to maximize return and minimize risk. Based on their argument, MCC was defined as "the effective cost of additional finance normally required for the execution of new projects". It can be assumed to be the difference between the cost of

capital before the project is accepted and the cost of capital after the project has been undertaken.

However, in calculating the MCC, market values should also be used in weighting the various components of the capital structure. But where additional finance does not change the risk profile of the capital structure, the MCC will be exactly equal to the WACC. Therefore, if the risk in the capital structure increases, MCC will be higher than WACC and vice-versa. The example below is used to illustrate the above concept.

### ILLUSTRATION 10 – 7

Ajuluchukwu Group of Companies is considering raising ₦100,000 by issuing 10% debentures. At present, its capital consists entirely of ordinary shares being 200,000 25k ordinary shares valued at 40k. Cumulative dividend and the dividend which is about to be paid is 4k. Dividend has been stable over the years but if the group's level of gearing is altered by the raising of these debentures, it is felt that the ordinary shareholders will require a rate of return of 15% while the market value will remain unchanged.

Calculate the marginal cost of the new debentures and the weighted average cost of capital for the group with its revised capital structure.

### SUGGESTED SOLUTION 10 – 7

(a) Calculation of Marginal Cost of Capital

	₦
100,000 Debentures @ 10%	10,000
Increase required by Equity (15% - 11.11%) x 72,000	<u>2,801</u>
	<u>12,801</u>

$$\text{Where current } K_e = \frac{0.04}{0.36} = 11.11\%$$

$$\text{And market value of equity} = 200,000 \times (40k - 4k) = \text{₦}72,000$$

$$\text{Therefore, MCC} = \frac{12,801}{10,000} = 12,801\%$$

(b) Calculation of WACC

Source	Market Value ₦	Cost	Return ₦
Equity	72,000	15%	10,800
Debenture	<u>100,000</u>	12.80%	<u>12,800</u>
	<u>172,000</u>		<u>23,600</u>

$$\text{WACC} = \frac{23,600}{172,000} \times 100 = 13.721\%$$

The revised capital structure is as follows:

	N
Issued and fully paid:	
200,000 25k ordinary share	50,000
10% Debentures	<u>100,000</u>
	<u>150,000</u>

### 3.5 COST OF CAPITAL AND GEARING

#### Gearing

The term 'gearing' is a measure of the financial risk of a company, that is, a measure of the relationship between equity capital and fixed interest capital including securities. This can be expressed mathematically or by formulae as follow:

$$\text{Gearing Ratio} = \frac{\text{MV of Debt}}{\text{MV of Equity}}$$

Gearing, therefore, means the introduction of substantial debt into the financial structure of a company.

In order to have a full appreciation of this concept, it will be discussed based on the views of two schools of thought namely;

- (a) Traditional School of Theory; and
- (b) Modigliani and Miller (MM) Theory.

#### 3.5.1 Traditional Theory:

This school believes that the cost of capital of a company is dependent on the level of gearing and that there is an optimal level of gearing at which point the average cost of capital is lowest. Their theory is based on the following propositions:

- (a) As gearing increase, the cost of equity will not initially show a significant increase, the reason being that, there will be sufficient profits to pay debenture interest and still pay an acceptable level of dividends. However, as substantial debt finance is introduced, (gearing increases) the cost of equity will show an upward trend after an attained optimal gearing level. This is because; equity providers of finance will require an extra return to compensate them for their perceived increase in risk.

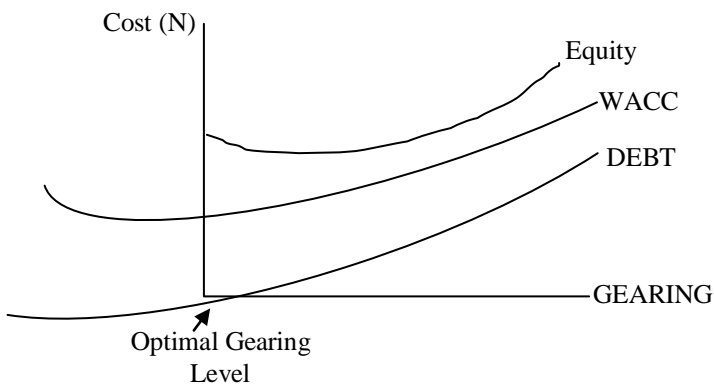
Under the above circumstances, there are two major areas of concern to the shareholders, They are:

- (i) will there be sufficient profits to pay dividend after the deduction of the high debenture interest?

- (ii) can debenture holders interfere in the management of the company in the even of non-payment of either principal or interest or the disposal of a charged asset?
- (b) In the same manner, the returns required by existing and additional debenture holders will show a significant upward trend after a particular level of gearing. This level is known as the **OPTIMAL GEARING LEVEL**.
- (c) As substantial level of gearing is introduced, the WACC will show a downward trend up to optimal gearing level. This is because of the cheaper source of finance (debt capital).

The main reason for the cheapness of debt are tax and lower risk. After the optimal gearing level, as debt and equity costs increase, the WACC will also increase.

The above assumptions can be graphically shown as follows:



**Figure 10.1: Optimal Gearing Graph**

In summary, the traditional theory states that, there is an optimal gearing level (mixture of debt and equity) at which the WACC for every company is at the lowest. They also stated that companies should determine and maintain that optimal level because it is the point at which they will maximize their market values. Therefore, companies will finance projects using the gearing mix of debt and equity funds.

### 3.5.2 MM Theory

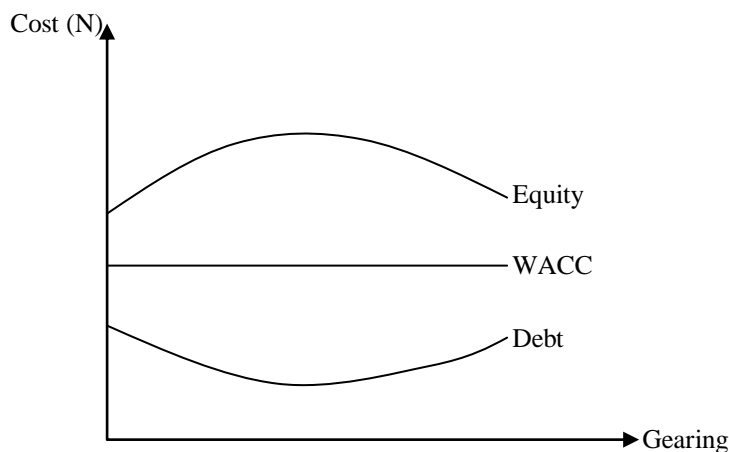
This alternative theory believes that, the capital structure of a company will not influence the level of a company's cost of capital. Modigliani and Miller (1958) provided a behavioural justification for the net operating profit or income approach. They based their theory on the arbitrage process which entails investors switching their funds from a geared company to price differential and make financial gains. They believed that difference, in market value of companies, create the opportunity for arbitrage.

Their propositions are as follows:



- (a) As gearing increases, cost of equity will increase in a manner that is derivable from the arbitrage process. This means that there will be movement of investors from this geared company to other ungeared companies.
- (b) The increase in the cost of equity will exactly offset the advantage of using the cheaper debentures as a result of this arbitrage process. The arbitrage process result in an equilibrium level of pricing of company's shares or market value of companies. Therefore, the WACC will remain constant irrespective of the level gearing.

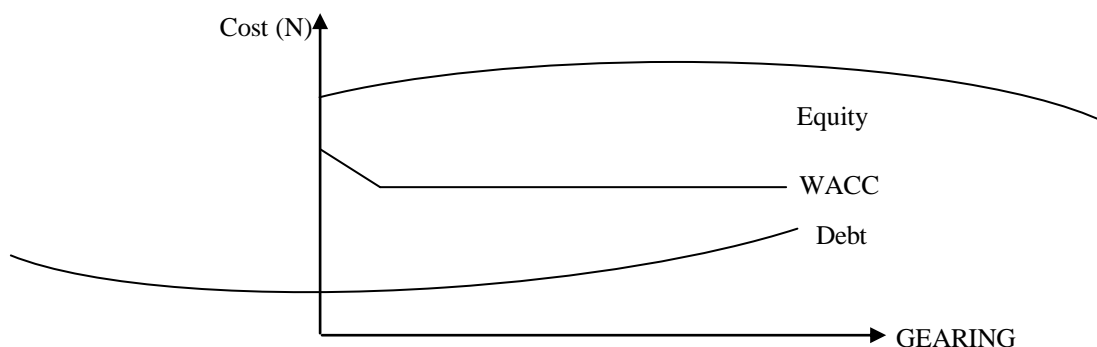
This can be graphically shown as follows:



**Figure 10.2: Gearing Graph**

The MM theory states that, it is not relevant for management to determine the optimal gearing level because it does not exist. However, what is relevant in the valuation of companies is the level of earnings of the company and the risk classification of such earnings (business risk or financial risk). Therefore, companies in the same kind of business and the same level of risk classification, will have the same market values if, their level of earnings is the same irrespective of differences in their gearing or capital structures.

However in 1962, Modiglian and Miller amended their original theory to recognize the mutual impact of using debentures as a result of taxation. They now amended their conclusion to state that, the WACC will initially show a downward trend as gearing is introduced because of taxation after which it will remain constant as depicted in the diagram below:



### Figure 10.3: Modified Gearing Graph

#### Assumptions of MM Theory

- (a) A perfect capital market exists.
- (b) Individuals and companies can borrow and lend unlimited amounts of money at the same rate.
- (c) Individuals do not have fear of bankruptcy.
- (d) Taxation can be ignored initially.
- (e) Companies can be classified into the same risk class.
- (f) Individuals will substitute personal gearing for corporate gearing.

The above classifications can be illustrated with the example below:

#### ILLUSTRATION 10 – 8

Mokun Limited and Lara Limited are quoted companies. The following figures are from their current balance sheets.

	Mokun Ltd N'000	Lara Ltd N'000
Ordinary Share Capitals Authorized 2,000,000 Shares of 50k each	<u>1,000</u>	<u>1,000</u>
Issued 1,000,000 shares Of 50k each	500	500
Reserves	<u>1,750</u>	<u>150</u>
Shareholders fund	2,250	650
6% Irredeemable debenture	—	<u>2,500</u>

Both companies earn an annual profit, before charging debenture interest of N500,000 which is expected to remain constant for the indefinite future. The profits of both companies before charging debenture interest are generally regarded as being subject to identical levels of risks. It is the policy of both companies to distribute all available profits as dividends at the end of each year.

The current market value of Mokun Ltd's ordinary share is N3.00 per share cum-div. Annual dividends is due to be paid in the very near future.

Lara Ltd., has just made annual dividend and interest both on its ordinary shares and on its debentures. The current market value of the ordinary shares is N1.40 per share and of the debentures, N50 per cent.

Mr. Bukunola owns 50,000 ordinary shares in Lara Ltd. He is wondering whether, he could increase his annual income, without incurring any extra risk by selling his shares in Lara Ltd. And buying some of the ordinary shares of Mokun Ltd. Mr. Bukunola is able to borrow money at an annual compound rate of interest of 12%.

You are required to:

- (a) estimate the cost of ordinary share capital and the weighted average cost of capital of Mokun Ltd. and Lara Ltd.
- (b) explain briefly, why both the cost of ordinary share capital and the weighted average cost of Mokun Ltd differ from those of Lara Ltd.
- (c) prepare calculations to demonstrate to Mr. Bukunola how he might improve his position in the way he suggested, stating clearly any reservations you have about the scheme

Ignore taxation for (a), (b) and (c).

### SUGGESTED SOLUTION 10 – 8

(a)	Ke	=	$\frac{d}{MV}$	=	<b>Mokun</b>		<b>Lara</b>
					0.50		<u>0.35</u>
					(3 – 0.5)		1.40
					20%	=	25%
	Ke	=	$\frac{\text{Interest}}{MV}$		Nil		<u>0.06</u>
							0.50
						=	12%
	WACC		$20\% \times \frac{1.40}{2.65}$	+	$12\% \times \frac{1.25}{2.65}$		

**Note:**

- (a) The ₦150,000 deducted from ₦500,000 annual profit of Lara Ltd. is the interest paid which is derived by taking 6% of ₦2,500,000.
- (b) The cost of ordinary share capital differs in view of the fact that the returns required by the equity shareholders of Lara Limited is higher because of the higher risk they carry in relation to gearing compared to Karim Limited.

Also the WACC differs because Lara Limited is using a cheaper source of fund, that is, debentures to complement its financial needs.

- (c) The current risk gearing ratio of Lara is given thus:

$$\frac{\text{MV of Debt}}{\text{MV of Equity}} = \frac{1,250,000}{1,400,000}$$

Sales proceeds of 50,000 shares in Lara @ 1.40	₦ 70,000
Mr. Bukunola should borrow from the market in the ratio of <u>1.25</u> x 70,000	

	1.40	<u>62,500</u>
Therefore, Total funds available to Mr. Bukunola		<u>132,500</u>

Mr. Bukunola will then buy shares from Mokun Limited @ ₦2.50

$$\frac{\text{₦}132,500}{2.50} = 53,000 \text{ shares}$$

Gain (loss) to Mr. Bukunola can be determined as follows:

	₦	₦
Portion before switching (income)		
50,000 shares in Lara @ 35k		(17,500)
Portion after switching		
53,000 shares in Mokun @ 50k	26,500	
Less interest on borrowed funds		
12% of ₦62,500	<u>(7,500)</u>	<u>19,000</u>
Gain		<u>1,500</u>

The solution above is derived by relaxing the assumptions of MM as stated below:

- (1) Cost of borrowing may not be the same as that of the company
- (2) Taxation has been ignored
- (3) Transaction costs has been ignored
- (4) There may be inability to raise up enough funds from the market.
- (5) He may not be the only one that may be involved in the switching and thus the sales value of his share and the switching and thus the sales of value of his share and purchase of shares may not be as stated in the answer.

#### 4.0 CONCLUSIONS

The cost of capital is the required rate of return or cut-off rate by which the acceptability (or viability) of a proposed project is measured i.e. the cost of funds used for a project. It is the opportunity cost of financing projects.

It can be calculated for equity, preference share, debentures and retained earnings on an individual basis or collectively by determining the weighted average cost of the different sources of capital using either the market value basis or the book value basis.

#### 5.0 SUMMARY

In this unit, we have discussed that one approach to estimating the cost of capital is by the use of the Gordon growth or dividend valuation model.

Gearing is the ratio of fixed interest capital such as preference shares and debentures to equity. Highly geared firm i.e. those with a higher ratio of fixed interest capital to equity are more vulnerable to takeover bids under fluctuating trade conditions.

The Capital Asset Pricing Model which measures the relationship between risk and return in the capital market is an alternative method for the determination of the cost of equity capital.

## 6.0 TUTOR MARKED ASSIGNMENT

1. A share has a current market value of 96k and the last dividend was 12k. If the expected growth rate of dividend is 4% per annum, therefore the cost of equity capital is
  - A 18%
  - B 17.5%
  - C 17%
  - D 19%
  - E 20.50%
  
2. Oweh Nigeria Limited has issue 10% debentures of a nominal value of ₦100. The market price is N90 ex-interest. Therefore, the debt capital irredeemable is
  - A 11.3%
  - B 11.1%
  - C 11.4%
  - D 12.1%
  - E 12.4%
  
3. Prudence Nigeria Limited is financed partly by equity and partly by debentures. The equity proportion is kept always at two thirds of the total. The cost of equity is 18% and that of debt 12%. The weighted average cost of capital is
  - A 17.5%
  - B 17%
  - C 15%
  - D 14%
  - E 16%
  
4. Wale Limited has Ordinary Share capital with a market value of ₦450,000 and cost of 20% per annum. It has debentures with a market value of ₦150,000 and a cost of 10% per annum. The weighted average cost of capital is
  - A 17.5%
  - B 18.5%
  - C 19.5%
  - D 17%
  - E 18%
  
5. Every Sisters Limited has a 1 million Ordinary Share. Ex-dividend market values are ordinary shares of ₦2.00. Dividend previously paid was 20k. The growth of 5% on dividend is expected to grow indefinitely. The ordinary equity cost of capital is
  - A 15.0%
  - B 15.5%
  - C 16.0%
  - D 16.5%
  - E 17.5%

6. The minimum acceptable rate of return on funds committed to the project is called .....
7. What is the formula for calculating the imputed cost of capital?
8. What are the implications of cost of capital for accepting or rejecting a project?
9. Mention three factors to be borne in mind when marketing securities.
10. What is the formula for calculating the cost of equity when growth rate is involved?

## **7.0 REFERNCES/FURTHER READINGS**

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## **MODULE III: QUANTATIVE METHODS AND MANAGEMENT ACCOUNTING**

- Unit 11: The Application of Quantative Methods to Management Accounting
- Unit 12: Working Capital Management
- Unit 13: Capital Investment Decision
- Unit 14: Decision Making under Risk and Uncertainty
- Unit 15: Divisional Performance Evaluation

### **UNIT 11 THE APPLICATION OF QUANTITATIVE METHODS TO MANAGEMENT ACCOUNTING**

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- 2.0 Objectives
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  - 3.1.1 Conditions under which learning curve theory operate
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  - 3.1.3 Learning curve procedures
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## **1.0 INTRODUCTION**

Investment in stocks represents a major asset of most industrial and commercial organisations, and it is essential that stocks be managed efficiently so that such investments do not become unnecessarily large. We will also examine the use of linear programming techniques and to consider how they can be applied to some specific types of decisions that a firm may have to make.

## **2.0 OBJECTIVES**

In this unit, readers would be able to understand:

- The learning curve theory and the situations when it can be applied.
- The computation of average and incremental labour for different output levels.
- The advantages and limitations of the learning curve theory.
- The various ways of classifying stock
- The various stock control techniques and their applications
- The weaknesses of the various stock control techniques;
- The situations when it may be appropriate to use the Linear Programming technique;
- The various Linear Programming techniques and their applications
- The meaning and usefulness of the term ‘shadow price’.

## **3.0 MAIN CONTENT**

### **3.1 LEARNING CURVE THEORY**

Learning curve theory was first developed in 1925 at the Wright Patterson Airforce Base in Ohio, United States. It was observed that as output doubled, the labour hours required reduced by 20%. This was regarded as an 80% learning factor. The theory assumes that as a worker becomes familiar with a new job, his experience increases resulting in a decline in time required by him to perform the job. The learning curve theory states that whenever a repetitive job is being performed, the average time spend in producing a unit falls by the specific percentage whenever the activity level is doubled.

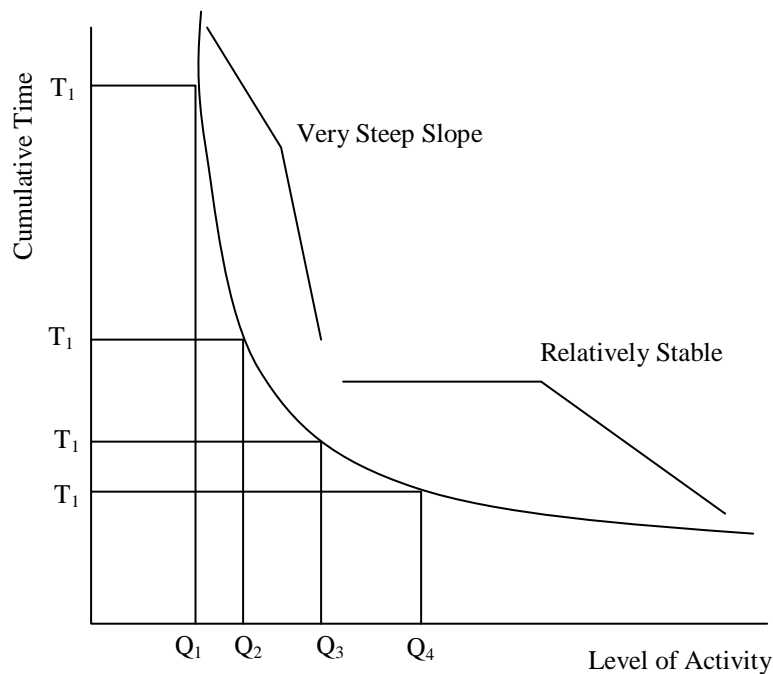
This can be explained for the simple reason that as a worker carries out a repetitive task:

- (a) his dexterity will improve



- (b) the initial bottleneck associated with the task will be overcome gradually.
- (c) he becomes familiar with the problem areas and finds an appropriate solution to take care of such areas.

As a result of all these taken together, a lot of time is saved and the time used in the task reduces. However it must be appreciated that the reduction in time will not continue indefinitely as it will get to a particular point where it will no longer be possible for the average time spent in producing a unit to fall further. This can be illustrated graphically as seen in figure 11.1 below:



**Fig 11.1 Learning Curve Graph**

At level of activity  $Q_1$  the cumulative time spent is  $T_1$ , with the level of activity increase to  $Q_2$ , there is a sharp reduction in cumulative time to  $T_2$ . At  $Q_3$ , there was a further decline in cumulative time spent to  $T_3$ . By the time the activity level increase to  $Q_4$ , the reduction in time becomes less pronounced and the curve becomes relatively stable.

Looking at the graph, at the onset, the concept of learning effect is heavily pronounced because of the simple reason that, as more units are produced, the initial bottleneck or problem starts to diminish. With continuous doubling of the activity level the initial bottleneck is fully overcome and eliminated as shown by  $T_2Q_2$  and  $T_3Q_3$ .

With a continuous increase in production and repetitive performance the rate of efficiency continues to increase also until a point is reached when it will no longer be possible for the average time spent in producing a unit to fall. This is because it is not

possible for a worker to spend a zero time in producing a particular unit or performing a particular task.

### **3.1.1 Conditions under which Learning Curve Theory Operate**

For the learning curve to operate, the following conditions must exist:

- (a) The task must be repetitive in nature.
- (b) The task must be such that it is labour intensive. In other words, the labour content of the task must be very high. With mechanized task, there is little or no scope for a lessening of operating time.
- (c) Management must be able to motivate workers to be at their productive best.
- (d) There should be little or no labour turnover.
- (e) The task must be continuous (i.e. no frequent break).

### **3.1.2 Learning Curve Applications**

Learning curve may be applied to the following situation:

- (a) Cost estimation for example, determination of the cost of prototype and the expected cost of future production.
- (b) Pricing tenders for contracts, where the price must be competitive, but at the same time profitable over the contract period.
- (c) Project evaluation
- (d) Deciding wage incentive plans.
- (e) Production scheduling and manpower planning which could improve customer relationships and possibly result in increased future sales.
- (f) Cost control as the learning curve expectations of time to do a job may be much more appropriate than a customer standard, thus efficiency being improved upon.

### **3.1.3 Learning Curve Procedures**

The following steps or procedures must be followed in determining the Learning curve.

- (a) Ascertain the learning rate or factor.
- (b) Calculate the time expected to be used to produce the first unit.
- (c) Determine the average time taken per unit for the first batch
- (d) Calculate the average time taken per unit for the second batch.
- (e) Calculate the cumulative time taken
- (f) Repeat the calculations for each subsequent batch.

In applying the learning factor, it will be noticed that the batches are being doubled each time. Where the batches do not double, the tabular approach described above will collapse and the use of the algebraic approach will be feasible.

The algebraic approach is expressed as:

$$Y = ax^b$$

Where

- Y = Expected average time per unit based on expected output.  
 a = average time per unit spent on the first batch  
 x = index of learning given as expected output divided by  
 Number of units in the first batch.  
 b =  $\frac{\text{log of learning Curve}}{\text{log of 2}}$

### ILLUSTRATION 11 – 1

A customer has asked a firm to produce a bill for the supply of 1,600 units of a product. Production will be in batches of 100 units. The firm has estimated that the time for the first batch of 100 units will average 50 hour per unit. The firm also expects that an 80% learning curve will apply to the cumulative labour hours on his contract.

#### **Required:**

- (a) Prepare an estimate of labour hours of fulfilling this contract.  
 (b) Estimate the incremental hours of extending the production run of producing an additional 1,600 units.  
 (c) Estimate the incremental hours of extending the production run from 1,600 to 2,000 units.

### SUGGESTED SOLUTION 11 – 1

(a) and (b) using the Tabular Approach

(1)	(2)	(3)	(4)	(5)	(6)
Units Produced	Cumulative Unit	Time Spent	Cumulative Time per unit	Average Time	Workings
100	100	5,000	5,000	50	-
100	200	3,000	8,000	40	50 x 0.80
200	400	4,800	12,800	320	40 x 0.80
400	800	7,680	20,480	25.6	32 x 0.80
800	1600	12,288	32,768	20.48	25.6 x 0.80
1600	3,200	19,660.8	52,428.8	16.38	20.48 x 0.80

The average labour hour for the first batch of 100 units is given as 50 hours per unit. The average time per unit is shown in column (5) and the unit in the first batch which is 100 is shown in column (1). The cumulative unit is 100 as shown in column (2). The cumulative time spent is column (2) x column (5), giving us column (2). The cumulative time spent is column (2) x column (5), giving us column (4). To double the level of activity, that is the units to produce the cumulative unit becomes 200. The average time per unit for these units will be 50 hours x 0.8 giving us 40 in column 5. The cumulative time spent becomes 200 x 40 giving as 8,000 – 5,000 = 3,000 as shown in column (3).

To double the level of activity again, the cumulative unit will become 400 units.

Average time per unit =  $40 \times 0.80 = 32$  hours. Cumulative time will be  $400 \times 32 = 12,800$ . The time spend for the additional units will be  $12,800 - 8,000 = 4,800$ . The process is to continue as long as there is doubling in the level of activity.

To answer the question from table above

- (a) An estimate of labour hours of producing the 1,600 units = 32,768 hours, that is  $1,600 \times 20.48$ .
- (b) The incremental labour hours of extending the production run to produce an additional 1,600 units is  $52,428.8 - 32,768 = 19,660$  hours.
- (c) The incremental hours of extending the production from 1,600 units to 2,000 units cannot be determined with tabular approach since 2,000 units does not amount to doubling 1,600 units, hence the algebraic approach will be used.

$$\begin{aligned}
 Y &= ax^b && \frac{\log \text{ of } 80}{\log \text{ of } 2} \\
 &= 50 \times \left[ \frac{2,000}{100} \right]^{-0.3219} \\
 &= 50 [20]^{-0.3219} \\
 &= 19.06 \text{ hours}
 \end{aligned}$$

Therefore, total hours for producing 2000 units will be  $2,000 \times 19.06 \text{ hours} = 38,120$  hours.

To determine the incremental hours of producing 2,000 units

Cumulative Hours of producing 2,000 units ( $2,000 \times 19.06$ )	38,120
Cumulative Hours of producing 1,600 units ( $1,600 \times 20.48$ )	<u>32,768</u>
Incremental Hours of producing 400 units	<u>5,352</u>

### ILLUSTRATION 11 – 2

The average cost of producing the first batch of 2000 litres of flavoured milk by a certain dairy company is ₦20 per litre. From past experience, the company's operating cost decreases by 25% each time the output is doubled.

**Required:**

Use the data given above to demonstrate your understanding of the theory by finding the learning curve ratio and the average cost of producing 64,000 litres of the product.

### SUGGESTED SOLUTION 11 – 2

If the company's operating cost reduces by 25% each time the output is doubled, it implies that the learning curve ratio of the company is 75%.

Determination of the average cost of producing 64,000 litres.

Litres	Cum. Litres	Cost (₦)	Cum. Cost	Average Cost	Workings
2,000	2,000	40,000	40,000	20	-
2,000	4,000	20,000	60,000	15	20 x 0.75
4,000	8,000	30,000	90,000	11.25	15 x 0.75
8,000	16,000	45,040	135,040	8.44	11.25 x 0.75
16,000	32,000	67,520	202,560	6.33	8.4 x 0.75
32,000	64,000	101,446	304,000	4.75	6.3 x 0.75

From the table, the average cost of producing 64,000 litres of the product is ₦4.75.

Alternatively this can be determined through the algebraic method thus:

$$\frac{\log \text{ of } .75}{\log \text{ of } 2}$$

$$Y = ax^b \left( \frac{64,000}{1,000} \right)$$

$$= 20$$

$$= 20 (32)$$

$$= 20 \times 0.2373$$

$$= \text{₦}4.75$$

### ILLUSTRATION 11 – 3

You have been asked about the application of the learning curve as a management accounting techniques.

Using the data given below:

Director labour needed to make the first machine hours	1,000
Learning curve	80%
Direct Labour Cost	₦3 per hour
Direct Material cost	₦1,800 per machine
Fixed Cost for either size order	₦8,000

You are required to:

- Define the term learning curve;
- Explain the theory of learning curve;
- Indicate the areas where learning curves may assist in management accounting.
- Illustrate the use of learning curves for calculating the expected average until cost of making:
  - 4 Machines; and
  - 8 Machines.

### SUGGESTED SOLUTION 11 – 3

Answer to (a), (b) and (c) can be taken from the text, while (d) will be solved as follows:

Calculation of Average time of direct labour using algebraic approach

- (i) Average Time at cumulative output of 4 machines
- (ii) Average Time at cumulative output of 8 machines.

Cost per unit of making 4 machines will be

	₦
Material	1,800
Direct Labour cost (640 x ₦3)	1,920
Fixed Cost (₦8,000/4)	<u>2,000</u>
	<u>5,720</u>

Expected Average Unit Cost of making 8 machines

	₦
Material	1,800
Direct Labour Cost (512 x ₦3)	1,536
Fixed Cost (₦8,000/8)	<u>1,000</u>
	<u>4,336</u>

### 3.1.4 Advantages of Learning Curve Theory

- (1) It is very useful in planning personnel numbers as well as other related cost.
- (2) It is useful in estimating cost of future production.
- (3) It can be used in deciding wage incentive plans.
- (4) It is an effective basis of exercising cost control.
- (5) It is an effective means of setting labour standard time.

### 3.1.5 Limitations of Learning Curve Theory

The learning curve theory suffers from some setbacks which can be listed as follows;

- (1) It is only applicable to labour intensive operations.
- (2) It is also only inapplicable to situation where continuous increase in production does not occur.
- (3) It assumes that there would be stable condition at work whereas there could be high labour turnover.
- (4) There may be insufficient data, hence there may be difficulty in knowing what the learning curve is.
- (5) It may be difficult to highlight cost reduction due to the effect of learning curve in a situation where a new machinery-and improved techniques are introduced leading to increase output and reduced cost.

## 3.2 INVENTORY CONTROL TECHNIQUES

In most manufacturing companies, inventories or materials carry a large proportion of the investments, hence the need for proper control in order to ensure that losses due to

wastage, theft, production stoppages, idleness of employees, absenteeism, goodwill, sales reduction etc. are brought to the barest minimum.

However, for one to appreciate the importance or significance attached to the element of inventory or material, a proper classification need be made as follows:

- (a) Raw materials- which are to be used in manufacturing a good or product, for example. limestone, used for making cement; wheat used for making beer and bread: cassava used for making "apu" or "lulu", even though they might have gone through some forms of processing.
- (b) Work-in-progress, which are used to maintain continuity within the production cycle;
- (c) Finished goods which are used to satisfy customers demand and sustain goodwill;
- (d) Consumable supplies which are items used proportionately to the quantity or volume of a manufactured product, but which because of their small value are identified for costing purposes with the cost centres where they are used rather than with the cost units to which they relate, for example, nuts, bolts, screws, nails, stationeries, lubricants, petrol etc.

### **3.2.1 Objectives of Inventory Control**

The main objectives of stock control are:

- (a) To maintain adequate stocks and thus minimise the risk of shortages which could disrupt production or cause customer dissatisfaction.
- (b) To avoid excessive stock level and consequent tying up of capital.
- (c) To relieve management of taking frequent procurement decisions for each item maintained in the store.

### **3.2.2 Factors Considered for Effective Stock Control**

From the cost point of view, the essentials of materials control before the normal usage in the production process are as below:

- (a) Materials of the adequate quality and size should be bought only when needed and properly authorised.
- (b) In choosing the supplier(s) for the materials, proper care need be taken in terms of quality, price and other terms of delivery.
- (c) There should be adequate receipt and inspection of materials.
- (d) The basis for pricing materials for production of goods.
- (e) There should be adequate storage facilities and the consistent checking of stock levels.
- (f) Cost centre should be appropriately charged with the indirect materials consumed by them.
- (g) Stock taking should be well organised to ensure availability of stock quantities when needed.
- (h) The documentation, accounting procedures and controls at each stage must be designed and efficient.

### 3.2.3 Purposes for Holding Inventory

There are three reasons or purposes for holding inventory.

- (a) **Transactional Motive:** The purpose is to meet demand for the stock item, where the size of demand is known with certainty or replenishment of stock is immediate when stock-out occurs.
- (b) **Precautionary Motive:** Where either (or both) the demand for the stock item or the re-supply or re-order is uncertain because it varies between one occasion and the next, there will be need to avoid customer dissatisfaction and lost sales. Therefore, safety stocks may be held to reduce the likelihood that the company may run out of supply.
- (c) **Speculative Motive:** A decision may be taken to increase current stocks in anticipation of a price rise, so as to make a speculative profit. The major control issue for speculative profit stock holding is administrative; there is a clear need to ensure that limits to a firm's financial risks in speculative stock holding are established and observed.

### 3.2.4 Factors Influencing Stock Holding Decisions

The factors influencing stock holding decisions are:

- (a) Amount of cash available,
- (b) The storage space available;
- (c) The storage costs (insurance, interest on capital etc.);
- (d) Delivery delays;
- (e) Risk of stock losses (wastage, obsolescence etc.);
- (f) Minimum ordering quantities imposed by the supplier;
- (g) Purchase ordering costs (clerical, transportation etc.);
- (h) Required service level to workers or customer.

### 3.2.5 Stocks or Inventory Control Systems

The following are the stocks control system and each will be discussed in turn:

- (a) Periodic Review System;
- (b) Re-order Level System;
- (c) Perpetual Inventory/Continuous Stock Taking;
- (d) ABC Principles or Selective Approach; and
- (e) Economic Order Quantity (EOQ).

### 3.2.6 Periodic Review System

Under this system, purchase orders are placed at fixed intervals of time and the quantity to be ordered on any occasion will be decided by reviewing the trend of demand for or usage of the item concerned. This should help avoid over-ordering, but if there should be an unexpected increase in demand, the stock of an item may be exhausted before the next regular ordering state.



It may be necessary, therefore, to hold a safety stock or margin to cover possible fluctuations in demand.

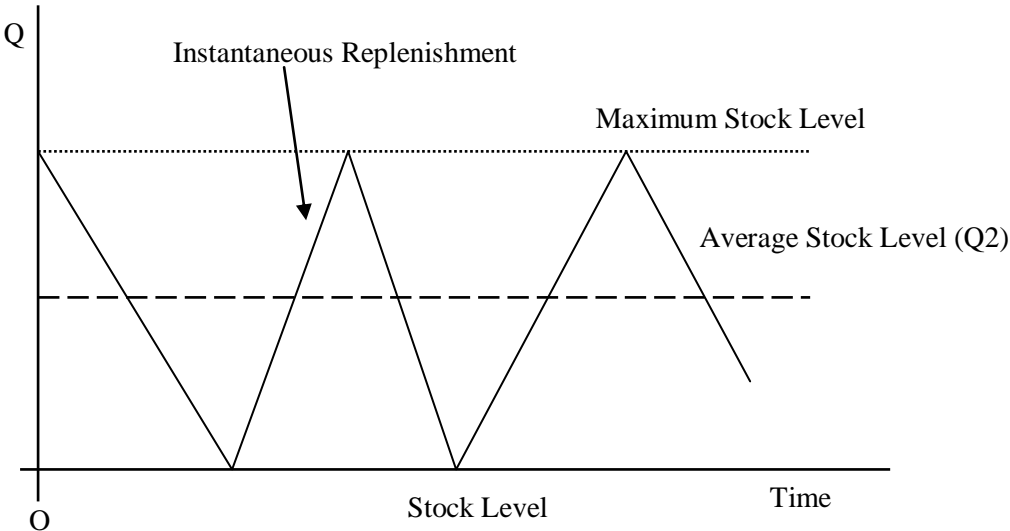
**3.2.7 Stock Levels Control (Re-order Level) System**

This system involves deciding a level of stock holding at which new purchase orders should be placed. If stock falls to the re-order level, an order will be placed for fixed quantity of the stock. However, the reorder quantity must have been decided having regard to the normal delivery period, the rate of usage of stock, variations in delivery time and the minimum level of stock.

To provide a safety margin against unforeseen situations, a minimum level of stock holding will be fixed. If at any time stock falls below the said level, the storekeeper will consider the need for special emergency order. This is the stock allowance to cover errors in forecasting the lead time or demand during the lead time and it is set so that management are warned when usage is above average and buffer stock is being used.

The re-order quantity is the replenishment ordered frequently but not always the COQ. This is to ensure that when goods are received, the stock holding will be restored to an amount sufficient to last for a reasonable period ahead. The re-order quantity is set by giving consideration to the rate of consumption, cost of holding stock against cost of buying; bulk discounts; obsolescence and deterioration risks and transportation cost. The upper figure in the diagram below is referred to as the maximum level. This is used as an indicator to management to show when stocks have risen too high. This is set so that management will be warned when demand is the minimum anticipated and consequently stock may rise above maximum intended. This level is set after giving effect to: rate of consumption; risk of obsolescence; cost of storing above normal stocks; storage space availability: the re-order quantity; and the time necessary to obtain the delivery of the materials.

The diagram below illustrates the above items.



**Figure 11.2: Stock Control Levels**

#### ILLUSTRATION 11-4

The data given below is to be used for calculating the following stock control levels.

- (a) Re-order level
- (b) Minimum level
- (c) Maximum level and
- (d) Average level

Average usage 50 units per day

Maximum usage 70 units per day

Minimum usage 30 units per day

Re-order period 11-13 days

EOQ 1000 units

#### SUGGESTED SOLUTION 11 – 14

Reorder Level = Maximum Usage x Maximum Reorder Period

$$\begin{aligned} &= 70 \times 13 \\ &= 910 \text{ units} \end{aligned}$$

Minimum Level = Re-order level - Average usage x Average reorder Period

$$\begin{aligned} &= 910 - (50 \times 12) \\ &= 910 - 600 \\ &= 310 \text{ units} \end{aligned}$$

Maximum Level = Re-order Level + EOQ – (Minimum usage x Minimum reorder period)

$$\begin{aligned} &= 910 + 1000 - (30 \times 11) \\ &= 1,580 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Average Level} &= \frac{\text{Maximum Level} + \text{Minimum Level}}{2} \\ &= \frac{1,580 + 310}{2} = 945 \text{ units} \end{aligned}$$

#### ILLUSTRATION 11 – 5

- (a) Calculate three control levels for a stock control system having the following characteristics:

Average Usage 3000 units per week

Minimum Usage 220 units per week

Maximum Usage 4200 units per week

Reorder Period 10 – 14 weeks

EOQ – 35,000 units

#### SUGGESTED SOLUTION 11 – 5

$$\begin{aligned} \text{Reorder Level} &= \text{Maximum Usage} \times \text{Maximum Reorder Period} \\ &= 4200 \times 14 \\ &= 58,800 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Maximum Level} &= \text{Reorder Level} + \text{EOQ} - (\text{Minimum Usage} - \text{Minimum Usage}) \\ &= 58,800 + 35,000 - (2,200 \times 10) \\ &= 93,800 - 22,000 \\ &= 71,800 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Minimum Level} &= \text{Reorder Level} - \text{Average Usage} \times \text{Average Reorder Period} \\ &= 58,800 - (3,000 \times 12) \\ &= 58,800 - 36,000 \\ &= 22,800 \text{ units} \end{aligned}$$

### 3.2.8 Perpetual Inventory System/Continuous Stock Taking

The perpetual inventory system refers to a situation whereby after each issue or receipt the physical balance is calculated. The total of the balanced represents the stock on hand, thus making for the avoidance or wholesale periodic stock taking. However, the continuous stock taking system may be adopted, and it is that which allows for the comparison or checking of the actual stock against what is maintained in the stock records on a continuous basis. The system is operated by checking a few items each day so that all items are checked two or three times a year, thus rendering the annual stock process a worthless assignment.

The procedures, however, are as follows:

- (a) A small group of employees is assigned the job of stock check on a permanent basis. Sometimes, cost department staff may be utilized for control purposes.
- (b) Items are checked on a daily basis to ensure:
  - (i) Complete or full check of all items
  - (ii) Emphasis is laid on fast moving
- (c) The balances on the store ledger card is not to be revealed to any staff authorized to check physical stock in the stores.
- (d) All the end of each stock account period, the staff given the task of counting should report the physical units to the office who assigned the job.

#### ILLUSTRATION 11-6

- (a) Daily Consumption = 130 – 180 units
- (b) Lead Time = 16 – 20 days
- (c) EOQ – 4,800 units  
Holding cost per unit ₦

**Required:**

- (a) Find the average stock level
- (b) What is the total cost of the base stock per annum?
- (c) Would your answer to (b) above differ, if the normal daily consumption is 160 units?

**SUGGESTED SOLUTION 11 – 6**

The average stock level cannot be ascertained except the following stock level are known: re-order level; maximum stock level; and minimum stock level. Hence, we calculate the above first, even though the question was silent on them.

$$\begin{aligned} \text{Reorder Level} &= \text{Maximum Usage} \times \text{Maximum Lead Time} \\ &= 180 \times 20 \\ &= 3600 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Maximum Stock Level} &= \text{ROL} + \text{EOQ} - (\text{Minimum Usage} \times \text{Minimum Lead Time}) \\ &= 3600 + 4800 - (130 \times 16) \\ &= 8400 - 2080 = 6320 \text{ units} \end{aligned}$$

$$\begin{aligned} \text{Minimum Stock Level} &= \text{ROL} - (\text{Average Usage} \times \text{Average Lead Time}) \\ &= 3600 - (155 \times 18) \\ &= 3600 - 2790 = 810 \text{ units} \end{aligned}$$

$$\text{Average Stock Level} = \frac{6320 + 810}{2} = 3565 \text{ units}$$

(b) Cost of holding base stock = Qh  
 Q = Base Stock = 810  
 H = Annual Holding Cost/Unit = 10  
 Base Stock annual holding cost = ~~₦~~10 x 810 = ~~₦~~8100

(c) If the normal consumption is 160 units  
 Minimum Stock Level – ROL – (Normal Usage x Normal Lead Time)  
 = 3600 – (160 x 18)  
 = 3600 – 2880 = 720 units  
 Therefore, total cost of base stock = ~~₦~~720 x ~~₦~~10 = ~~₦~~7200  
 Hence, the difference in cost = ~~₦~~(8100 – 7200) = ~~₦~~900

Any difference(s) between the recorded figure and physical stock count is/are immediately investigated. The typical causes of discrepancies between actual stocks and recorded stocks are the following:

- (a) errors caused by incorrect recording and calculations, for example, using the wrong stock price.
- (b) incorrect coding causing the wrong stock to be issued and wrong card to be altered.
- (c) under or over issues not noted
- (d) parts and materials returned to stores not documented

- (e) shrinkages, pilferage, evaporation, wastages etc.
- (f) Loss of non usage of goods received notes, materials requisition notes and other essential documentations.

The following are the advantages of the perpetual inventory/continuous stock taking exercise:

- (a) production or sales stoppages are easily tracked.
- (b) likely errors are reduced by the usage of skilled staff.
- (c) the process of investigation is accelerated
- (d) staff morale is increased and standard raised
- (e) discrepancies and losses are revealed sooner than they would be, if stock taking were limited to an annual check.

### 3.2.9 ABC Principle or Selective Approach

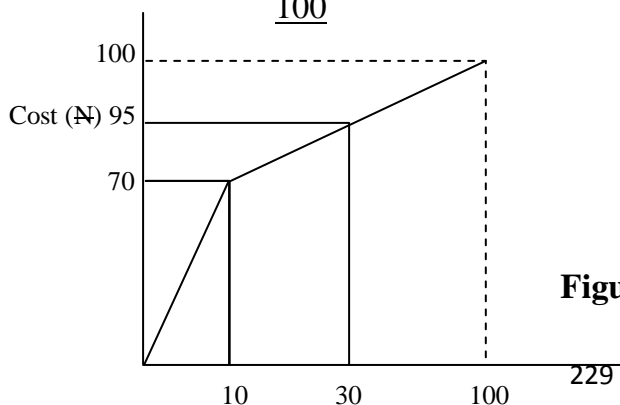
Under this system, control of stock is maintained by classifying materials or items into expensive, inexpensive or a middle cost range because of the advantages of simplifying stores procedures without incurring unnecessarily high cost. The segregation of materials for selective stores control purposes may be done having the following in mind:

- (a) expensive and medium cost materials are subject to careful stores control procedures to reduce costs, that is, items or high values even though few in number are given priority to avoid a high loss.
- (b) inexpensive materials can be stored in large quantities with a slow turnover period because the cost savings from careful stores control do not justify the administrative effort needed to carry out the controls. Large quantities of these items may be stored without increasing stores costs by any appreciable amount.

The selective method to stores control is at times referred to as the ABC method whereby materials are classified into A, B and C groups according to their values to the organization and it is better explained by the table and diagram below.

**TABLE 11.1**

Group	Unit of Quantities	%	Values ₦	%
A	10	10	7,000	70
B	30	30	2,600	25
C	<u>60</u>	60	<u>500</u>	5
	<u>100</u>		<u>10,000</u>	



**Figure 11.3 ABC Control Graph**

### 3.2.10 Economic Order Quantity

#### Inventory Costs

Inventory Control can be defined as the system used in a firm to control the firm's capital outlay on stock. Thus, typically, it involves the recording and monitoring of stock levels, forecasting future demands and deciding when and how many units to order.

However, the main purpose is to minimize, in total, the cost associated with stock, which are hereby categorized into three groups viz:

- (a) Carrying Cost
- (b) Ordering Cost
- (c) Stock-out Cost

(a) **Carrying Cost:** These are the cost of holding stock in the store and it may be calculated as a percentage of purchase price of an item or materials. The examples are:

- (i) interest on capital invested in stock;
- (ii) storage charges (rent, lighting etc.);
- (iii) Stores staffing, equipment maintenance and running cost;
- (iv) material handling costs;
- (v) audit, stock taking, stock recording costs;
- (vi) insurance;
- (vii) deterioration and obsolescence;
- (viii) pilferage, evaporation, etc.

(b) **Ordering Cost:** These are basically the costs of obtaining stocks and examples are :

- (i) transport costs
- (ii) set up and tooling costs
- (iii) clerical costs

(c) **Stock-out Cost:** These are costs of running out of stocks and examples are:

- (i) lost contribution or profit through lost sales.
- (ii) loss of future sales because of lack of patronage by customers
- (iii) cost of production stoppages caused by lack of work in progress and raw materials
- (iv) extra costs associated with urgent, often small quantity, replenishment orders.

### 3.2.11 Assumptions Underlying the Operation of the EOQ Model

The following are the assumptions underlying the operations of the EOQ model viz:

- (a) there is a known constant holding or carrying stock.

- (b) there is a known constant stock ordering cost.
- (c) there is a known constant price per unit
- (d) the rates of demand are known
- (e) the replenishment of stock is made instantaneously.

It should be noted that all the assumptions mentioned may not be present in all situations. In most cases, EOQ focuses on the holding and ordering costs. Therefore from the foregoing, the EOQ can be explained to be a calculated re-order quantity which minimizes the balances of costs between carrying costs and ordering costs.

The cost of holding stock could be reduced to some extent if the average quantity of stock held could be reduced and this could be made possible by reducing the reorder quantity but the implication is frequent orders being placed.

### 3.2.12 Simple EOQ Model

The EOQ model can be determined by either of the two methods as shown below when there are no discounts:

- (a) simple graphical method
  - (b) by formula (Algebraic method and Calculus)
- (a) **Graphic Method:** The procedures to be followed if the graphical method is to be used are the following:
- (i) Put up a graph showing on Y-axis the total annual cost of buying and holding stocks, and on the X-axis the selected range of possible order quantities.
  - (ii) Select a number of order quantities and determine for each of the following:
    - The annual cost of buying which is determined by multiplying the cost per ordering ( $C_o$ ) by the number of orders that would be placed in a period (that is, the total annual quantity divided by quantity ordered at each buying  $D/Q$ ),
    - The annual cost of carrying stock which is determined by multiplying the annual cost of carrying one unit of stock by the average number of units held in stock (that is, dividing the opening stock and closing stock by 2). Thus, the annual carrying cost: is  $\frac{1}{2} Q \times C_c$ .
    - The total annual cost of ordering and carrying cost is determined by adding costs (a) and (b) above together.
  - (iii) Plot on a graph the total annual cost of ordering and holding or carrying stock against each selected order quantity and consequently rule a smooth curve through the identified points.

- (iv) Determine the point at which the curve or line is at its minimum level and this is the point where it is advantageous to place an economic order since costs are at the minimum point.

The stated steps are depicted in Figure 11.4 as above.

**(b) Formula method (Algebraic and Calculus Methods):**

- (i) Algebraic Method: For the EOQ to be determined, both ordering cost and the carrying cost must be at their minimum levels, thus, mathematically, the formula given will have to be equated to each other, that is:

$$\frac{DC_0}{Q} = \frac{OCc}{2}$$

By cross multiplication

$$2DC_0 = Q^2C_c$$

$$Q^2 = \frac{2DC_0}{C_c}$$

$$EOQ = \sqrt{\frac{2DC_0}{C_c}}$$

Where:

Q = Economic Order quantity

Cc = Carrying Cost per item per annum

Co = Ordering cost per order

D = annual demand per annum

- (ii) Calculus:

The Total Relevant Cost = Total Ordering Cost +  
Total Carrying Cost

$$\frac{DC_0}{Q} + \frac{QCc}{2}$$

Differentiate total relevant cost with respect to Q

$$\frac{dTRC}{dQ} = -DCQ^{-2} + \frac{C_c}{2}$$

At the turning point  $\frac{dTRC}{dQ} = 0$

$$\frac{DC_0}{Q^2} = \frac{C_c}{2}$$

$$Q = \sqrt{\frac{2DC_0}{C_c}}$$



The above formula was based on the fact that stock can be replenished on a constant basis.

The following illustrates the EOQ model for stock control purposes:

### ILLUSTRATION 11-7

ALAYAKI Enterprises has an annual demand of 1000 units per month, the ordering cost ₦350 per order, the units cost ₦8 each and it is estimated that carrying costs are 15% per annum of the purchase price. You are required to find the Economic Order Quantity.

### SUGGESTED SOLUTION 11-7

$$\text{By formula EOQ} = \sqrt{\frac{2DC_o}{C_c}}$$

Where:

$$D = 1000 \times 12 = 12,000 \text{ units}$$

$$C_o = \text{₦}350.00$$

$$C_c = \text{₦}8 \times 15\% = \text{₦}1.2$$

$$\begin{aligned} \text{EOQ} &= \sqrt{\frac{2 \times 12000 \times 350}{1.2}} \\ &= 2,645 \text{ units} \end{aligned}$$

### 3.2.13 EOQ with Discounts

One of the major assumptions of the simple EOQ model is that the price is fixed and known with certainty. However, in a real-life situation, it is possible for the price to vary. This occurs when there are discounts resulting from bulk purchases. Whenever there is a discount, the simple EOQ formula will break down. The illustration below is used to determine EOQ whenever there is purchase discount.

### ILLUSTRATION 11-8

A retailer has an annual demand for a certain non-perishable commodity of 1000 units. He buys from a wholesaler at a cost of ₦5 per unit and the cost of ordering and receiving delivery of a replenishment order is ₦25 each time. His stock holding cost are 25% of the average stock value per year.

**Required:**

- (a) How many units should the retailer order per occasion and how often should he order this quantity to minimize the total relevant cost?
- (b) What is the total stock cost?
- (c) Suppose the wholesaler offer 5% discount on the purchase price per unit on orders between 300 and 1999. 10% discounts on orders of 2000 or more. Determine whether the retailer should take advantage of either of the discount offered.

**SUGGESTED 11 – 8**

(a) (i)  $Q = \sqrt{\frac{2DCo}{Cc}} = \sqrt{\frac{2 \times 1,000 \times 25}{0.25 \times 5}} = 200 \text{ units}$

(ii) No. of Orders =  $\frac{D}{Q} = \frac{1,000}{200} = 5 \text{ times}$

(b) Total Stock Cost = Total Carrying Cost + Total Ordering Cost + Total Purchase Cost

$$\begin{aligned} &= \frac{QCc}{2} + \frac{DCc}{Q} + DX \text{ Purchase} \\ &= \frac{200 \times 1.25}{2} + \frac{1,000}{200} \times 25 + 1,000 \times 5 \\ &= 125 + 125 + 5,000 \\ &= \text{₹}5,250. \end{aligned}$$

(c) With discount of 5%

$$Q = \sqrt{\frac{2 \times 1,000 \times 25}{25\% \times 4.75}} = \sqrt{\frac{50,000}{1.1875}} = 205 \text{ units} = \text{Not feasible}$$

with discount of 10%

$$Q = \sqrt{\frac{2 \times 1,000 \times 25}{25\% \times 4.75}} = \sqrt{\frac{50,000}{1.1875}} = 211 \text{ units} = \text{Not feasible}$$

**Recommendation:**

He should not take advantage of the offer because the EOQ is below the given range. If he does, he will incur higher carrying cost.

**3.2.14 EOQ with Gradual Replenishment**

$$\text{EOQ (with gradual replenishment)} = \sqrt{\frac{2DC_o}{C_c \left(1 - \frac{D}{R}\right)}}$$

Where R = Replenishment rate per annum

This can be illustrated with the example below:

### ILLUSTRATION 11 – 9

A company uses 50,000 rings per annum which are N10 each to purchase. The ordering and handling costs are N150 per order and carrying costs are 15% per annum. However, on purchasing its own machinery: the company now has the capacity to produce 250,000 rings per annum. You are required to calculate the EOQ (assuming that there is now a gradual replenishment of stock).

### SUGGESTED SOLUTION 11 – 9

$$\begin{aligned} &= \sqrt{\frac{2DC_c}{C_c \left(1 - \frac{D}{R}\right)}} \\ &= \sqrt{\frac{2 \times 150 \times 50000}{1.5 \left(1 - \frac{50000}{250000}\right)}} \\ &= \sqrt{\frac{15,000,000}{1.5 (0.8)}} = \sqrt{12,500,000} = 3,535 \text{ rings} \end{aligned}$$

### 3.2.15 Limitations of the EOQ Model

According to Harper (1982), the EOQ model suffers from the following set-backs

- (a) The fact that in practice, the total annual cost curve is relatively flat in the vicinity of the EOQ, means that quite significant divergences from the quantity will result in only minor cost increases. The EOQ, then is by no means a critical figure.
- (b) the actual optimum order quantity is in fact, often much more crucially dependent on the storage space and facilities available, work load of purchase office, economics of delivery and overall convenience of all involved in the purchase such that, it is only a potential savings of a few naira.
- (c) the cost of purchasing and holding stocks is often difficult to quantify with any accuracy. Consequently, even when the EOQ has been calculated, there is little certainty that the result is particularly accurate.
- (d) charging prices or usage rates in theory requires recomputation of the EOQ, with the consequential need to alter all the relevant records in the purchase office and stores office. If interest rates change, then the order quantities and records of all materials bought and stocked will need to be changed.

### **3.3 PRODUCT MIX WITH MULTIPLE CONSTRAINTS (LINEAR PROGRAMMING)**

#### **3.3.1 Definition**

The technique used in the allocation of resources where more than one key factor or constraint is involved is referred to as LINEAR PROGRAMMING. It is a method of solving equations and can be programmed for computer so that difficult and multi-constraint problems will show how scarce resources in a firm can best be utilized. It is a procedure to optimize the value of some objectives, for example, maximize profits or minimize costs when the factors involved (for example, labour or machine hours) are subject to some constraints.

#### **3.3.2 Assumptions of LP**

The basic assumptions underlying the operation of the technique are:

- (a) Certainty: It is believed that all relevant information relating to a problem situation are known, for example, the resources available.
- (b) Linearity: It is believed that there is a proportional relationship between the resources utilized and the contribution or the cost incurred.
- (c) Non-Negativity: There is no negative output that will be produced, that is, at worst we achieve zero level of production.
- (d) Single-Objective: There is an assumption of only one economic objective, that is maximization of profit or minimization of costs.
- (e) Divisibility: It is generally believed that fractional output could be produced, that is, all the variables are assumed to be completely divisible.

#### **3.3.3 Uses of Linear Programming**

The specific uses of the Linear Programme technique are:

- (a) It can be used in determining the optimal product mix
- (b) It is an effective method of solving capital rationing problems
- (c) It can be used to plan the production activities effectively
- (d) It is an effective aid to financial modeling
- (e) It can assist in solving transportation and assignment problems

#### **3.3.4 Methods of Linear Programming**

Three main methods of solving linear programming problem are:

- (a) Graphical solution method.
- (b) Algebraic or Simultaneous Solution method.
- (c) Simplex Solution method.

- (a) **Graphical Solution Method:** It is simple but is very limiting in nature where the variables are more than 2 unless 3 dimensional graph will help to determine the optimal solution as in illustrations 15 and 16 below.
- (b) **Algebraic or Simultaneous Solution method:** It will handle more than 2 variables and explore all the values and bring out an optimal value for satisfying the objective function (see illustration 17 below).
- (c) **Simplex Solution Method:** It is an algorithmic method in the sense that certain steps will be given and followed to the end till the optimal solution is arrived at (see illustrations 18 and 19 for details of procedures to be followed).

### 3.3.5 Formulating a Linear Programming Problem

In order to formulate a Linear programming problem, the following are the steps involved:

- (i) Determine the objective function
- (ii) Formulate the constraint
- (iii) Formulate the non-negativity constraint

#### ILLUSTRATION 11-10

The Okiki Farm Ltd. Manufacturers two models of garden cutters: “Opeke” and the “Opaka” in a two stage process involving casting and machining. When preparing the 2003 budget, it was found that the following weekly limitations on capacity existed;  
 Foundry hours available 480  
 Machining hours available 600

Each “Opaka” takes two hours in the machine shop whereas an “Opeke” takes three hours in each. In addition, the material required for the “Opeke” was in short supply and only sufficient materials for 140 units per week could be guaranteed for the year.

If the profit contribution from “Opeke” is ₦8 and the “Opaka” is ₦6, formulate the optimum production schedule and the weekly contribution using the linear programming model.

#### SUGGESTED SOLUTION 11-10

	OPEKE	OPAKA	
Foundry hours	3	2	480
Machine hours	3	4	600
Direct material	1	-	140
Contribution	₦8	₦6	

Formulation: Let B represents Opeke and R represents Opaka  
 Maximum weekly contribution:  $8B + 6R$

Subject to the following constraints:

$3B + 2R \leq 480$	-	Foundry hours
$3B + 4R \leq 600$	-	Machine hours
$B \leq 140$	-	Direct material
$B, R \geq 0$	-	Non negativity

### ILLUSTRATION 11-11

A manufacturer wishes to produce 100 tons of a product containing at least 50% factor of A and 30% factor of B. He can use two ingredients, X costing ₦20 per ton, which will yield 60% of A and 20% of B and Y costing ₦40 per ton which will yield 40% of A and 50% of B.

**Required:**

Formulate the programme for the expected mix of X and Y that is needed to yield the minimum material cost of production and state what the objective function should be.

### SUGGESTED SOLUTION 11-11

Let X represent tons of ingredients X and Y tons of ingredient Y.

Objective function: Minimize  $20X + 40Y$

Subject to:  $0.6X + 0.4Y \geq 50$  factor A constraint

$0.2X + 0.5Y \geq 30$  factor B constraint

$X + Y \geq 100$  production constraint

$X, Y \geq 0$  non negativity constraint

### ILLUSTRATION 11-12

Abiola Farms uses two crop yielding ingredients (Vim and Moom) on its farms in order to enhance its production capacity.

The local agricultural centre has advised Abiola Farm to spend at least 4,800kg of a special nitrogen fertilizer ingredient and at least 5,000kg of a special phosphate fertilizer ingredient in order to increase his crops. Neither ingredient is available in pure form.

A dealer has offered 100kg bags of Vim at ₦1 each. Vim contains the equivalent of 20kg of nitrogen and 80kg of phosphate. Moom is available in 100kg bags at ₦3 each, it contains the equivalent of 75kg of nitrogen and 25kg of phosphate.

**Required:**

Express the relationships as inequalities. How many bags of Vim and Moom should Abiola Farms buy in order to obtain the required fertilizer at minimum cost? Solve graphically

**SUGGESTED SOLUTION 11-12**

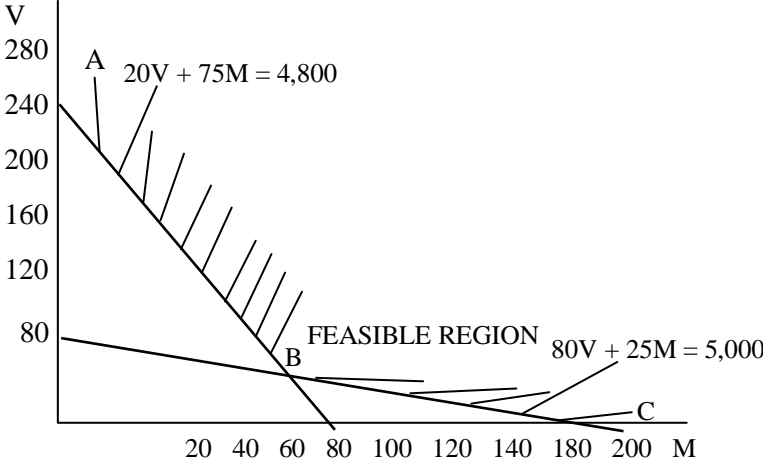
Let Vim be represented by V and Moom represented by M

Objective function: Minimize Cost  $V + 3M$

Subject to:  $20V + 75M \geq 4800$  .....(1)  
 $80V + 25M \geq 5000$  .....(2)  
 $V, M \geq 0$

	V	M
In equation 1: $20V + 75M = 4800$	0	64
	240	0
In equation 2: $80V + 25M = 5000$	0	200
	62.5	0

The graph is now plotted as below:



Points	V	M	$V + 3M$	
A	240	0	$240 + 3(0)$	= 240
B	46.36	51.64	$46.36 + 3(51.64)$	= 201.28
C	0	200	$0 + 3(200)$	= 600

The objective point is Point B where we have the lowest cost of ₦201.28 when the firm will have to buy 46.36kg of Vim and Moom.

**3.3.6 Shadow Price**

It can be defined as the amount by which the profit of a company will increase if an additional unit of a scarce resource is made available i.e. it is the maximum amount which a company is prepared to pay for the use of an additional unit of a constraint. Generally, only binding constraints have shadow price, the shadow price of the feasible region and the resources are fully utilized at that optimal level.

### 3.3.7 Usefulness of Shadow Price

- (1) It is the extra profit that may be earned for having an additional unit of a constraint.
- (2) It can be used to determine the maximum amount which a company is willing to pay for scarce resource.
- (3) It will generally indicate the effect of unit change of the constraints, that is, it provides a measure of the sensitivity of the resources.

### 11.3.8 Simplex Method

This involves algorithms and the following procedures or steps are to be taken in order to formulate the tableau for the purpose of determining the optimal solution:

- (a) Formulate the objective function.
- (b) Formulate the non-negativity constraints
- (c) Formulate the constraints
- (d) Get rid of inequality signs in constraints by introduction of slack variables
- (e) Set up the initial simplex tableau.
- (f) Locate the pivot column in the tableau set up in the initial simplex tableau.
- (g) The pivot column is one that house the lease element on the objective function row if you are maximizing and the maximum value on the objectives function row if you are minimizing.
- (h) Locate the pivot row by dividing each position element of the pivot column into the corresponding constant value of the last column. Select the row with the least quotient. This is the pivot row. The element in the pivot row and the pivot column is the pivot element.
- (i) The pivot element is then turned to unity by dividing through all the elements in the pivot column by the pivot element.
- (j) Using a procedure to obtain zeros in the pivot column other than the pivot element, by adding suitable products of the pivot row to the remaining ones i.e. we use pivot row to eliminate all other rows.
- (k) If a negative number remains in the objective function row, go to step (f) and start all over if we are maximizing. If none of the element in the objectives function row is negative, the optimum solution has been found.

On the other hand, if we are minimizing and one of the elements in the objectives function row is still negative, then we have not arrived at the optimal solution, if all the elements in the objective function row are zero or positive, then we have arrived at the solution.

The examples below are used to illustrate the equation of the simplex method of solving linear programming problems.



### ILLUSTRATION 11-13

Given the following below information, use the simplex method in arriving at the optimal solution:

$$\begin{aligned} \text{Maximize P: } & 8x_1 + 6x_2 \\ & 4x_1 + 2x_2 \leq 60 \\ & 2x_1 + 4x_2 \leq 48 \\ & x_1, x_2 > 0 \end{aligned}$$

### SUGGESTED SOLUTION 11-13

Introduce the slack variable and the equation becomes:

$$4x_1 + 2x_2 + S_1 = 60$$

$$2x_1 + 4x_2 + S_2 = 48$$

$$P = 8x_1 + 6x_2 + 0S_1 + 0S_2$$

$$\text{Therefore, } P - 8x_1 - 6x_2 - 0S_1 - 0S_2 = 0$$

	x <sub>1</sub>	x <sub>2</sub>	S <sub>1</sub>	S <sub>2</sub>	P	C	
	(4)	2	1	0	0	60	T <sub>2</sub>
T <sub>1</sub>	<u>2</u>	4	0	1	0	48	NR <sub>1</sub> = R <sub>1</sub> + 4
	-8	-6	0	0	1	0	NR <sub>2</sub> = R <sub>2</sub> + 0
							NR <sub>3</sub> = R <sub>3</sub> + 0

The pivot column is x<sub>1</sub>

The pivot row is that with 15 (1<sup>st</sup> row) that is, (60/4)

The pivot element is 4

	x <sub>1</sub>	x <sub>2</sub>	S <sub>1</sub>	S <sub>2</sub>	P	C	
	1	½	¼	0	0	15	T <sub>3</sub>
T <sub>2</sub>	<u>2</u>	4	0	1	0	48	NR <sub>2</sub> = R <sub>2</sub> - 2R <sub>1</sub>
	-8	-6	0	0	1	0	NR <sub>3</sub> = R <sub>2</sub> + 8R <sub>1</sub>

	x <sub>1</sub>	x <sub>2</sub>	S <sub>1</sub>	S <sub>2</sub>	P	C	
	1	½	¼	0	0	15	T <sub>4</sub>
T <sub>3</sub>	<u>2</u>	4	0	1	0	18	NR <sub>2</sub> = R <sub>2</sub> + 3
	0	-2	2	0	1	120	NR <sub>3</sub> = R <sub>3</sub> + 0

Since we still have a negative in the objective function row, we have to go back to step (f), the pivot column is x and the pivot row is that containing 3.

	x <sub>1</sub>	x <sub>2</sub>	S <sub>1</sub>	S <sub>2</sub>	P	C	
	1	½	¼	0	0	15	T <sub>5</sub>
T <sub>4</sub>	<u>0</u>	1	-1/6	1/3	0	6	NR <sub>1</sub> = R <sub>1</sub> - ½R <sub>2</sub>
	0	-2	2	0	1	120	NR <sub>3</sub> = R <sub>3</sub> + 8R <sub>1</sub>

	$x_1$	$x_2$	$S_1$	$S_2$	P	C
	1	0	$\frac{1}{3}$	$-\frac{1}{6}$	0	12
$T_5$	0	1	$-\frac{1}{6}$	$\frac{1}{3}$	0	6
	0	0	$\frac{5}{3}$	$\frac{2}{3}$	1	132

Proof:  $P = 8x_1 + 6x_2$

$$x_1 = 12$$

$$x_2 = 6$$

$$\text{Therefore, } P = 8(12) + 6(6) = 96 + 36 = 132$$

#### 4.0 CONCLUSIONS

Manufacturing inventory can be conveniently categorized into raw materials, work in progress, finished goods and consumable stores and they are held for precautionary, transactionary and speculative reasons with the attendant costs of holding, ordering and if any stock out.

The various methods for controlling stocks are re-order level, periodic review system and economic order quantity.

The overall objective of inventory control is to maintain stock at a level, which minimizes total stock costs.

Linear programming technique is a resource allocation technique which provided a valuable extension to cost-volume-profit-analysis.

The assumptions thereof are: linearity, single objective function, non-negativity and divisibility.

Linear programming problem can be solved by using any of the following methods: graphical, simultaneous equation and simplex method.

The major limitations of Linear Programming techniques are: the assumptions of linearity, certainty and continuity.

#### 5.0 SUMMARY

The underline logic behind this theory is premised on the fact that human being unlike machine acquires a lot of skills, experience, exposure, specialisation and dexterity for performing a repetitive assignment.

#### 6.0 TUTOR MARKED ASSIGNMENT

1. Bogu Plc has recently developed a new product. The nature of Bogu Plc's work is repetitive and it is usual for there to be an 80% learning curve effect when a

new product is developed. The time taken for the first unit was 22 minutes. Assuming that an 80% learning effect applies, the time to be taken for the fourth unit is nearest to

- A. 9.91 minutes
- B. 9.97 minutes
- C. 14.08 minutes
- D. 15.45 minutes
- E. 17.60 minutes.

Use the below data to answer questions 2 and 3

A domestic appliance retailer with multiple outlets stocks a popular toaster known as the Autocycle 2000, for which the following information is available

Average sales	75 per day
Maximum sales	95 per day
Minimum sales	50 per day
Lead time	12 – 18 days
Re-order quantity	1,750

2. Based on the above, at what level of stocks would a replenishment order be issued?
- A. 1050
  - B. 1330
  - C. 1710
  - D. 1750
  - E. 1760
3. Based on the data above, what is the maximum level of stock possible?
- A. 1750
  - B. 2860
  - C. 3460
  - D. 5210
  - E. 5310
4. Tunde Limited mixes four raw materials to produce a plastic. Material W costs ₦40 per kg, Material X Costs ₦112 per kg, Material Y costs ₦90 per kg, and quality to the plastic and it is required to use the least cost mix. The objective function therefore is:
- A.  $₦40x_1 + 120x_2 + 80x_3 + 260x_4$
  - B.  $₦40x_1 + 80x_2 + 120x_3 + 260x_4$
  - C.  $₦40x_1 + 260x_2 + 120x_3 + 50x_4$
  - D.  $₦40x_1 + 120x_2 + 90x_3 + 260x_4$
  - E.  $₦40x_1 + 100x_2 + 90x_3 + 260x_4$

5. Zulu Plc uses the economic order quantity formular (EOQ) to establish its optimal re-order quantity for its single raw material, the following data relates to the stock costs:
- |                |               |
|----------------|---------------|
| Purchase price | ₦15 per item  |
| Carriage costs | ₦50 per order |
| Ordering costs | ₦5 per order  |
- Storage cost 10% of purchase price plus ₦0.20 unit per annum.  
Annual demand 4000 units  
What is the EOQ to the nearest whole unit?
- 153 units
  - 170 units
  - 485 units
  - 509 units
  - 500 units
6. A mathematical technique concerned with the allocation scarce resources is called \_\_\_\_\_
7. In the pricing model, the increase in the value of the objective function which would be achieved if one unit of the resources was available is called \_\_\_\_\_
8. That linear programming refers to the quantification of an objective and usually takes the formal maximizing profits or minimizing costs is called \_\_\_\_\_
9. When can graphical solution method be used in linear programming?
10. What is a slack variable?

## 7.0 REFERENCES/FURTHER READINGS

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## **UNIT 12      WORKING CAPITAL MANAGEMENT**

### **CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
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  - 3.4 Working Capital Ratio
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### **1.0 INTRODUCTION**

The term working capital refers to the capital available for running the day to day operations of an organization. It is defined as current assets less current liabilities.

### **2.0 LEARNING OBJECTIVES**

In this unit, the readers will be able to understand:

- The definition of working capital management and its component.
- The need for managing current assets and current liabilities.
- The proper mix of short-term and long-term financing for current assets.
- Factors that affect credit policy.
- The techniques of inventory management.
- The techniques used in cash management.
- The preparation of cash flow statement.

### **3.0 MAIN CONTENT**

### 3.1 DEFINITION OF WORKING CAPITAL

Working capital may be defined as the excess of current assets over current liabilities. Working Capital is therefore concerned with the availability of fund to run a business. It also assists in measuring the amount of credit applicable to the running of an enterprise.

Working capital comprises four balance sheet items which are regarded as the short-term areas of the balance sheet.

- **Stock:** This includes raw materials, work in progress and finished goods, engineering spares, etc.
- **Debtors and prepayments:** These are amounts owed to the company by its customers in respect of credit sales
- **Cash:** These are physical cash balances in the till boxes of the company, cash balances in the Banks and short-term investments in form of bank deposits, quoted investments and other cash equivalents that could be turned into cash within the shortest possible time.
- **Creditors and accruals:** These represent the amount owed to suppliers of materials, services, unpaid taxes, unpaid dividends and other accrued expenses.

A company may make profit and still groan under serious debt burden that could hinder both long and short term performance. In order to prevent the occurrence of such situation, there is a need to manage working capital effectively in an organisation.

### 3.2 WORKING CAPITAL REQUIREMENTS

There are no set rules or formulae to determine the working capital requirements of firms. Several factors, each having a different importance may over time influence changes in working capital needs of firms. Therefore, an analysis of relevant factors would be made to determine total investment in working capital.

Factors that influence the working capital requirements are:

**(a) Nature of Business**

The nature of the business determines the requirements of the working capital. Some companies require little working capital while others are working capital intensive, for example, retail businesses and construction firms need to invest substantially in working capital and lesser amount in fixed assets. In contrast, parastatals such as NEPA, now PHCN, etc. have a very limited need for working capital and have to invest abundantly in fixed assets.

**(b) Sales and Demand conditions**

The availability of fund, type of the products and sales environment will determine the extent of the working capital requirement. The class of customers, the price and quality of the product, the location of the business as well as climate are some of the factors that determine the level of sales achievable. Some products also have a high degree of seasonal variability, for

example, household consumptions. Some products are purely sold in cash depending upon the demand of the products.

**(c) Technology and Manufacturing policy**

The production process has a lot of impact on the working capital requirement. The time-lag of the production from the input of raw materials to finished goods also affects the requirement, for example, the manufacturing cycle of products such as detergent powder, soaps, chocolates etc. may be produced within a day, and the sales proceeds could be realised within shortest time.

**(d) Credit Policy**

The credit policy of the firm is influenced by the nature of the business, the type of the products, the size of the company and its perceived market share. The credit terms to be granted to customers may depend upon the norms of the industry to which the firm belongs, for example, pharmaceutical companies deal mainly in cash while hoteliers may give, say, two weeks to a month for corporate guests to settle their bills. Companies have to be flexible in determining their credit policy.

**(e) Credit Granted by Suppliers**

The working capital requirements of a company are also affected by credit terms allowed by its suppliers. A company will need less working capital if liberal credit terms are available to it. The availability of credit from banks also influences the working capital requirements, for instance, a company that enjoys less credit period than it gives its customers would have high incidence of working capital requirements and the need for short-terms funds may become necessary. A firm, which can get bank credit easily on favourable conditions, will operate with less working capital than firms without such a facility.

**(f) Price Level Changes**

Price is relevant to purchases of material, printing of finished goods and eventual sales. The increasing shifts in price level make functions of financial managers difficult. He should anticipate the effects of price level changes on working capital requirements of the firm. Generally, rising price levels will require a firm to maintain higher amount of working capital. Same levels of current assets will need increased investment when prices are increasing.

### **3.3 OVER-TRADING AND OVER-CAPITALISATION**

A company that is not making optimum use of its resources is either overcapitalised or under-trading. Over-trading arises when a company tries to conduct a volume of trade over and above that for which it is financially equipped. This can be extremely dangerous in the longer-term.

Symptoms of Over-trading include:

- (a) A poor current ratio and quick ratio caused by:
  - (i) Excessive creditors or bank overdrafts, and
  - (ii) High stock levels (the business having unnecessarily acquired heavy stocks on credit in excess of normal demand levels within an accounting period).
- (b) A high stocks to net current assets ratio.
- (c) Bank overdraft consistently at disproportionately high level.
- (d) New fixed assets on hire purchase.
- (e) Fall in profit margin as a result, for instance, of cash discount given to debtors in order to reduce the average collection period.

**Over-Capitalisation** - When a company manages its working capital inefficiently, so that there are excessive stock, debtors and cash and very few creditors, there will be an over-investment by the company in current assets, that is working capital will be excessive and the company will be overcapitalised. The return on capital employed (ROCE) would therefore be lower than it should be and long-term funds would be unnecessarily "tied up" when they could be invested elsewhere to earn profit.

### 3.4 WORKING CAPITAL RATIO

This measures the relationship among the various sequents of balance sheet, profit and loss items in order to determine the optimum level of the working capital required to maximize the shareholders' wealth. This could be done by giving a close monitoring of the various working capital ratios and the operating cycle.

The ratios which can assist in judging whether investment in working capital is reasonable to avoid over-trading or over-capitalization are as follows:

- (a) **Sales/Working Capital**  
The volume of sales as in multiple of the working capital investment should be able to indicate whether, in comparison with previous years or with similar companies, the normal volume of working capital is too high.
- (b) **Liquidity Ratios**  
A current ratio in excess of 2:1 or a quick ratio in excess of 1:1 may indicate over-investment in working capital.
- (c) **Turnover Periods (Working Capital Cycle)**  
Excessive turnover periods for stocks and debtors or a low period of credit taken from suppliers would indicate whether the volume of stocks or debtors is unnecessarily high or the volume of creditors too low.

The turnover periods may be calculated approximately as follows:

- (i) Raw materials stock turnover  
=  $\frac{\text{Average raw materials stock}}{\text{Purchases per annum}} \times 365 \text{ days}$



$$(ii) \quad \text{Work-in-progress (WIP) turnover stock turnover} = \frac{\text{Average WIP} \times 12 \text{ months [or 365 days]}}{\text{Cost of production per annum}}$$

Readers should be conscious that cost of sales [or even sales] may be a necessary alternative to cost of production in an examination question.

$$(iii) \quad \text{Finished goods stock turnover} = \frac{\text{Average finished goods stock} \times 365}{\text{Cost of production per annum}}$$

$$(iv) \quad \text{Debtors turnover period} = \frac{\text{Average debtor} \times 365}{\text{Sales per annum}}$$

$$(v) \quad \text{Creditors turnover period} = \frac{\text{Average Trade creditors} \times 365}{\text{Purchases of raw materials per annum}}$$

Average stock, debtors and creditors should be used but an examination question may only give the end of year balance sheet figures and these should then be used.

### 3.5 OPERATING CYCLE

There is a difference between current and fixed assets in terms of their liquidity. A firm requires many years to recover the initial investment in fixed assets such as plant and machinery or land and buildings. On the contrary, investment in current assets is turned over many times in a year. The shorter the length of the turnover period, the better for the company. Alternatively, the higher the number of times investment in current assets is turned over, the better. Investment in current assets such as inventories and debtors, that is, account receivable is realized at least more than once within an accounting year.

Operating cycle, therefore, is the time duration required to convert sales, after the conversion of resources into inventories, into cash. The operating cycle of a manufacturing company involves three phases:

- *Acquisition of resources such as raw materials, labour, power and fuel etc.*
- *Manufacturing of the product* which includes conversion of raw materials into work-in-progress then into finished goods.
- *Sales of the product* either for cash or on credit. Credit sales create account receivable for collection.

The operating cycle may be expressed as a period of time, for example:

- (a) Raw materials stocks are obtained from suppliers who are paid thereby cash is paid out.
- (b) The trade creditors are paid, therefore, cash is paid out.
- (c) Raw materials are held in stock until they are issued for production (work-in-progress). At this time, additional creditors (for labour and other expenses) may be incurred.

- (d) On completion of production, the finished goods are held in stock until sold.
  - (e) Cash is received eventually when the debtors pay up.
- The operating cycle is, therefore, the period between the payment of cash to creditors (cash out) and the receipt of cash from debtors (cash in).

As the turnover periods for stocks and debtors get longer and as payment period to creditors becomes shorter:

- (i) The operating cycle will be lengthened, and
- (ii) The investment in working capital will increase and this could create a serious liquidity problem for the company.

A good knowledge of the operating cycle would help management in cash budgeting and also financial planning especially where sales and production are subject to seasonal variations.

**The computation of the length of operating cycle for a firm:**

Turnover periods [working capital cycle] — Excessive turnover periods for stocks and debtors or a low period of credit taken from suppliers would indicate whether the volume of stocks or debtors is unnecessarily high or the volume of creditors too low.

**ILLUSTRATION 12 – 1**

The following figures have been extracted from Lamina Company Limited balance sheet.

<b><u>CURRENT ASSETS</u></b>	<b>₦'000</b>
Stocks – Raw Materials	10,800
Debtors	16,000
Cash	<u>20</u>
	<u>26,820</u>
<b><u>CURRENT LIABILITIES</u></b>	
Creditors	<u>5,040</u>
Net Current Assets (Working Capital)	<u>21,780</u>

Purchases during the year were ₦52,560,000 while total sales were ₦84,000,000.

You are required to:

- (a) Calculate the following working capital ratios:
  - (i) Current Ratio
  - (ii) Quick ratio or acid ratio.
- (b) Determine the operating cycle for the working capital

**SUGGESTED SOLUTION 12 – 1**

**LAMINA COMPANY LIMITED**

$$(a) \quad i. \quad \text{Sales/Working Capital Ratio} = \frac{84,000}{21,780} = \underline{3.86:1}$$

$$ii. \quad \text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}} = \frac{26,820}{5,040} = \underline{5.32:1}$$

$$iii. \quad \text{Acid Test Ratio/Liquidity Ratio:} \\ = \frac{\text{Total Current Assets} - \text{Stock}}{\text{Current Liabilities}} \\ = \frac{26,820 - 10,800}{5,040} \\ = \underline{3.18:1}$$

(b) Operating Cycle

$$(i) \quad \text{Raw Material Stock Turnover} \\ = \frac{\text{Average Raw Material Stock}}{\text{Purchases per annum}} \times \frac{365 \text{ days}}{1} \\ = \frac{10,800 \times 365}{52,560} \\ = 75 \text{ days}$$

$$(ii) \quad \text{Debtors Turnover Period} \\ = \frac{\text{Average Debtors}}{\text{Sales}} \times 365 \\ = \frac{16,000,000}{84,000,000} \times 365 \\ = 70 \text{ days}$$

(iii) Creditors Turnover Period

$$\frac{\text{Average Trade Creditor}}{\text{Purchases per annum}} \times 365 = \frac{35 \text{ days}}{110 \text{ days}}$$

$$\text{Net Operating Cycle} = \frac{5,040,000}{52,560,000} \times \frac{365}{1} \\ = 35 \text{ days}$$

### ILLUSTRATION 12-2

The following data relates to Beula Limited, a manufacturing Company:

Turnover for the year	N3,000,000
Direct Material	30%
Direct Labour	25%
Variable Overheads	10%
Fixed overheads	15%
Selling and distribution	5%

On average:

- (a) Debtors take 2½ months before payment
- (b) Raw materials are in stock for 3 months
- (c) Work in progress represents 2 month's half produced goods:
- (d) Finished goods represents 1 month's production;
- (e) Credit taken as follows:
  - (i) Direct materials - 2 months
  - (ii) Direct labour - 1 week
  - (iii) Variable O/heads - 1 month
  - (iv) Fixed overheads - 1 month
  - (v) Selling and distribution - ½ month

Work-in progress and finished goods are valued at materials, labour and variable expense cost. Compute the working capital requirement of Beula Limited assuming the labour force is paid for 50 working weeks.

### SUGGESTED SOLUTION 12-2

#### BEULA LIMITED

(a) The cost incurred will be:	N	
Direct materials 30% of 3,000,000	=	900,000
Direct labour 25% of 3,000,000	=	750,000
Variable overheads 10% of 3,000,000	=	300,000
Fixed overheads 15% of 3,000,000	=	450,000
Selling and distribution 5% of 3,000,000	=	150,000
(b) Current Assets		Raw
materials $\frac{3}{12} \times 900,000$	225,000	
*Work-in-progress		
Materials $\frac{2}{12} \times 900,000$	150,000	
Labour $\frac{1}{12} \times 375$	31,250	
Variable overheads $\frac{1}{12} \times 150$	<u>25,000</u>	237,500
Finished goods 65% x 1,500 x $\frac{1}{12}$		162,500
(material, labour, variable overheads)		
Debtors $2\frac{1}{2} \times 1,500$		<u>625,000</u>
		1,250,000
Less Current Liabilities		
Creditors – materials $\frac{2}{12} \times 450,000$	=	75,000
” – labour $\frac{1}{50} \times 375,000$	=	7,500

”	– variable o/head $\frac{1}{12} \times 150,000$	=	12,500	
”	– fixed overhead	=	18,750	
”	– selling and distribution $\frac{1}{24} \times 75,000$	=	<u>3,125</u>	<u>116,875</u>
	Working capital required			<u>508,125</u>

It has been assumed that all the direct materials are allocated to work-in-progress when production is commenced. (Materials is 100% complete while labour and variable overheads are assumed to be 50% complete).

### 3.6 METHODS OF FINANCING CURRENT ASSETS

There are different ways by which a company may adopt to finance current assets. Some of which are:

- (a) **Long-term financing:** A more permanent form of long-term finance includes ordinary share capital, preference share capital, and reserves and profit (retained earnings). Other forms of long-term finance that are less permanent in nature are long-term borrowings, loans, finance leases, debentures, etc.
- (b) **Short-term financing:** This is fund obtained by refundable within a year, usually from the banks or any other financial institutions. Examples are commercial papers, debt factoring, disposal of investments in stocks, etc.
- (c) **Spontaneous financing:** These are financing arrangements obtained in the course of ordinary business. Examples are credit granted by the suppliers, accrued expenses, etc. There is no cost for this type of financing.

### 3.7 CREDIT CONTROL

Credit connotes short term leverage. It refers to a situation whereby a company makes sales for which cash is now wholly collected immediately. To the seller, credits boost sales, increases market share and profits. To the buyer, credit facilitates that raw materials could be bought with relative ease and at minimal cost to the business and ensures that factory works at a steady rate. The value of credit depends on the length of time given. The seller creates trade debtors/receivables in its records while the buyer creates trade creditors in its own financial records. The lengthier the credit period, the larger the debtors and creditors values and hence, the need for control to avoid high cost to the business.

#### 3.7.1 Reasons for Granting Credit

The following may be considered as factors for granting credit:

- (a) The level of competition among companies in the same industry may force the company to grant credit to boost sales.
- (b) The type of product the company produces would enhance its bargaining power. For example, a monopolist or oligopolist supplier may refuse to grant

credit to customers for example, large telecommunication companies, such as, MTN, VMOBILE, in Nigeria.

- (c) Relationship with customers – A long built-up relationship and has strong financial discipline may be granted credit.
- (d) Launching New Product – The launch of a new product may force the company to grant credit in order to penetrate into the market.

### ILLUSTRATION 12-3

The following information relates to Tayo Limited:

	Current Policy	Option 1	Option 2
Expenditure on debt collection Procedures, per annum	₦240,000	₦300,000	₦400,000
Bad debt losses (% of sales)	3%	2%	1%
Average collection period	2 Months	1½ Months	1 month

Current sales are ₦9.6 million per annum, and the variable cost of sales is 90% of sales value. The company requires a 15% return on its investments.

### SUGGESTED SOLUTION 12-3

	Current Policy	Option 1	Option 2
	₦	₦	₦
Average debtors	1,600,000	1,200,000	800,000
Cost of average debtors (90%)	1,440,000	1,080,000	720,000
Reduction in work capital [Note]	-	<u>360,000</u>	<u>720,000</u>
Savings:			
(a) Reduction in losses Benefits of each option	-	96,000	192,000
(b) Interest saving [15% of reduction in working capital Bad debt losses [sales value]	288,000	54,000	108,000
		192,000	96,000
(a) + (b)	-	150,000	300,000
Less Extra costs of debt collection	-	<u>120,000</u>	<u>320,000</u>
Benefit/(Loss) from option		<u>₦30,000</u>	<u>₦(20,000)</u>

**Conclusion:** Option 1 is preferable to the current policy, because option 2 is more costly. The reduction in debtors has been taken as the reduction in the cost of debtors, although there is an argument that the sales value of debtors should be used instead.

Using sales values rather than variable costs the interest savings would be N60,000 for Option 1 and N120,000 for Option 2, giving net benefits/(losses) of N38,000 for Option 1 and (N8,000) for Option 2. The conclusion is still the same.

### **Credit Control: Individual Accounts**

Credit control involves the initial investigation of potential credit customers and the continuing control of outstanding accounts. The main points to note are as follows:

- (a) new customers should give two good references, including one from a bank, before being accepted;
- (b) credit rating should be checked through a credit consultants
- (c) a new customer's credit limit should be fixed at a low level and only increased if the payment record warrants it;
- (d) for large value customers, files should be maintained of any available financial information;
- (e) age lists of debts should be produced and reviewed at regular intervals;
- (f) the credit limit for existing customers should be periodically reviewed, but should only be raised at the request of the customer and if his credit standing is good.
- (g) Personal judgment or favouritism should be ignored.

### **Debt Collection**

There are three main areas which need to be considered in connection with the control of debtors.

- (a) paperwork;
- (b) debt collection;
- (c) credit control.

It is important that sales paperwork should be dealt with promptly and accurately;

- (a) invoices should be sent out immediately after delivery;
- (b) checks should be carried out to ensure that invoices are accurate
- (c) the investigation of queries and complaints and, if appropriate, the issue of credit notes should be carried out promptly;
- (d) if practical, monthly statement should be issued early so that they can be included in the customers' monthly settlement of bills.

The use of pre-printed letters to remind customers to pay their accounts is ineffective. Although it will be more expensive, it is usually better to adopt a more personal approach. A good method of positive debt collection may include the following stages;

- (a) request for payment by telephone;
- (b) telegram or letter
- (c) personal visit e.g. by sales representative;
- (d) withdrawal of credit facilities;
- (e) place debt in hands of a debt collection agency;
- (f) legal proceedings.

## Discount Policies

Varying the discount allowed for early payment of debts:

- (a) shortens the average collect period
- (b) affects the volume of demand [and possibly, therefore, indirectly affects bad debts losses].

It is necessary to compare the cost of the discount with the benefit of a reduced investment in debtors. We shall begin with examples where the offer of a discount for early payment does not affect the volume of demand.

### ILLUSTRATION 12-4

An Extension of the payment period allowed to debtors may be introduced in order to increase sales volume. For example, suppose that Clara Limited currently expects sales of ₦100,000 per month. Variable costs of sales are ₦80,000 per month (all payable in the month of sale). It is estimated that by extending the credit allowed to debtors from 30 days to 60 days, sales volume would increase by 10%. All customers would be expected to take advantage of the extended credit. If the cost of capital is 12½% per annum (or approximately 1% per month), is the extension of the credit period justifiable in financial terms?

### SUGGESTED SOLUTION 12-4

	₦
Current debtors (1 month)	100,000
Debtors after implementing the proposal (2 months)	240,000
Increase in debtors	<u>140,000</u>
Financing cost (12½% of increase in debtors)	17,500
Contribution p.a. from additional sales (12 months x 10% of ₦10,000)	<u>24,000</u>
Not benefit from extension of credit period, per annum	<u>₦6,500</u>

### Advice

Different credit policies are likely to have differing levels of bad debt risk. The higher the turnover resulting from easier credit terms should be sufficiently profitable to exceed the cost of:

- (a) bad debts; and
- (b) the additional investment necessary to achieve the higher sales.

## 3.8 FACTORING

Credit management requires professional skills because it involves a lot of time and efforts of a company in collecting their debts from their credit customers. Collection of debts is a problem on its own, particularly for small scale enterprises. A company can engage the services of a professional to assist in collection of its debts, this services are known as factoring. Factoring is a popular mechanism for managing, financing and



collecting debts.

Factoring is not yet common in Nigeria business environment but gradually, it is being introduced. What is in vogue in the country is the use of debt collectors.

Factoring usually involves executing legal agreement which is intended to create legal relations between the factor and a business concern (the client) selling goods or providing services to credit customers whereby the factor purchases the client's book debts and administers the controls of credit extended to customers.

### **3.8.1 Factoring Features**

Factoring differs from other types of short-term credit in the following ways:

- (a) It involves 'sale' of book debts.
- (b) It is a unique professional service which provides not only financial succour to the client in time of needs but also could involve the total management of client's book debts.

### **3.8.2 Functions of Factor**

The functions of the factor would substantially depend on its agreement with the sales company (the principal) that engages it. Generally, these functions may include:

- (a) Assisting the company by providing immediate advance as part of debt underwritten to ease the cash flow problem.
- (b) Maintenance of accounts ledger of debtors.
- (c) Recovering of debts.
- (d) Protection against default in payment by debtors, having assumed responsibility for all the book debts
- (e) Providing information on prospective buyers.
- (f) Assist in managing the client's liquidity.

The agreement between the supplier and the factor specifies the factoring procedure. Usually, the firm sends the customer's order to the factor for evaluating the customer's creditworthiness and agrees to buy receivables, the firm dispatches goods to the customer. The customer will be informed that his account has been sold to the factor, and he is instructed to make payment directly to the factor. To perform his functions of credit evaluation and collection for a large number of clients, a factor may maintain a credit department with specialized staff. Once the factor has purchased a firm's receivables and if this is on the basis of factoring without recourse, he will have to provide protection against any bad-debt losses to the firm.

### **3.8.3 Types of Factoring**

Although, in Nigeria, the commonly used methods of managing book debts are the offering of discounts, credits and appointment of debt recovery agents, the use of factoring is slowly but gradually gaining acceptance.

The following are four popular types of factoring facilities:

- (a) Full service non-recourse (old line)
- (b) Full service recourse factoring
- (c) Bulk/agency factoring
- (d) Non-notification factoring

**(a) Full Service Non-Recourse**

Book debts are purchased by the factor with 100% risk protection. The total amount of invoices has to be paid to clients in the event of debt becoming bad. Based on the agreement that subsists between the factor and the company the factor may also advance cash up to 60 - 70 per cent of the book immediately to the client. Payments will therefore be domiciled directly to the factor. The factor on its own part maintains the customers account and sends reports to the client periodically.

A company may employ this approach if it operates a compact or slim staff profile; debtors are usually substantial and has limited capability to monitor the credit management system of the organisation.

**(b) Full Service Recourse Factoring**

Under this method of factoring, the factor does not take full responsibility of debts because he is not protected against the risk of bad debts.

Most companies practise recourse factoring since it is not easy to obtain credit information, and the cost of bad debt protection is very high. This type of factoring is often used as a method of short-term financing, rather than pure credit management and protection service.

**(c) Bulk / Agency Factoring**

Under this method, factors provide temporary cash advance against the expectation of recovering the book debt. The client maintains its sales ledger and administer the credit either on recourse or without recourse.

**(d) Non-Notification Factoring**

The customers are not informed about the existence of the factor. The factor maintains the sales ledgers of the client and pursues the recovery of the debt with customers without revealing that he has vested interest in it. Clients that can muster the financial commitment use this method.

### **3.8.4 Costs and Benefits of Factoring**

There are two types of costs involved:

- (a) The factoring commission or service fee

This relates to the remuneration for the professional services of evaluation, ascertainment and collection of the book debts. The service fees would be

charged for keeping the books and records and advise on credit rating of customers, etc.

- (b) The interest on advance granted by the factor to the firm.  
If factoring is so expensive, why should firms go for it? There are certain benefits which result from factoring receivables, and they more than offset the costs of factoring. Factoring has the following benefits:
- (i) Factoring provides specialized service in credit management, and thus, helps the firm's management to concentrate on manufacturing and marketing,
  - (ii) Factoring helps the firm to save cost of credit administration due to the scale of economies and specialization.

### ILLUSTRATION 12 – 5

Jimo Ltd. has a total credit sales of ₦16 million and its average collection period is 80 days. The past experience indicated that bad-debt losses are round 1 per cent of credit sales. The firm spends about ₦240,000 per annum on administering its credit sales. This cost includes salaries of one officer and two clerks who handle credit checking, collection, etc., telephone and telex charges.

These are avoidable costs. A factor is prepared to buy the firm's debts. He will charge 2 per cent commission and also pay advance against debts to the firm at an interest rate of 18 per cent after withholding 10 per cent as reserve.

What should the firm do?

### SUGGESTED SOLUTION 12 – 5

Let us first calculate the average level of debts. The average collection period is 80 days and credit sales are ₦16,000,000; therefore, assuming 360 days in a year.

$$\text{Average level of debtors} = \frac{16,000,000}{360} \times \frac{80}{1} = \text{₦}3,555,556$$

The advance which the factor will pay will be the average level of receivables less factoring commission, reserve and interest on advance. The factoring commission is 2 per cent of average receivables (80 days):

$$\text{Factoring commission} = 0.02 \times 3,555,556 = \text{₦}71,111$$

and reserve is:

$$\text{Reserve} = 0.10 \times 3,555,556 = \text{₦}355,556$$

The amount available for advance is:

$$\text{Advance available} = 3,555,556 - 71,111 - 355,556 = \text{₦}3,128,889$$

However, the factor will also deduct 18 per cent interest before paying the advance for

80 days.

Therefore, the amount of advance to be paid by the factor is:

$$\begin{aligned} \text{Advance to be paid} &= 3,128,889 - (0.18 \times 3,128,889 \times 80 / 360) \\ &= 3,128,889 - 125,156 = \underline{\underline{N3,003,733}} \end{aligned}$$

The annual cost of factoring to the company include the following:

Factoring commission	71,111 x 360/80	320,000
Interest charges	125,156 x 360/80	<u>563,202</u>
		<u><u>N883,202</u></u>

The firm saves the following costs:

Cost of credit administration	240,000
Cost of bad-debt loss, 0.01 x 16,000,000	<u>160,000</u>
	<u><u>400,000</u></u>

The net cost of factoring to the firm is:

$$\text{Net cost of factoring} = 883,202 - 400,000 = \text{N}483,202$$

The effective rate of interest of firm is:

$$\begin{aligned} \text{Effective rate of annual cost} &= \frac{483,202}{3,003,733} = 16 \text{ per cent} \end{aligned}$$

The effective rate of financing the factory is 15%. Jimo Ltd would have to evaluate and compare alternative short-term financing options. The decision should be the option that provides the lower effective rate.

### Forms of Bank Finance

A firm can draw funds from its bank within the maximum credit limit sanctioned. It can draw funds in the following forms:

- (a) overdraft
- (b) bills purchasing or discounting, and
- (c) venture capital loan
- (d) direct equity participation
- (e) commercial paper.

### 3.9 STOCK MANAGEMENT

Stock comprises a very large part of a business working capital and therefore, it is very important to control it effectively.

**Amey and Egginton (1973)** identified three reasons for holding stocks;

- (a) transactional) motive - that is, to meet demand for the stock item, where the size of demand is known with certainty or replenishment of stocks is immediate when stock-out occurs.
- (b) precautionary motive - that is, either ( or both) the demand for the stock item, or the re-supply 'lead' time, is uncertain because it varies between one occasion

and the next. To avoid customer dissatisfaction and lost sales, 'buffer stocks' or safety stocks may be held to reduce the likelihood that the company runs out of supply.

- (c) speculative motive - that is, a decision may be taken to increase current stocks in anticipation of a price rise, so as to make a speculative profit. The major control issue for speculative stock holding is administrative: there is a clear need to ensure that limits to a firm's financial risks in speculative stockholding are established and observed.

### **Costs of Holding Stocks**

The costs of holding stocks are as follows:

- (a) obsolescence: when materials or components become out of date and are no longer required, existing stocks must be thrown away and written off as a loss to the profit and loss account;
- (b) deterioration: when materials in store deteriorate to the extent that they are unusable, they must be thrown away (with the likelihood that disposal costs would be incurred). The value written off stock plus the disposal costs would be a charge to the profit and loss account;
- (c) theft and pilferages;
- (d) interest charges: holding stocks involves the tying up of capital (cash) on which interest charges must be paid;
- (e) costs of storage and stores operations: stocks require more storage space and possibly extra staff and equipment to control and handle them.

The costs of the stock themselves - that is, the supplier's price, or the cost of production, will also need to be considered.

### **Management Accountant and Stock Control**

The interest of management accountants in stock control is one of cost control. The volume of stocks held should be kept to an optimum level which minimizes their cost to the organization.

It is possible to decide what quantities of stocks should be ordered at any one time (that is, in each 'batch') in order to minimize the costs of having stocks.

- (a) The basic stock order decision model known as the Economic Order Quantity (EOQ) or Economic Batch Quantity (EBQ), indicates the cost-minimising order size;
- (b) The model cannot be used in isolation where there are bulk purchase discounts for large-sized orders from suppliers, or reductions in unit variable costs for larger batches when materials are produced that is, supplied internally. The bulk purchase discount 'model' may, therefore, need to be applied; and
- (c) Where demand for an item is variable and uncertain, or supply lead times are similarly unknown, uncertainty analysis should be applied to determine the optimum size of safety stocks.

The stock order quantity decision models use relevant costs, just as any other decision requires relevant cost data.

Once the relevant costs have been supplied, most stock ordering decisions can be programmed to take place automatically without management intervention. Many companies have computerised stock control systems, part of whose functions is automatic re-ordering of stock items in optimal order quantities. Management accountants have the more difficult task of ensuring that the relevant cost data are complete and sufficiently accurate, so that correct decisions can be made.

### 3.10 CASH / TREASURY MANAGEMENT

Cash management involves the planning and controlling of cash to ensure that cash is available when required and that it is used efficiently.

Cash are held by companies for the following reasons:

- (a) **Transactionary Motive:** This is to meet the payments in the ordinary course of business to creditors, employees, etc.
- (b) **Precautionary Motive:** This is held for unexpected needs during the course of the business.
- (c) **Speculative Motive:** This is required for immediate unexpected purchase or other business related expenses.

Cash activities would cover the following area:

- (a) Planning and Controlling cash levels - There would be need for continuous reviews of the organisation's liquidity policy and the working capital position.
- (b) In case there is any surplus in cash holding, it may be necessary to consider the efficient allocation of these surpluses to profitable use.
- (c) Ensuring that cash is available to meet all running costs, taxation, payments and dividends.
- (d) There will be need to provide insurance protection to ensure that cash can be provided in case of emergency as the needs arises.
- (e) It is essential that the organisation develop a good understanding and relationship with their bankers.

### 4.0 CONCLUSIONS

Working capital is the term used to express the relationship between current assets and current liabilities. The difference could be either positive or negative, where the current assets are more than the current liabilities respectively or vice-versa. However, the gross working capital is the firm's investment in current assets.

The current assets are made up of cash, short-term securities, debtors, bills receivables, prepayments and stocks (inventory) while the current liabilities include creditors, bills payable, bank overdraft and accrued expenses.

It is considered important that the finance manager maintains an optimum balance or level of current assets and current liabilities, that is, he should not allow excess or inadequate working capital.

The Finance Manager would consider the need to invest funds in current assets; the quantum of investment, the proportion of long-term and short-term funds to finance current assets and the determination of appropriate sources of funds to be used to finance current assets.

It is equally important to determine the need for working capital and its determinants; the dimensions of working capital and determination of the optimum level of current assets in terms of the estimation and financing of current assets.

## **5.0 SUMMARY**

Some general remarks highlighting the need for effective utilization of working capital and some possible approaches for the same have been discussed in this unit. But the ingredients of the theory of working capital management should cover a wide range.

## **6.0 TUTOR MARKED ASSIGNMENT**

1. Wasa Nigeria Limited made sales of ₦250,000 in the year and had outstanding debtors balances of ₦15,000 at the end of the year. Calculate the company's debtors collection period.
  - A 20.90 days
  - B 21.90 days
  - C 22.90 days
  - D 23.90 days
  - E 19.90 days.

Use the data below to answer questions 12.2 and 12.3

The demand for a commodity is 40,000 per year at a steady rate. It costs ₦20 to place an order, and 40k to hold a unit for a year.

2. Find the batch size to minimize inventory costs
  - A 2200 units
  - B 2000 units
  - C 2400 units
  - D 3200 units
  - E 3100 units.
3. The length of the inventory cycle
  - A 2.5 weeks
  - B 2.8 weeks
  - C 2.6 weeks

- D 2.7 weeks
  - E 2.4 weeks.
4. If in Monilabi Limited, it takes 10 days to convert raw materials into work-in-progress, and it takes another 5 days for work-in-progress to be converted to finished goods and that the finished goods will stay another 7 days before being sold on credit and debtors are allowed 8 days of grace. It is also assumed that all the above scenario will work well. Determine the working capital cycle.
- A 31 days
  - B 32 days
  - C 29 days
  - D 30 days
  - E 34 days.
5. A trade discount is
- A reduction in price per unit
  - B discount for early payment
  - C special sales promotion
  - D reduction in overhead cost per unit
  - E reduction in production cost per unit.
6. State three determinants of working capital
7. State three assumptions underlining EOQ model.
8. What are the symptoms of over-trading?
9. What is credit standard in granting credit to a customer?
10. What is factoring?

## **7.0 REFERENCES/FURTHER READINGS**

- ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.
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## **UNIT 13    CAPITAL INVESTMENT DECISION**

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### **1.0    INTRODUCTION**

Capital budgeting can be explained in the context of a firm's decision to invest its current funds in long term activities in anticipation of an expected flow of future benefits over a number of years. However, the investment decisions could be in the form of acquisition of additional fixed assets, replacements and modifications of

activities or expansion of a plant. Therefore, the financial manager should give due consideration to the following factors when capital budgeting decisions are involved:

- (a) Availability of investment capital and its alternative uses.
- (b) The huge expenditures or large cash outlay.
- (c) The gestation period between initial expenditures and returns and
- (d) The expectation of higher returns because of factors (a) and (b) above.

**2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- The opportunity cost of an investment;
- The concepts of payback period, accounting rate of return, net present value and the internal rate of return;
- The limitations of the various concepts;
- How to calculate PBP, ARR, NPV and IRR;
- Superiority of NPV over the IRR;
- Exclusive projects with unequal lives;
- Capital rationing and select the optimum combination of investments when capital is rationed for a single period;
- The concept of profitability index;
- Treatment of inflation in capital investment appraisal.

**3.0 MAIN CONTENT**

**3.1 CAPITAL BUDGETING TECHNIQUES**

There are two major methods of appraising capital projects. These are:

- (i) The Non-Discounted Cash Flow (Traditional) method
- (ii) The Discounted Cash Flow (DCF) method.

These are briefly discussed below.

- (a) Payback Period (PBP) Method
  - (b) Accounting Rate of Return (ARR) Method
  - (c) Net Present Value (NPV)
  - (d) Internal Rate of Return (IRR)
- } *Non-Discounted Cash flow Techniques*
- } *Discounted Cash flow Techniques*

**3.1.1 Payback Period Method (PBP)**

This technique measures projects on the basis of the period over which the investment pays back itself or the period of recovery of the initial investment. This means that we would measure the full recovery of the projects' cash outflow through the projects cash inflows. Payback is defined as the period usually expressed in years, in which the cash outflows will equate the cash inflows from a project (CIMA). It is evident that this method pays attention to the shortness of the project i.e. the shorter the period of

recovery of initial outlay, the more acceptable the project becomes and this constitutes the decision rule.

### ILLUSTRATION 13 – 1

Kokori Limited is a manufacturing outfit, having a project which involves an immediate cash outlay of ₦200,000. The company estimates that the net cash inflows from the project will be as follows:

Year	Cash flows ₦
1	20,000
2	40,000
3	220,000
4	80,000

Calculate the payback period for the above project.

### SUGGESTED SOLUTION 13 – 1

#### KOKORI LIMITED – INVESTMENT APPRAISAL

Year	Cash flows ₦	Cumulative Cash Flows ₦
0	(200,000)	(200,000)
1	20,000	(180,000)
2	40,000	(140,000)
3	220,000	80,000
4	80,000	

$$\text{Payback Period} = 2 \text{ years} + \frac{140,000}{220,000} \times 12 \text{ months}$$

$$\text{Payback Period} = 2 \text{ years} + 7.6 \text{ months} \cong 2 \text{ years } 8 \text{ months}$$

#### Decision Rules:

- Using the payback method, accept all projects whose payback period are shorter than the company's predetermined minimum acceptable payback period.
- If mutually exclusive projects are involved, whereby only one of the projects can be undertaken and others rejected, the rule is to accept the project with the shortest payback period.

#### Advantages

- It is simple to calculate and understand
- Of all the methods of capital budgeting, it least exposes the firm to problems of uncertainty, since it focuses on shortness of project to pay back the initial outlay.

- (c) It is a fast screening technique, especially for the firms that have liquidity problems.

**Disadvantages:**

- (a) It does not incorporate time value of money that is it does not recognise the fact that the value of ₦1 today will be far more than the value of ₦1 in two or three years time. This constitutes the alternative forgone of money due to passage of time and not inflation.
- (b) It ignores cash flows after the payback period.
- (c) It does not take into account the risks associated with each project and the attitude of the company to risk.

**3.1.2 Accounting Rate of Return Method (ARR)**

This method is derived from the concept of return on capital employed (ROCE) or return on investment (ROI), in that it measures the ratio of accounting profits to the accounting investments and evaluates projects based on this ratio or return. The following two ways of determining the ratio are acceptable for examination purposes:

(a)  $ARR = \frac{\text{Average annual accounting profits after depreciation, interest but before taxation}}{\text{Initial capital invested}} \times \frac{100}{1}$

Where the initial capital invested is equal to original cost of a new project or the written down value or net book value of an existing project. The reason for this assertion is that since companies are going concern, there must be replacement of assets that is, the need for depreciation.

(b)  $ARR = \frac{\text{Average annual accounting profits after depreciation, interest but before taxation}}{\text{Average capital invested}} \times \frac{100}{1}$

Where the average capital invested is equal to initial capital invested plus scrap value (if any) divided by 2.

It should be noted that if a particular question specifically defines the accounting rate of return, such definition as stipulated in the question must be adopted in solving the problem.

**ILLUSTRATION 13 – 2**

Mr. Millenia recently convinced his friends and relations to grant him a loan of ₦200,000, which he intends to invest in a farming project. He estimates that the project will yield the following returns annually for next five consecutive years.

Year	₦
1	60,000
2	60,000

3	80,000
4	60,000
5	40,000

There was no scrap values, at the end of the fifth year and the company desires to evaluate the project on the basis of accounting rate of return.

**Required:**

Provide the accounting rate of return of this project on the assumption that the annual returns are profits after depreciation but before taxation.

**SUGGESTED SOLUTION 13 – 2**

If option (a) under the ARR method is used, then the ARR will be:

$$= \frac{\text{Average Profits}}{\text{Initial Investments}}$$

$$= \frac{\cancel{N}60,000 + 60,000 + 80,000 + 60,000 + 40,000}{5} = \cancel{N}60,000$$

$$\text{Therefore, ARR} = \frac{\cancel{N}60,000}{\cancel{N}200,000} \times \frac{100}{1} = 30\%$$

If option (b) under the ARR method is adopted, then the ARR will be:

$$\frac{\text{Average Profits}}{\text{Average Initial Investment of Capital}} \times \frac{100}{1}$$

$$\text{Average Capital} = \frac{\cancel{N}200,000}{2} = \cancel{N}100,000$$

$$\text{Therefore, ARR} = \frac{\cancel{N}60,000}{\cancel{N}100,000} \times 100 = 60\%$$

**Decision Rules:**

- (a) The rule is to invest in all projects whose accounting rate of return are higher than the company's predetermined minimum acceptable ARR.
- (b) Where mutually exclusive projects are concerned, the rule is to accept the project with the highest ARR.

**Advantages of ARR**

- (a) It is easy to calculate.
- (b) Unlike the payback period, it makes use of all the profits for all the years of project.
- (c) For divisionalised companies, managers would find the technique easier to

understand because it is similar to their normal annual performance evaluation technique.

### **Disadvantages of ARR**

- (a) It does not recognise the time value of money
- (b) It is an average concept and as such will hide the sizes and timing of the individual cash flows.
- (c) It is based on accounting profits which may differ as a result of differences in accounting methods and does not necessarily represent relevant cash flows.
- (d) It recognises depreciation instead of the more relevant capital allowances.
- (e) It does not take into consideration the risk associated with each project as well as the attitude of the management of the company to risk.
- (f) There is no unique definition for ARR. For instance "average profits " may be profits after depreciation, interest and before tax or profit after depreciation, interest and tax. Initial investment could be initial investment plus scrap value or just initial investment.

## **3.2 CONCEPTS IN CAPITAL BUDGETING DECISIONS**

To understand the relevance of the other two methods (that is, *NEW* and *IRR*) we shall explain some basic concepts as they apply to capital budgeting decisions. The concepts are the following:

- (a) Concept of time value of money
- (b) Concept of annuity
- (c) Concept of perpetuity
- (d) Concept of relevant cash flows.

### **3.2.1 Concept of Time Value of Money**

This concept recognises the opportunity cost of receiving the same amount of money sometime in future instead of now. This alternative forgone is as a result of lost returns or interest on the money, due to passage of time. This concept is based on the compound interest formulae.

The compound interest formulae states that the future value (*FV*) of money receivable in a period at a specified interest rate shall be equal to:

$$FV = P(1 + r)^n$$

Where:

- FV = future value of money receivable in a period
- PV = Principal or present value
- r = the rate of interest or cost of capital
- n = number of years

Therefore, by deduction, the present value (PV) can be determined as follows:

$$PV = \frac{FV}{(1+r)^n} \Rightarrow PV = FV \times \frac{[1]}{(1+r)^n}$$

where,

$1/(1+r)^n = (1+r)^{-n}$  is the discount factor

### ILLUSTRATION 13 – 3

Calculate the present value of ₦10,000 receivable in 5 years time if the interest rate is 10%.

### SUGGESTED SOLUTION 13 – 3

$$PV = \frac{FV}{(1+r)^n} = FV \times \frac{1}{(1+r)^n} = 10,000 \times \frac{1}{(1+0.1)^5} = 10,000 \times 0.6029 \\ = \text{₦}6,209$$

### 3.2.2 Concept of Annuity

An annuity is a constant sum of money receivable or payable over a specified period of time.

The present value of annuity can be calculated using the annuity formula as follows:

$$Pv = \frac{1 - (1+r)^{-n}}{R}$$

Where      A      =      the constant or equal annual sum  
                  n      =      number of years  
                  r      =      rate of interest or cost of capital

### ILLUSTRATION 13 – 4

Calculate the present value of ₦10,000 receivable every year for 5 years at the interest rate of 10% per annum.

A      =      ₦10,000  
 N      =      5yrs  
 R      =      10% = 0.1

### SUGGESTED SOLUTION 13 – 4

$$PV = A \frac{1 - (1+r)^{-n}}{R} \\ = 10,000 \frac{1 - (1+0.1)^{-5}}{0.1}$$

$$\begin{aligned}
&= 10,000 \frac{1 - 0.6209}{0.1} \\
&= 10,000 \frac{0.3791}{0.1} \\
&= 10,000 \times 3.791 = \text{N}37,910
\end{aligned}$$

### 3.2.3 Relevant Cash Flows

Where the present value is used, in which case, time value of money has been incorporated, we state that the cash flows used are Discounted Cash Flows (DCF). The DCF techniques namely the NPV and IRR for evaluation of capital projects recognise only the relevant cash flows of a project or a decision. During examination, a list of cash flows both relevant and irrelevant may be provided, therefore, in order to properly evaluate projects, we need to determine the relevant cash flows and this is done by taking the following steps:

- (a) Determine the decision to be taken, for example, accept or reject a project, scrap a product line, make or buy an item etc.
- (b) Any cash flow that will influence or affect (a) above is relevant.
- (c) Look beyond the decision or project being evaluated and examine its effects on the other operations of the company.

This is referred to as the opportunity cost concept which can be a function of cost or revenue thus:

- (i) If the decision will result in additional expenses or increased running costs in other operations of the company, then this cost must be included as relevant cash outflows in the original decision in (a) above.
- (ii) Similarly, if the decision or project being evaluated will result in additional contributions or savings from other operations of the company, then those savings must be treated as relevant cash inflows in the evaluation of decisions in (a) above,
- (d) The following are not relevant for decision or projects being evaluated, namely:
  - (i) all appropriations, reserves and other non-cash items.
  - (ii) all fixed costs except incremental or attributable fixed costs.
- (e) All historical or past or sunk costs.

### 3.2.4 Further Assumptions

The following additional assumptions may be required in capital budgeting situations:

- (a) Year zero is the initial period of investments or the point at which the investment decision is to be made. It is always the beginning of investments of year one or the first year and it is to be taken as a year on its own.



- (b) Apart from year zero, there is no other beginning of a year in the stream of cash flows i.e. all cash flows after year zero are assumed to arise at the end of the year to which they relate.
- (c) For working capital, in case of practical situations or problems, assumption (b) above may not hold. In this case, we are to assume that working capital required in year 'n' will be provided in year n - 1.
- (d) It may also be assumed that working capital utilized in a project will be recovered in full at the end of the project i.e. the total sum of all working capital used for the life of the project will be treated as relevant cash flows at the end of the project.

You need to realise that where a project becomes profitable only on the full recovery of working capital, we must bring the attention of management to the control of working in our recommendation for the acceptance of the project.

### 3.3 DISCOUNTED PAYBACK PERIOD METHOD

The principles and decision rules are the same as in the normal payback period method, the only difference, is that the cash flows to be used are discounted at the given or appropriate cost of capital. Therefore, this version of payback technique, will not suffer from the disadvantage of discounting of time value concerned.

#### ILLUSTRATION 13 – 5

Using the Mr. Millenia example, calculate the discounted payback of the project, if the cost of capital is 10% per annum.

#### SUGGESTED SOLUTION 13 – 5

Year	Cashflow	DCF @ 10%	PV	Cumm. Cash flow
0	(200,000)	1.0000	(200,000)	(200,000)
1	60,000	0.9091	54,546	(145,454)
2	60,000	0.8264	49,584	( 95,870)
3	80,000	0.7513	60,104	( 35,766)
4	60,000	0.6830	40,980	5,214
5	40,000	0.6209	24,836	

$$PBP = 3 \text{ yrs} + \frac{35,766}{40,980} \times 12 = 3 \text{ years } 10 \text{ months.}$$

### 3.4 NET PRESENT VALUE METHOD (NPV)

The net present value is a summation of all discounted cash flows (PV) associated with a project i.e. (the difference between the PV of cash outlay or outflow and the positive PV of the cash inflows).

**Decision Rules:**

- (a) Accept all projects that produce positive net present value (NPV)
- (b) If mutually exclusive projects are involved, the rule is to accept the project that produces the highest positive net present value.

**ILLUSTRATION 13 – 6**

At a cost of capital of 10% per annum. Calculate the NPV of Mr. Millenia's project.

**SUGGESTED SOLUTION 13 – 6**

Year	Cash flows ₦	DF @ 10% ₦	PV ₦
0	(200,000)	1.0000	(200,000)
1	60,000	0.9091	54,546
2	60,000	0.8264	49,584
3	80,000	0.7513	60,104
4	60,000	0.6830	40,980
5	40,000	0.6209	<u>24,836</u>
		+ NPV	<u>30,050</u>

**Advantages of NPV:**

- (a) The time value of money is recognised.
- (b) It measures in absolute terms (Nvalue), the increase in the wealth of the shareholders.
- (c) It is additive, in that decisions can be reached on a combination of projects, through the addition of their respective NPVs.
- (d) Unlike the payback period, it measures projects by the utilization of all cash flows of the project.
- (e) It is more preferable to IRR in decisions under capital rationing i.e. shortage of investments funds.

**Disadvantages of NPV:**

- (a) It is more difficult to calculate than PBP and ARR.
- (b) It relies heavily on the correct estimation of the cost of capital i.e. where errors occur in the cost of capital used for discounting the decision, using the NPV would be misleading.
- (c) Unlike the IRR, non-accounting managers may not be conversant with the decision rule of NPV, especially in large decentralised organisations.
- (d) Like all the other methods, it does not take risk into account.
- (e) It ignores inflation.

**3.5 INTERNAL RATE OF RETURN METHOD (IRR)**

The IRR is that cost of capital, or return that will produce an NPV of zero if applied to a project. It is a break-even point cost of capital. It is also the cost of capital or

discount rate that will equate the cash inflows of a project with the cash outflows of that project. In order to generate the cost of capital that will produce exactly zero NPV, the following procedures may be followed:

- (a) Generate two (2) opposite values of NPV (+ and - values) using two different discount rates earlier calculated.
- (b) Interpolate between the two discount rates generated in (a) above in order to estimate the cost of capital that will produce an NPV of zero. The assumption here is that there is a linear relationship between the cost of capital and the NPV. Moreover, it is implied that the higher the cost of capital, the lower the NPV and vice-versa.
- (c) The interpolation formulae can be defined as:  
Let R1 be the lower cost of capital that will generate positive NPV1; and R2 be the highest cost of capital that will generate negative NPV2.

$$IRR = R1 + \frac{NPV1}{(NPV1 + NPV2)} \times (R2 - R1)$$

Note: The absolute value of the negative NPV is used in the computation.

4%	8.33%	10%
----- -----		
A	B	C
NPV200	0	-80
	A	

$$\begin{aligned} \text{Therefore, IRR} &= 4\% + \frac{200}{200 + 80} \times [10\% - 4\%] \\ &= 4\% + \frac{200}{280} \times 6\% \\ &= \underline{8.33\%} \end{aligned}$$

### ILLUSTRATION 13 – 7

Using the same Mr. Millenia example, calculate the IRR for the project.

### SUGGESTED SOLUTION 13 – 7

Year	Cashflows ₦	DF @ 10%	PV ₦	DF @ 20%	PV ₦
0	(200,000)	1.00	(200,000)	1.00	(200,000)
1	60,000	0.9091	54,546	0.8333	49,998
2	60,000	0.8264	49,584	0.6944	41,664
3	60,000	0.7513	60,104	0.5787	46,296
4	60,000	0.6830	40,980	0.4822	28,932
5	60,000	0.6209	<u>24,836</u>	0.4109	<u>16,436</u>
			<u>30,050</u>	-NPV	<u>(16,674)</u>

$$\begin{aligned} R_1 &= 10\%, \text{ NPV}_1 = \text{N}30,050 \\ R_2 &= 20\%, \text{ NPV}_2 = (\text{N}16,674) \end{aligned}$$

$$\text{IRR} = R_1 + \frac{\text{NPV}_1}{(\text{NPV}_1 + \text{NPV}_2)} \times (R_2 - R_1)$$

$$\text{IRR} = 10\% + \frac{30,050}{16,674 + 30,050} \times [20 - 10]\%$$

$$= 10\% + 6.43\%$$

$$= 16.43\%$$

### Decision Rules:

- (a) Using the IRR technique, the rule is to accept all projects whose IRR are greater than the company's cost of capital.
- (b) If mutually exclusive projects are being considered, the rule is to accept the project that produces the highest IRR.

### Advantages of IRR

- (a) It recognises the time value of money.
- (b) It is more attractive to divisional managers in large organisations since they are used to the return approach in evaluations.
- (c) It provides to us a margin of safety in the calculation of a company's cost of capital i.e. it measures all allowable margin of errors.

### Disadvantages of IRR

- (a) It is difficult to calculate than the other methods.
- (b) Where the cash flows of a project are unconventional in which case, cash inflows occur in between cash outflows and vice-versa, the IRR technique will produce more than one IRR for a project. It can lead to a situation of sub-optimal decision.
- (c) Where mutually exclusive projects are being considered, the IRR may produce a decision that will conflict with the NPV decision in that the IRR, being a rate of return, does not recognise the size or scale of project.
- (d) A project may produce more than one IRR. This also occurs when a project has unconventional cashflows.

### 3.5.1 Modification of IRR

The IRR can be modified under the following circumstances:

- Where the cash flows are unconventional.
- Where projects are mutually exclusive.

However, the above can be taken care of by the following two methods:

- extended yield method
- incremental yield approach.

**(a) Extended Yield Method**

By this method, we modify the IRR technique in order to produce a unique IRR rather than multiple IRR. The following steps may be adopted:

- (i) Convert the unconventional cash flows into conventional cash flows by discounting all future cash flows backwards at the given cost of capital until they are fully absorbed by the positive cash flows (cash inflows) or they become year zero cash flow.
- (ii) Calculate the IRR of the revised (conventional) cash flows in the normal way. This is the required IRR.

**(b) Incremental Yield Method**

Where projects are mutually exclusive, it means that we cannot undertake all the projects. We must undertake only one and this assumes that acceptance of only one project is equivalent to rejection of all other mutually exclusive projects.

IRR will produce conflicting result with NPV where mutually exclusive projects are involved because IRR does not recognise the scale or size of investments. For this reason, we must modify the cash flow of mutually exclusive projects if we are forced to evaluate them using IRR. Hence, the method for this modification is called INCREMENTAL YIELD APPROACH. Under this method, we revise the cash flows to generate differential or incremental cash flows. Thereafter, we calculate the IRR of these incremental cash flow and base our decision for project selection on the project that generated this incremental cash flows, that is, the project that was kept constant).

### **3.5.2 Steps for Calculating Incremental IRR**

The following Steps are to be followed in calculating the incremental IRR.

- (a) Calculate the incremental cash flows by keeping one project constant (i.e. subtracting the cash flows of the other project from the cash flows of the project that was kept constant e.g. project Y – Z - if incremental cash flows are generated from Y - Z, then Y must be kept constant.
- (b) Calculate the IRR of these incremental cash flows in the normal way.
- (c) If the IRR of these incremental cash flows is greater than the company's cost of capital, then the project that was kept constant must be better than the other project and must be accepted. On the other hand, if the IRR of the incremental cash flows is lower than the cost of capital, then the project that was kept constant must be rejected.

### **ILLUSTRATION 13 – 8**

Dike Ltd's two accountants are in disagreement as to which of two mutually exclusive

projects to undertake. One has based his conclusions on an IRR computation, and the other, using NPV. Dike required rate of return is 10%. The first project requires an investment of ₦1,410,400 and will generate net cash savings of ₦300,000 per annum for 10 years. The second project requires ₦867,800 to be invested to generate ₦200,000 per annum for 10 years.

### Required

- Produce the calculation of the two accountants.
- Produce an unambiguous result by considering the internal investment.
- If the alternative investment rate was 14%, which of the two projects would be accepted.
- Compare your conclusions in (c) with calculation of the NPV of the both projects at the alternative rate of 14%.

### SUGGESTED SOLUTION 13 – 8

<b>Project 1</b>				<b>Project 2</b>			
Year	Cashflow	DF	PV	Year	Cashflow	DF	PV
	₦	@ 10%	₦		₦	@ 10%	₦
0	(1,410,400)	1.0000	(1,410,400)	0	(867,800)	1.0000	(867,800)
1-10	300,000	6.1446	<u>1,843,380</u>	1-10	200,000	6.1446	<u>1,228,9</u>
+NPV			<u>432,980</u>	+NPV			<u>361,120</u>

@ 20%

Year	Cashflow	DF	PV	Year	Cashflow	DF	PV
	₦	@ 20%	₦		₦	@ 10%	₦
0	(1,410,400)	1.0000	(1,410,400)	0	(867,800)	1.0000	(867,800)
1-10	300,000	4.1925	<u>1,257,750</u>	1-10	200,000	6.1446	<u>838,500</u>
	+NPV		<u>(152,650)</u>		NPV		<u>(29,300)</u>

$$\text{IRR} = 10\% + \frac{432,980}{585,630} \times 10\% \quad \text{IRR} = 10\% + \frac{361,120}{390,420} \times 10\%$$

$$= 10\% + 7.39$$

$$= 17.39\%$$

$$= 10\% + 9.25$$

$$= 19.25\%$$

Using NPV, Project 1 should be accepted, because project 1 has the higher NPV.

Using IRR, Project 2 should be accepted, because project 2 has the higher IRR.

<b>Project 1</b>		<b>Project 2</b>		<b>Incremental Cashflow</b>
Year	Cashflow	Year	Cashflow	
	₦		₦	₦
0	(1,410,400)	0	(867,800)	(542,600)
1-10	300,000	1-10	200,000	100,000

### Incremental Cash Flows

Year	Cashflow ₦	@10%	PV ₦	@20%	PV ₦
0	(542,600)	1.00	(542,600)	1.00	(542,600)
1-10	100,000	6.1446	<u>614,460</u>	4.1925	<u>419,250</u>
		+NPV	<u>71,860</u>	-NPV	<u>123,350</u>

Since the IRR of the incremental cash flows is greater than the company's cost of capital, it means project 1, which was held constant, should be accepted. This agrees with the result of the NPV.

- (c) If the investment rate is now 14%, it means the decision to accept project 1 will no more hold as the incremental IRR is lesser than the cost of capital of 14%. Therefore, project 2, now looks more attractive and should be accepted.

Project 1				Project 2			
Year	Cashflow N	DF @14%	PV N	Year	Cashflow N	DF @14%	PV N
0	(1,410,400)	1.0	(1,410,400)	0	(867,800)	1.00	(867,800)
1-10	300,000	5.2161	<u>1,564,830</u>	1-10	200,000	5.2161	<u>1,043,220</u>
		+NPV	<u>154,430</u>			+NPV	<u>175,420</u>

From the calculations of this NPV based on 14% cost of capital, Project 2 shows higher NPV, and therefore should be accepted. This confirms the decision in (c) above.

### NPV Vs IRR

Since the two methods belong to the same class of appraisal technique, one will expect that their decisions will tally at all times.

However, on few occasions, (like when the cash flows are unconventional and where there is difference in the initial cash flow), the decision will not tally. For instance, NPV may say accept project A and reject project B, whereas IRR will say accept B and reject A. This shows that there is a conflict in the decision of NPV and IRR.

As a management accountant, if you are faced with this situation, which of the two appraisal techniques would you recommend for acceptance.

The solution to the above problem is that whenever there is a conflict in the decisions of NPV and IRR, NPV decision is superior. This is because NPV has many technical advantages over IRR.

- (a) NPV is technically superior to IRR and is simpler to calculate.  
 (b) Where cash-flow patterns are non-conventional, there may be nil or several internal rates of return making the IRR impossible to apply.

- (c) NPV is superior for ranking investments in order of attractiveness because shareholders prefer absolute figures than percentages.
- (d) With conventional cash flow patterns, both methods give the same accept or reject decision.
- (e) Where discount rates are expected to differ over the life of the project such variations can be readily incorporated into NPV calculations, but not in those for the IRR.
- (f) The NPV calculations assume that funds generated by the project, are reinvested at the firm's cost of capital. IRR assumes reinvestment at the calculated IRR which could be unrealistic if the IRR is significantly higher than the firm's cost of capital. A modified IRR can be calculated based on the assumption that funds generated are reinvested at the firm's cost of capital. However, this introduces a further layer of assumption and calculation merely in order to overcome one of the inherent characteristics of the IRR approach.
- (g) Notwithstanding the technical advantages of NPV over IRR, IRR is widely used in practice so that it is essential that students are aware of its inherent limitations.

### 3.6 CAPITAL RATIONING

A capital rationing situation is one in which a company does not have sufficient fund to execute worthwhile investment projects. Under this situation, a company has projects with positive NPV whose combined outlays exceed all available finance to the company for the same period.

Capital rationing is the technique for selecting projects during a period of funds restriction which normally requires the ranking of projects in a descending order of desirability and accepting them in that order until all available funds have been exhausted.

#### 3.6.1 Single Period Capital Rationing

This is where restriction is for only one period, we must use the profitability index.

#### 3.6.2 Profitability Index (PI)

This concept is based on the contribution per limiting factor approach. It is actually a benefit/cost analysis of projects, that is, the ₦ receivable per ₦ of expenditure. It can be measured as the ratio of NPV or in some cases, Gross Present Value (GPV) of a project to the outlay required for the project during the year of restriction. The PVs are the contributions while the expenditure, or the outlays are the limiting factors. However, two definitions of PI are allowable as follows:

$$(a) \quad PI = \frac{\text{NPV of a project}}{\text{Outlay required during the year of restriction}}$$



$$(b) \quad PI = \frac{\text{Gross Present Value (GPV) of a project}}{\text{Outlay required during the year of restriction.}}$$

Where GPV will normally equal to NPV + Initial Outlay

### Steps to be taken in a Single Period Capital Rationing Situation

The following are recommended when questions are being attempted concerning a single period capital rationing situation:

- (a) Identify the year of restriction.
- (b) Calculate the NPV of projects (if not given).
- (c) Rank all projects using the PI.
- (d) Allocate available finance or funds to all projects in a descending order of the PI.
- (e) If a project does not require outlay during the year of restriction, its PI would be an infinite sum (i.e. NPV +∞) and such projects must be ranked first and must be selected.

### ILLUSTRATION 13-9

Alubarika Ltd. has a capital budget of ₦500,000 for the year to 30th June, 2003. The available projects have been identified and quantified by the Technical Director and the Works Manager as listed below. The individual project's related profitability index has been computed by a financial management team and stated hereunder.

Projects	Initial Outlay ₦	Profitability Index ₦
A	250,000	1.10
B	100,000	0.95
C	200,000	1.25
D	200,000	1.23
E	250,000	1.05
F	100,000	1.20
G	50,000	0.99

- (a) Which projects should the company invest in?
- (b) What difference would the absence of capital rationing make to your selection in (a) above.

### SUGGESTED SOLUTION 13-9

(a)	Projects	Initial Outlay	Profitability Index	Ranking
	A	250,000	1.10	4th
	B	100,000	0.95	7th
	C	200,000	1.25	1st

D	200,000	1.23	2nd
E	250,000	1.05	5th
F	100,000	1.20	3rd
G	50,000	0.99	6th
Allocation	₦1000		
Available Funds	500		
Select Project C	<u>(200)</u>		
	300		
Select Project D	<u>(200)</u>		
	100		
Select Project F	<u>100</u>		
	<u>NIL</u>		

The company should invest in Projects C, D and F in that order of priority.

- (b) If there is no capital rationing, the company should undertake all projects with positive NPV. In this case, the company should invest in all projects except Projects B and G which have negative NPV.

### 3.6.3 Different Situations of Capital Rationing

The different situations of capital rationing are as follows:

- Where projects are divisible
- Where projects are not divisible
- Where projects are mutually dependent.
- Where projects are mutually exclusive.

#### Divisible Projects

In this case, there is an implicit linearity assumption between the initial outlays and the NPVs of project. This follows from the basic assumption that fractions of a project can be undertaken. Therefore, a fractional investment in the outlay would yield a proportionate fractional return in NPV e.g. Investment of 20% in outlay, would yield 20% of NPV.

#### Indivisible Projects

Projects are not divisible fractions and cannot be undertaken and it is only in this case, that you have surplus funds and the latter represents the balance of available funds after allocation that cannot meet the requirement in full for the remaining projects. Where this situation exists, you are to explain the need to invest such surplus funds in the bank. This is one of such situations where a company can invest at a rate below its cost of capital.

### ILLUSTRATION 13-10

**SUMREM Ltd.** is experiencing a shortage of funds for investment in the current year, when only ₦100,000 is available for investment. No fund shortages are foreseen thereafter. The cost of investment funds is 20%. The following projects are available:

Projects	1	2	3	4	5	6
Initial outlay	₦50,000	₦80,000	₦60,000	₦30,000	₦25,000	₦40,000
Annual receipts						
From projects to						
Perpetuity	15,000	20,000	18,000	10,000	8,000	10,000

You are required to advise management on the projects which you would recommend for acceptance if they were:

- (a) divisible
- (b) indivisible
- (c) would your answer to (b) change if surplus could be invested at 12%? Ignore Taxation.

### SUGGESTED SOLUTION 13-10

(a) Projects	Outlay	Annual Receipts (₦)	NPV ₦	PI ₦	Rank
1	50,000	15,000	25,000	0.50	3rd
2	80,000	20,000	20,000	0.25	6th
3	60,000	18,000	30,000	0.50	4th
4	30,000	10,000	20,000	0.67	1st
5	25,000	8,000	15,000	0.60	2nd
6	40,000	10,000	10,000	0.25	5th

If the projects are divisible:

Allocations	₦1000
Available funds	100
Select Project 4	<u>(30)</u>
	70
Select Project 5	<u>(25)</u>
	45
Select 90% of Project 1	<u>45</u>
	<u>NIL</u>

Management should accept Project 4, 5 and 90% of Project 1

If the Projects are indivisible

Allocations	₦'000
Available funds	100
Select Project 4	<u>(30)</u>
	70
Select Project 5	<u>(25)</u>
	45
Select Project 6	<u>(40)</u>
Surplus Fund	<u>5</u>

Since projects are indivisible, management should accept projects 4, 5 and 6.

- (c) The answer would can change, except that management will be advised to invest the surplus funds at the 12% rate rather than not having any returns since 12% is still under cost of investments to the company. This will make the management to earn some interest, rather than losing it.

**Working Note:**

- (i) NPV is derived by the perpetuity formula of  
for example, Year 1 is  
$$\frac{A}{r} = \frac{15,000}{0.2} = \text{N}75,000 - 50,000 = \text{N}25,000 \text{ etc.}$$

- (ii) Profitability index is  
For example, Year 1 is  
$$\frac{\text{NPV of a Project}}{\text{Initial Outlay}} = \frac{25,000}{50,000} = 0.5 \text{ etc.}$$

**Where projects are mutually dependent**

In this case, an acceptance of one of the mutually dependent projects automatically implies an acceptance of the remaining mutually dependent projects, e.g. if projects A and B are mutually dependent, it means that one can only accept or reject both projects and not undertake only one of them. However, any of two methods may be adopted as follows:

- (i) In ranking all the projects, one can decide to rank all the mutually dependent projects as soon as or immediately after any of the mutually dependent projects is ranked irrespective of the sizes of their respective profitability index. For instance, if projects A and B are mutually dependent in a group of the under listed projects, our ranking can be done as follows:

Projects	PI	Initial Outlay	Ranking
A	1.1	200	3rd
B	1.6	100	2nd
C	1.7	200	1st
D	1.2	300	5th
E	1.3	400	4th

Therefore, one can select and allocate funds in that order as above

- (ii) If one wants to arrive at a more accurate solution, he has to combine all mutually dependent projects into a unique single project. Where the latter would have as its initial outlay, a combined total of all initial outlays of the mutually dependent projects. The PI would be weighted average PI, where the weight to be attached to the PI will be initial outlays of the respective projects.

Using the same group of projects as above, we can rank these projects after a combination of projects A and B as follows:

$$\frac{\text{PI} \times \text{Initial Outlay}}{300}$$

$$\text{PI} = \frac{1.100 \times 200 + 1.6 \times 100}{300} = 1.27$$

A and B = 1.27

The new ranking/project is    1st            2nd            3rd            4th  
    C = 1.7        E = 1.3        AB = 1.27    D = 1.2

### Where Projects are Mutually Exclusive

In this case, an acceptance of one project group implies the rejection of all the other project group. To resolve this issue, there is a need to modify the ranking procedures and it is done as follows:

- (i) create as many groups of projects as long as they are mutually exclusive i.e. each group must contain only one of the mutually exclusive project and would of course exclude the others.
- (ii) rank and select projects in each group
- (iii) calculate the total NPVs of the selected projects in each group.
- (iv) the decision would be to accept projects from the groups that produces maximum total NPVs.

### ILLUSTRATION 13-11

Dele and Okafor have just received their gratuities which amounted to ₦250,000 and they are prepared to invest in a new venture XYZ Ltd. The Bank of Nigeria Ltd has expressed the desire to grant them long-term loan of up to ₦950,000. They have presented the following investment proposals to you for financial advice.

PROJECTS	1	2	3	4	5	6	7	8	9	10
<b>PROFITABILITY INDEX</b>	1.19	1.20	1.17	1.20	1.22	1.15	1.10	1.15	1.22	1.16
<b>OUTLAY (N'000)</b>	150	150	200	300	400	400	300	200	100	100

Their expected cost of capital is 15%. Projects 3 and 6 are mutually exclusive while Projects 1 and 4 are mutually dependent.

- (a) As a financial adviser, what projects would you recommend that the new venture should embark upon?
- (b) What is the opportunity cost of the accepted project?

## SUGGESTED SOLUTION 13-11

Group A (includes Project 3)

Ranking

Project	Profitability Index	Initial Outlay N'000	NPV N'000
9	1.22	100	22
5	1.22	400	88
2	1.20	150	30
1 of 4	1.197	450	88.65
3	1.17	200	34
10	1.16	100	16
8	1.15	200	30
7	1.10	300	30

Allocation	N'000	NPV
Available funds	1,200	
Select Project 9	<u>(100)</u>	22
	1,100	
Select Project 5	<u>(400)</u>	88
	700	
Select Project 2	<u>(150)</u>	30
	550	
Select 1	<u>(450)</u>	88.65
	100	
Select 50% of Project 3	<u>100</u>	<u>17</u>
	<u>NIL</u>	<u>245.65</u>

Group B (Includes Project 6)

Ranking

Project	Profitability Index	Initial Outlay N'000	NPV N'000
9	1.22	100	22
5	1.22	400	88
2	1.20	150	30
1	1.197	450	88.65
3	1.17	200	34
10	1.16	100	16
8	1.15	200	30
7	1.10	300	30

The total NPV here is  $22 + 88 + 30 + 88.65 + 16 = 244.65$ . Since they constitute projects for which the total allocation of funds is made.

However, the company is advised to select projects 9, 5, 2, “1 of 4” and 50% of 3 because they produced the higher NPV of ₦245.65 compared to that of Group B of ₦244.65.

Note: The P1 for “1 of 4” is derived thus:

$$P1 = \frac{1.19 \times 150 + 1.20 \times 300}{150 + 300} = 1.197$$

The projects are assumed to be divisible.

- (b) The opportunity cost of accepted projects is the lost NPV from projects not accepted. These actions were as a result of capital rationing and the nature of the relationship between the projects. This is equal to NPVs of 50% of Project 3, 6, 7, 8 and 10 which sum up to ₦153. The position of project 6 in this regard may be debated, and the argument is that with or without capital rationing we would not undertake project 6, if Project 3 is undertaken, therefore, the opportunity cost of accepted projects should not include the NPV of Project 6. However, the acceptance of Project 3, is the opportunity cost of project 6 and vice-versa.

### 3.6.4 Multi-Period Capital Rationing

Where capital is restricted in more than one period, the requirement is likely in the least, a formulation of the Linear Programming required, to select projects which will maximise the NPVs for the company. For this reason, the following steps will be required.

- (a) Identify the relevant variables (e.g. available funds, required fund for each project, years of restriction of respective projects and the resultant NPV etc.)
- (b) Specify these variables in a form adaptable to mathematical manipulation by representing the variables in (a) above with symbols Let x represent the LAGOS project etc. or let y represent the fraction of SHOGUNLE project accepted.
- (c) State the objective function, which normally is the maximisation of the NPVs of all the projects.
- (d) Specify the constraints as follows:
- (i) Financial constraints: this ensures that total required funds for all the projects and other operations of the company do not exceed the available funds for each corresponding period.
  - (ii) Non-negativity constraints: this ensures that projects are either accepted or rejected and in no situation would a negative portion of a project be accepted.
  - (iii) Logical constraints: this ensures that fractions of projects can be undertaken whereas no project will be repeated.

**Note:** Steps (b), (c) and (d) will constitute the Linear Programming formula or plan for multi-period capital rationing.

### **3.6.5 Limitations of Capital Rationing**

The following constitute the limitations of capital rationing:

- (a) The assumption of divisibility of projects may not be possible in practice for all projects.
- (b) In addition to (a), we also assume linearity between outlays and NPV of projects i.e. a fractional investment in outlay will yield the same fraction of NPV. In practice, because of economies and diseconomies of scale, this may not hold.
- (c) On many occasions, capital rationing treats projects in isolation. It does not recognise the interdependence of projects e.g. an investment in a project may result in substantial savings only if another project is undertaken, which capital rationing ignores.
- (d) Where more than two projects are involved and capital is restricted in more than one period, the profitability index approach will no longer be sufficient for resolving project acceptance under capital rationing. In such cases, linear programming technique may be applied.

### **3.7 INFLATION IN CAPITAL BUDGETING**

Inflation in capital budgeting refers to increases in estimates as a result of changes in price levels. This means that, if we ignore inflation we may end up overstating or understating our net cash flows in which case the NPVs used for decision making would be wrong.

A school of thought believes that inflation can be ignored, because it affects both variables that make up NPV on which we base our decision whereby the variables are the cash flows and cost of capital. They argue that, since inflation will generate increases in cash flows and cost of capital, the provider will increase their required returns to meet changes in price level. Therefore, the effect of inflation will be cancelled out in arriving at the NPV.

The above assertions may be contested because of the following reasons:

- (a) Inflation does not affect the cash flows and cost of capital in the same way. Cash flow may increase, whereas providers of funds especially shareholders may not ask for the proportionate increase in their required return (i.e. cost of capital).
- (b) Even among the cash flows, inflation will not affect them in the same way A company may translate expected inflation rate into estimates of materials and overhead costs. It will be wrong if estimates for sales related cash flows also incorporate the same expected inflation rate. This inability of the company to adjust for inflation in its selling price is dependent on the nature of the demand for its product or service.
- (c) Labour cost and labour related cash flows may not move in line with the general inflation rate because of the actions of labour and industrial unions.
- (d) For the manager, making estimates for inflation rate will be



compounded by the fact that there must be full provision for variable cost of production with full effects of inflation if the company intends to remain in operation.

From the above reasons, we will arrive at sub-optimal decisions if we ignore inflation. The presence of inflation will complicate planning and forecasting problems of the manager, predicting the estimates of future cash flows is troublesome in its own case and would be worsened if inflation is recognized.

### 3.7.1 Relevant Concepts

Inflation can be incorporated in capital budgeting by the usage of any of the following two concepts:

- (a) money cost of capital
- (b) real cost of capital

#### Concept of Money Cost of Capital

The money cost of capital is the normal cost of capital of a company which would have been calculated by reference to money market rate of interest of the providers of capital or funds. It is the cost of capital that has not been adjusted for inflation (i.e. it does not incorporate inflation). Where cash flows are inflated or incorporates inflation, or are given in money terms, we should discount such cash flows using the money cost of capital.

#### Concept of Real Cost of Capital

The real cost of capital is, the cost of capital that has been adjusted for inflation and the adjustment formula is as follows:

$$1 + r = \frac{1 + m}{1 + I} - r = \frac{1 + m}{1 + i} - 1$$

Where  $i$  = inflation rate  
 $m$  = money cost of capital  
 $r$  = real rate or real cost of capital

In order to use the real cost of capital, we must ensure that the cash flows to be discounted are the real cash flows. The real cash flows are cash flows given in today's prices, also known as current values or year zero cash flows. To use the real cost of capital, we must bring this cash flows to year zero values. We shall get exactly the same result whether real or money cost is applied i.e. it is not material which concept is applied as long as the concepts are properly applied.

### ILLUSTRATION 13 – 12

The Directors of Newline Nigeria Ltd. are considering under taking the manufacture

of a new product. The company's current cost of capital is 20% in money terms. Construction of the plant required to produce the new product would take one year; i.e. production would commence on 1 January 1996. The plant would cost ₦500,000 of which ₦300,000 is payable immediately and ₦200,000 on 31 December 1995. The construction cost is fixed by contract. One hundred thousand units of the new product would be produced and sold each year from 1 January 1996 until 31 December 1999. Revenues and costs expected, expressed in terms of 1 January 1994 price level are as follows:

	Per Unit
Selling price	₦5.0
Variable cost (excluding labour)	₦1.50
Labour	₦1.00

Additional overhead costs ₦60,000 per annum, selling price, variable costs (excluding labour) and additional overhead costs are expected to increase in line with general price index. For a number of years, this index has increased at an annual compound rate of 10% and it is generally expected to continue increasing in line with the wage rate index which has been increasing at an annual compound rate of 20%. The same rate of increase is expected in the future. All revenues and costs occur at the end of the year in which they arise. Advise the directors of Newline Nigeria Ltd. whether the manufacture of the new products is worthwhile. Ignore taxation.

### SUGGESTED SOLUTION 13 – 12

#### Evaluation

Year	Item	Cash Flows ₦	DF/AF appropriate rate	at the	PV
0	Plant	(300,000)	20%	1.00	(300,000)
1	Plant	(200,000)	20%	0.8333	(166,660)
2 – 5	Sales less Overhead and Labour	(319,000)	0.09%	2.964	945,516
2 – 5		(120,000)	10%	4	<u>(480,000)</u>
				NPV	<u>(1,144)</u>

#### Decision Rule:

Management should not manufacture the product since it results in negative NPV of ₦1144.

#### Note:

(a)	Year	0	1 January 1995
		1	31 December 1995
		2	31 December 1996
		3	31 December 1997
		4	31 December 1998
		5	31 December 1999

(b) Real Cost of Capital

- (i) For selling price, additional overhead, variable cost (excluding labour)  
inflation rate: 10%

$$r = \frac{1 + m}{1 + i} - 1 = \frac{1 - 20}{1.10} - 1 = 9.09\%$$

Inflation : 10%

$$r = \frac{1 + m}{1 + I} - 1 = \frac{1.20}{1.20} - 1 = 0\%$$

(c) Revenues and costs are given in 1 January, 1994 index:

- (i) Year 1 January, 1995

Selling Price = 5.0

Variable Costs = 1.50

$$\begin{aligned} \text{Contribution} &= 3.50 \times 100,000 = 350,000 \times 110\% \\ &= \text{N}385,000 \end{aligned}$$

- (ii) Additional Overhead = 60,000 x 110% = Year 0  
= N66,000

- (iii) Labour costs 1 x 100,000 = 100,000 x 120%  
= Year 0 = N120,000

- (iv) Contribution = N385,000  
Less Additional Overhead = N66,000  
Profit or Cash inflows = N319,000

### 3.7.2 Other Considerations

- (a) The real cost of capital should be used under the following conditions:

- (i) where the inflation rate for the same cash flow will differ annually e.g. sales will increase by 10% in first year; 20% in second year etc.  
(ii) if in addition to inflation, relevant cash flows concept or any other capital budgeting concept or decision is being tested, usage of real cost of capital approach may become cumbersome.  
(iii) where the inflation rate is greater than the real cost of capital, in this case, the real cost of capital is a negative cost.

- (b) The differential inflation rate is a situation where different rates of inflation apply to different cash flows of a project. We can still apply the real cost of capital approach as follows:

- (i) calculate the real cost of capital for a collection of cash flows that have the same inflation rate.  
(ii) calculate the present values of each cash flows that have the same inflation rate.

- (iii) a summation of all the relevant PV of the project will be equal to the NPV.

### 3.8 TAXATION IN CAPITAL BUDGETING

In this area, and in other areas where cash flows are to be used, we must reflect in the solution, as far as information is available which will allow the following:

- (a) All capital allowances claimable including balancing allowances.  
This should be reflected as tax savings in the cash flows. These tax savings will result in cash inflows which should be calculated thus:  $\text{Tax Rate} \times \text{Capital Allowances} = \text{Tax Savings}$ .
- (b) All balancing charges will give rise to additional tax payments known as tax cost. This tax cost should be recognised as relevant cash out flows and calculated as;  $\text{Tax Cost} = \text{Tax Rate} \times \text{Balancing Charges}$ .
- (c) Additional tax cost or tax savings from allowable income and expenditure respectively. Additional income = Tax Costs which is relevant cash outflows and determined thus;  $\text{Tax Rate} \times \text{Additional Income}$ . Additional expenditure = Tax Saving which is relevant cash inflows and is determined thus:  $\text{Tax Rate} \times \text{Additional Expenditure}$ .
- (d) Timing of tax related cash flows. The inflows and outflows above arising from tax costs and savings should be incorporated in the cash flow during the period for the payment of tax in relation to the allowable timing period for tax. It is usual to assume, where there is silence on the issue of tax, that it is payable one year after the end of the period to which the tax cash flow relates. If no tax rate is given or you are asked to ignore taxation, you need not adjust for taxation in the cash flow.

### 3.9 LEASE OR BUY DECISIONS

These decisions are usually mutually exclusive, hence the usage of the incremental approach will hasten the rate of attempting problems in this area. Capital allowances would substantially affect our lease or buy decision, therefore the earlier explained adjustment for capital allowances are expected under lease or buy decision with particular reference to the buy option. However, in financial management it is assumed that the lessee whether in operating or finance lease arrangement would not enjoy capital allowance, that is, implicit assumption of leases as operating lease for capital budgeting.

#### 3.9.1 Qualitative Factors Affecting Lease or Buy Decisions

The following qualitative factors need be considered when lease or buy decisions are involved:

- (a) **Liquidity**
  - (i) Do we have enough funds now to buy the asset instead of leasing it?

- (ii) Will we have sufficient funds in future to meet lease obligations?
- (b) **Off balance sheet financing:** Leasing will be more attractive than borrowing or buying if a company is already highly geared.
- (c) Availability of spare parts and ease of maintenance:  
Most lease contracts contain maintenance clauses. In many cases it will be more economical for the lessor who has more exposure units to import spare parts and runs maintenance centre.
- (d) **Changes in technology or obsolescence:** Leasing may become attractive, if the asset is exposed to frequent changes in technology e.g. leasing is a regular feature in the Hi-tech industries like aircraft and computer.
- (e) **Inflation:** This may affect lease or buy decisions in terms of changes in prices visa-vis replacement cost, scrap value and maintenance charges.
- (f) **Beneficial ownership**
  - (i) It is advisable not to lease specialised equipment or accommodation,
  - (ii) Purchase increases the asset base of companies, thereby improving the company's ability to raise further finance.
- (g) **Distribution in production:** This will lead to Losses if the lessor repossesses the asset for any reason.
- (h) **Changes in taxation rate:** This factor can also affect either the lease or buy decision.

### 3.9.2 Assumptions

Logical assumptions are allowed to be made in this area of decision making and the major issue of choice centres around the cost of capital to be used in discounting the relevant cash flows. Therefore, as a guide, the following may be adopted:

### 3.9.2 Choice of Cost of Capital

- (i) **Nature of cost of capital:** If a company is in a taxable position, use the after tax cost of capital, whereby the after, tax cost of capital is that cost of capital that has been directly or indirectly adjusted for taxation. Tax adjustments are considered direct if the specific calculation of the cost of capital has recognised taxation. It is indirect if the figure for the cost of capital is adjusted using the following formula:

After Tax Cost = Cost of Capital x (1 - Tax Rate)

e.g. Cost of Capital = 10% and Tax Rate = 40%

After Tax Cost of Capital = 10% x (1 - 0.4) = 6%

However, if the company is not in a taxable position, we should use before tax cost of capital. A company is in a taxable position if it is required to pay tax during its normal course of business. If a company is currently making losses and therefore not paying taxes, it does not mean that the company is not in a taxable position. The loss position of the company will only mean a deferral of tax payments.

- (ii) **Specific cost of capital:** The choice of a particular cost of capital to use for either the lease or buy decision can be by reference to source of finance or by reference to nature of cash flow. If the source of finance for the decision is specified or known, we should use the specific cost or cost of borrowing. However, if the source is from the company's pool of funds, we should use the company's weighted average cost of funds (WACC).

### 3.9.4 Nature of Cash Flows

Cash flows are considered certain if they do not fluctuate over time and they are not linked to sales or production, for example, lease rentals, hire purchases etc. On the other hand, cash flows are uncertain if they are dependent on the level of activity of the company or if they can be linked with the demand or sales of the company's production or services, for example, all variable cost including sales price, labour etc.

The example below is used to illustrate the effect of taxation in capital budgeting decisions as well as the element of lease or buy decision by a firm.

#### ILLUSTRATION 13 – 13

MOSORIRE NIG. LTD. intends to obtain the use of an asset, but is uncertain of the best financing method to be employed. The financing methods under consideration are:

- (a) To borrow and purchase the asset: borrowing would cost 12% before tax, the current competitive market rate for debt. The asset would cost ₦90,000 to purchase and will have a guaranteed salvage value of N10,000 in five years. Expenditure on the asset qualifies for capital allowance at 25% per annum on the reducing balance.
- (b) To lease the asset, two financial leases are being considered, the details are:

YEAR	Payments to be made	
	LEASE A (₦'000)	LEASE B (₦'000)
0	20	4
1	20	8
2	20	16
3	20	30
4	20	50

If the asset is leased the entire salvage value will accrue to the lessor. The firm's weighted average cost of capital is 15%. Advise on the best method of financing the use of the asset if the firm is:

- (a) subject to company tax at 35% with a one year delay and has large taxable

- profits.  
 (b) permanently in a non-taxable position.

### SUGGESTED SOLUTION 13 – 13

#### BUY DECISION

Year	(a) Cash flow	(b) Tax Savings/Cost	(a + b) Net Cash Flow	DF @ 7.8%	PV
0	(90,000)	-	-	1.0000	(90,000)
1		7875	7875	0.9276	7,305
2		5906	5906	0.8605	5,082
3		4430	4430	0.7983	3,536
4		3322	3322	0.7405	2,460
5	10,000	2492	3975	0.6372	2,533
6		3975	12492	0.6869	<u>8,581</u>
				NPV	<u>(60,503)</u>

#### Lease A

Year	(a) Cash flow	(b) Tax Savings/Cost	(a + b) Net Cash Flow	DF @ 7.8%	PV
0	(20,000)	-	(20,000)	1.0000	(20,000)
1	(20,000)	7000	(13,000)	0.9276	(12,059)
2	(20,000)	7000	(13,000)	0.8605	(11,187)
3	(20,000)	7000	(13,000)	0.7983	(10,378)
4	(20,000)	7000	(13,000)	0.7405	(9,627)
5	-	7000	7,000	0.6869	<u>4,808</u>
					<u>(58,443)</u>

#### Lease B

Year	(a) Cash flow	(b) Tax Savings/Cost	(a + b) Net Cash Flow	DF @ 7.8%	PV
0	( 4,000)	-	(4,000)	1.0000	(4,000)
1	( 8,000)	1,400	(6,600)	0.9276	(6,122)
2	(16,000)	2,800	(13,200)	0.8605	(11,359)
3	(30,000)	5,600	(24,400)	0.7983	(19,479)
4	(50,000)	10,500	(39,500)	0.7405	(29,250)
5	-	17,500	17,500	0.6869	<u>12,025</u>
					<u>(58,185)</u>

#### Decision Rule:

Lease from B since it has the lowest figure in terms of the investment cost or present value of cost.

### Working Notes:

- (a) Cost of borrowing is 12%  
after tax cost of borrowing =  $12\% \times (1 - 0.35) = 7.8\%$
- (b) Capital allowance calculation
- |      |   |                               |                      |
|------|---|-------------------------------|----------------------|
| Year | 1 | $90,000 \times 25\% = 22,500$ | $\times 35\% = 7875$ |
|      | 2 | $67,500 \times 25\% = 16,875$ | $\times 35\% = 5906$ |
|      | 3 | $50,625 \times 25\% = 12,656$ | $\times 35\% = 4430$ |
|      | 4 | $37,969 \times 25\% = 9,492$  | $\times 35\% = 3322$ |

Written Down Value (WDV) =  $28,477 - 7,119 = 21,358$

Balancing Allowance = WDV less scrap value  
=  $21,358 - 10,000$   
=  $11,358 \times 35\% = 3975$

## 4.0 CONCLUSIONS

Investment decisions are long — run decision where consumption and investment opportunities are balanced over time after taking into consideration investor's beliefs in the future, the alternatives available and attitude to risks.

The appraisal techniques are of two main types viz: Traditional and discounted cash flow (DCF) whereby the traditional elements are payback period and accounting rate of return while the DCF that uses cash flows rather than profits and take account of the time value of money are net present value and internal rate of return.

With the conventional projects, IRR and NPV give the same accept or reject decision. NPV is an absolute measure whereas IRR is a relative one, hence the superiority of the NPV over IRR when the decision making is involved.

Capital rationing is where all apparently profitable projects cannot be initiated because of shortage of capital and decision rule under this instance is to maximise the return from project(s) selected rather than simply accept / reject decision of projects in isolation.

The probability index is used in ranking single period projects in terms of the expected value having regards to mutually exclusive projects.

Multi-period capital rationing with divisible projects is usually solved by linear programming technique which produces the optimal solution.

Specific inflation is of more direct concern in investment appraisal and differential inflation is commonly encountered with the need to distinguish between real and nominal value of money.

Because taxation affects the cash' flows of a project, it is a factor to be considered because it affects a project in three ways: taxes on profits, investment incentives and effects on cost of capital.



## 5.0 SUMMARY

Based on the factors listed above under introduction regarding Capital budgeting Decisions, the manager must not fail to make appropriate investment or selection of good projects because, the volume of fixed assets far exceed current assets and the owners of the company (shareholders) are long term investors, whose high expected returns can only be met with the higher returns from long term assets. These assertions, call for the need to examine the different methods of selecting investments in long term assets.

## 6.0 TUTOR MARKED ASSIGNMENT

1. Dotun is considering an investment that gives a positive net present value of ₦3,664 at 15%. At a discount rate of 20%, it has a negative net present value of ₦21,451. What is the internal rate of return of this investment?  
A 15.75%  
B 16.0%  
C 19.30%  
D 19.90%  
E 18.40%.
2. Ayo Limited is planning on paying ₦300 into a fund on a monthly basis starting 3 months from now for 12 months. The interest earned will be at a rate of 3% per month. What is the present value of these payment?  
A ₦2816  
B ₦2733  
C ₦2541  
D ₦2986  
E ₦2886.

The following data relates to question 13.3 and 13.4.

Yemi Limited is considering investing in a manufacturing project that would have a three years life span. The investment would involve an immediate cash outflow of ₦50,000 and have a zero residual value. In each of the three years, 4000 units would be produced and sold. The contribution per unit based on current price is ₦5. The company has an annual cost of capital of 8%. It is expected that the inflation rate will be 3% in each of the next three years.

3. The net present value of the project to the (nearest ₦500) is  
A ₦4500  
B ₦5000  
C ₦5500  
D ₦6000  
E ₦6500.

4. If the annual inflation rate is now projected to be 4%, the maximum necessary cost of capital for this project to remain viable is (to the nearest 0.5%)
- A 13.0%
  - B 13.5%
  - C 14.0%
  - D 14.5%
  - E 15.0%.
5. If ₦400 is invested today and generate ₦500 in one year's time. What is the internal rate of returns?
- A 30%
  - B 32%
  - C 31%
  - D 25%
  - E 27%.
6. Explain the concept of Capital Rationing.
7. What is a Profitability Index?
8. State any four main factors to be considered in a lease or buy decision.
9. What is Internal Rate of Return?
10. The discount rate used in DCF calculation is known as\_\_\_\_\_

## **7.0 REFERNCES/ FURTHER READINGS**

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## **UNIT 14    DECISIONS MAKING UNDER RISK AND UNCERTAINTY**

### **CONTENTS**

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    - 3.1.1 Risk
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    - 3.2.3 Where no cost of capital is given
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### **1.0 INTRODUCTION**

In this unit we will be discussing Risk and Uncertainty as relevant issues in investment appraisal with reference to individual project uncertainty, the decision makers' attitude to risk and the diversification effect

### **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- The terms risk and uncertainty;
- Payback, risk premium and finite horizon methods;
- The application of probability in project appraisal;
- The calculation and explanation of expected value;
- The terms standard deviation and coefficient of variation as measures of risk and their limitations;
- The construction of a decision tree when there is a range of alternatives and possible outcomes.
- The description and calculation of the value of perfect and imperfect information;
- The maximin, maximax and regret rules;
- Sensitivity analysis and its application to project appraisal; and
- Portfolio analysis and its implication for project appraisal;
- Asset replacement decisions.

### **3.0 MAIN CONTENT**

### **3.1 RISK AND UNCERTAINTY**

In capital budgeting decisions, it is assumed that the variables and estimates used are known with certainty. However, under the risk and uncertainty situations, we are faced with the fact that the actual returns that will be realised from a project may differ from the expected return (usually NPV) on which we have based our decision. The risk is that, we may have accepted a project that should have been rejected or rejected a project that should have been accepted. Furthermore, another problem that may be solved by incorporating risk and uncertainty is the estimation of errors needed in determining the risk factor.

Based on the above, there will be need for us to define the elements of risks and uncertainty as well as the techniques used in adjusting for such risks and uncertainty in long term decision making processes especially when projects are to be rejected or accepted.

#### **3.1.1 Risk**

A risk is a situation in which we do not know exactly the occurrence of future uncertain events but we can quantify the possibilities of such future events. The quantification of occurrence of such events is usually called **PROBABILITIES**. However for long term decision making, such future events can be categorised into;

- (a) Cash flows
- (b) Project lives.
- (c) Cost of capital.

#### **3.1.2 Uncertainty**

An uncertainty is a situation in which we cannot quantify the probability or possibility of occurrence of such future events. Therefore, the inability to be able to quantify the possibility of occurrence may be as a result of lack of experience in that area of business or absence of research data in that area.

The above distinctions between risks and uncertainty is purely theoretical and would not affect our methods for adjusting or incorporating risks and uncertainties in long term decisions. The reason, is that most long term projects will have elements of both risks and uncertainties.

#### **3.1.3 Adjusting for risks and uncertainties**

Any of the following methods can be used to adjust for risk and uncertainty in long term projects;

- (a) Accounting Rate of Return Adjustment (ARR)
- (b) Payback Adjustment
- (c) Finite Horizon Method

- (d) Risk Premium Method
- (e) Expected Value Approach or Probability Theory
- (f) Risk Analysis
- (g) Sensitivity Analysis
- (h) Simulation Analysis
- (i) Pay-Off Matrix
- (j) Decision Tree
- (k) Portfolio Theory.

A discussion of the methods in turn are as follows; however, a knowledge of capital budgeting is assumed for the first four methods.

**(a) ARR Adjustment Method**

Under this method, projects that are considered risky are evaluated by using a higher ARR than the normal ARR for the company, for example, if a company usually evaluates projects at an ARR of 30%, it may evaluate risky projects at 40%.

**(b) Payback Adjustment Method**

Like in the method above, risky projects would require a more stringent condition, that is, risky projects would meet a payback period that is shorter than the company's normal payback period e.g. if a company usually evaluates projects using a three year payback period, risky projects may be required to payback within two years.

**(c) Finite Horizon Method**

This method involves evaluating a project that is considered risky within a reduced number of years that the appraiser will be comfortable with. This reduced number of years is usually called the FINITE HORIZON or the foreseeable future. The assumptions for using this method are the following:

- (i) Cash flows of future years for conventional projects would normally be the net cash in-flows.
- (ii) Our inability to forecast cash flows of distant future years is unavoidable.
- (iii) The present values of such distant future cash flows will be insignificant or immaterial since they will tend to zero, for example, a project with a ten year life-span may be evaluated with cash flows of only the first five years.

**(d) Risk Premium or Risk Adjusted Discount Rate Method**

In this case, the adjustment for risk is done on the cost of capital. Risky projects will then be evaluated at a cost of capital that will be higher than the company's normal cost of capital, for example, if the company's normal cost of capital is 10% per annum, then, a risky project may be evaluated at 15% per annum cost of capital. The difference between the company's normal cost of capital and the risk adjusted cost of capital is known as the RISK PREMIUM which in this

case is 5%, that is, (15% -10%). Readers should refer to chapter 10 for a full understanding of the concept of cost of capital.

(e) **Expected Value Approach or Probability Theory Method**

Decision making under risk generally involves the use of probability, and by probability, we mean the likelihood of an event occurring. The values of probabilities range between 0 and 1 and the higher the probability the more likely or certain the occurrence of that event. Basically, there are two major types of probability namely:

- (i) **Objective probability:** by this we mean, the frequency of the occurrence of an event if repeated several times over, for example, the probability of having a "3", when a fair dice is cast is 1/6th.
- (ii) **Subjective probability:** they are probabilities based on the decision makers' personal experience, guesses, judgement and initiatives. This is due to the fact that, most business problems are not repeatable in nature and, therefore, the rate of frequency of the occurrence of that event cannot be easily determined. In using this method, probabilities are already attached to a stratified form of the variable, that is, the variable would be broken down for each period into units or strata which a question can also refer to as states of the world or possibilities.

However, whenever probabilities are attached to variables, the weighted average of those variables must be used in the quantification of any decision to be arrived at under a given circumstance. In calculating the weighted average, the weights to be attached will be the respective probabilities of each unit. The weighted averages for the variables are known as EXPECTED VALUES. Thus, this expected value would be used in the normal discounting technique to arrive at an expected net present value (NPV). The expected net present value is considered to be a risk adjusted net present value (NPV).

The advantages of probability theory in decision making are:

- (i) A constructive effort is made to deal with uncertainty or forecasting of specific output or event.
- (ii) It assists in achieving a better result in the preparation of realistic budget which would be of assistance to management.
- (iii) Questioning of budget variables lays a better foundation for the control of actions and cost.
- (iv) The final figure may be more acceptable to management approving the budget or expenditure because management may see it as the outcome of a more considered management process.

The examples below are used to illustrate the application of the techniques of adjusting for risk on investments or projects.

**ILLUSTRATION 14 – 1**

- (a) Kosalabaro Plc can introduce one new product with its range of products next year. The extra cost will be ₦750,000 for either product x and y. The selling price of X would be ₦20 and for Y, ₦25. The variable costs would be ₦10 and ₦13, respectively.

From past experience with similar products, the demand probabilities have been estimated at:

Demand in units	Probabilities	
	X	Y
50,000	0.2	0.1
75,000	0.4	0.2
100,000	0.3	0.4
125,000	<u>0.1</u>	<u>0.3</u>
	<u>1.0</u>	<u>1.0</u>

You are required to compute the breakeven point for each product and advise with reasons, which product should be chosen.

- (b) Three choices are being considered for honouring a two year free service guarantee. Your company had an offer to obtain the sale of 2,000 communication sets to a hotel group. The choices are;
- (i) Do the servicing with own staff based on past experience, the costs will be:

Probability of Occurrence	Event of Servicing	Total Cost (₦)
0.30	Very little trouble (500 Calls/year)	7,000
0.50	Usual trouble (1,000 Calls/year)	12,000
0.20	A lot of trouble (1,500 calls/year)	25,000

- (ii) Sub contract to firm K who has quoted a fixed cost of ₦14,000 plus N2 for each visit in excess of 750 visits over the two year period.
- (iii) Sub-contract to firm P who has quoted a fixed cost of ₦16,000 plus.

You are required to advise the management on the choice they should adopt. Justify your recommendations.

### SUGGESTED SOLUTION 14.1

(a) Calculation of BEP for product X and Y are as follows:

$$\text{BEP in units} = \frac{\text{Fixed Cost}}{\text{Contribution Per Unit}} \quad \text{or} \quad \frac{\text{FC}}{\text{C/U}}$$

OR

$$\text{BEP in N sales} = \frac{\text{Fixed cost}}{\text{Contribution Margin Ratio}} \quad \text{or} \quad \frac{\text{FC}}{\text{CMR}}$$

Products	X	Y
BEP Sales in units	$\frac{750,000}{20 - 10}$	$\frac{750,000}{25 - 13}$
	= 75,000 units	= 62,500 units
CMR	= $\frac{10}{20}$	= $\frac{12}{25}$
	= 0.5	= 0.48
BEP in N sales	= $\frac{750,000}{0.5}$	= $\frac{750,000}{0.48}$
	= ₦1,500,000	= ₦1,562,500

## EXPECTED DEMAND

### PRODUCT X

Units	Probabilities	Expected Demand
50,000	0.2	10,000
75,000	0.4	30,000
100,000	0.3	30,000
125,000	0.1	<u>12,500</u>
		<u>82,500</u>

### PRODUCT Y

Units	Probabilities	Expected Demand
50,000	0.1	5,000
75,000	0.2	15,000
100,000	0.3	30,000
125,000	0.4	<u>50,000</u>
		<u>100,000</u>

### ADVICE:

Product Y should be chosen because of the following reasons:

- (1) It reports a higher contribution margin
  - (2) There is a higher margin of safety
  - (3) There is a higher expected demand
  - (4) There is lower breakeven point.
- (b) (i) Use own staff

Total Cost	Probabilities	Expected Demand
₦		₦



7,000	0.3	2,100
12,000	0.5	6,000
25,000	0.2	<u>5,000</u>
		<u>13,100</u>

(ii) Sub-Contract to firm K

	N
Fixed Cost	14,000
Variable Cost	<u>2,300</u>
	<u>16,300</u>

Note: Variable costs are determined thus:

No. of Visits	Probabilities	Expected Visits
500	0.3	150
1000	0.5	500
1500	0.2	<u>300</u>
Expected Visits		<u>950</u>

For 2 years (950 x 2)	=	1,900
Less visits for 2 periods		<u>750</u>
		<u>1,150</u>
Excess visits 1150 x N2	=	<u>2,300</u>

(iii) Sub-contract to firm P – N16,000 plus  
Decision – Management should use own staff as they would incur the lowest cost of N13,100 as against the other alternatives.

The following are the advantages and disadvantages of the Expected value approach to decision making.

#### **Advantages of Expected value Approach**

- It is simple to understand and easy to calculate
- It takes account of expected variability of all outcomes
- It represents the whole distribution by a simple figure
- It leads directly to a simple optimizing decision rule.

#### **Disadvantages of Expected Value Approach**

- It makes a general assumption that the decision maker is risk neutral
- It is in itself meaningless, only by coincidence will it be an actual outcome. Infact, it is not an expected value, but more of a weighted average.
- By asking for a series of forecast, the forecasting procedure is complicated and infact inaccurate forecasting is a major weakness in most business decisions.
- By representing the whole distribution by a single figure, it ignores the other characteristics of the distribution.
- Risk Analysis**

This method measures the risks in projects through an examination of the standard deviations. Harry Markowitz in his article “Portfolio Selection” equated risk to standard deviation. The argument being that decisions on long term projects where probabilities are attached are based on the expected values. The expected value is a central measure under a normal distribution. It follows, therefore, that deviations from the mean will capture the risks in projects which is the inaccuracy of our decisions.

Standard deviation (SD) can be measured as follows:

$$\text{SD of cash flows} = \sqrt{\frac{\text{Variance}}{n}}$$

$$\text{where variance} = \sum_{i=1}^n (x_i - \bar{x}_1)^2 P_i$$

$$\text{Therefore, SD} = \sqrt{\frac{\text{Variance}}{n}} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x}_1)^2 P_i}{n}}$$

where x = each possible outcome

$\bar{x}$  = expected or mean outcome

p = probability attached to each outcome

The rule is, the higher the standard deviation, the higher the risk.

The major problem with using standard deviation as a measure of risk is that it does not recognize differences in sizes or scales of projects. The reason is that standard deviation is not a relative measure of dispersion.

A more perfect measure is the co-efficient of variation.

$$\text{The co-efficient of variation} = \frac{SD}{\text{mean}} = \frac{(x-x)^2 P}{\sqrt{\bar{x}}}$$

The rule remains, that is, the higher the co-efficient of variation (COV) the higher the risk. It is clear that the correct way to measure risks among projects if the expected value or scales are not the same is the co-efficient of variation (COV).

(g) **Standard Deviation of Projects**

The discussions on projects will normally be based on NPV rather than cash flows. For this reason, it is more relevant to calculate the risk on a project by calculating the standard deviation of NPV rather than standard deviation of cash flows. The standard deviation of NPV of a project can be calculated through the stream of cashflows in a project as follows:

- (a) If the cash flows are dependent annually, the standard deviation of NPV of a project is:

$$\text{SD of NPV} = S \frac{\text{in year } t/n}{(1+r)^n} = \frac{S^2_1}{(1+r)^1} + \frac{S^2_2}{(1+r)^2} + \frac{S^2_3}{(1+r)^3} + \dots + \frac{S^2}{(1+r)^n}$$

Where  $\delta$  = standard deviation of cash flows

The cash flows are considered dependent, if each years' cash flow will occur on the basis of a particular level in previous years of will influence future level of cash flows.

- (b) However, where cash flows are independent annually, the standard deviation of the project will be calculated as below:

$$\text{SD of NPV of Project} = S \frac{\text{in year } t/n}{(1+r)^n} = \frac{S^2_1}{(1+r)^2} + \frac{S^2_2}{(1+r)^4} + \frac{S^2_3}{(1+r)^6} + \dots + \frac{S^2}{(1+r)^{2n}}$$

Where =  $S(x - x)^2 P$  the variable of each year's cash flows.

The example below can be used to illustrate the operation of this method.

#### ILLUSTRATION 14 – 2

Omoba Aseye Enterprises Limited has two investment options, each of which involves an initial outlay of ₦3,000 and an expected life of 3 years.

Annual net cash flows from each project being one year after the initial investment is made and have the following probability distributions.

	State of the World	Probability	Annual net cash flows (₦)
Project A	i	0.2	2,400
	ii	0.6	3,000
	iii	0.2	3,600
Project B	i	0.2	2,400
	ii	0.6	3,000
	iii	0.2	3,600

- (a) What is the expected value of the annual cash flow from each project?
- (b) What is the risk adjusted net present value of each project if the company has decided to evaluate the riskier project at 10% and the less riskier project at 8%.

#### SUGGESTED 14 -2

- (a) The expected value of the annual cash flow are determined as follows:

State of	PROJECT A		PROJECT B	
	Probabilities	Cash	Expected	Probabilities

Expected the world Value	Value	Flows	Value	Value	Value	Flows
	₦	₦	₦	₦	₦	₦
i	0.2	2,400	480	0.2	0	0
ii	0.6	3,000	1,800	0.6	3,000	1,800
iii	0.2	3,600	<u>720</u>	0.2	7,500	<u>1,500</u>
Expected annual cash flow			<u>3,000</u>	Expected Annual Cash flow		<u>3,300</u>

(b) **PROJECT A**

$$\text{SD of cash flows} = \sqrt{\sum (x - \bar{x})^2 P}$$

X	P	XP	X - $\bar{X}$	(X - $\bar{X}$ ) <sup>2</sup>	(X - $\bar{X}$ ) <sup>2</sup> P
2400	0.2	480	(600)	360,000	72,000
1000	0.6	1,800	-	-	-
3600	0.2	<u>720</u>	600	160,000	<u>72,000</u>
	$\bar{X} =$	<u>3,000</u>			<u>144,000</u>

Therefore, standard variation =  $\sqrt{144,000} = 379$

Therefore, Co-efficient of variation =  $\frac{379}{3,000} = 0.126 = 12.60\%$

**PROJECT B**

X	P	XP	X - $\bar{X}$	(X - $\bar{X}$ ) <sup>2</sup>	(X - $\bar{X}$ ) <sup>2</sup> P
0	0.2	0	(3300)	10,890,000	2,178,000
3000	0.6	1,800	(300)	90,000	54,000
7500	0.2	<u>1,500</u>	4,200	17,640,000	<u>3,528,000</u>
	$\bar{X} =$	<u>3,300</u>			<u>5,760,000</u>

Therefore, standard variation =  $\sqrt{5,760,000} = 2,400$

Therefore, Co-efficient of variation =  $\frac{2,400}{3,000} = 0.727 = 72.7\%$

From the computations above, Project B is riskier than Project A. Therefore, the risk adjusted net present value can be determined thus:

**PROJECT A**

Year	Cash Flows ₦	DCF @ 8%	PV ₦
0	(3,000)	1	(3,000)
1 - 3	3,000	2,577	<u>7,731</u>
			ENPV <u>4,731</u>

**PROJECT B**

Year	Cash Flows ₦	DCF @ 10%	PV ₦
0	(3,000)	1,000	(3,000)
1 – 3	3,300	2,487	<u>8,207</u>
		ENPV	<u>5,207</u>

(h) **Sensitivity Analysis**

Sensitivity Analysis is a term used to describe any technique whereby decision options are tested for their vulnerability to adverse changes in its constituent “variables” such as expected sales, volume, sales per unit, material cost, labour cost, etc.

In practice, many companies try to resolve some of the risks in projects by applying sensitive analysis to the major component of the project. The aim is to quantify the impact of changes in the variables of a project on the decision. Since decisions are always based on NPV and ultimately change our decisions.

If the percentage change that will affect our decision is very small, then the project will be considered very sensitive to the particular variable being examined. A major advantage of sensitivity analysis is that it will identify the key variables of a project before a decision is taken and with this, management will take a more accurate decision. Secondly, it makes the management to be more accurate decision. Secondly, it makes the management to be more conscious of the errors and dangers in incorrect estimations. Finally, it will enable the management to make contingency plan should the sensitive changes occur.

However, a major problem with the sensitivity analysis is the fact that the variables of a project are inter-related in many cases. Therefore, it does not make much sense to examine in isolation the effect of changes in a particular variable only. Nonetheless, many companies try to cope with this problem by examining a combination of related variables and in this way, they look at different scenarios. But where the number of variables and interrelationships are large or complicated, it may be better to use simulation analysis. There are two (2) popular ways of analyzing the sensitivity in project as follows:

- (a) The first method involves changing the values of different project variables arbitrarily and checking the effect of those changes on our decisions (NPV).
- (b) Alternatively, we may want to calculate the percentage change in a variable that would change our decision. As a guide, the following definitions may apply:

- (i) Sensitivity of a project to cash flows is determined thus:

$$\frac{\text{NPV of the Project}}{\text{NPV of the Project}} \times 100$$

### PV of the Cash flow

(ii) Sensitivity of a project to cost of capital can be thus:

$$\frac{\text{IRR} - \text{Cost of Capital}}{\text{Cost of Capital}} \times 100$$

(iii) Sensitivity of a project to the life of the project is thus:

$$\frac{\text{Project Life} - \text{BEP of Project Life}}{\text{Project Life}} \times 100$$

The example below is used to illustrate the application of the above method as that used in adjusting for risk in projects.

### ILLUSTRATION 14 – 3

A project costing ₦20,000 is expected to last four years. Annual sales and related costs are shown below:

	₦	₦
Sales (50 Units)		21,500
Direct Material	4,000	
Direct Labour	3,000	
Direct Factory Overhead:		
Variable	1,500	<u>8,500</u>
Contribution		13,000
Fixed Cost		<u>5,000</u>
Annual Profit		<u>8,000</u>

#### **Required:**

- (a) Calculate the project's NPV
- (b) Prepare a statement showing how sensitive the NPV is to errors of estimation in each component of your calculation in (a) above, namely:
  - (i) Annual Sales Volume
  - (ii) Unit selling price
  - (iii) Direct material cost
  - (iv) Direct Labour cost
  - (v) Variable overhead
  - (vi) Annual fixed costs
  - (vii) Initial Outlay
  - (viii) Product Life
  - (ix) Cost of Capital

### SUGGESTED SOLUTION 14 – 3

- (a) The project's NPV is determined thus:

Year	Cash Flows ₦	DCF @ 10%	PV ₦
0	(20,000)	1,0000	(20,000)
1 – 4	8,000	3,1699	<u>25,359</u>
Net Present Value			<u>₦5,359</u>

The project should be accepted since it has positive NPV of ₦5,359

(b) (i) Sensitivity of annual sales volume

$$\frac{\text{NPV}}{\text{DCF contribution}} \times \frac{100}{1}$$

$$\frac{5359}{13,000} \times \frac{100}{3,1699} = 13\%$$

The annual sales volume must not fall below 13% otherwise the project will be unacceptable.

(ii) Sensitivity of unit selling price:

$$\frac{\text{NPV}}{\text{DCF of Sales Value}} \times \frac{100}{1} = \frac{5,359}{21,500} \times \frac{100}{3,1699}$$

$$= 7,86\% = 8\%$$

The unit selling price must not decrease below 8% otherwise the project becomes unacceptable.

(iii) Sensitivity of direct material cost

$$\frac{\text{NPV}}{\text{DCF of direct material cost}} \times \frac{100}{1} = \frac{5,359}{4,000 \times 3.1699} \times \frac{100}{1} = 42\%$$

The direct cost must increase by more than 42% otherwise, the project becomes unacceptable.

(iv) Sensitivity of Director Labour Cost

$$\frac{\text{NPV}}{\text{DCF of direct labour cost}} \times \frac{100}{1} = \frac{5,359}{3,000 \times 3.1699} \times \frac{100}{1} = 56\%$$

The direct labour cost must not increase by more than 56%.

(v) Sensitivity of variable overhead cost

$$\frac{\text{NPV}}{\text{DCF of variable overhead}} \times \frac{100}{1} = \frac{5,359}{1,500 \times 3.1699} \times \frac{100}{1} = 112\%$$

The variable overhead cost must not increase beyond 112%

(vi) Sensitivity of fixed overhead cost

$$\frac{\text{NPV}}{\text{DCF of fixed overhead}} \times \frac{100}{1} = \frac{5,359}{5,000 \times 3.1699} \times \frac{100}{1} = 34\%$$

(vii) Sensitivity of Initial Outlay

$$\frac{\text{NPV}}{\text{DCF of initial outlay}} \times \frac{100}{1} = \frac{5,359}{20,000 \times 3.1699} \times \frac{100}{1} = 27\%$$

The initial outlay must not increase more than 27% for the project to be acceptable.

(viii) Sensitivity of product life

NPV @ 3 years

Year	Cash Flows N	DCF @ 10%	PV N
0	(20,000)	1	(20,000)
1 – 3	8,000	2,4869	<u>19,895</u>
		NPV	<u>(105)</u>

$$3 \text{ years} + \frac{105}{5,359 + 103} \times 1 = \frac{105}{5,464} = 3 + 0.02 \text{ years}$$

$$= 3.02 \text{ years.}$$

$$\text{Therefore, } \frac{4 - 3.02}{4} \times 100 = 24.5\%$$

The product life should not fall by more than 24.5%, that is, 9 months of project life. Otherwise, the project becomes unacceptable.

(ix) Sensitivity of Cost of Capital

The IRR is calculated thus:

Year	Cash Flows N	DCF @ 10%	PV N
0	(20,000)	1	(20,000)
1 – 4	8,000	2,855	<u>22,840</u>
		+ NPV	<u>2,840</u>

Try DCF @ 20% N



0	(20,000)	1	(20,000)
1 – 4	8,000	2.5887	<u>20,710</u>
		+ NPV	<u>710</u>

Try DCF @ 25%		N	
0	(20,000)	1	(20,000)
1 – 4	8,000	2,3616	<u>18,893</u>
		+ NPV	1,107

$$\text{IRR} = 10 + \frac{5,359}{6,466} \times 15\% (25\% - 10) = 24.36\%$$

The cost of capital must not increase by more than 14.36% or the cost of capital should not be more than 24.36% otherwise the project will become unacceptable.

(i) **Simulation Analysis**

Simulation analysis is fashioned after Monte-Carlo simulation which is based on the idea of taking random samples from mathematical models that represent a real life system. However, the use of this method involves establishing a probability distribution for each of the variables that make up the model. Basically, from the distribution of values, one particular value is selected at random whereby the individual values selected are therefore combined and used to determine the appropriate decision.

**Uses and Applications of simulation Technique**

The technique is applicable to decision making situations as follows:

- (a) It can be used in determining stock requirements, for example; Canteen, filling station etc.
- (b) It can be used to determine the optimal number of facilities in complex sequence situations e.g. production scheduling.
- (c) It is very useful in evaluating alternative investment policies.
- (d) It can be used to determine optimum stock levels in situations involving a variation of supply and demand.

**Advantages of Simulation Technique**

- (a) It enables various alternatives to be deeply examined.
- (b) The degree of assumption is not as great as it is with analytical method.
- (c) It provides a means of solution for problems which are of a kind and for which the application of analytical method is unsuitable.

**Disadvantages of Simulation Technique**

- (a) It is non-optimizing instead a good enough solution is obtained
- (b) It involves the use of computers which is above the reach of many firms. (This technique can be used to illustrate how decisions can be taken as in the example below):

### ILLUSTRATION 14 – 4

Ugochukwu Nigeria Limited is considering the following investment opportunities; The project is expected to have a life of two years. Estimate of initial outlay is as follows:

ESTIMATED Initial Outlay (₦)	PROBABILITY
200,000	0.25
250,000	0.40
300,000	0.35

The volume of sales in the years is estimated as follows:

Year 1		Year 2	
Volume (In Units)	Probability	Volume (in Units)	Probability
500,000	0.24	400,000	0.30
600,000	0.60	560,000	0.50
800,000	0.16	600,000	0.20

The volume in Year 2 is independent of volume achieved in Year 1. The contribution per unit is also subject to uncertainty and the following probability distribution is assumed.

Contribution per unit (₦)	Probability
0.30	0.15
0.50	0.58
0.80	0.27

Cost of capital is 10%

**Required:**

Carry out a simulation of the above project and determine whether or not the project should be accepted. Random number digits to be used for the various outcomes are 935381, 03882322, 9679061494. The use of these random number is to start with the initial cost, followed by volume in Year 1, followed by volume in Year 2 and then contribution – Strictly in That Order.

### SUGGESTED SOLUTION 14 – 4

Simulation of the project is calculated as follows:

(a) Initial Outlay

Cost	Prob.	Cum Prob.	Allocation of
------	-------	-----------	---------------

N			Random Numbers
200,000	0.25	0.25	0 – 24
250,000	0.40	0.65	25 – 64
300,000	0.35	1.00	65 – 99

(b) Volume in Year 1

Volume	Prob.	Cum Prob.	Allocation
500,000	0.24	0.24	0 – 23
600,000	0.60	0.84	24 – 83
800,000	0.16	1.00	84 – 99

Volume	Prob.	Cum Prob.	Allocation
400,000	0.3	0.3	0 – 29
560,000	0.5	0.8	30 – 79
600,000	0.2	1.00	80 – 99

Volume	Prob.	Cum Prob.	Allocation
0.3	0.15	0.15	0 – 14
0.5	0.58	0.73	15 – 72
0.8	0.27	1.0	73 – 99

Year	Cash Flow ₦	DCF @ 10%	PV ₦
0	(300,000)	1.0	(300,000)
1	180,000	0.9091	163,638
2	180,000	0.8264	<u>148,752</u>
		+NPV	<u>12,390</u>

**Decision:**

The project should be accepted since it has a positive net present value of ₦12,390.

Note: The cash inflow of constant amount in the two years is derived thus:

Year 1 Volume of 600,000 x 0.3 (contribution per unit) = ₦180,000

Year 2 Volume of 600,000 x 0.3 (contribution per unit) = ₦180,000

Therefore, ₦180,000 is the contribution on the sales volume of the respective years.

(1) **Pay-off Matrix**

When a decision maker is under a complete uncertainty, that is, the probability of occurrence of non-occurrence of the event cannot be quantified, then any of the following decision criteria could be used:

- (i) **Maximax Decision Rule:** The decision maker believes that the best out of the best possible outcomes will always happen to him. This is the decision rule of an optimist.

- (ii) **Maximin Decision Rule:** Under this situation, the decision maker believes that the best out of the worst possible outcomes will always occur. This is the decision rule of a pessimist. The shortcoming of the maximax and maximin criteria is that they both fail to account for the uncertainty inherent in the decision making problem, that is, they ignore the likelihood or the probability of the various events occurring.
- (iii) **Minimax Regret Rule:** Here, the decision maker believes in minimizing the possible maximum opportunity cost to be suffered or incurred. Example is a military strategist who wants to win a war with minimal casualty.

### Concept of Value of Perfect Information

Generally, information has no value, unless it is used to change the course of events. Therefore, perfect information, is an information that will predict what will happen with 100% certainty. In most cases, when a decision maker opts to obtain information, he does not know in advance what the information will tell him about the future outcomes, but, he does know that whatever the information turns out to be, he can rely on it completely with 100% accuracy.

Imperfect information on the other hand, only adds to what the decision maker knows, but the information cannot be relied on for accuracy with 100% certainty. The information might be wrong, but whether it is right or wrong, can only be judged later in retrospect. Therefore, the decision maker has no option but to act on the information as though it is accurate.

The value of information can, therefore, be quantified only if it is going to change the course of event and the value, therefore, is the expected value of benefits that information might provide to the decision maker by making him change his mind from what it would have otherwise been and so choose a different alternative.

Therefore, in order to determine the Naira value of perfect information, the following need to be determined.

- (a) Expected value based on perfect information
- (b) The optimal expected value under risk
- (c) A comparison of the two i.e. (a) and (b) above.

### 3.2 ASSET REPLACEMENT DECISIONS

This decision area is also referred to as Optimum Replacement Theory. In asset replacement decision, we concentrate on productive machine and expect that all other assets can have replacement decision model in a similar manner. We evaluate the relevant cash flows associated with the replacement cycles and period of the assets. This involves striking an ideal balance between the cost and advantage of early replacement against the cost and advantage of later replacement. However, the following concepts should be properly explained:

- (a) **Replacement Cycle:** This covers the frequency of replacement of an asset with an implied assumption that the asset will be put to continuous usage over an indefinite period, for example, if an asset has a three year life span, we can replace it every year, or every two years or every three years. Therefore, these options are referred to as replacement cycle.
- (b) **Replacement period:** This relates to a point in time for discontinuing usage of an existing asset. It relates mainly to old assets that are being replaced with new assets that are unidentical, for example, if an existing asset with a remaining life span of three years is to be replaced with a new non-identical type, it means that we can replace the old asset now or after one year, or after two years or after two years or after three years. Therefore, these options are referred to as replacement period for the old asset.

Assets are considered to be identical if cash flows streams and the life span of the assets are the same, even though the assets need not be physically identical, that is, we are concerned with financially identical asset. Whereas, non-identical assets are those that are not financially identical i.e. replacement of an old asset with a new asset that is not financially identical.

The above issues form the basis for taking decisions when assets are to be replaced or decision taken on them for replacement purposes.

### 3.2.1 Identical Replacement

As earlier mentioned, this involves the replacement of existing assets with new assets that are financially identical with existing ones. Our decisions are normally based on replacement cycle (replace every year, every two years, every three years, etc.) that provides the least present value of cost of the highest present value of revenue.

However, for the purpose of making the decisions, the following methods can be adopted:

- (a) Least Common Multiple method:
- (b) Finite Horizon method; and
- (c) Annual Equivalent Cost Method.

#### (a) **Least Common Multiple Method (ICM)**

This method examines the cash flows of all possible cycle of the machine over an equal number of years. This period is usually the least common multiple (LCM) of all cycle, for example, for a machine that has a life span of four years, we can choose to replace it every year, every two years, every three years or every four years.

The LCM approach required the examination of the relevant cash flows of these cycle over a period of twelve years. The cycle with the least present value, of cost or highest present value of revenue would be chosen.

A major draw back of this method, is that an asset with a long life span will require computation over a very long period, for example, if the LCM of a seven year period is four hundred and twenty years.

(b) **The Finite Horizon Method:**

This method examines cash flows of all cycles over a foreseeable period. This period is normally the length of time within which the company's financial management team can generate reliable estimates. As a result of availability of decision makers to accurately forecast the distant future cash flows and the fact that the present value of such future cash flows will tend to zero, a company will only evaluate replacement decisions over a specified period of time, for example, an asset that has a life span of eight years, may be evaluated on the cycle of the cash flows for the first ten years.

A major drawback of this method is that the choice of the foreseeable future or the finite horizon is subjective and varies among decision makers.

(c) **Annual Equivalent Cost Method (AEC)**

This is the most popular of all the asset replacement techniques and it consists of the following steps.

- (a) identify the relevant cash flows for the relevant cycle (every year, every two years etc) of the asset.
- (b) Calculate the present value of each cycle
- (c) Calculate the annual equivalent cost of revenue for each cycle, thus:

$$AEC = \frac{\text{Present value of each cycle}}{\text{Cumulative discount factors (annually factors) for each year}}$$

- (d) The optimal replacement cycle is the cycle with the least annual equivalent cost or the highest annual equivalent revenue.

Remember that the equivalent annual method is recommended especially where there is no inflation, as it is quicker and less cumbersome than any of the previous two methods described above. The identical replacement decision is illustrated in 14.10 as follows:

**ILLUSTRATION 14 -5**

Isaac Boro Limited with a fleet of 20 motor vehicle is considering its vehicles replacement policy. Under an existing policy, the fleet is exchanged every three years. In addition, to the trade in values, a discount of 5% is given from the list of the replacement vehicles.

The company is considering an offer from another motor dealer which gives allowance of 100% of the total cost price for companies exchanging their vehicle annually. A guarantee covering repairs and breakdown is also included in the offer. The company's cost of capital is 10%.

- (1) Cost Price of each vehicle is ₦2,200  
 (2) Estimated trade in value of each vehicle

After	Per Vehicle
	₦
12 Months	1,600
24 Months	1,200
30 Months	1,000

- (3) Estimated annual repairs and running costs:

Year	Per Vehicle
	₦
1	50
2	100
3	200

As the Management Accountant of the company, you are required to determine, from the above estimates of the vehicle trade in values and repair costs whether the company should adopt the new policy of changing their fleet of vehicle each year.

**Note:** Ignore taxation.

### SUGGESTED SOLUTION 14 -5

Replace every three years

Year	Cost	DCF @ 10%	PV
	₦		₦
0	(41,800)	1,0000	(41,800)
1	(1,000)	0,9091	(909,1)
2	(2,000)	0,8264	(1,653)
3	(4,000)	0.7513	(3,005)
4	20,000	0.7513	<u>15,026</u>
		+ NPV	<u>32,341.1</u>

Replace every year

Year	Cost	DCF @ 10%	PV
0	(39,600)	1,0000	(39,600)
1	-	-	-
1	32,000	0,9091	<u>29,091</u>
		NPV	<u>10,509</u>

$$\text{Annual Equivalent Cost (AEC)} = \frac{\text{NPV}}{\text{AF}} = \frac{\text{Net Present Value}}{\text{Annuity Factor}}$$

AEC

$$\begin{aligned} \text{Ever 3 years:} &= \text{NPV} = (32,341) \\ \text{Annuity Factor (AF) for 3 years} &= 2,4868 \\ \text{Therefore, AEC} &= \frac{(32,341)}{2,4868} = \underline{\underline{\text{N}(13,005)}} \end{aligned}$$

Every 1 year:

$$\text{NPV} = \text{N}10,509$$

$$\text{AF for 1 year} = 0.9091$$

$$\text{Therefore, AEC} = \frac{10,509}{0,9091} = \underline{\underline{\text{N}11,509}}$$

The company should change policy and replace annually since it results in a saving in cost of N2,496, that is, (13,005 – 10,509).

### Workings:

(i) For replacement every 3 years.

$$\text{Year 0 cost flow} = 2,200 \times 20 \times 95\% (100 - 5) = 41,800$$

$$\text{Year 1 repairs and running costs} = \text{N}50 \times 20 = \text{N}1,000$$

$$\text{Year 2 repairs and running costs} = \text{N}100 \times 20 = \text{N}2,000$$

$$\text{Year 3 repairs and running costs} = \text{N}200 \times 20 = \text{N}4,000$$

$$\text{Year 3 scrap value} = \text{N}1,000 \times 20 = \text{N}20,000$$

(ii) For replacement every 1 year

$$\text{Year 0 cost flow} = 2,200 \times 20 \times 90\% (100 - 10) = 39,600$$

$$\text{Year 1 Scrap Value} = 1,600 \times 20 = \text{N}32,000$$

### 3.2.2 Non Identical Replacements

In this case, we are examining the replacement of existing assets (machines) with new assets that are not financially identical. The question will no longer be how often do we replace the machine. The relevant question will be when do we replace the old (existing) machine. For instance, if the old machine can still be used for two more years, we need to identify the optimal replacement period for these old machines. The possible replacement period will be to replace the old machine now, or after one year or to replace the old machine after two years.

The basic assumption in this case derivable from the going concern is that the new machine would be replaced indefinitely with identical machine. Therefore, we must always determine first the optimal replacement cycle for the new machine. Because of this assumption of indefinite replacement for the new machine, the relevant cash flow for the machine will be a perpetuity of the optimal replacement cycle that is equal to  $\text{AEC}/r$  where 'r' is the cost of capital.



### Steps for Non-Identical Replacements

- (a) Identify the optimal replacement cycle for the new machine.
- (b) Calculate the NPV of the relevant cash flows of each replacement period of the old machine (replace now or after one year etc).
- (c) To arrive at the NPV in (b) above, you must incorporate at the end of each replacement period, the cost of the new machine (assets). This cost is equal to the perpetuity  $(\text{Annual Equivalent Cost})/r$ .
- (d) The optimal replacement period for the old machine is that period that produces the lowest NPV of cost or highest NPV of revenue.

### 3.2.3 Where no cost of Capital is Given

Where no cost of capital is given, we are not to assume any cost of capital. It means that time value of money has been ignored or that there is a zero% of cost of capital. In this case, our decision will be based on the average cash flow concept, therefore, the following steps would be involved.

- (a) Identify the relevant cash flow for each cycle or period
- (b) Add the relevant cash flows for each cycle or period.
- (c) Calculate the average cost or average revenue for each cycle or period. The average costs is equal to:  
To cash flows for each cycle  
Number of years in each cycle
- (d) Optimal replacement cycle or period is that cycle which produces the least average cost or highest average revenue.

### ILLUSTRATION 14.5

Baguda Rentals Limited estimated the following cost possible for “Workaholic”, one of its equipment costing ₦57,200.

Age (Years)	1	2	3	4	5	6
	₦	₦	₦	₦	₦	₦
Annual Running Cost	8,800	9,900	11,000	13,200	15,400	19,250
Resale Price	44,000	34,100	27,500	24,200	20,900	18,150

- (a) At what point should Baguda Rentals Limited replace “Workaholic”.
- (b) Assuming the “Workaholic” will be on hire for 120 days per annum and that Baguda wants a minimum annual return of 25% on the initial cost of the equipment, what will be the minimum daily hire rate?

### SUGGESTED SOLUTION 14 – 5

(a)	(a) Year	(b) Net Cash flow NCF ₦	(c) Cumulative NCF ₦	(d) = (c)/(a) Average Annual NCF ₦
	1	22,000	22,000	22,000
	2	19,800	41,800	20,900
	3	17,600	59,400	19,800
	4	16,500	75,900	18,975
	5	18,700	94,600	18,920
	6	22,000	166,600	19,433 *minimum

**Decision:**

- (a) Baguda Rentals Limited should replace workaholic at the end of year 5, when the average annual NCF is least.
- (b) In order to achieve the minimum return of 25% throughout the life of “workaholic” we have to select the highest daily rental which is N302.50. This incidentally occurs at years 1 and 6.

**Workings:**

- (a) Since the company’s cost of capital is not given. It is assumed that the replacement of the equipment will be at the point in time when the average annual net costs now is minimum
- (b) The net cash outflow (NCF) = depreciation + running costs where the depreciation in this case is the difference in cost price between what the asset can be sold for at the beginning of the year and what it can be sold for at the end of the same year, for example, for year 1, depreciation is ₦57,200 – ₦44,000 = ₦13,200 etc.
- (c) The calculation of the NCF for each year is as follows:

Age (years)	1	2	3	4	5	6
	₦	₦	₦	₦	₦	₦
Value at beginning of age	57,200	44,000	34,100	27,500	24,200	20,900
Value at end of age	44,000	34,100	27,500	24,200	20,900	18,150
Depreciation (a)	13,200	9,900	6,000	3,300	3,300	2,750
Annual running cost (b)	<u>8,800</u>	<u>9,900</u>	<u>11,000</u>	<u>13,200</u>	<u>15,400</u>	<u>19,250</u>
Total cost (a + b)	<u>22,000</u>	<u>19,800</u>	<u>17,600</u>	<u>16,500</u>	<u>18,700</u>	<u>22,000</u>

- (d) It is assumed that all costs accrue at the end of the year.
- (e) The minimum return of 25% on the initial cost of ₦57,200 is  $0.25 \times 57,200 = ₦14,300$ .

The sum is added to NCF for each year to arrive at minimum annual revenue for the respective years. These minimum annual revenues are divided by 120 days to arrive at the minimum daily hire rate as follows:

Age (years)	1	2	3	4	5	6
	₦	₦	₦	₦	₦	₦
NCF	22,000	19,800	17,600	16,500	18,700	22,000
Minimum Return	14,300	14,300	14,300	14,300	14,300	14,300
Minimum Revenue	36,300	34,100	31,900	30,800	33,000	36,300
Minimum Daily Rental	320,50	284,17	265,83	256,67	275,00	302,50

#### 4.0 CONCLUSION

Risk and uncertainty are relevant issues to be considered in investment appraisal with reference to individual project uncertainty, the decision makers' attitude to risk and the diversification effect.

#### 5.0 SUMMARY

Various methods are available for taking care of risk and uncertainty and they include: sensitivity analysis, simulation, finite horizon, expected value, decision tree, risk analysis, pay-off matrix, risk premium, adjusted ARR, adjusted payback, asset replacement decisions, and portfolio theory.

#### 6.0 TUTOR MARKED ASSIGNMENT

- Risk adjusted discount rates for a firm can be calculated using
  - Net present value
  - Internal rate of return
  - Capital rationing
  - Capital asset pricing model
  - Accounting rate of returns.
- In calculating equivalent annual cash flow the formula is
  - $\frac{\text{Present value of revenue}}{\text{Annuity factor of N years at R\%}}$
  - $\frac{\text{Present value of total cost}}{\text{Present factor for N years at R\%}}$
  - $\frac{\text{Present value of costs}}{\text{Annuity factor for N years at R\%}}$
  - $\frac{\text{Present value}}{\text{Annuity factor for N years at R\%}}$

Present factor

E     Present value of costs  
       Present factor

3. A division within the Wazobia Plc considering whether to undertake a project that will cost N1 million and will have the following cash inflows:

Year	I	₦600,000
	II	₦400,000
	III	₦1,000,000

The cost of capital is 10%. The net present value is

- A     + N617,500
- B     + N637,500
- C     + N637,320
- D     + N627,320
- E     + N647,320

Use data below to answer questions 4 and 5.

Expected value of a product is 7,800 units. The net positive present value is ₦10,470. The break-even point is 7,200 units and the cost of capital is 10%, while the capital outlay is ₦40,000.

4. Sensitivity to sales volume is

- A     7.7%
- B     10.7%
- C     7.5%
- D     8.5%
- E     8.4%

5. Sensitivity of cost of capital is

- A     25.5%
- B     26.2%
- C     25.9%
- D     26..5%
- E     26.8%

6. What is the formula for standard deviation?

7. A term used to describe any technique whereby decision are tested by their vulnerability to changes in any variable is known as \_\_\_\_\_

8. The standard deviation of project A is ₦3,500 and its expected value is ₦6,000 while standard deviation of project B is ₦4,500 and its expected value is ₦12,500, which project should be accepted using coefficient of variation as decision model.

9. Distinguish between risk and uncertainty?
10. The sales demand of a product are as follows:  
10,000 units 0.3  
20,000 units 0.4  
50,000 units 0.2  
100,000 units 0.1  
Selling price per unit is N20 and variable cost is N6. What is the total contribution of the product?

## **7.0 REFERENCES/FURTHER READINGS**

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## **UNIT 15 DIVISIONAL PERFORMANCE EVALUATION**

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## **1.0 INTRODUCTION**

Many large business organisations have complex structures. These type of set up have their own advantage and problems. While it may be possible for a single proprietor to monitor and oversee the detailed operation of a small business outfit, it may be impossible for the individual to oversee all the operations of a large scale organization and take all the relevant decisions required.

In view of the above, it becomes necessary to transfer some management functions to subordinate managers leading to some form of decentralization.

## **2.0 OBJECTIVES**

In this unit, readers would be able to understand:

- The term decentralization and the various decision areas involved and those that can be delegated, with the attendant benefits/or draw-backs;
- The responsibility accounting and the characteristics of the various centres;
- The various divisional performance evaluation techniques;

- The issues involved in appraising multinational and government agencies; and
- The effect value for money audit.

### **3.0 MAIN CONTENT**

#### **3.1 Meaning of Decentralisation**

Decentralisation is defined as a system in which the authority for decision making is delegated to the other levels of management. The lower in the organisation that the authority for decision making exists, the greater the decentralisation. In practice, it is impossible to have either a completely centralized organisation, or a completely decentralised organisation. In effect, decentralisation is a matter of degree along a continuum. It must be noted that decentralisation is more evident in profit- seeking organisations than in nonprofit organisations.

##### **3.1.1 Advantages of Decentralisation**

The following are the advantages of decentralisation:

- (a) Senior management are relieved from mundane or trivial matters leaving them with more time for overall review and consideration of issues of more strategic importance.
- (b) It speeds up operation decision as the manager at the division swiftly reacts to changing local circumstances.
- (c) It provides better training ground to junior staff who aspires to be at the topmost level of the organisation.
- (d) The more responsibility a manager has for the performance of his unit, the more he is motivated and the more he will strive to be at his productive best.
- (e) It increases flexibility and reduces communication gap.

##### **3.1.2 Disadvantages of Decentralisation**

The following are the disadvantages of decentralisation:

- (a) It often leads to duplication of services which may be less expensive when centralised.
- (b) Managers tend to take decision improving their own sub-unit's performance at the expense of the entire organisation, that is, sub-optimal decision.
- (c) It leads to frequent rise in the cost of accumulating and processing information.
- (d) It may result in friction between divisional managers particularly where the performance of one division is dependent on another division.
- (e) Decentralisation often encourages narrow mindedness in that a divisional manager only knows what is going on in his division.

Additional problems may arise in the following areas:

- (a) Apportionment of overhead cost into individual profit centres.
- (b) Introduction of appropriate recording and measuring procedures.

- (c) Determination of the form, content and effective basis for the preparation of budget at different level of management.
- (d) The extent of decentralisation of the accounting function and the attendant problems of communication.
- (e) Monitoring and evaluation of results.

### **3.2 DECISION AREAS RETAINED BY TOP MANAGEMENT**

Top management retained important decision or some decision while others are delegated. The following are the ones retained by management:

- (a) Appointment of senior staff
- (b) Determination of the corporate objectives of the organisation.
- (c) Centralised services such as legal services.
- (d) Decision relating to sourcing of funds and investment of surplus funds.
- (e) Approval for all major capital expenditure proposals.
- (f) Product line closure and departmental closure decisions.
- (g) Monitoring overall result and settling inter-departmental disputes (for example on transfer pricing).

### **3.3 DECISION AREAS DELEGATED TO OTHER LEVELS OF MANAGEMENT**

The following are the main areas of decision usually delegated to other levels of management, particularly, lower and functional line management:

- (a) Divisional planning and control.
- (b) Divisional profitability and financial control;
- (c) Appointment and dismissal of junior staff;
- (d) Transfer pricing decisions;
- (e) Short-term financing arrangement;
- (f) Granting credit to customers; and
- (g) Stock carrying decisions.

### **3.4 RESPONSIBILITY ACCOUNTING**

Responsibility accounting is defined as "a system of accounting that segregates revenues and costs into areas of personal responsibility in order to assess the performance attained by persons to whom authority has been assigned" (CIMA).

With responsibility accounting, it is possible to identify or recognise decision centres within an organisation for the purpose of tracing costs to the individual managers who are charged with the responsibility of making decision about costs and revenues in an organisation.

Within the concept of divisional performance evaluation, there are three types of responsibility centres: cost centre, profit centre and investment centre. Each of the centres will be considered appropriately with the conditions that need to exist for its



adoption.

### **3.5 COST CENTRE**

A cost centre is defined as a location, function, department or section, in respect of which costs may be ascertained and related to cost units for control purpose only (CIMA)

To adopt a cost centre:

- (i) The cost centre should be relatively easy to establish.
- (ii) The cost centres should form the basis for building up cost records for measurement, budgeting and control.
- (iii) Managers of functional departments might be treated as cost centre and made responsible for their costs.

### **3.6 PROFIT CENTRE**

A profit centre is any sub-unit of any organisation (for instance, a division of a company) which is responsible for both revenue and cost and profit. In other words, it is a unit to which both revenue and costs are assigned, such that the profitability of the sub-unit can be measured. The following conditions must exist before the adoption of profit centres:

- (a) There must be units of the organisation to which both revenues and costs can be separately attributed.
- (b) The revenue might come from external sources through sales of goods or services or from internal work done for other profit centres for which transfer price can be charged.
- (c) There should be sufficient decentralisation of authority within the company to permit profit centre managers to make decisions about selling prices (include transfer prices) and output levels at those prices.

### **3.7 INVESTMENT CENTRE**

This is a unit of an organization where a divisional manager is allowed to exercise some discretion about the amount of investment undertaken by the division. In assessing the result of the investment centre, the profit earned must be related to the amount of capital invested. Performance here is measured by return on capital employed (ROCE) otherwise referred to as return on investment (ROI).

The following conditions must exist before a centre is adopted as an investment centre:

- (a) All the conditions listed under profit centre above.
- (b) The centre must make use of assets which can be separately attributed to it.
- (c) The centre must make use of assets which the centre manager has control over in terms of new investment decisions, asset replacement decisions, etc.

### **3.8 CHARACTERISTICS OF COST, PROFIT AND INVESTMENT CENTRES**

#### **Characteristics**

- (a) Cost centre manager has control over costs (that is, only controllable cost items).
- (b) Profit centre manager has control over costs; sales prices (including transfer prices) and over output volumes.
- (c) Investment centre manager in addition to the characteristics of the profit centre has control over investment in fixed and current assets.

### **3.9 MEASURES OF DIVISIONAL PERFORMANCE**

The following are measures of divisional performance:

- (a) Return on Capital Employed
- (b) Absolute divisional profit
- (c) Residual income
- (d) Increase in market share
- (e) Share of goodwill
- (f) Growth of assets
- (g) Growth of sales.

The first three are the most common measures and are considered in detail below.

### **3.10 RETURN ON CAPITAL EMPLOYED (ROCE)**

This is otherwise referred to as return on investment (ROI). It measures overall profitability by relating net income to the level of investment. ROCE can be defined by using a simple formula:

$$\text{ROCE} = \frac{\text{Net Income}}{\text{Investment}} \times \frac{100}{1}$$

The return on investment here is tied to the capital base, hence, it is void of any dispute. It is the most objective. It gives consideration to the capital base of each division, thereby considering each division as an autonomous investment unit. It enables divisions with different sizes to be compared. It equally has a benefit of facilitating interpretation on the part of the manager because it makes use of data input contained in the conventional financial report.

However, it suffers some serious setbacks. For example, the variables in its constituent such as net income, investment or capital employed are subject to many definitions. Taking net income for instance, should it be income before tax or after tax? Similarly, different bases are used to value the capital employed in a division. Should the investment be valued at book value, gross book value or current replacement costs? Caution must therefore, be exercised to ensure that bias from accounting procedure does not undermine the level of operational efficiency.

Another shortcoming is that managers of those divisions with an existing ROI in excess of the company's cost of capital incorrectly reject projects with positive net present value. It is, therefore, an unsatisfactory measure of divisional managers' performance where a manager can significantly influence the amount which is invested in working capital.

### 3.11 ABSOLUTE DIVISIONAL PROFIT

This is profit from divisional operation. The measure of performance by absolute divisional profit is derived as divisional profit less non-controllable cost. The divisional profit might then be compared with budgeted profit, past profit or other divisions' profit dealing in the same line of market. The advantage of this method is that, it derives the needed profit figure from the normal accounting profit. The following are the disadvantages:

- (a) Difficulty in comparing divisions of unequal sizes.
- (b) Determination of controllable overhead costs may not be easy.

### 3.12 RESIDUAL INCOME (RI)

This is defined as divisional profit less imputed interest charges on the net assets employed by the division. The word imputed in the definition means that, the charge is made irrespective of whether the company as a whole, has actually incurred an interest cost in the ordinary sense of cash disbursement. The rate used represents the minimum acceptable for investment in that division. This method encourages managers to act in the interest of both his division and the company. In other words, as a performance measurement method, it ensures that sub-optimal decisions are reduced to the minimum while goal congruence is encouraged. However, it suffers from similar problem with the ROI in terms of what should constitute the division's cost of capital.

#### ILLUSTRATION 15 – 1

Akinyemi Ltd. has four divisions operating in Ibadan, Sokoto, Calabar and Maiduguri. The following data are in respect of them.

	Ibadan	Sokoto	Calabar	Maiduguri
Total Assets (₦)	12m	10m	14m	18m
Total Sales (₦)	20m	30m	36m	28m
Total Costs (₦)	18m	27m	33.6m	26m
Cost of Capital (%)	14	18	16	1

**Required:**

- (i) Calculate the annual returns on investment
- (ii) Calculate the residual income.

#### SUGGESTED SOLUTION 15 – 1

(i) Calculation of Annual Return on Investment (ROI)

	Ibadan	Sokoto	Calabar	Maiduguri
Total Sales (₦)	20m	30m	36m	28m
Less:				
Total Cost (N)	<u>(18m)</u>	<u>(27m)</u>	<u>(33.6m)</u>	<u>(26m)</u>
Profit	<u>2m</u>	<u>3m</u>	<u>2.4m</u>	<u>2m</u>

Return on Investment (ROI)

$$\text{ROI} = \frac{\text{Net Income}}{\text{Investment}} \times \frac{100}{1}$$

Ibadan	Sokoto	Calabar	Maiduguri
$\frac{2m}{12m} \times 100$	$\frac{3m}{10m} \times 100$	$\frac{2.4m}{12m} \times 100$	$\frac{2m}{18m} \times 100$
16.7%	30%	17.1%	11.1%

(ii) Calculation of Residual Income

	Ibadan	Sokoto	Calabar	Maiduguri
	₦	₦	₦	₦
Profit	2m	3m	2.4m	2m
Less: Imputed interest (COC x Total Assets)	<u>1.68m</u>	<u>1.8m</u>	<u>2.24m</u>	<u>1.8m</u>
	<u>0.32m</u>	<u>1.2m</u>	<u>0.16m</u>	<u>0.2m</u>

**ILLUSTRATION 15.2**

- (a) In the context of performance evaluation, distinguish between a profit centre and an investment centre.
- (b) Mention three advantages of divisionalisation.
- (c) Standard Ltd currently uses the Return on Investment (ROI) to measure the performance of its two operating divisions K and B. Summary of the annual reports from the two divisions for the past year is given below. The company's cost of capital is 12%.

	Division K	Division B
	₦	₦
Capital Investment	60,000	100,000
Net Income	12,000	18,000
ROI	20%	18%

**Required:**

- (i) As a Management Accountant, what performance measurement would you recommend that will show more clearly the relative profitability of the two divisions and why?

- (ii) Which division is more profitable? Support your answer with suitable calculations.
- (iii) Assume that the manager of Division K was offered a one-year project that would increase his investment base (for that year) by ₦25,000 and shows a net profit of ₦3,750, would the manager accept this project if he were re-evaluated on the basis of his divisional Return on Investment (ROI)?

Note: Both divisions are investment centres.

### SUGGESTED SOLUTION 15 – 2

Refer to the text for answers to (a) and (b)

- (c) (i) The Return on Investment (ROI) is not a very good measure of divisional performance in that it results in taking sub-optimal decisions. The residual income as earlier explained will be more favoured because it critically evaluates divisional performance. It is defined as divisional controllable profit less imputed cost of capital on investment (that is, divisional controllable investment).

- (ii) Determination of Profitable Division

	Division K ₦	Division B ₦
Capital Invested	<u>60,000</u>	<u>100,000</u>
Net Income	12,000	18,000
Less imputed cost of capital (12% of capital invested)	<u>7,200</u>	<u>12,000</u>
	<u>4,800</u>	<u>6,000</u>
ROI	20%	18%

**Comment:** Going by the ROI given, one will be tempted to say that Division K is more profitable than Division B. However, with the above calculations it is apparent that Division B is indeed more profitable than Division K judging from absolute profits generated by the divisions.

	Division K ₦
Additional Capital	<u>25,000</u>
Increment in Net Income	3,750
Less imputed cost of capital (12 x 25,000)	<u>3,000</u>
Residual Income	<u>750</u>
Divisional ROI =	$\frac{3,750}{25,000} \times 100$
	= 15%

**comment:** If the manager is re-evaluated on the basis of ROI, he would likely reject

the new project under the pretext that it would reduce his current ROI of 20% to 17.5% [that is,  $(20\% + 15\%) / 2$ ]. However, going by the computation in (iii) using residual income approach, the project should be accepted in that it makes an additional return of N750 to the overall income of the company.

### ILLUSTRATION 15 – 3

Didi Company Ltd is a large integrated conglomerate with shipping, metals and mining operation throughout the country. The General Manager of the shipping division has been directed by the Board to submit his proposed capital budget for 2003 for inclusion in the company wide budget. The divisional manager is considering the following projects, all of which require an outlay of capital and have equal risk.

Project	Investment required N'000	Return N'000
1	24,000	5,520
2	9,600	3,072
3	7,000	980
4	4,800	864
5	3,200	640
6	1,400	392

The divisional manager must decide which of the projects to accept. The company has a cost of capital of 15%. An amount of N60 million is available to the division for investment purposes.

#### **Required:**

Compute the total investment, total return on capital invested and residual income on each of the following assumptions stating, selected projects:

- The company has a rule that all projects promising at least 20% or more should be accepted.
- The divisional manager is evaluated on his ability to maximize his return on capital invested.
- The divisional manager is expected to maximize residual income as computed by using the 15% cost of capital.

### SUGGESTED SOLUTION 15 – 3

Project	Investment Required N'000	Didi Company		ROCE/ROI
		Returns N'000		
1	24,000	$\frac{5,520}{24,000}$	$\times \frac{100}{1}$	= 23%
2	9,600	$\frac{3,072}{9,600}$	$\times \frac{100}{1}$	= 32%

3	7,000	$\frac{980}{7,000} \times \frac{100}{1}$	= 14%
4	4,800	$\frac{864}{4,800} \times \frac{100}{1}$	= 18%
5	3,200	$\frac{640}{3,200} \times \frac{100}{1}$	= 20%
6	1,400	$\frac{392}{1,400} \times \frac{100}{1}$	= 28%

(a) Assumption: Assuming that all projects promising at least 20% or more should be selected.

Accept Projects 1,2,5 and 6 with ROCE greater than 20%

Therefore,

(i) Total Investment will be:

<u>Projects</u>	<u>Investments</u>
	<u>₦</u>
1	24,000,000
2	9,600,000
5	3,200,000
6	<u>1,400,000</u>
	<u>38,200,000</u>

(ii) Total Returns will be

<u>Projects</u>	<u>Returns</u>
	<u>₦</u>
1	5,520,000
2	3,072,000
5	640,000
6	<u>392,000</u>
	<u>9,624,000</u>

(iii) Return on Capital Invested

$$= \frac{\text{Total Returns}}{\text{Total investment}} \times \frac{100}{1}$$

$$= \frac{\text{₦9,624,000}}{\text{₦38,200,000}} \times \frac{100}{1} = 25.5\%$$

(iv) Residual Income

= Total Returns less imputed cost of capital

	<u>₦</u>
Total Returns	9,624,000
Less Imputed cost	
(15% of ₦38,200,000)	<u>5,730,000</u>
	<u>3,894,000</u>

(b) The assumption here is the maximization of ROI. Project 2 should be chosen in that it provides the highest ROI of 32%.

$$\begin{aligned}
 \text{(i)} \quad \text{Total Investment} &= \text{₦}9,600,000 \\
 \text{(ii)} \quad \text{Total Return} &= \text{₦}3,072,000 \\
 \text{(iii)} \quad \text{Returns on Capital Invested} &= \frac{\text{₦}3,072,000}{\text{₦}9,600,000} \times \frac{100}{1} \\
 &= 32\%
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad \text{Residual Income} &= \text{Total Return} && \text{₦} && 3,072,000 \\
 &\text{Less Imputed Cost} && && \\
 &\text{(15\% of ₦9,600,000)} && && \underline{1,440,000} \\
 &&& && \underline{1,632,000}
 \end{aligned}$$

- (c) The assumption here is maximization of residual income.
- Project 1:  $\text{RI} = 5,520,000 - (15\% \text{ of } 24,000,000) = \text{₦}1,920,000$
- Project 2:  $\text{RI} = 3,072,000 - (15\% \text{ of } 9,600,000) = \text{₦}1,632,000$
- Project 3:  $\text{RI} = 980,000 - (15\% \text{ of } 7,000,000) = (\text{₦}70,000)$
- Project 4:  $\text{RI} = 864,000 - (15\% \text{ of } 4,800,000) = \text{₦}144,000$
- Project 5:  $\text{RI} = 640,000 - (15\% \text{ of } 3,200,000) = \text{₦}160,000$
- Project 6:  $\text{RI} = 392,000 - (15\% \text{ of } 1,400,000) = \text{₦}182,000$

**Decision:**

Choose all the projects that have positive RI. Therefore, projects 1, 2, 4, 5, and 6 should be selected.

(c) (i) Total Investment will be:

Projects	Investment (₦)
1	28,800,000
2	9,600,000
4	4,800,000
5	3,200,000
6	<u>1,400,000</u>
	<u>43,000,000</u>

(ii) Total Return will be:

Projects	Investment (₦)
1	5,520,000
2	3,072,000
4	864,000
5	640,000
6	<u>392,000</u>
	<u>10,488,000</u>

(iii) Return on Investment

$$\begin{aligned}
 &= \frac{\text{₦}10,488,000}{\text{₦}43,000,000} \times \frac{100}{1} \\
 &= 24.4\%
 \end{aligned}$$



(iv) Residual Income	
	₦
Returns	10,488,000
Less imputed cost (15% of 43,000,000)	<u>6,450,000</u>
	<u>4,038,000</u>

### **3.13 PERFORMANCE APPRAISAL IN MULTI-NATIONAL ORGANISATIONS**

Performance appraisal takes place in multi-national concerns and establishments who operate on cross-border basis with activity or establishments spread all over various nations. However, control becomes an issue to be taken seriously because of the level of activities, the variability of circumstance and categories of workers involved as well as the separation due to gap in areas to be covered. Other short-comings envisaged are:

- (a) Inadequacy of information due to communication gap.
- (b) Different local taxation and corporate regulations.
- (c) Government policies and restrictions in the different countries.
- (d) Pricing and tariff regulations established by the governments of a particular country.
- (e) Exchange rate difficulties due to fluctuations.
- (f) Transportation delivery problems and transfer pricing difficulties concerned with trade between divisions.
- (g) Accounting standards and policies may not be the same across the borders of the various countries.
- (h) Discouragement may set in where there is disparity in staffing policies as compared to those of the home country.

### **3.14 PERFORMANCE APPRAISAL AND MEASUREMENT IN THE PUBLIC SECTOR**

By public sector, it is meant government owned establishments such as ministries, parastatals, agencies, as well as local, state and federal governments and other related organisations.

Therefore, performance evaluation is required to ensure probity accountability and honesty in the discharge of responsibilities to the public from whom taxes are collected.

Even though performance evaluation is a good thing, the following are considered to be the areas that call for attention:

- (a) Costs are not easily attributable to inputs, thus making output immeasurable.
- (b) Objectives may be many, thereby making it difficult to ascertain the relationships between causes and effects.

### **3.15 VALUE FOR MONEY AUDIT (VFM)**

Value for money audit can be defined as "an investigation into whether proper arrangements have been made for securing economy, efficiency and effectiveness in the use of resources. (CIMA).

- (a) Effectiveness is a measure of ability to attain desired goals.
- (b) Efficiency is a measure of the relatedness of inputs and outputs, in order to measure the extent of usage of resources to realise the set goals of a company.
- (c) Economy is getting the desired goals at the least costs without compromising the quality of input.

VFM audits are usually carried out in the public sector establishments such as local, state and federal governments and their associated departments, parastatals, agencies, ministries and related organisations as the case maybe. It can also be of use in the private sector of an economy.

VFM audits cover wide areas of operation especially where corporate governance is the order of the day. The following are determined and weighed:

- Staffing policies including selection, training encouragement etc.
- Means of forecasting and gauging expenses.
- Decision matters as they relate to strategic and tactical issues.
- Effective safeguard of all fixed assets such as equipment, motor vehicles etc.
- Organisation depicting the chain of command
- Specific initiatives to improve economy, effectiveness and efficiency
- The manner of monitoring performance and the basis of comparison with goals.

### **3.16 STEPS IN A VFM AUDIT**

VFM audit involves the following six steps:

- Step 1. Determine the goals of the public sector establishment or system being verified.
- Step 2. Ascertain the systems and controls utilised to attain the goals. That is how to determine the procedures for engaging and valuing the success attained.
- Step 3. Have a detailed documentation of the system/procedures/ setup being examined including the ascertainment of the chain control elements.
- Step 4. Examine and carry out a test of the system/procedure in existence with a focus on the economy involved.
- Step 5. Verify the adequacy of the system with emphasis on the utilization of resources involved. (Link with Step 2)
- Step 6. Evaluate the effectiveness of the organisation, in order to determine the applicability of the system to the achievement of set goals. (Link with Step 1)

## **4.0 CONCLUSIONS**

An individual cannot oversee all the operations of a large scale establishment and at the same time take all the relevant decisions required, thus, the need to delegate some management functions to subordinate managers leading to some form of

decentralisation that will enhance motivation, communication, planning etc.

Decentralisation is not without its short-comings of increase cost of accumulating and processing information, friction between managers, duplication of services, narrow mindedness of managers, sub-optimal decision making etc.

Performance appraisal systems should promote goal congruency, provide meaningful feedback, encourage initiative and longer-term view.

Performances may be appraised by using the ROCE, residual income and absolute divisional profit methods amongst others.

## 5.0 SUMMARY

Responsibility accounting ensures that recognition is being given to cost centres, profit centres and investment centres.

Value for money audits are usually carried out in government establishments with emphasis on staffing policies, strategies and tactical issues, effective safeguard of assets, the manner of monitoring performance and the basis of comparison with goals. It is to ascertain the economy, efficiency and effectiveness in the utilisation of resources.

## 6.0 TUTOR MARKED ASSIGNMENT

Use data below to answer questions 1 and 2

Jokotola Limited is considering a project with an initial investment of ₦50,000. The project will produce cash inflow of ₦17,350 per year for 4 years. The cost of capital is 10% and there is nil scrap value.

1. The NPV of the project is
  - A ₦4,960
  - B ₦4,996
  - C ₦4,936
  - D ₦4,956
  - E ₦4,969.
  
2. The Residual profit of the project in year 1 using straight-line depreciation is
  - A ₦(250)
  - B ₦150
  - C (150)
  - D ₦250
  - E ₦(170).
  
3. Which of the following perspectives are encompassed in a balanced scorecard?
  - i. customer perspective

- ii. financial perspective
- iii. supplier perspective
- A i and ii only
- B i and iii only
- C ii and iii only
- D i, ii and iii
- E iii only.

Use the data below to answer questions 4 and 5. Blending division of Tom James has assets of ₦200,000 operating profit of ₦600,000.

4. The division's return on investment is
  - A 30%
  - B 35%
  - C 32%
  - D 33%
  - E 36%
  
5. If the interest is imputed at 14%, the residual income is
  - A ₦31,400
  - B ₦31,000
  - C ₦31,500
  - D ₦32,500
  - E ₦32,000.
  
6. State any two objectives of decentralization.
  
7. Distinguish between profit and investment centres.
  
8. Enumerate any three short comings of appraising multi-national organizations.
  
9. What is Value for money audit?

## **7.0 REFERENCES/FURTHER READINGS**

ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.  
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## **MODULE IV: PRICING, RATIO, COST AND CURRENT TREND IN MANAGEMENT ACCOUNTING**

Unit 16:	Transfer Pricing Systems
Unit 17	Pricing Decisions
Unit 18:	Ratio Analysis
Unit 19:	Cost Control and Cost Reduction
Unit 20:	Current Trends in Management Accounting

## **UNIT 16    TRANSFER PRICING SYSTEMS**

### **CONTENTS**

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Objectives of Transfer Pricing
3.2	Broad Categories of Transfer Pricing Methods
3.3	Cost Based Transfer Pricing
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3.5	Negotiated Transfer Pricing
3.6	Arbitrary Transfer Pricing
3.7	Dual Transfer Pricing System
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3.8	International Transfer Pricing
4.0	Conclusion
5.0	Summary
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### **1.0    INTRODUCTION**

In this unit, we shall examine the various approaches that can be adopted to arrive at transfer prices between divisions. Although our focus will be on transfer pricing between divisions of the same organisation. It is peculiar to all divisionalised organisations where the activities are segmented into autonomous units and a great deal of authority delegated to the divisional heads.

### **2.0    OBJECTIVES**

In this unit, readers will be able to understand:

- The objectives of transfer pricing;
- The different transfer pricing methods;
- Merits and demerits of the transfer methods;
- Factors that must be considered when setting transfer for multinational transactions.
- The nature and meaning of dual transfer pricing system.

### 3.0 MAIN CONTENT

#### 3.1 OBJECTIVES OF TRANSFER PRICING

The following are the objectives of transfer pricing to management:

- Goal Congruency:** We are to select the transfer pricing method that any optimal decision taken by the division will also be optimal from the corporate perspective. In other words, any method chosen must reduce sub-optimality to the barest minimum.
- Performance Evaluation:** We are to select the transfer method that management would be in a position to adopt in evaluating the performance of each divisional manager as effectively as possible. Sequel to this, the contribution made towards the corporate profit by each division should not be distorted by the transfer pricing method chosen.
- Autonomy:** We are to select the method that will preserve the independence of each division so that the failure of one will not affect the success of the other.

#### 3.2 BROAD CATEGORIES OF TRANSFER PRICING METHODS

A transfer price may be based upon:

- Cost
- Market
- Negotiation
- Arbitrary.

#### 3.3 COST BASED TRANSFER PRICING

The selling division sells to the buying division at the cost of production incurred by the selling division. The following are the various types of cost based transfer pricing methods:

- Full cost, that is, at full cost or at a full cost plus price.
- Marginal cost, that is, at marginal cost or with a gross profit margin on top of marginal cost.
- Standard cost.
- Cost plus mark up.

#### **Advantages**

- (a) It is very useful in decision making analysis especially with the use of marginal cost approach.
- (b) It assists in measuring production efficiency by comparing actual cost with budgeted cost.
- (c) No unrealised profit is involved in stock computation.
- (d) The transfer pricing could be fixed and agreed in advance without being subject to external function.
- (e) It offers the only available opportunity for products that have no market.

#### **Disadvantages**

- (a) It may lead to unpredictable month by month fluctuations unless standard costs are used.
- (b) The cost of the selling division maybe rejected by the buying division on the ground that it is inefficient especially when the full cost method is used.
- (c) Profitability of the autonomous divisions cannot be effectively measured as revenues are completely ignored.
- (d) When transfers are made at cost plus, the selling division is guaranteed a certain level of profits which the division may not be capable of earning in an open market situation.
- (e) With the use of cost based method, the incentive required for divisional planning and motivation is lacking.

### **3.4 MARKET BASED TRANSFER PRICING**

Under this method, the selling division sells to the buying division at the prevailing market price. In other words, the two divisions will be operating at arm's length.

#### **Advantages**

- (a) There is goal congruency
- (b) Divisional autonomy is maintained
- (c) it is most adequate for measuring performance and motivating managers.
- (d) Marketing prices are objective and verifiable.
- (e) Top managements' time is not devoted to the bargaining process.
- (f) The method can have no influence on the efficiency or inefficiency of the manufacturing units.

#### **Disadvantages**

- (a) The element of profit often complicates stock valuation.
- (b) Accurate information about the market may not be readily available
- (c) The market price for intermediate products is not often determinable since the market is either non existing, ill-structured or imperfect.
- (d) The method may act as a disincentive to the use of any spare capacity in the division under some peculiar circumstances.

### **3.5 NEGOTIATED TRANSFER PRICING**

Under this method, the selling division and the buying division agree in advance to use a mutually acceptable transfer price.

#### **Advantages**

- (a) With the use of this method, the motivational impact will be stronger.
- (b) There are less disputes on the transfer price fixed because many factors would have been effectively considered.
- (c) Performance evaluation by central management will be devoid of any disputes on the part of the divisional managers.

#### **Disadvantages**

- (a) Negotiation may be time consuming.
- (b) A negotiated price may be influenced by the negotiating ability; personality and fluency of the managers involved.
- (c) The corporate interest may be subordinated to individual divisional interest.
- (d) A negotiated price will not be fixed forever. It may need constant review.

### **3.6 ARBITRARY TRANSFER PRICING**

Under this method, the transfer price is determined centrally based on what top management conceived to be most beneficial to the company as a whole. Individual divisional managers may have some say but no control over the price set.

#### **Advantages**

- (a) The time spent in negotiation is saved.
- (b) Uniformity and stability tend to prevail.

#### **Disadvantages**

- (a) The autonomy granted divisional managers is eroded.
- (b) Profit and cost consciousness may suffer where arbitrarily fixed price is not considered realistic.

### **ILLUSTRATION 16 – 1**

The ORISIRISI Company Limited is a multi divisional company and its managers have been delegated full profit responsibility and complete autonomy to accept or reject transfers from other divisions. Division A produces a sub assembly with a ready competitive market. This sub-assembly is currently used by division B. A charges division B market price for the sub-assembly which is ₦700 per unit. Variable costs are N520 and N600 for divisions A and B respectively. The manager of Division B feels that Division A should transfer the sub assembly at a lower price than the market price because at this price, Division B is unable to make a profit.

#### **Required:**

- (a) Compute Division B's contribution margin if transfers are made at the, market prices and also the total contribution to profit for the company.



(b) Assume that Division A can sell in the open market only 500 units at ₦700 per unit out of the 1000 units that it can produce every month and that a 20% reduction in price is necessary to sell at full capacity. Should transfers be made?

If so, how many units should it transfer and at what price? Submit a schedule showing comparisons of contribution margins under four different alternatives to support your decision.

### SUGGESTED SOLUTION 16 – 1

(a) Contribution margin of Division B if transfer price is ₦700

	₦	₦
Selling Price		1,200
Less:		
Variable Cost Per Unit	600	
Transfer Price	700	<u>1,300</u>
Contribution of Division B		<u>(100)</u>
Contribution margin to the company if Division B buys from Division A		
	₦	₦
Selling Price of Division B		1,200
Less: Variable Cost: Div. A	520	
Div. B	<u>600</u>	<u>1,120</u>
Contribution margin of the company		<u><u>₦80</u></u>

Alternatively, the contribution margin of the company, ₦80 can be arrived at through another approach as explained below

	Div. A	Div. B
	₦	₦
Transfer Price/Selling Price	700	1,200
Less:		
Variable Cost	(520)	(600)
Transfer Price	<u>      </u>	<u>(700)</u>
Contribution margin	<u>180</u>	<u>(100)</u>

The company's contribution margin  $180 + (100) = ₦80$

(b) In this case, Division A is operating at full capacity. We need to compare the contribution margin of the company if A transfers to B and when A fails to sell to B.

As earlier computed, the contribution margin to the company if A transfers to B is ₦80.

However, the contribution margin to the company if A does not transfer to B is calculated below.

	Div A	Div B
	₦	₦
Selling Price	700	
Less: Variable Cost	<u>520</u>	
Contribution margin	<u>180</u>	0

Contribution margin to the company = ₦180 + ₦0 = ₦180

**Decision:**

Division A should not transfer to Division B because the contribution margin to the company if there is transfer is only ₦80 whereas the contribution margin to the whole organisation if there is no transfer is ₦180.

If so, the question of “at what price” is not relevant since the decision is that there should not be any transfer whatsoever.

**Alternative strategies:**

- (i) sell 500 units at ₦700 per unit and transfer 500 units
- (ii) sell 1000 units at ₦560 and transfer nothing
- (iii) sell 500 units at ₦700 per unit and transfer nothing
- (iv) transfer 1000 units.

Calculation of total contribution to the company.

**ALTERNATIVE STRATEGIES**

	I	II	III	IV
	₦	₦	₦	₦
Total Revenue				
Div A	350,000 <sup>(w1)</sup>	560,000	350,000	-
Div B	600,000	-	-	1,200,000
	<u>950,000</u>	<u>560,000</u>	<u>350,000</u>	<u>1,200,000</u>
Total Variable Cost				
Div A	520,000 <sup>(w2)</sup>	520,000 <sup>(w4)</sup>	260,000	520,000
Div B	300,000 <sup>(w3)</sup>	-	-	600,000
	<u>820,000</u>	<u>520,000</u>	<u>260,000</u>	<u>1,120,000</u>
Total Contribution	<u>130,000</u>	<u>40,000</u>	<u>90,000</u>	<u>80,000</u>

(That is, TR – TVC)

The optimal alternative is strategy 1 and it requires 1,000 units to be produced and distributed as follows:

- (i) sell 500 units at ₦700 per unit
- (ii) transfer 500 units to B

**Workings**

1. 500 units @ ₦1200 per unit = ₦600,000
2. Note: A produced 1000 units. Hence the total variable cost incurred by A = ₦520 x 1000 = ₦520,000.
3. B obtained 500 units from A. B's variable cost per unit = ₦600. Hence, total variable cost incurred by B is 500 x ₦600 = ₦300,000.
4. A produced 1000 units at variable cost per unit of ₦520.

Therefore, total variable cost = ₦520 x 1,000 = ₦520,000.

At what relevant price?

The transfer price should be such that will induce transfer i.e. it should be acceptable to the two divisions. Consequently, the following should be satisfied.

- (i) The minimum transfer price must be greater than the variable cost of Division A, that is, ₦520.
- (ii) The maximum transfer price must be less than the contribution margin of Division B before the transfer price is recognized, that is, ₦600. (₦1,200 – ₦600). Hence, any price between the range ₦520 and ₦600 will be acceptable the two divisions.

#### ILLUSTRATION 16 – 2

A transportation-equipment manufacturer, BOSE Limited is heavily decentralized. Each divisional head has full authority on all decisions regarding sales to internal or external customers. Division P has always acquired a certain equipment component from Division S. However, when informed that Division S was increasing its unit price to ₦220, Division P's management decided to purchase the component from outside suppliers at a price of ₦200. Division S had recently acquired some specialized equipment resulting high depreciation charges as the justification for the price hike. He asked the chairman of the company to instruct Division P to buy from Division S at the ₦220 price. He supplied the following:

Division P's annual purchase of component	₦2000 units
Division S's variable cost per unit	₦190
Division S's fixed cost per unit	₦20

#### **Required:**

- (a) Suppose that there are no alternative uses of the S facilities, will the company as a whole benefit if P buys from the outside suppliers for ₦200 per units? Show computation to support your answer.
- (b) Suppose that internal facilities of S would not otherwise be idle, the equipment and other facilities would be assigned to other production operations that would otherwise require an additional annual outlay of ₦29,000. Should P purchase from outsider at ₦200 per unit?
- (c) Suppose that there are no alternative uses for S's internal facilities and that

- selling price drops by N15. Should P purchase from outsiders?
- (d) As the chairman, how would you respond to the request of the manager of S? Would response differ, depending on the specific situation described in requirements (a) through (c) above? Why?

### SUGGESTED SOLUTION 16 – 2

- (a) If P buys from outsiders at ~~N~~200 per unit:

	<del>N</del>
Cash Outflow through P ( <del>N</del> 200 x 2000)	400,000
Cash Savings through S ( <del>N</del> 190 x 2000)	<u>380,000</u>
Loss to the Group if P buys from outside	<u><del>N</del>20,000</u>

**Note 1:** If P buys from outside, then no variable cost will be incurred so it is a savings to the company.

- (b)

	<del>N</del>	<del>N</del>
Cash Outflow through P ( <del>N</del> 200 x 2000)		400,000
Savings:		
S's Variable Cost	380,000	
Initial Outlay	<u>29,000</u>	<u>409,000</u>
Savings to the Group if P buys from outside		<u><del>N</del>9,000</u>

- (c)

	<del>N</del>
Cash Outflow through P ( <del>N</del> 185 x 2000)	370,000
Cash Savings through S ( <del>N</del> 190 x 2000)	<u>380,000</u>
Savings to the Group if P buys from outside	<u><del>N</del>10,000</u>

- (d) As the chairman of the organisation, I will not grant the Division S because of the following reasons:

- (i) It will be contrary to the organizational policy which states emphatically that each division head has full authority on all decisions regarding sales to internal and external customers.
- (ii) It will amount to an erosion of the autonomy of the divisional manager. This could have negative consequences on morale, productivity and even profitability of the divisions especially in the long run.

The group will benefit in situations (b) and (c) but the group would lose in situation (a). The loss in situation (a) perhaps may be the sacrifice that the group may have to make in order to maintain the present divisionalised structure and to enjoy all the potential benefits associated with it.

### 3.7 DUAL TRANSFER PRICING SYSTEM

It is worthwhile to note that no single transfer pricing method is capable of satisfying the three broad objectives of transfer pricing. In fact, it is just not possible to have a

single transfer price. The buying division and the selling division have different interest in the transfer price.

Of recent, a case has been made for dual transfer hypothetical pricing system. In a dual pricing situation, the buying division is charged hypothetical market price while the selling division is given credit for either full cost plus a normal mark-up. The income for the company as a whole will be less than the total income for the divisions. However, in preparing financial statements, intra-company eliminations would have to be made for these differences.

Finally, it has been established that only dual transfer pricing system is capable of promoting goal congruence, motivation, autonomy and performance evaluation under all conditions.

### **3.7.1 Demerits of Dual Transfer Pricing**

However, the dual-rate transfer prices are not widely used in practice for several reasons, which include;

- (a) The use of different transfer prices causes confusion, particularly when the transfers spread outside two divisions;
- (b) They are considered to be artificial;
- (c) They limit the divisional motivation to compete effectively, thus, reducing their productivity; and
- (d) Top-level executives do not like to double count internal profits because these can result in misleading information and create a false impression of divisional profits.

## **3.8 INTERNATIONAL TRANSFER PRICING**

With the advent of multinational corporations and their continued growth, they have added another more complicated dimension to transfer pricing. In setting an international transfer price, a company will usually concentrate on satisfying a single objective i.e. minimize income taxation. The other broad objectives of transfer pricing are considered secondary. By minimising income taxes through the use of transfer pricing, the company's profit after tax will increase. It should be noted, however, that national tax authorities of countries involved (that is, the home country of the multinational corporation and the host country) are now taking a very close look at whether the international transfer price constitutes an "arm's length price", that is, the price the two parties would have agreed to if they had not been related.

Benke and Edwards (1980) recognised some other issues that merit consideration in the setting of international transfer prices. These include import duty minimization, adjusting for currency fluctuations, avoiding economic restrictions and presenting a favourable financial picture for a foreign affiliate in order to enhance borrowing opportunity or provide a temporary competitive edge.

Lucey (2003) stressed that the level of the transfer price can also affect the amount of import duties to be paid and is a way of repatriating dividends. In fact, some countries place restrictions on the amounts of dividends that can be paid from the branches of multi-national companies in their country. Where this restriction exists, it may be partially avoided by charging a high transfer price in the particular country.

#### **4.0 CONCLUSION**

This is the monetary value attached to goods and services exchanged between divisions of the same organisation segmented into autonomous units and with a great deal of authority delegated to the divisional heads.

The objectives of transfer pricing are mainly those of goal congruency, performance evaluation and ensuring the independence of each division.

The broad categories of basis on which transfer pricing are based include: cost, market, negotiated and arbitrary

The dual transfer pricing system is used to tackle the area of difficulties in the application of the various bases of pricing a firm's products or services.

#### **5.0 SUMMARY**

In this unit, we have discussed the different purposes of transfer pricing. We also described the methods of transfer pricing and explain that cost plus transfer prices will not result in the optimum output.

#### **6.0 TUTOR MARKED ASSIGNMENT**

1. The main objectives of transfer prices are stated below except
  - A Goal Congruence
  - B Price Determination
  - C Motivation
  - D Performance appraisal
  - E Divisional Autonomy.
  
2. The following are the methods for determining the transfer price except
  - A Variable cost
  - B Skimming cost
  - C Full cost
  - D Market price
  - E Negotiated price.

Use the data below to answer questions 3 and 4  
Selected data from Ben Company's Limited records the following

Sales	₦700,000
Average investment	₦350,000
Net Income	₦ 50,000
Minimum rate of return 12%.	

3. Return on investment is
  - A ₦10,900
  - B ₦10,500
  - C ₦10,000
  - D ₦12,000
  - E ₦12,500.
  
4. Residual Income is
  - A 14.9%
  - B 14.5%
  - C 14%
  - D 15%
  - E 16%
  
5. The process of determining the price at which goods are transferred from one profit centre within same company is
  - A Market pricing
  - B Skimming pricing
  - C Pro-rata pricing
  - D Arm's length pricing
  - E Transfer pricing.
  
6. State two objectives which transfer pricing should achieve
  
7. What is the theoretically optimum transfer price?
  
8. What is negotiated transfer pricing?
  
9. Explain dual pricing.
  
10. State two advantages of the Market Based Transfer Pricing.

## **7.0 REFERNCES/FURTHER READINGS**

ICAN Pack, (2006) Management Accounting, Lagos: VI Publishing Ltd.  
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## **UNIT 17 PRICING DECISIONS**

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## **1.0 INTRODUCTION**

In this unit, we shall focus on the role that accounting information plays in determining the selling price by a price setting firm. Where prices are set by the market, our emphasis will be on examining the cost information that is required for product mix decisions.

## **2.0 OBJECTIVES**

In this unit, the reader will be able to understand:

- The factors which affect pricing decisions;
- Objectives of pricing decisions;
- The relationship between selling price, demand and output and price;
- The various pricing methods and their applications;
- The use of differential calculus to find the optimal price; and
- What the different pricing policies are and their description.

## **3.0 MAIN CONTENT**

### **3.1 MEANING OF PRICING DECISION**



The issue in pricing is the determination of selling prices. In many profit oriented organizations, pricing constitutes a major policy decision issue. It may be possible for the Accountant to make a useful contribution by providing the decision making arm of the company with costs which are relevant for the pricing decision under view. There are contrary opinions between the marketers and accountants when it comes to the issue of pricing in the sense that the former claims that accountants do not understand the importance of competitive pricing while the latter is strongly of the opinion that marketers ignore costs when setting prices.

However, management accounting statements for pricing decisions are based on the adoption of total or full or absorption costing technique which shows product costs assume a normal level of output or normal mix of products. Nonetheless, the contribution or marginal costing technique which is another form of approach to pricing, provides a better basis for pricing decisions than the absorption technique in that it offers information about cost-volume profit relation which thus makes it convenient to derive pricing formulae.

There is no direct relationship between selling prices and product costs because of competition and elasticity of consumer demand. Therefore, profits will be a product of a good combination of a selected factors which include price, volume and product mix.

### **3.1.1 Factors In Pricing Decisions**

The main factors in pricing decisions are as follows:

- (a) Pricing objectives;
- (b) Relationship between price and output,
- (c) Selling price/demand relationship; and
- (d) Other factors.

### **3.1.2 Pricing Objectives**

The pricing objectives of companies fall into three categories. These are:

- (a) To achieve a target return on investment ;
- (b) To stabilize price and output; and
- (c) To realize a target market share.

### **3.1.3 Relationship Between Price and Output**

The element of price is always instrumental to level of demand. In most cases, the lower the selling price for an item, the higher is the quantity demanded. Therefore, a company should consider the relationship between price and demand when deciding on an efficient or optimal plan of action. However, the level of profit made by a company is a function of the output levels agreed for the company's products. It is reasonable to say that changes in output affect both total revenue and total costs, which

are the determinants of the profit level to be made at a given point in time.

### 3.1.4 Relationship Between Selling Price and Demand

The relationship between the selling price for a set of item and the quantity demanded at that price is influenced by a group of factors among which are:

- (a) Variation in quality;
- (b) Advertising and other promotional techniques;
- (c) Buyers choice and the manner in which they overcome them; and
- (d) Pricing and advertising policy decisions of competitors.

### 3.1.5 Other Factors

The other factors, amongst a host of factors, which interfere in pricing decisions, and at the same time exercise fundamental effect are:

- (a) **Overall company goals:** These may include target return objectives such as investment, sales or costs, profit maximization objective, require for the best possible return on investment and maximum profitability; and non-profit oriented-objectives which may include increase in firm status or goodwill.
- (b) **Costs:** These play an indirect role in that it secures the profitability of alternative prices to be determined and also ensure a comparison of the profit margin at a present price with expected return. However, costs play a direct role in setting prices in tactical situation, that is, contribution pricing.
- (c) **Demand:** This factor cannot be overlooked in the pricing decisions of a firm. It is based on two economics principles, that is. the law of demand and supply, and the price elasticity of demand.
- (d) **Legal:** This is considered from the point of view of Government interfering in price control, anti-monopoly measures, interest rates, taxation, and so on.
- (e) **Social Responsibility:** The social impact of a firm who sells on national scale or basis is expected to be felt in the price charged on the goods.

## 3.2 PRICING METHODS

The various pricing methods encountered in practice are:

- (a) Full cost based or cost - plus method;
- (b) Marginal cost based method;
- (c) Minimum price method;
- (d) Pricing based on mark up;
- (e) Theoretical pricing policy or demand analysis; and
- (f) Others.

### 3.2.1 Full Cost based or Cost - Plus Method

This is a traditional approach to pricing products whereby the selling price is

determined by:

- (a) Calculating the full cost of the product; and
- (b) Adding a percentage mark-up for profit.

The full cost method vary in its approach to pricing decisions.

- (a) It may be a fully absorbed production cost only;
- (b) It includes some opportunity costs as well as such as the opportunity cost of production resources that is in short supply;
- (c) It includes some absorbed administration, selling and distribution overheads.

Generally, the percentage profit mark-up does not have to be rigid, but can be varied to suit the particular circumstances.

Full cost based method has been frequently condemned by a number of authors. According to John Sizer, full cost appears to be used by many firms as a starting point in selling pricing decisions while marginal judgement determines the size of the full cost plus. It is therefore unrealistic to use full cost as a starting point since the size of the full cost plus is determined subjectively.

### **Benefits of full Cost Pricing Method**

- (a) Since the size of the profit margin can be varied at management's discretion, a price in excess of cost should ensure that a company working at normal capacity will cover all its fixed cost and subsequently make a profit. Also, companies may benefit from full cost based method when they:
  - (i) carry out large contract which must make a sufficient profit margin to cover a fair share of fixed cost.
  - (ii) Must justify their prices to potential customers, that is, for government contracts, and
  - (iii) Find it difficult to estimate expected quantity at different selling price.
- (b) It is a simple, quick and cheap method of pricing.

### **Problems of Full Cost Pricing Method**

- (a) There is the need to adjust prices to market conditions.
- (b) Budgeting output volume is a very difficult task which is a key factor in determining the fixed overhead absorption rate and in circumstances where more than one product is produced.
- (c) It fails to allow for competition, that is. a company may need to merge the prices of rival firms when the competitors take a price cutting or price raising decision.
- (d) Since the selling price is part of the marketing mix of the company's policy, rigid price setting may be too restrictive for marketing management.

### **3.2.2 Marginal Cost Based Pricing Method**

Under this method, a profit margin is added either to marginal cost of production or to

marginal cost of sales. This method is often called mark-up pricing. Generally, typical mark-up on variable cost will be higher than the typical profit margin on full cost otherwise selling price may fail to cover fixed cost. Whereas, full cost plus approach to pricing draws attention to profit margin, a variable cost approach to pricing draws attention to contribution which is a better pointer of profit.

### **Advantages of Marginal Cost Based Pricing Method**

- (a) It draws management's attention to contribution and the effect of higher or lower sales volume on profit.
- (b) It is a simple method to understand and easy to calculate.
- (c) The mark-up can be varied to reflect conditions.
- (d) In practice, mark-up pricing is more applicable in business where there is readily identifiable basic variable cost for example, retail industries.

### **Disadvantages of Marginal Cost Based Pricing Method**

- (a) The size of the mark-up can be varied.
- (b) The method ignores fixed overhead in pricing decision.

The selling price must be sufficiently high to ensure that a profit is made after recovering fixed cost, thereby leaving most companies in a position of arbitrary charge on the marginal cost.

### **ILLUSTRATION 17 – 1**

Odunayo Limited produced product A for which the following estimates have been made:

	₦
Direct Material	12
Direct Labour (2 hours @ ₦5)	10
Variable production overhead-machine $\frac{1}{2}$ hr @ ₦6/hr	<u>3</u>
	<u>25</u>

Products fixed overhead are budgeted based on 12,000 machine hours at N144,000 per month and because of the shortage of available machining capacity, the company will be restricted to 8,000 hours of machine time per month. The fixed absorption rate will be a direct labour rate. However, budgeted direct labour hour per month is 24,000 hours. It is estimated that the company could obtain a minimum contribution of N14 per machine hour producing another item other than product A. The direct costs estimate are not certain as to material usage rates and direct labour cost may be subject to an error of plus or minus 15%. Machine time estimates are similarly subject to an error of plus or minus 10%. The company wishes to make a profit of 30% on full production cost from the product.

#### **Required:**

What price should be charged using the full cost plus method under the following circumstances:

- (a) Exclude machine time opportunity cost and ignore possible errors.
- (b) Include machine time opportunity cost and ignore possible costing

- errors.
- (c) Exclude machine time opportunity cost but make a full provision for possible under estimation of cost.
- (d) Include machine time opportunity cost and make a full allowance for possible under estimation cost.

### SUGGESTED SOLUTION 17 – 1

- (a) Excluding Machine time opportunity cost and possible errors.

	N
Direct Material	12
Direct Labour	10
Variable Overhead	3
Fixed Overhead	12
	<u>37</u>
Add mark up	<u>11.1</u>
	<u>48.1</u>

(b)

	N
Full production cost	37
Opportunity cost ( $\frac{1}{2}$ @ N14/machine)	<u>7</u>
	44
Add mark up	<u>13.2</u>
	<u>57.2</u>

- (c) Excluding machine time opportunity cost but making a full provision for possible underestimation of cost.

	N	N
Direct Materials	12	
Direct Labour	10	
	22	
Possible error @ 15%	<u>3.3</u>	25.30
Variable production overhead	3	
Possible error 10%	<u>0.3</u>	3.30
Fixed Overhead	12	
Possible error @ 15%	<u>1.8</u>	<u>13.80</u>
Full cost		42.40
Markup		<u>12.72</u>
		<u>55.12</u>

(d)

	N
Full cost	43.40
Opportunity cost ( $\frac{1}{2}$ hr x N14 x 110%)	<u>7.70</u>
	51.10

	<u>15.33</u>
Mark-up	<u>66.43</u>

### ILLUSTRATION 17 – 2

Tiger Limited budgets to make 50,000 units of its product time. The variable cost of a unit is ₦5 and annual fixed cost are expected to be ₦150,000.00. The Financial Director of Tiger Limited has suggested that a profit margin of 25% on full cost should be charged for every unit sold. The Marketing Director has challenged the wisdom of this suggestion and has produced the following estimates of sales demand.

Price Per Unit ₦	Demand (Units)
9	42,000
10	38,000
11	35,000
12	32,000
13	27,000

You are to assume a production sales level of 50,000 units.

#### **Required:**

- What is be the profit for the year if cost plus price were charged with a 25% profit mark up?
- What would be the profit for the year if a profit maximizing price were charged?

### SUGGESTED SOLUTION 17 – 2

(a)	₦	
Variable cost	5	
Fixed cost	3	
Full cost	8	
Markup	<u>2</u>	
	<u>10</u>	
	₦	₦
Total sales (38,000 units @ ₦10)		380,000
Less: Cost of sales:		
Opening Stock-Production (50,000 units @ ₦8)	400,000	
Less: Closing stock (₦8 x 50,000 – 38,000)	<u>96,000</u>	
		<u>304,000</u>
		<u>76,000</u>

- Price Unit Contribution Demand Units Total Contributions

			N
9	4	42,000	168,000
10	5	38,000	190,000
11	6	35,000	210,000
*12	7	32,000	224,000*
13	8	27,000	216,000

The company should sell 32,000 units at a price of N12 since this gives the highest contribution of N224,000.

	N	N
Total Sales		384,000
Production	400,000	
Closing Stock	<u>144,000</u>	<u>256,000</u>
		<u>128,000</u>

### 3.2.3 Minimum Price Method

A minimum price is the price that would have to be charged so as to cover:

- (a) The incremental cost of producing and selling the item
- (b) The opportunity cost of the resource consumed in making and selling the item.

A minimum price generally, will leave the business no better or worse off than if it did not sell the item, that is, no gain no loss. Basically, two essential points about minimum price should be considered:

- (a) It is based on relevant cost, and
- (b) It is very much unlikely that a minimum price will actually be charged because if it is charged, it will not provide the business with any incremental profit. However, the minimum price of an item would generally show an absolute minimum below which the price should not be fixed.

The incremental profit is that which would be obtained from any price that is actually charged in excess of the minimum, for example, the minimum price is N200 and the actual price charged is N240, then the incremental profit on the sale would be N40.

However, if there are no scarce resources, and a company has spare capacity, the minimum price of a product would be an amount which equates the incremental cost of incremental contribution towards profit.

### ILLUSTRATION 17 – 3

A firm was required to submit a quotation for a special contract job. Cost estimates were made as follows:

	N
Material – D 75,000 kgs at 20k per kg	15,000
- E 25,000 kgs at 40k per kg	10,000
Labour – 3,000 hours at N2.25 per hour	6,750

Variable Overhead	<u>9,750</u>
Total Cost (external opportunity cost)	<u>41,500</u>

**Required:**

What is the minimum price to be quoted by the firm?

**SUGGESTED SOLUTION 17 – 3**

1. If the company has no scarce resources, the minimum price will be ~~₦~~41,500, the total incremental costs to the firm. Any price in excess of ~~₦~~41,500 will be an incremental contribution towards fixed costs and profit.
2. If there are scarce resources and a company makes more than one product, minimum price would include an allowance for the opportunity cost of using the resources to make and sell the product (instead of using the resource on the next most profitable product.)

**ILLUSTRATION 17 – 4**

Using the same data in the previous example and assuming that the firm does not have skilled labour to undertake the special contract job without delaying other production activities. The contribution expected from other production activities, after charging labour costs is ₦5,500. What is the minimum price to be quoted by the firm?

**SUGGESTED SOLUTION 17 – 4**

The minimum price to be quoted by the firm is as follows:

	₦
Material – D 75,000 kgs at 20k per kg	15,000
- E 25,000 kgs at 40k per kg	10,000
Labour – 3,000 hours at <del>₦</del> 2.25 per hour	6,750
Variable Overhead	9,750
Contribution lost on production delay (Internal opportunity cost)	<u>5,500</u>
Total Cost (internal and external opportunity cost)	<u>47,000</u>

Therefore, the minimum price at ~~₦~~47,000 is the sum of both internet and external opportunity cost. Any price above ~~₦~~47,000 will create an incremental contribution to fixed costs and profit.

**3.2.4 Pricing Based on mark Up/Unit of Limiting Factor**

When a business is looking at full capacity and it is restricted by a shortage of resources from expanding output further, by deciding on what target it will like to earn. It could, therefore establish a mark up per unit of limiting factor.



### ILLUSTRATION 17 – 5

Temidire Services Ltd. produces a window cleaning services to offices and factories. Business is very brisk but the company is restricted from expanding its activities further by a shortage of window cleaners. The workforce consists of 12 window cleaners each of whom works 35 hours a week. They are paid ₦4 per hour. Other variable expenses are 50kobo per hour and fixed cost is ₦5,000 per week. The company wishes to make a contribution of at least ₦15 per man hour.

**Required:**

Determine the minimum charge per hour for window cleaning. What is the resulting profit?

### SUGGESTED SOLUTION 17 – 5

	₦
Direct wages	4.00
Other variable expenses	0.50
Contribution/man hour	<u>15.00</u>
	<u>19.50</u>
	₦
Total Contribution/week (12 x 35 x 15)	6,300
Less fixed cost	<u>5,000</u>
Profit	<u>1,300</u>

### 3.3 DEMAND ANALYSIS (OR THEORETICAL PRICING POLICY)

Generally, demand analysis theory is based on the idea that a connection can be made between price, quantity demanded and sold as well as total revenue (TR). In a perfect competitive market, demand varies with price and so if a realistic estimate can be made of demand, at different price levels, it should therefore be possible to determine:

- (i) a profit maximising price;
- (ii) a revenue maximizing price.

However, in practice, business organisations, make pricing decisions on the basis of demand conditions and competition in the market. On the other hand, most businesses enjoy a monopoly situation in the market. This is because they develop a unique marketing mix. The significance of a monopoly situation is that the business does not have to follow the market price, that is. it is not a price taker and therefore has more say and flexibility in the prices it sets. In a perfect competitive market, at higher prices, demand for products or services will be lower. Basically, there will be a selling price at which the business can maximize its profit. This is the price level at which marginal cost (MC) is equal to the marginal revenue (MR), that is, the cost of making an extra unit of output which is equal to the revenue obtained from selling it.

### 3.4 Other Pricing Methods

The other pricing methods that may be adopted by companies are as follows:

- (a) **Intuitive Pricing:** This involves pricing by the "feel of the market" and can vary from a pure guess to a well-informed attempt to interpret past data and future trends. It is occasionally used to adjust the cost-plus price according to the management's perception of likely demand, competition, etc.
- (b) **Experimental Pricing:** This involves the selection of a sample test markets to create a statistical model which is used to manipulate the price among markets in order to arrive at a price which maximizes profits. It can be used when there is a pricing decision concerning a new profit.
- (c) **Incremental Cost Pricing:** It is based on the concept that a price should be such that incremental cost is less than the incremental revenue.
- (d) **Pricing in a Multi-product Situation: From a** more objective view, companies are seen not to be producers of **only** one but a multiple of products. However, two issues are of importance in a multi-product environment, namely:
  - (i) pricing substitute goods, for example, pharmaceuticals where two methods are in use.
    - Uniform margin on the entire range of similar products.
    - Varying the size of the margin depending on the cost of each product in the range.
  - (ii) Pricing complementary goods such as bread and butter – since the demand for the product is positively correlated, a decrease in price of one product increases the demand for its complement.
- (e) **Demand Oriented Pricing:** It is in the attitude of customers influencing pricing decisions, that is, the price a customer is willing to pay for a product and it is not simply a consequence of the product itself.

### 3.5 PRICE DISCRIMINATION

Price discrimination is the 'sales of technically similar products at prices which are not proportional to their marginal costs'.

This is possible if a firm's management can establish separate market segments for the same basic product, and prevent contact between ('seal off') the different segments, so that a different price can be charged for the same product in each segment.

There are several ways, in practice, by which price discrimination may be exercised:

- (a) Through negotiation with individual customers. For example, A might buy a video cassette recorder from firm X for ₦600 cash, whereas customer B might buy the same item and negotiate a discount for cash of say 20%;
- (b) On the basis of quantities purchased: bulk purchase discounts are a well-

established form of price discrimination which offers favourable prices to large customers.

#### **4.0 CONCLUSION**

Pricing is to ensure the determination of selling prices with the objective of achieving a target return on investment; stabilize output and realization of a target market share. The factors that influence pricing decisions include the pricing objectives, relationships between price and output, selling price/demand relationships, costs, government interference and overall company goals.

#### **5.0 SUMMARY**

The unit also covers the main pricing methods, which include full cost based or cost plus; marginal cost based, minimum price, pricing based in mark-up and demand analysis.

Other pricing methods are: Intuitive, experimental, incremental, multi-products, demand oriented.

Price discrimination is the sales of technically similar products at prices which are not proportional to their marginal costs. It could be practiced through negotiation, quality purchased, product type, location or area.

#### **6.0 TUTOR MARKED ASSIGNMENT**

1. What is marginal pricing?
2. State three factors which may need to be considered in a pricing decision.
3. What are the short comings of using cost-plus-system pricing?
4. Explain full-cost-pricing.
5. Define price discrimination.
6. Explain demand oriented pricing.
7. A price which exactly covers incremental costs of making the items sold, the opportunity costs of the resources consumed in making the item is called.....
8. A product or service sold at lower than normal margins in order to attract customers who might then buy other items at normal prices is known as.....

#### **7.0 REFERENCES/FURTHER READINGS**

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## **UNIT 18     RATIO ANALYSIS**

### **CONTENT**

1.0	Introduction
2.0	Objectives
3.0	Main Content
3.1	Nature of Ratio Analysis
3.2	Classes of Ratios
3.2.1	Profitability Ratios
3.2.2	Solvency Ratios
3.2.3	Investment Ratios
3.2.4	Activity Ratios
3.2.5	Value Added Ratios
4.0	Conclusion
5.0	Summary
6.0	Tutor Marked Assignment
7.0	References/Further Readings

## **1.0 INTRODUCTION**

A ratio is expressed as the measure of the relationship between two mathematically inclined items or objects. (That is, the relationship between two or more variables). A financial ratio is that which measures the mathematical relationship between two or more accounting items, such that qualitative opinion about a company's financial results can be expressed at a point in time.

The various users of financial statements (that is, management, shareholders, employees, trade unions, government and government agencies, lenders, auditors, suppliers, public/customers, competitors, financial analysts, and researchers) have different reasons for analyzing the results as a basis to form their opinions on how well the operations of a firm had been run as well as its financial position as at a given date. It would assist in determining the strengths and weaknesses of a firm and also be able to predict the future. A good knowledge of the interpretation of the ratios is therefore, desirable for management in taking decisions.

## **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- Ratio analysis as a concept.
- The basis for comparing ratios and the associated analysis that are involved.
- The benefit and limitations of ratio analysis.
- The computation of the various ratios.
- And identify the main value-added ratios and the manner of computation.

## **3.0 MAIN CONTENT**

### **3.1 NATURE OF RATIO ANALYSIS**

Ratio analysis forms the basis for assessing the financial results and performance of a company using accounting data or figures that make the measure of financial relationship possible. For example, current ratio can be determined by the relationship between current assets and current liabilities. Hence, the nature of ratio analysis is such that, the quantitative expression is used to arrive at qualitative opinion.

A single financial ratio is not itself enough to determine a good or bad situation, hence the need to compare with some other ratios using some standards which may include:

- (a) **Historical ratios:** These are those computed from the past records of the same company;
- (b) **Industry ratios:** These are, those that were computed on the average of all the firms in the same sector of the economy. It is the industrial average ratio;
- (c) **Projected ratios:** These are, those that were derived based on the budgeted financial statements of the same company; and
- (d) **Competitors' ratios:** These are, those of chosen competitor companies, most importantly the ones adjudged adequate in the same period. The ratios are computed based on the financial statements of the competitor company for the same period.

The ability to properly evaluate a company's performance is also a function of the following analysis which are off-shots of ratio analysis:

### **Trend Analysis (Time Series)**

This has to do with the comparism of financial ratio over a given period of time. This helps to ascertain the mode of change and the determination of the company's financial results in terms of being constant, diminished or increased over a given period of time. Nonetheless, focus should also be on the reason for the change and not just the change itself.

### **Industry Analysis**

The comparison of a company's financial ratios with that of the industry average ratios which it belongs to is referred to as industry analysis. The latter provides a basis for assessing the financial position and performance of the company when weighed alongside those of other companies within the same industry. Nevertheless this basis is not without its shortcomings:

- (a) Difficulties in obtaining information for deriving the industry average ratios, (that is, financial statement of similar companies may not be readily available).
- (b) The averages so derived are those of both the viable and less viable companies within the industry
- (c) Accounting policies and mode of operation may not be the same for all the companies within the industry
- (d) Differences in parameter of the variables (that is, of the numerator and denominator).

### **Cross-Sectional Analysis**

Where the ratios relating to the same period and of particular company is compared with that of some companies within the same industry relating to the same time, we have what can be referred to as cross-sectional analysis. This is usually done by picking out the ratios of the relevant competitors to the company especially where they operate on a similar basis. Thus, what is being measured here, is the relative financial standing and operational results of the company under consideration.

### **Budgeted Analysis**

It is possible for future ratios to be used as basis for comparing two or more companies and where this is the case, we have what is referred to as budgeted analysis. What is actually involved here, is the comparison of the current/ past ratios with the future ratios in order to determine the company's relative strength and inadequacy before, now and in the future. The effect of this, is to show the deficiency of the financial situation so that remedial actions can be put in place.

From the foregoing, ratio analysis can focus on different issues as they relate to the measurement of a company's performance which include:

- The financial results of the company as they have to do with the generation of revenue.
- The company's ability to meet up with her obligations in both the long and short run.
- The evaluation of the company 's results relative to the benefits to be derived by the owners of the business (existing or potential).

## **3.2 CLASSES OF RATIOS**

Based on the needs of the different users of financial statements, ratios have been classified as follows:

- Profitability ratios
- Solvency ratios
- Investment ratios
- Activity ratios
- Value-added ratios.

### **3.2.1 Profitability Ratios**

The profitability ratios are determined in order to ascertain or evaluate the operating adequacy of a company over time. Apart from the management of the company, the other interested parties in the profits made by the company are the creditors and the shareholders.

The debenture holders are conscious of their principal and the accrued interest while the shareholders await the return on their investments in terms of dividend.

In order to give room for effective analysis, the ratios under this category are:

- (a) Return on capital employed
- (b) Asset turnover ratios
- (c) Profitability margin ratios
- (d) Other margin ratios.

### **Return on Capital Employed (ROCE)**

This is an important ratio in that it measures the relationship between the Net Profit and the Capital Employed or the Total Net Assets. The ROCE shows the effects of sales, different assets, and various costs on the total company's results or position.

The ROCE can be defined in different ways depending on the objective to be achieved and the comparisons to be made. The following can be adopted for the purpose of defining 'capital employed':

- (a) Total capital which is a function of share capital, retained profits, reserves, long-term liabilities and current liabilities.
- (b) Long term capital which is made up of total capital less current liabilities.

Of importance is the numerator, which is the profit and it can be defined as net profit before tax, loan interest and bank interest or net profit before tax and loan interest.

Therefore, ROCE can be expressed as:

$$\frac{\text{Net Profit Before Interest and Tax}}{\text{Total Capital}} \times 100$$

### **Asset Turnover Ratio**

This ratio shows the extent to which the assets have been utilised and is used to predict the degree of future profits.

### **Profitability Margin Ratios**

These ratios are used to measure the total relationship of the margin on sales and asset turnover as well as those of operating costs. These ratios are used to determine managerial capability.

### **ILLUSTRATION 18 – 1**

The following is the final accounts of Prospect Plc:

#### **Prospect Plc**

Profit and Loss Account for the period ended 31 December 2005.

	N'000	N'000
Sales		9,800



less	Manufacturing cost of sales		
	Materials	3,915	
	Labour	1,710	
	Factory Overheads	<u>1,088</u>	<u>6,713</u>
	GROSS PROFIT		3,087
less	Administrative Expenses	1,010	
	Selling & Distribution Expenses	640	
	Bank Interest	100	
	Loan Interest	<u>450</u>	<u>2,200</u>
	NET PROFIT BEFORE TAX		887
less	Tax		<u>174</u>
	PROFIT AFTER TAX		713
less	Dividends		
	15% Preference	113	
	Ordinary – Interim (paid)	270	
	Ordinary – Final (proposed)	<u>270</u>	<u>653</u>
	TRANSFERRED TO RESERVES		<u>60</u>

### Prospect Plc

Balance Sheet as at 31 December 2005

	N'000	N'000	N'000
<b><u>FIXED ASSETS</u></b>			
Premises	3,750		
Plants and Equipments	5,625		
Motor Vehicle	893		
Goodwill	263		
Patent Right	<u>75</u>		10,606
<b><u>CURRENT ASSETS</u></b>			
Stock: Finished Goods	300		
Raw Materials	292		
Consumables	480		
Trade Debtors	1,537		
Cash Bank	<u>240</u>	2,849	
Less <b><u>CURRENT LIABILITIES</u></b>			
Bank overdraft	1,275		
Trade Creditors	1,236		
Taxation payable	174		
Proposed dividend	<u>270</u>	<u>2,955</u>	<u>(106)</u>
		<u>10,500</u>	

Represented by

**SHARE CAPITAL**

Ordinary Shares ₦1 each	4,125
15% Preference Shares ₦1 each	750
RETAINED PROFIT	<u>2,625</u>
	7,500

**DEBENTURES**

15% loan stock	<u>3,000</u>
CAPITAL EMPLOYED	<u>10,500</u>

**Required:** Calculate the profitability ratios of Prospect Plc.

**SUGGESTED SOLUTION 18 – 1**

Profitability Ratios:

(a)  $ROCE = \frac{\text{Net Profit before Interest and Tax}}{\text{Total Capital}} \times 100$   
 $= \frac{\text{₦1,437,000}}{13,455,000} \times 100$   
 $= 10.68\%$

Total Capital = ₦10,606,000 + 2,849,000 = ₦13,455,000  
Net Profit, that is PBIT = ₦887,000 + 100,000 + 450,000  
= ₦1,437,000

(b) The various asset turnover ratios can be computed thus:

$$\frac{\text{Sales}}{\text{Total Assets}} = \frac{9,800,000}{13,455,000} = 0.73:1$$

$$\frac{\text{Sales}}{\text{Fixed Assets}} = \frac{9,800,000}{10,606,000} = 0.92:1$$

$$\frac{\text{Sales}}{\text{Stock}} = \frac{9,800,000}{1,072,000} = 9.14:1$$

$$\frac{\text{Sales}}{\text{Current Assets}} = \frac{9,800,000}{2,849,000} = 3.44:1$$

Profit margin ratios

$$\frac{\text{PBIT} \times 100}{\text{Sales}} = \frac{1,437,000 \times 100}{9,800,000} = 14.7\%$$

$$\frac{\text{Manufacturing Costs} \times 100}{\text{Sales}} = \frac{6,713,000 \times 100}{9,800,000} = 68.5\%$$

$$\frac{\text{Selling and Distribution Exp.}}{\text{Sales}} \times \frac{100}{1} = \frac{640,000}{9,800,000} \times \frac{100}{1} = 6.5\%$$

$$\frac{\text{Administrative Overheads}}{\text{Sales}} \times \frac{100}{1} = \frac{1,010,000}{9,800,000} \times \frac{100}{1} = 10.31\%$$

$$\frac{\text{Material Costs}}{\text{Sales}} \times \frac{100}{1} = \frac{3,915,000}{9,800,000} \times \frac{100}{1} = 40.0\%$$

$$\frac{\text{Labour Costs}}{\text{Sales}} \times \frac{100}{1} = \frac{1,710,000}{9,800,000} \times \frac{100}{1} = 17.45\%$$

$$\frac{\text{Factory Overheads}}{\text{Sales}} \times \frac{100}{1} = \frac{1,088,000}{9,800,000} \times \frac{100}{1} = 11.1\%$$

In addition to computing the above ratios, past years' ratios, time analysis and issues advanced for draw backs need be compared in order to address laxities in operations.

### 3.2.2 Solvency Ratios

These ratios can be categorised into two:

- (a) Short-term solvency or liquidity ratios
- (b) Long-term solvency or leverage ratios.

#### Liquidity or Short-Term Solvency Ratios

The liquidity ratios are used to determine the ability of the company to meet its current obligations or liabilities. Illiquidity will lead to loss of goodwill, poor credit ratings and undue legal tussles which may eventually lead to the winding up of a company. Excess liquidity could also lead to under utilisation of assets.

The liquid ratio can be classified as:

- (a) Current ratio;
  - (b) Quick or add test ratio;
  - (c) Cash ratio;
  - (d) Interval measure; and
  - (e) Net working capital ratio.
- (a) The Current ratio is a measure of the relationship between the current assets and current liabilities. The current assets are made up of cash, debtors, bank and those assets that can be easily turned into cash within a period of one year, these include stock, marketable securities and prepayments. The liabilities payable within one year are referred to as current liabilities such as trade creditors, bills payable, bank overdraft, tax liability, proposed dividend and portion of long-term debt due within a year. A ratio greater than one shows that the company has more of current assets than current liabilities. The ratio ideally, is expected to be 2:1.

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

- (b) The quick or acid test ratio shows the relationship between liquid assets and current liabilities. The stock and prepayment items are not always included in the current assets because stock items are not usually the same in the different companies while prepayments may not be easily recoverable, for example, advance payment for electricity or telephone.

The quick ratio is calculated as:

$$\frac{\text{Current assets} - \text{stock} - \text{prepayments}}{\text{Current liabilities}}$$

A general quick ratio of 1:1 is considered reasonable for financial purposes.

(c) **Cash ratio**

Since cash is an important element of the current assets, it is considered important to measure it along with trade investments which are cash equivalents against current liabilities especially where the value of the former is significant. This ratio is used to determine the degree of responsiveness of cash and cash equivalents to take care of current liabilities and ascertain the ability of the company to hold enough cash and cash equivalents per time. It can be expressed as:

$$\frac{\text{Cash} + \text{marketable securities/trade investments}}{\text{Current liabilities}}$$

- (d) **The interval measure ratio** is that which is used to evaluate the company's ability to take care of its constant cash expenditures, that is, it is used to measure the relationship of liquid assets to average daily operating cash outflows. It may also be expressed as a measure of additional operating expenditures such as discharging of interest, acquisition of assets and repayment of debts. It is also used to determine the number of days that there will be sufficient liquid asset to finance operation without having any cash intake.

$$\text{Interval measure} = \frac{\text{Current Assets} - \text{Inventory/Stocks}}{\text{Average daily operating expenditures}}$$

- (e) Net Working Capital ratio is that which measures the difference between the current assets and current liabilities which is an expression of the company's potential funds reserved. Therefore, it can be measured as the relationship with net assets.

$$\text{Net Working Capital} = \frac{\text{Net Current Assets}}{\text{Net Current Assets}}$$

## Net Assets (Capital Employed)

### Leverage or Long-Term Solvency Ratios

These are ratios that are used to ascertain the long-term financial performance of a company, hence, the usage of the terms financial leverage or capital structure. Therefore, they are used to determine the manner in which funds provided by shareholders (owners) and debenture holders (lenders) are mixed up in order to finance the assets of the company. In general, the leverage ratios are determined in order to compute the financial risks and the company's competence to engage debts to the shareholders' benefits.

The usage of external funds in relation to the internal funds is a function of the following issues:

- (a) External funds (debts) are riskier from the company's view point, because of the need to pay interest not minding the amount of profits or losses made,
- (b) Shareholders can benefit from the arrangement in terms of sustaining control with minimum risk and their earning could be improved upon when the rate of return on capital is greater than rate of interest paid on borrowed funds. However, the reverse could be the case if the latter is greater than the former, and
- (c) The company may not be able to secure funds from external sources if the equity provided is small compared to the funds being borrowed.

The ratios that can be computed under leverage ratio include:

$$(a) \quad \textbf{Gearing ratio} = \frac{\text{Fixed Interest Capital}}{\text{Capital Employed (Net Total Assets)}} \times 100$$

Where the fixed interest capital is made up of the long-term loans from the financial institutions as well as the debentures or bonds raised from the capital markets and any other interest-bearing loan, whereas capital employed is the totality of net fixed and current assets.

$$(b) \quad \textbf{Debt ratio} = \frac{\text{Total debts}}{\text{Capital employed}} \times 100$$

Where the total debts is a function of the fixed interest capital and short-term funds, deferred charges and various deposits. This ratio is to measure the extent to which the external providers of funds have contributed to the financing of the company.

$$(c) \quad \textbf{Equity to Assets ratio} \\ = \frac{\text{Shareholders Funds (Capital and reserves)}}{\text{Total Assets}} \times 100$$

This is to measure the degree of contribution of owners of business in financing

the total assets put to use at a point in time.

(d) **Coverage ratios**

These are used to assess the debt-servicing capacity of a company in terms of meeting the payment of interest on loan and other charges that are fixed in nature.

The various ratios that can be calculated under the heading include:

- (a) Interest coverage ratio
- (b) Fixed charges coverage ratio.

$$\text{Interest coverage ratio} = \frac{\text{Net Profit Before Interest and Taxes}}{\text{Interest}}$$

This reflects the number of times the charges for interest are paid for in the ordinary course of doing business. However, a variation of this could be computed.

The interest coverage ratio can be calculated as:

$$\text{Interest coverage ratio} = \frac{\text{Net profit before deprecation, interest and taxes}}{\text{Interest}}$$

This ratio is however, computed in order to determine the degree to which profits may diminish without indicating any decline in the ability of the company to meet up with her obligation in paying interest expenses.

$$\text{Fixed charges coverage ratio} = \frac{\text{Net profit before deprecation, interest and taxes}}{\text{Interest} + (\text{Loan repayment}/1 - \text{tax rate})}$$

As a result of interest coverage ratios inability to consider the repayment of loan, the above ratio is computed in order to provide coverage measure in terms of cash flow rather than profits earned.

Nonetheless, other fixed charges like lease rental fees and dividend paid to preference shareholders can be recognised in the computation of the fixed charges coverage ratio and can be recomputed as follows:

$$\frac{\text{Net profit before depreciation, interest and taxes plus rentals lease}}{\text{Interest} + \text{lease rentals} + (\text{Preq. dividend} + \text{loan repayment})/1 - \text{tax rate}}$$

**ILLUSTRATION 18 – 2**

Using the data from illustration 18 – 1, compute the short term, leverage and coverage ratios of Prospect Plc. You may assume that average stock is the same as stock figure given in the balance sheet.

## SUGGESTED SOLUTION 18 – 2

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} = \frac{2,849,000}{2,595,000} = 0.96:1$$

Since the above is not in conformity with the norm of 2:1, it could be said that the above ratio is not acceptable.

$$\begin{aligned} \text{Acid or Quick Test Ratio} &= \frac{\text{Current assets} - \text{stock} - \text{repayments}}{\text{Current liabilities}} \\ &= \frac{2,849,000 - 1,072,000}{2,595,000} = \frac{1,777,000}{2,955,000} \\ &= 0.60:1 \end{aligned}$$

$$\text{Cash ratio} = \frac{\text{Cash} + \text{trade investments}}{\text{Current liabilities}} = \frac{240,000}{2,955,000} = 0.08:1$$

This goes to indicate that the cash position of the company is so tiny that the company may require a lot of cash to meet up her immediate obligations.

### Interval measure

$$\begin{aligned} &= \frac{\text{Current assets} - \text{Stocks/inventory}}{\text{Average daily operating expenditure}} = \frac{2,849,000 - 1,072,000}{8,913,000} \times \frac{365}{1} \\ &= 72.77 \cong 73 \text{ days} \end{aligned}$$

$$\text{Net-working capital ratio} = \frac{\text{Net Current Assets}}{\text{Capital Employed}} = \frac{(106,000)}{13,455,000} = (0.008):1$$

This is a bad picture as the company is not in any position to take care of her immediate obligations and contributions of net assets to capital employed being negative is too good.

### Leverage ratios

$$\text{Gearing ratio} = \frac{\text{Fixed Interest Capital}}{\text{Capital employed}} \times 100 = \frac{3,000,000}{10,500,000} \times 100$$

The company is not highly geared.

$$\begin{aligned} \text{Debt ratio} &= \frac{\text{Total debts}}{\text{Capital employed}} \times 100 = \frac{5,955,000}{10,500,000} \times 100 \\ &= 56.71\% \end{aligned}$$

This is relatively on the high side and calls for caution if the company is not to be seen as over-trading and the need to manage current assets very well.

$$\text{Equity to Asset ratio} = \frac{\text{Shareholders Funds}}{\text{Total Assets}} \times 100 = \frac{7,500,000}{13,455,000} \times 100 = 55.74\%$$

$$\text{Interest Coverage ratio} = \frac{\text{Net Profit before Interest and Taxes}}{\text{Interest}} = \frac{1,437,000}{550,000} = 2.61 \text{ times}$$

### 3.2.3 Investment Ratios

As an off-shoot of the profitability ratios, the investment ratios are calculated in order to determine the ability of the company as it relates to consistency in sustaining investment potentials and stability.

The various ratios that can be calculated include:

- (a) Earnings per share (EPS)
- (b) Dividends per share (DPS)
- (b) Dividends pay-out ratio
- (c) Earnings yields
- (d) Dividends yields
- (e) Price - earnings ratio (PER)
- (f) Market value - to- book value ratio.

#### Earnings Per Share

This is a ratio that indicates the relationship of the distribution of profits to every shareholding in a company, even though, there is no reflection of the amount paid as dividend or retained by the business. It is calculated thus,

$$\text{EPS} = \frac{\text{Net Profit After Tax - Preference Dividend (Gross)}}{\text{Number of ordinary share on issue}}$$

#### Dividends Per Share (DPS)

Since dividend is the return on investments made by the shareholders after taxes might have been considered, then, it is this dividend that is expressed as a function of the number of ordinary shareholdings in the company. It is calculated as:

$$\text{DPS} = \frac{\text{Ordinary Dividend (Interim and Final)}}{\text{Number of Ordinary share in issue}}$$

#### Dividend Cover /Pay-Out Ratio

This is a ratio that shows the relationship between the DPS and EPS, that is, it shows the proportion of earnings or profit after tax that is required to pay the current dividends due to each ordinary shareholder. It is calculated as:

$$\text{Dividend - Payout Ratios} = \frac{\text{Dividend Per Share}}{\text{Earnings Per Share}} \times \frac{100}{1}$$



### **Dividend Yield**

This is a ratio that is used to determine the percentage of return on investment made and it is calculated as:

$$\text{Dividend yield} = \frac{\text{DPS}}{\text{MVS}} \times 100$$

MVS where mvs is market value per share.

### **Earning yields/E/P Ratio**

This is a ratio used to measure the degree of responsiveness of net profit after tax per share to market value per share. The latter can be sourced from the stock exchange official daily listing made available through the financial periodicals or the stock exchange itself. It is calculated as:

$$\text{Earnings yield} = \frac{\text{EPS}}{\text{MVS}} \times 100$$

### **P/E Ratio**

The inverse of the earnings yield is referred to as the price-earnings (P/E) ratio and is determined as:

$$\text{Price-earnings ratio} = \frac{\text{MVS}}{\text{EPS}}$$

This is a ratio that shows the shareholder's future outlook about the increase in the company's profit after tax. The security market operators also use it to evaluate the company's financial position as required by the shareholders.

### **Market Value -to-Book Value Ratio**

This is a ratio that measures the relationship between the ruling share price of a security and the book value of the security. The ratio is calculated thus:

$$\frac{\text{Market value per share}}{\text{Book Value per share.}}$$

### **ILLUSTRATION 18 – 3**

Using the data given in illustration 18.1, determine the various investment ratios for Prospect Plc, assuming that the market value for ordinary share is ₦3.00 per share, preference shares N1, and debentures are listed at 98.

### **SUGGESTED SOLUTIONS 18 – 3**

Earnings Per Share (EPS)

$$\begin{aligned} &= \frac{\text{Net Profit after tax less preference dividend (gross)}}{\text{Number of ordinary shares on issue}} \\ &= \frac{\text{₦600,000}}{\text{₦4,125,000}} = 14.56\text{k} \end{aligned}$$

$$\begin{aligned} \text{Dividends Per Share (DPS)} &= \frac{\text{Ordinary Dividend}}{\text{Number of Ordinary Shares On Issue}} \\ &= \frac{\text{N}540,000}{\text{N}4,125,000} = 13.09\text{k} \end{aligned}$$

$$\begin{aligned} \text{Dividends Cover/Payout Ratio} &= \frac{\text{DPS}}{\text{EPS}} \times 100 = \frac{0.131}{0.146} \times 100 \\ &= 89.73\% \end{aligned}$$

$$\begin{aligned} \text{Dividend Yields} &= \frac{\text{DPS}}{\text{MVS}} \times 100 = \frac{0.131}{3.00} \times 100 \\ &= 4.37\% \end{aligned}$$

$$\begin{aligned} \text{Earnings yield} &= \frac{\text{EPS}}{\text{MVS}} \times 100 = \frac{0.146}{3.00} \times 100 \\ &= 4.87\% \end{aligned}$$

$$\text{Price-Earnings Ratio} = \frac{\text{MVS}}{\text{EPS}} = \frac{3.00}{0.15} = 20 \text{ times}$$

$$\text{Market Value-to-Book Value} = \frac{\text{MVS}}{\text{BVS}} = \frac{3.00}{2.55} = 1.18:1$$

$$\begin{aligned} \text{Capital Gearing} &= \frac{\text{Market value of preference shares} + \text{debentures}}{\text{Market value of equity}} \times 100 \\ &= \frac{750,000 + 2,940,000}{12,375,000} \times 100 = 29,82\% \end{aligned}$$

### 3.2.4 Activity Ratios

These are ratios used by companies to assess the degree of effectiveness achieved with the utilization of their assets. They also show the rate at which assets are turned over into sales. Therefore, they are used to measure the relationship between sales and assets. The ratios that can be calculated include:

- (a) Stock turnover
- (b) Debtors turnover
- (c) Average collection period
- (d) Assets turnover
- (e) Working capital turnover.

#### Stock Turnover Ratio

This ratio shows the ability of a company in manufacturing and marketing of its product and is computed by dividing the cost of sales by the average stock, that is.

$$\text{Stock turnover} = \frac{\text{Cost of Sales}}{\text{Average Stock}}$$

where the average stock (is the opening and closing balances of stock divided by 2).

However, the stock turnover can be given on percentage basis by having its reciprocal which is referred to as the stock holding period and this is calculated thus:

$$\begin{aligned} \text{Stock holding period} &= \frac{\text{Average stock}}{\text{Cost of sales}} \times 365 \text{ days} && \text{Or} \\ &= \frac{365 \text{ days}}{\text{Stock turnover}} \end{aligned}$$

However, where the cost of sales is not available, the stock turnover can be calculated thus:

$$\text{Stock turnover} = \frac{\text{Sales}}{\text{Stock}} \text{ and}$$

$$\text{Stock holding period} = \frac{\text{Stock}}{\text{Sales}} \times 365 \text{ days}$$

It is to be noted that the first basis for calculating stock turnover is preferable because costs are related to costs unlike the second basis whereby value is related to costs.

Of importance is the fact that, it may also be required to look at the efficiency in turning raw materials to work in progress and the latter to finished goods, therefore, the calculation can be as follows:

$$\text{Raw material stock turnover} = \frac{\text{Raw materials consumed}}{\text{Average raw material stock}}$$

And,

$$\text{Work-in-progress stock turnover} = \frac{\text{Cost of production}}{\text{Average work-in-progress}}$$

Note that where the data for raw materials consumed and cost of production are not accessible, raw material consumed and work in progress can be associated with the sales figure.

### **Debtors Turnover Ratios**

These are the ratios that are calculated to determine the degree of responsiveness of debtors to credit sales activities. Hence, the following ratios are calculated: (a) debtors turnover and (b) debtors average collection period.

### **Debtors Turnover**

This ratio is used to show the number of times that debtors are turned over in a year. The management is adjudged reliable and effective if the ratio of debtors turnover is high.

The ratio is determined thus:

$$\text{Debtors turnover} = \frac{\text{Credit Sales}}{\text{Average debtors}}$$

However, where the credit sales and the opening and closing debtors balances are not available, then, the calculation can be determined as:

$$\text{Debtors turnover} = \frac{\text{Sales}}{\text{Debtors}}$$

### **Debtors Average Collection Period**

This is the ratio that is used to determine the average number of days for which amounts due from debtors remain uncollected and it is also used to determine a company's ability to sustain its credit policy compared with those of its competitors. It can be calculated as follows:

$$\text{Average collection period} = \frac{365 \text{ days}}{\text{Debtors turnover}} \quad \text{or} \quad \frac{\text{Debtors}}{\text{sales}} \times 365 \text{ days}$$

It is also to be noted that sales are assumed to be consistent throughout the year.

### **Assets Turnover Ratios**

Sales are generated by putting assets to work. It is therefore, necessary for the assets to be fully utilised so that sales can be increased. These ratios are to measure the relationship between sales and assets. Some of the ratios that can be calculated are:

$$(a) \quad \text{Net Asset Turnover} = \frac{\text{Sales}}{\text{Net Assets}}$$

$$(b) \quad \text{Total Asset Turnover} = \frac{\text{Sales}}{\text{Total Assets}}$$

$$(a) \quad \text{Fixed Asset Turnover} = \frac{\text{Sales}}{\text{Net fixed Assets and}}$$

$$(a) \quad \text{Current Asset Turnover} = \frac{\text{Sales}}{\text{Current Assets}}$$

### **Working Capital Turnover Ratios**

This is the ratio that compares the net current assets (net working capital) to sales which is indicative of determining every naira of net current assets required for every naira of sales. It can be calculated by dividing sales by net working capital.

$$\text{Working capital turnover} = \frac{\text{Sales}}{\text{Net Current Assets}}$$

### **ILLUSTRATION 18 – 4**

Using the data provided in illustration 18 – 1, calculate the various activity ratios for Prospect Plc assuming that the stock values given in the Balance Sheet is the same as the average stocks during the year.

### SUGGESTED SOLUTION 18 – 4

$$\text{Stock turnover} = \frac{\text{Cost of sales}}{\text{Average Stock}} = \frac{6,713,000}{1,072,000} = 6.26 \text{ times}$$

$$\begin{aligned} \text{Stock holding period} &= \frac{\text{Average stock}}{\text{Cost of sales}} \times 365 \text{ days} \\ &= \frac{1,072,000}{6,713,000} \times 365 \text{ days} \\ &= 58.29 \text{ days} \end{aligned}$$

$$\text{Debtors turnover} = \frac{\text{Sales}}{\text{Average debtors}} = \frac{9,800,000}{1,537,000} = 6.38 \text{ times}$$

$$\begin{aligned} \text{Average Collection period} &= \frac{\text{Debtors}}{\text{Sales}} \times 365 \text{ days} \\ &= \frac{1,537,000}{9,800,000} \times 365 \text{ days} \\ &= 57.24 \text{ days} \end{aligned}$$

$$\text{Total Assets turnover} = \frac{\text{Sales}}{\text{Total Assets}} = \frac{9,800,000}{13,455,000} = 0.73 \text{ times}$$

$$\begin{aligned} \text{Fixed asset turnover} &= \frac{\text{Sales}}{\text{Net Fixed Assets}} = \frac{9,800,000}{10,268,000} \\ &= 0.95 \text{ times} \end{aligned}$$

$$\begin{aligned} \text{Working capital turnover} &= \frac{\text{Sales}}{\text{Net Current Assets}} = \frac{9,800,000}{(106,000)} \\ &= (92.45) \text{ times} \end{aligned}$$

### 3.2.5 Value Added Ratios

Value added is defined by CIMA as 'sales value less the cost of purchased materials and services. This represents the worth of an alteration in form, location or availability of a product or service'.

The value added is usually applied in paying employees, providers of capital (shareholders, debentures and long term loan), the government, as well as provisions made for maintenance and increasing the value of assets (depreciation and retained earnings).

Value Added ratios are therefore, those calculated to measure the degree of responsiveness of value added to the various beneficiaries of the wealth created. The typical ratios include:

- (a) Value added to fixed assets.
- (b) Value added to current assets.
- (c) Value added per employee.

#### **4.0 CONCLUSION**

The common ratios are profitability solvency, investment, activity and value added.

The profitability ratios include ROCE, asset turnover ratios etc. The activity ratios include debtors turnover, stock turnover, asset turnover etc.

The solvency ratios are of two types viz: short-term and long-term. The short-term include: current ratios and the add test ratio; while the long-term ratios are concerned with the financial stability and structure of the company e.g. gearing ratios.

The investment ratios include earnings per share, dividend per share etc.

Value added is the wealth created by a company through its own activities and expressed in a statement (Value Added Statement) to reflect the effective performance of a firm.

The value added ratios include value added per employee etc.

#### **5.0 SUMMARY**

In this unit, we have discussed that Ratio Analysis uses financial reports and data and explains key relationships (for example, gross profit to sales) in order to assess financial performance. Its importance becomes greatly enhanced when trends are determined, comparative ratios are available and inter-related ratios are made available.

#### **6.0 TUTOR MARKED ASSIGNMENT**

1. Define the term ratio analysis.
2. What are the formula for current ratio and quick or acid test ratio?
3. Explain how to calculate interest coverage ratio.
4. State two long-term solvency ratio.
5. What is the formula for earnings per share?
6. The difference between sales income and bought in goods and services is known as\_\_\_\_\_
7. A method of comparing one company's financial ratio with that of another within the industry average is referred to as\_\_\_\_\_

## **7.0 REFERENCES/FURTHER READINGS**

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## **UNIT 19 COST CONTROL AND COST REDUCTION**

### **CONTENTS**

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## **1.0 INTRODUCTION**

Cost control is the regulation of the costs of operating a business and it is concerned with keeping expenditure within acceptable limits whereas cost reduction is a planned, positive approach at reducing expenditure where it is in excess. It entails focus on material costs, labour costs, finance costs and rationalization measures.

## **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- The concepts of cost control and cost reduction;
- The main differences between cost control and cost reduction;
- The similarities between cost control and cost reduction;
- The factors considered for cost reduction purposes;
- The various cost reduction techniques.

## **3.0 MAIN CONTENT**

### **3.1 COST CONTROL**

Cost control involves all methods of controlling costs within a pre-determined target. Examples of cost control techniques are budgetary control and standard costing.

Cost control actions lead to a reduction in excessive spending, for example, when material wastage is higher than budgeted or productivity level is below the agreed standard. Both budgets and standards reflect current costs and conditions, and not necessarily the cost and conditions which would minimize costs. Therefore:

- (a) Standard costing and variance analysis is often an inadequate means of



- controlling costs (although it is an effective means of control.)
- (b) Standards set may be generous and incorporate low standards of efficiency. This can be referred to as introduction of budget slack variable unto the system.
  - (c) Budgets may include contingency allowances.

Cost control process involves setting targets, receiving feedback information in order to ensure that actual performance are in line with target set, and if not, to take corrective actions.

### **3.2 COST REDUCTION**

This is an active, dynamic concept, which attempts to extract more from the factors of production without loss of effectiveness.

Cost reduction activities are planned efforts to reduce expenditure; they should preferably be continuous, long term efforts, so that short term cost reductions are not soon reversed and forgotten. The major difficulties with cost reduction programmes are:

- (a) Resistance by employees to pressure, to reduce costs, usually because the nature and purpose of the campaign has not been properly explained to them, and they feel threatened by the change.
- (b) Application may be limited to a small area of the business (e.g.. to one department) with the result that costs are reduced in one cost centre only to re-appear as an extra cost in another cost centre.
- (c) Efforts to cut materials or labour costs may erode confidence in the established systems for estimating material usage and labour efficiency standards.
- (d) Cost reduction campaigns are often introduced as a rushed, desperate measure instead of a carefully organized, well thought out exercise.

### **3.3 SIMILARITIES AND DIFFERENCES BETWEEN COST CONTROL AND COST REDUCTION**

They are similar as they both:

1. Ensure the efficient utilisation of resources.
2. Involve the pre-setting of a target after an initial cost analysis.

The differences include the following:

- (i) Cost control is static with the basic objectives of containing cost within pre-set target while cost reduction aims to reduce costs from some predetermined target without reducing the benefits derived from the product made or service rendered.
- (ii) Cost control is an on-going process while cost reduction is on ad-hoc basis.
- (iii) They both have quite distinct objectives and different techniques are used to achieve their goals.

### **3.4 THE SCOPE OF COST REDUCTION**

The scope of cost reduction embraces activities of the entire company, from production to marketing and at all levels within the organization from the operative to top levels.

Costs reduction efforts may include the following:

(a) **Material costs:**

- (i) Quantity discounts or cash discounts for early payment to suppliers may be negotiated at favourable discount rates;
- (ii) Inventory control policy might need improvement;
- (iii) Value analysis may be carried out;
- (iv) Procedures for reducing material wastage in production should be instituted.

(b) **Labour costs:**

- (i) Labour efficiency may be improved by work study
- (ii) Unit labour costs and unit overhead costs may be reduced by having production efficiency rewarding plan with the employees.
- (iii) Total costs may be reduced by replacing labour intensive jobs with automated machines related jobs.

(c) **Finance costs:**

- (i) Where there is the desire to allow for discount, it should be done on a regular basis.
- (ii) Bank overdraft expenses may be better reduced by effective cash monitoring efforts.

(d) **Rationalization Measures:**

As a company expands in activities, there may be duplication of efforts in the different facets of its operations. However, this duplication can be removed by ensuring that resources are concentrated in the firm and this is referred to rationalisation efforts, which is aimed at cost reduction that brings about efficiency at the workplace.

### 3.5 FACTORS TO BE CONSIDERED FOR REDUCING COSTS

The following factors are to be considered if cost reduction is to be meaningful:

- (a) Efficient business may not be able to avoid undue expenses;
- (b) Inconsistency of management may add to costs;
- (c) Employees may want to resist change;
- (d) Faultless system may be costly;
- (e) Avoidance of elaborate procedures;
- (f) Cost reduction efforts can be enhanced by allowing for creative ideas;
- (g) The sources of costs must be given adequate and prompt attention;
- (h) Short-term action should be related to long-term objectives;
- (i) Cost reduction should be maintained; and

- (j) Communication of company policy and objectives in the context of cost reduction.

The following explanatory notes have been provided to clarify some key terms necessary for the understanding of the cost reduction factors.

**(i) Undue Expenses**

Undue expenses can be removed without having to compromise the quality of the items of production or units of service provided.

Consumers can only appreciate buying goods of better quality. Nonetheless, a lowering of the standard may ensure the reduction of costs but at the expense of the quality of goods.

**(ii) Management Inconsistency**

Cost reduction programme requires the support and commitment of the top management and this has to be on a regular and consistent basis in order to avoid complacency not minding whether the business climate is harsh or friendly.

**(iii) Resistance To Change By Employee**

Employees may want to react to change negatively as a result of past beliefs or norms. This can be addressed by ensuring that existing systems or work environment situations are constantly reviewed and friendly employees are involved at every stage in order to gain their confidence and support. With this, negative efforts will be eliminated and costs reduced.

**(iv) Faultless System**

A faultless system may be a desired one, but efforts should be made to ensure that it is not over blown so that unnecessary controls are removed.

**(v) Avoidance of Elaborate Procedures**

Elaborate procedures if allowed in a company, may bring about costly operations at the expense of ensuring that employee capabilities are recognised which could lower costs.

**(vi) Creative Ideas**

Since issues can be approached from different ways, ideas and contribution from everyone involved in cost reduction programme must be allowed for in order to eliminate wastes. Creative ideas can be enhanced by ensuring that employees are given good incentives to work and the work environment must be friendly so that any scheme put in place can be successful.

**(vii) Areas of Cost Reduction**

For cost reduction activities to be meaningful, the sources for incurring these costs such as finance, marketing, production, human resources, engineering, maintenance, etc. need be considered in terms of the material, labour and

overhead costs involved in the areas mentioned. There is a need for using an integrated approach whereby costs are not considered in isolation, but their inter-relatedness is given some consideration. The managers are, therefore, expected to exchange ideas that will allow for goal congruence to be attained.

**(viii) Maintaining Cost reduction**

Cost reduction can be sustained or maintained by ensuring that there is consistent control of costs in place with the aid of budgetary control technique.

**(ix) Short Term Action** should be related to Long Term Objectives A cost reduction campaign should have a long term aim as well as short term objectives.

- In the short term, only variable costs, for the most part, are susceptible to cost reduction efforts. Many fixed costs (for example, depreciation, rent) are unavoidable.
- Some fixed costs are avoidable, in the short term (e.g. advertising or sales promotion expenditure). These are called 'discretionary fixed costs'.
- In the long term, most costs can either be reduced or avoided. This includes fixed costs as well as variable cost expenditure items.

**(x) Communication**

Information to employees must be such that they are timely, relevant, focused and less costly. Information will be valued, where employees are convinced that their future is guaranteed and prospects can be ascertained at the same time. Good and equitable personnel manual must also be in place.

### 3.6 COST REDUCTION TECHNIQUES

The cost reduction techniques include:

- (i) **Value Analysis:** Value analysis or value engineering is an assessment process carried out by a team during the design stages of a product, with the aim of designing a product or methods of rendering a service which meets the essential design objectives at minimum cost.

Four aspects of value analysis that should be considered are:

- (a) *Cost Value*- that is. its cost of sale
- (b) *Exchange Value*-that is, its market value
- (c) *Use Value*- that is, what the article does, the purposes it fulfils. Value analysis attempts to provide the same (or a better) utilisation value at the lowest cost.
- (d) *Esteem Value*- that is, the prestige the customer attaches to the product. Value analysis attempts to 'maintain or enhance the prestige of a product at the lowest cost.

Value Analysis was a formal system developed after the second world war, when shortages of materials forced manufacturers to look for cheaper methods of production. It was found that cheaper production could be achieved with no loss in quality or value. From this, value analysis, the systematic investigation of every source

of cost and technique of production with the aim of getting rid of all unnecessary costs. An unnecessary cost is an additional cost incurred without adding use, exchange or esteem value to a product.

Value analysis (value engineering) embraces the investigation of specification, design, planning, buying, manufacture, testing, sales and distribution. Its methods include:

- (a) Organization and methods study;
- (b) A study of comparative costs; and
- (c) A study of new available materials.

Three areas of special importance are:

- (a) Product design; The designer should be cost-conscious and avoid unnecessary complications;
- (b) Components and materials cost: The purchasing department should beware of lapsing into the habit of routine buying decisions. Buyers ought to be fully aware of technological changes, and significant changes in material prices that new technology creates;
- (c) Production methods; These ought to be reviewed continually, on a product-by-product basis.

The origins of value analysis were in engineering industry, but its principles and applications spread wider. Value analysis can be applied to services, or aspects of office work, or to management information systems (for example, the value of information, reports. etc.)

### **The stages in value analysis**

A value analysis study should be carried out by a team of experts, preferably with varying backgrounds, which blends experience, skill and imagination.

The stages in value analysis are:

- (a) Select a product or service for study: The product selected should be one which accounts for a high proportion of the organizations' cost. since the greatest cost savings should be obtained from high cost areas. The choice should also have regard to the expected future life of the product and the stage of its "life cycle" that it has reached.
- (b) Obtain and record information: The question to be asked include what is the product or service supposed to do? Would it succeed? What are the costs of the product or service? Are there alternative ways of making or providing it? What do these alternatives cost?

### **(ii) Work Study:**

This involves the determination of the most efficient means of using input resources such as labour, materials and machinery. It is a technique for improving efficiency and rendering waste in factories and can be applied in many areas including factory layout, and work flow, material handling, tool design, scheduling, workplace methods and layout. Work study comprises

method study and measurement.

- a. **Method Study:** This is that part of work study which is aimed at improving methods, or establishing a correct method for a job or process to economise its human effort and make more efficient use of men, materials and machines. The procedure normally includes the selection of work to be studied, relevant facts or method used, examining the facts logically, developing a more effective method and installing and maintaining this method as a standard practice.
- b. **Work Measurement:** This is the application of techniques designed to establish the time for a qualified work to carry out a specified job at a defined level of performance. Although, method study can also examine the more effective use of manpower, measurement is distinct in that it aims to make improvements in the labour planning and control, and through incentive schemes the managing of organization. Thus, it is complementary to and can assist the former by examining the times that alternative methods of carrying out a work assignment would take. Thus, it can help to ascertain a balanced allocation of manpower resources between the various stages in the production of a product or service, In work measurement, time study may be used to examine performance, after considering time allowances for such things as relaxation. Frequently, statistical sampling techniques will be used in the analysis especially with the large production units where otherwise it would be impossible to consider each person and operation on an individual basis.

### 3.7 STANDARDISATION AND VARIETY REDUCTION

An examination of product components and final products can be carried out with the objectives of optimising the range of these. In this case, special consideration will be given to unprofitable products bearing in mind that such unprofitable products may be necessary to ensure that the organisation has a complete product range to offer to its customers. The intention as far as components of a product are concerned is to simplify and standardise them as much as possible. This may all appear to be a subset of value analysis. However, although the two techniques are inter-linked, there is the distinction that rationalisation is relevant in the consideration of standardisation of products and variety reduction.

### 4.0 CONCLUSION

We have discussed that Cost reduction techniques are value engineering analysis and work study.

Value engineering or analysis embraces the investigation of specification, design, buying, manufacture testing, sales and distribution.

Work study is a technique of management which is applied to existing procedures and problem areas to eliminate wastes and improve efficiency It incorporates both method

study and work measurement in order to achieve the most efficient and economic utilization of resources.

## **5.0 SUMMARY**

This unit has treated the concepts of cost control and cost reduction; the main differences between cost control and cost reduction; similarities between cost control and cost reduction; factors considered for cost reduction purposes; various cost reduction techniques.

## **6.0 TUTOR MARKED ASSIGNMENT**

- 1 The process of regulating costs of operation of a business and keeping the expenditure within acceptable limits is\_\_\_\_\_
- 2 A planned positive approach to reducing expenditure because of its excessiveness is\_\_\_\_\_
- 3 State three main objectives of method study.
- 4 A cost reduction technique which is concerned with new products at the design stage before production commences is known as\_\_\_\_\_
- 5 A cost reduction technique which attempts to reduce the manufacturing cost of a product without reducing its quantity, performance or value to the customer is called\_\_\_\_\_
- 6 A technique of management which is applied to existing procedures and problems areas to eliminate waste and improve efficiency is known as\_\_\_\_\_
- 7 State the stages in work measurement.

## **7.0 REFERENCES/FURTHER READINGS**

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## **UNIT 20     CURRENT TRENDS IN MANAGEMENT ACCOUNTING**

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### **1.0 INTRODUCTION**

The traditional management accounting when compared with the current trends management is deficient in the areas of absorption costing methods; cost behaviour analysis; standard costing and the pre-occupation with short-term financial measures. This unit will throw light on what is obtainable in this modern era.

### **2.0 OBJECTIVES**

In this unit, readers will be able to understand:

- The principal issues in Advanced Manufacturing Technology (AMT) and relationship with management accounting;



- The concept of total quality management (TQM);
- The relevance of AMT to activity-based costing (ABC);
- The principal principles as they relate to throughout accounting;
- The usage of back flush accounting;
- The principles of target costing;
- How performance evaluation can be carried out with the use of physical measures;
- Life-cycle costing and the stages involved in a product's life cycle (PLC);
- The tear-down analysis, value engineering and functional analysis;
- The aim of kaizen costing;
- The different types of environmental cost;
- The various elements of strategic management accounting;
- The balanced scorecard and the associated benefits thereof.

### **3.1 WHAT IS ADVANCED MANUFACTURING TECHNOLOGY (AMT)?**

Advanced Manufacturing Technology (AMT) is an umbrella word used to capture automated production technology, computer assisted design and manufacturing systems (CAD/CAM), flexible manufacturing systems (FMS), robotics, total quality control (TQC), advances in production management including materials requirement and manufacturing resources planning systems (MRP), just-in-time (JIT) systems etc., which are considered to be the new developments in the area of management accounting due to technological advancement.

Based on the above, the traditional management accounting systems have been found to be inadequate as basis for evaluating performance in companies that have adopted the AMT. This view is supported by Kaplan (1996) when he said that *"traditional management accounting produces", simply the wrong measures. They move me company in the wrong direction, reward managers for damaging the business and provide no incentive for improvement The best we can do is to switch them off, just stop doing them!"*

### **3.2 BENEFITS OF AMT**

The benefits of AMT include:

- (a) It assists companies to function effectively in the technologically and fast growing economies and global markets.
- (b) It ensures that consumers derive better satisfaction from super-quality goods that are made available at cheap rates.
- (c) Encourages companies to cope with short product life cycles which are enhanced by flexibility and innovation in production activities.
- (d) Abilities to sustain cost reduction programme and ensure that variety of goods are supplied.
- (e) The desire to minimise set-up times and costs as well as stock usage which are required for sustaining flexibility in production activities is achieved.

### **3.3 COMPUTER-AIDED DESIGN (CAD)**

This is a good part/component design and testing using a computer terminals. The designer, the computer and the database engineers come together so that more choice and designs can be looked at as a way of having activities carried out at the least cost. The basic function involved here is putting the CAD database to test in order to ascertain standard parts and systems that ensure the minimisation of production parts, stock and simplifies product design.

### **3.4 COMPUTER-AIDED MANUFACTURING EFFORTS (CAM)**

This is an umbrella word depicting the application of computers for the programming and control of production equipments which includes robots, machines operated numerically and those machines that operate numerically by computers. The benefits of CAM include:

- (a) Enhances efforts carrying out series of operation and production of various components;
- (b) Effective monitoring of production efforts;
- (c) Minimises set-up times and costs;
- (d) Ensures quality on constant basis;
- (f) Low defective units are involved; and
- (g) Jobs are machine intensive/highly automated.

### **3.5 FLEXIBLE MANUFACTURING SYSTEM (FMS)**

This is a system that ensures a linkage of computer controlled machines to ensure effective handling and transfer of parts from one location to another location, principally to give effect to the production of similar parts in a more flexible manner.

Even where the ultimate is to integrate manufacturing efforts by the use of computers, the human element is still of paramount importance.

### **3.6 TOTAL QUALITY CONTROL (TQC)**

Under the conventional management accounting practice, functions and costs associated with bad quality units addressed are by factoring into standard costs and process costs 'normal' allowances in percentages for scrap, waste and defects. In effect if the normal loss is kept within the set limits no matter the output involved, no problem is reported.

However, in based on modern trends, quality is a function of the design and not the inspection. Therefore, TQC is a matter to be considered at every point of activity, especially commencing with when the idea for the product was muted.

TQC is seen to be functional with the following activities: place; product design, production engineering, control charts, Just in time systems, goods inwards and output

inspection.

With the effective installation of TQC, the following among others happen: decrease in defects, scrapping, reworking, warranty and service expenses. Higher quality means lower costs.

### **3.7 TOTAL QUALITY MANAGEMENT (TQM)**

Total quality management has to do with ensuring that there is a spirit of defined culture of quality improvement in quality maintenance in every aspect of an organisation whether in terms of function and units. Of relevance is the recognition of three key elements of customers, products and employees.

In Nigeria, organisations can be recognised under Nigerian Standard Organisation (SON), if they comply with the required quality standards throughout the companies. SON's recognition applies to service organisations as well as production companies and there are various businesses that have received the recognition. These include: government, agencies, accountants, shipping companies, paints and food and beverages, etc.

### **3.8 MANAGEMENT ACCOUNTING AND AMT**

Under 20.1 above, it was asserted that the traditional management accounting is deficient and the issues involved are been discussed here.

The main problem areas as identified by Lucey (2003) are:

(a) **Absorption costing**

In the AMT environment, the application of overhead absorption basis of direct labour hours or machine hours in determining product costs is considered inadequate because of time lag or inconsistency in decision making efforts.

(b) **Cost behaviour**

The classification of costs as fixed or variable does not make for the effective recognition of overheads especially where costs are related to production volume, even though labour costs are not significant in view of relation to total costs.

(c) **Standard costing**

The traditional control techniques of standard costing and variance analysis have been considered inadequate in the AMT and JIT environments because they are not at par with the consistent improvement belief, in the AMT situation and that the variances lose their significance under the latter situation, for example, material usage variance is not relevant where quantity is involved because JIT does not allow for excess material as what is required is what is purchased.

**(d) Short-term financial measures**

Much traditional management accounting focuses on short-term financial issues which are related to industrial events or costs, whereas AMT addresses readily available non-cash issues such as those concerning machine failures, defective items etc.

**(e) Cost accounting methods**

Cost accounting is basically concerned with the determination of production processes, by methodically focusing at the movement of stocks of raw materials to the final stage of having the finished products and this also entails a lot of journal entries in order to give effect to all the transactions that were involved. However, with the advent of JIT, all the cumbersome processes are no longer required because activities are such that stocks are at almost nil level and production processes are carried out at small batch lots, even though on a continuous basis. Furthermore, casual labour system is now a thing of the past. Therefore, the cost accounting procedures and methods are now by no small means made simple to operate and results more effectively achieved.

### **3.9 THROUGHPUT ACCOUNTING**

Throughput accounting is a management accounting system of determining the rate at which capacity is achieved especially when costs are related to the throughput time, that is, the rate at which products and/or services can be made available to meet consumer's demand.

Throughput accounting is defined as:

'A management accounting system which focuses on ways by which the maximum return per unit of bottleneck activity can be achieved.' Throughput Accounting (TA) can be viewed from the following assumptions:

- (a) All factory costs, except material costs are assumed to be fixed costs, especially in the short run. All of these costs inclusive of the indirect labour costs are categorised as total factory costs (TFC).
- (b) One of the principles on which JIT is based is that if there are no orders there should be no production since the stock level is almost nil. The whole essence of this, is to ensure that there is no idle capacity except for the activity with bottleneck at present. Therefore, production will be meaningless, if stock-piling will not result in profits.
- (c) Efforts are to be geared towards the rate of producing to meet consumers' demand, if profits are to be realised or increased, of importance too, is the fact that key resources or capacity factors must be recognised, if contribution is to be effectively measured.

Using TA, product returns can be determined thus:

$$\text{Return per factory hour} = \frac{\text{Sales Price} - \text{Material Cost}}{\text{Time on key resource (i.e, the bottleneck)}}$$

Product costs are calculated thus:

$$\text{Cost per factory hour} = \frac{\text{Total factory costs (TFC)}}{\text{Total time available on the key resource}}$$

Therefore, the TA ratio can be calculated thus:

$$\text{TA ratio} = \frac{\text{Return factory hours (or Minute)}}{\text{Cost per factory Hour (or Minute)}}$$

A ratio of 1 and above is better but anything short of this would bring about loss of funds and the decision will be that of rejecting the product and non inclusion for marketing purposes.

The TA ratio can be computed by comparing the total return with the total fixed costs. This is a total concept.

$$\text{TA ratio} = \frac{\text{Return from total throughput (that is, Sales – Material Cost)}}{\text{TFC (that is, all costs other than materials)}}$$

It should be noted that since a bottleneck is; key factor that limits the production function or activity, then the issue of how to treat overheads involved at a point in time should be related to the actual period involved in terms of the key resource and not the period related to the utilised portion of the key resources which may be caused by factors not related to key resource, for example, poor quality production inputs.

The computation can be made thus:

$$\frac{\text{Standard minute throughput}}{\text{(Usage of key resource)}} \times \frac{\text{Budgeted TFC cost per minute}}{\text{Key resources}}$$

From the foregoing, an efficiency percentage can be determined thus:

$$\text{Efficiency \%} = \frac{\text{Throughput cost}}{\text{Actual TFC}} \times 100$$

Labour efficiency can be measured as:

$$\text{Labour Efficiency \%} = \frac{\text{Throughput cost}}{\text{Actual total labour cost}} \times 100$$

## ILLUSTRATION 20 – 1

A key resource (bottleneck) of facility Z is available for 15,650 minutes per period.

Budgeted factory costs and data for two products, A and B, are shown as below:

Product	Selling Price/unit	Material Cost/unit	Time in facility Z Mins
A	14	9	2
B	14	8	4

Budgeted factory costs per week:

	₦
Direct labour	10,000
Indirect labour	5,000
Lighting	700
Depreciation	9,000
Space costs	3,200
Maintenance	1,400
Administration	2,000

Calculate:

- Total Factory Costs (TFC)
- Cost per Factory Minute
- Return per Factory Minute for both products
- Throughput activity ratios for both products

### SUGGESTED SOLUTION 20 – 1

$$\begin{aligned} \text{Total Factory Costs} &= \text{Total of all costs except materials} \\ &= 10,000 + 5,000 + 700 + 9,000 + 3,200 + 1,400 + 2,000 \\ &= \text{₦}31,300 \end{aligned}$$

$$\begin{aligned} \text{Cost per factory minute} &= \frac{\text{TFC}}{\text{Minutes available in bottleneck}} \\ &= \frac{31,300}{15,650} \\ &= \text{₦}2 \end{aligned}$$

$$\begin{aligned} \text{Return per bottleneck minute for Product A} &= \frac{\text{Selling Price} - \text{Material cost}}{\text{Minutes in bottleneck}} \\ &= \frac{\text{₦}14 - 9}{2} \\ &= \text{₦}2.5 \end{aligned}$$

$$\begin{aligned} \text{Return per bottleneck minute for Product B} &= \frac{\text{₦}14 - 8}{4} \\ &= \text{₦}1.50 \end{aligned}$$

$$\text{Throughput Accounting (TA) Ratio for Product A} = \frac{\text{Return per minute}}{\text{Cost per minute}}$$

$$\begin{aligned}
 &= \frac{2.5}{2.0} \\
 &= 1.25 \\
 \text{TA Ratio for Product B} &= \frac{1.50}{2.0} = 0.75
 \end{aligned}$$

The TA ratios shows that if we only make Product B we would make a loss as its TA ratio is less than 1; when we make Product A we make a gain.

### ILLUSTRATION 20 – 2

Based on the data in illustration 20 – 1 above, during a week actual production was 6,000 units of Product A and 700 units of Products B. Actual factory costs were ₦31,300

Calculate:

- Throughput cost for the week
- Efficiency percentage
- State the possible reason(s) for the efficiency percentage calculated.

### SUGGESTED SOLUTION 20 – 2

#### *Workings*

$$\begin{aligned}
 \text{Standard minutes of throughput for the week} \\
 &= (6,000 \times 2) + (700 \times 4) \\
 &= 14,800 \text{ mins.}
 \end{aligned}$$

$$\begin{aligned}
 \text{Throughput cost for week} &= \\
 &= 14,800 \times \text{₦2 per min (from illustration 1)} \\
 &= \text{₦29,600}
 \end{aligned}$$

$$\begin{aligned}
 \text{Efficiency \%} &= \frac{\text{Throughput cost}}{\text{Actual TFC}} \times 100 \\
 &= \frac{29,600}{\text{₦31,300}} \times 100 = 94.57\%
 \end{aligned}$$

The bottleneck resource of facility A is available for 15,650 minutes per week but produced 14,800 standard minutes. Thus could be due to:

- The presence of a ‘wandering’ bottleneck causing facility Z to be under-utilised; or
- Inefficiency in facility Z.

Even though the TA has some similarity with the conventional contribution method in that it focuses on limiting key resources, the following constitute the difference.

In TA, return is defined as sales minus material costs unlike contribution which is

sales minus variable costs (material, labour and variable overheads). Furthermore, it is assumed under TA, that all costs, except materials, are fixed in relation to throughput in the short run.

Despite the criticism of TA on being a short-run concept, it has the following advantages:

- (a) It is useful in a JIT environment.
- (b) It enhances management's ability to focus on key resources that are required for profit making, for example, reduction of stock piled up as well as time required to attend to customers' request.

### 3.10 BACKFLUSH ACCOUNTING

This is defined as

'A method of costing, associated with JIT production systems, which applies cost to the output of a process. Costs do not mirror the flow of products through the production process, but are attached to output produced (finished goods stock and cost of sales), on the assumption that such back flushed costs are a realistic measure of the actual costs incurred'. (CIMA)

In effect, a single account is maintained for both the raw materials and work-in-progress item whereby the standard cost of the raw material in the finished goods would be credited to the single account already created. Furthermore, the processing costs would not be applied to the work-in-progress.

#### ILLUSTRATION 20 – 3

The following shows the transactions of Bisi Ltd. in a given period:

	N
Purchases of raw materials	510,000
Processing costs	411,600
	Qty.
Production	9,800
Sales	9,700

There were no opening stocks of raw materials, WIP or finished goods. The standard cost per unit is N93 (N51 materials + N42 processing cost). There was no closing WIP at the end of the period.

Journalise the entries for a backflush accounting system using a Raw Materials In Progress (RIP) account.

#### SUGGESTED SOLUTION 20 – 3

	N	N
RIP account	510,000	
Creditors		510,000



Being the cost of raw materials		
Bought in credit		
Finished Goods Stock	911,400	
RIP a/c		499,800
Processing cost control a/c		411,600
Being the cost of production (9,800 units)		
Cost of sales	902,100	
Finished Goods Stock		902,100
Being the cost of sales (9,700 units)		

At the end of the period there will be two separate stock balances:

	N
RIP account (510,000 – 499,800)	10,200
Finished Goods (100 @ N93)	9,300

### 3.11 ADVANTAGES OF BACKFLUSH ACCOUNTING

- (a) It is very simple to operate. Work-in-progress is not accounted for separately.
- (b) The accounting entries are very few and documentation is not vigorous.
- (c) It does not allow for the piling-up of inventory, since doing so may not really be of great importance to the managers.

### 3.12 TARGET COSTING

Target costing is a customer-focused management tool that is used to determine the market value share for a new product using the market research as basis for measuring performance needs and setting target selling price. However, the target cost is determined by deducting the target profit margin from the target selling price. Therefore, target costing as a tool is a function of the following phases:

- (a) Ascertain the target selling price at which demand are likely to be made.
- (b) The target cost is derived by subtracting the target profit margin from the target selling price.
- (c) Forecast the likely actual cost for the product
- (d) Make efforts at ensuring that the estimated cost is equal to the target cost.

Target costing entails the adoption of team spirit which ensures that the designers, engineers, purchasers, production, selling and distribution as well as the management accounting staffs are involved in order to attain the quality level required for realising the target cost. If the target cost cannot be attained, then the new item or goods should not be considered.

This technique is adopted at the design and planning stage, with the designers especially using the tear-down analysis, value engineering and functional analysis in order to attain the target cost.

The tear-down analysis has to do with the determination of openings for increasing the value of products and/or reducing cost by putting to test a competitor's product, in order to get at the area of competitive hedge that can be introduced into the product.

Whereas, value engineering is used to determine the elements that could have effects on the costs of a product such that measures can be taken to enhance product design and reduce unwanted activities that add to product costs which consumers would not appreciate.

Functional analysis is a variation of the value engineering which is used to determine product activities, the associated costs and value added to the consumers. In the CIMA terminology, it is an analysis of the relationships between product function, their perceived value to the customer and the cost of provision'.

**3.13 PERFORMANCE EVALUATION IN AN AMT ENVIRONMENT**

The conventional performance evaluation basis such as variances (material, labour, overhead cost) can no longer meet up with the requirements of the technological advancement in global world because of the following issues which include; inability to assess important elements of performance; inadequate use of standard costing; delays in reporting mechanism etc. Therefore, to overcome these short comings, some physical and non-financial measures have been put in place in order to enhance improvement and not just to monitor.

*As an example, Lacey (2003) asserted that I a Miller carried out an international survey on the measures being used to monitor and control production in Europe, USA and Japan. The key results are summarised in Figure 20.4.*

<b>Europe</b>	<b>United States</b>	<b>Japan</b>
1. <i>Outgoing quality</i>	<i>Incoming quality</i>	<i>Manufacturing lead times</i>
2. <i>Unit manufacturing costs</i>	<i>Inventory accuracy</i>	<i>Direct labour productivity</i>
3. <i>Unit material cost</i>	<i>Direct labour productivity</i>	<i>WIP turnover</i>
4. <i>Overhead costs</i>	<i>Manufacturing lead times</i>	<i>Incoming quality</i>
5. <i>On-time deliveries</i>	<i>Vendor lead times</i>	<i>Vendor lead times</i>
6. <i>Incoming quality</i>	<i>Set-up times</i>	<i>Indirect productivity</i>
7. <i>Direct labour productivity</i>	<i>WIP turnover</i>	<i>Material yield</i>

*Figure 20.4: Performance measures listed in order of importance*

Examples of non-financial measures:  
 Manufacturing cycle efficiency

$$\frac{\text{Processing time}}{\text{Processing time} + \text{waiting time} + \text{transport time} + \text{inspection time}}$$

*Ideally the above ratio should be 1. Progress in moving towards this should be*

monitored. This is a useful summary ratio for a JIT factory or line as it relates value added time to non-value added time.

$$\text{Machine availability} = \frac{\text{Machine down time}}{\text{Total machine hours}}$$

*Useful in monitoring machine availability, usage and efficiency*

$$\text{In-coming quality} = \frac{\text{Reject parts (numbers, weights as appropriate)}}{\text{Purchased parts}}$$

*This could be used to monitor the quality of existing and new suppliers. Customer satisfaction is the ultimate measure of product/service quality This can be measured in a variety of ways including:*

$$\frac{\text{Customer rejects/returns}}{\text{Total sales}}$$

*and/or percentage of sales which are repeat sales to existing customers.*

$$\text{Delivery performance} = \frac{\text{Delivery late}}{\text{Deliveries on Schedule}}$$

*Applied to sales, this provides a measure of the efficiency of production and production scheduling. Applied to purchasing it monitors supplier reliability.*

*In addition to ratios, many AMT performance measures are expressed in real terms; such as hours, minutes, quantities, weights and so on. The trends in these can be followed easily and have real and immediate meaning for everybody associated with production.*

*Examples include:*

- *Process times*
- *Set-up times*
- *Distance parts/materials travel*
- *Number of on time deliveries*
- *Number of lost machine time*

*Source: Lucey, T(2003) Management Accounting 5th Edition. London: Book Power. pp 594 - 595*

### **3.14 LIFE - CYCLE COSTING**

Life cycle costing or terotechnology can be defined as: 'The maintenance of physical asset cost records over the entire asset lines, so that decision concerning the acquisition, use or disposal of the assets can be made in a way that achieves the optimum asset usage at the lowest possible cost to the entity. This term may be applied to the profiting of cost over a product's life, including the pre-production stage

(terotechnology), and to both company and industry life cycle' (CIMA).

Even though the above definition is applicable to assets that are physical, there is a need to reflect the concept in relation to manufactured goods and services rendered.

The prevalent costs associated with product life-cycle of an asset, product or service may include the following:

- (a) **Acquisition costs** - Such as set-up costs, research and development costs, production etc., if they are produced by the company. However, where they are bought, the costs will include purchase costs, freight charges, installation costs etc.
- (b) **Operating costs** - Such as maintenance costs, lighting costs, spare components, storage costs, staff costs, safety regulation costs etc.
- (c) **Disposal costs** - Such as scrap costs.

The product life cycles are as depicted in figure 20.5 below. Thus, one can talk about the stages as being planning/design stage, production stage and the service and abandonment stage. This goes to show that more costs are incurred at the first stage as well as the last stage of abandonment where activities are considered to be heavy.

If life cycle costs are to be minimised, then, the issues of utilisation, maintenance and disposal should be properly addressed in terms of technical, engineering and production viability and exposure.

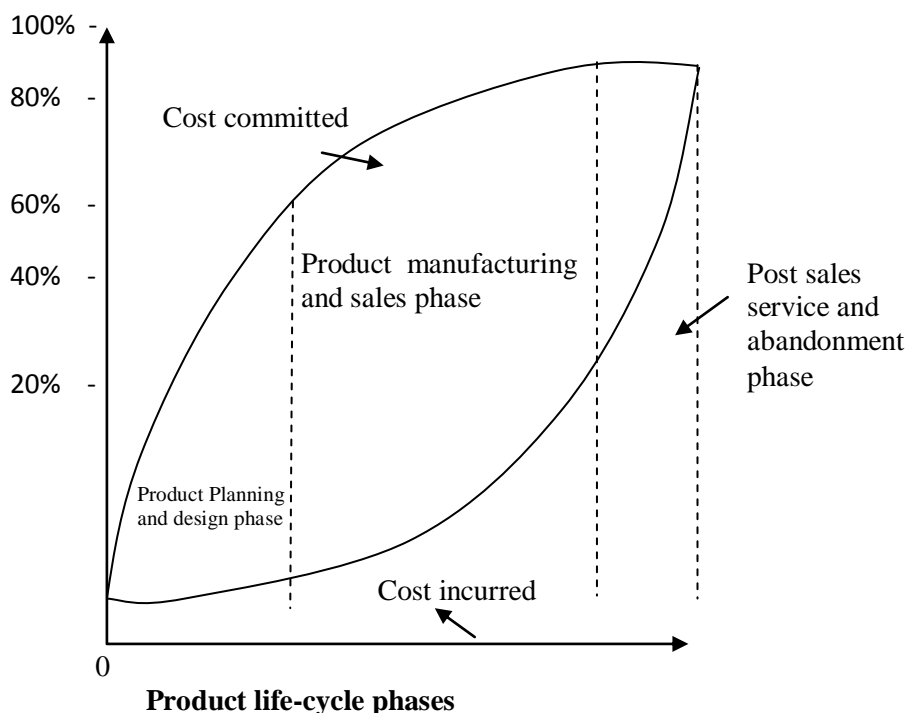


Figure 20.5 Product life-cycle phases: relationship between costs committed and costs incurred

Source: Drury C. (2004) Management and Cost accounting 6<sup>th</sup> edition. London: Book Power p 945.

**ILLUSTRATION 20 – 4**

Kogbodoku Nigeria Limited, with a 10% cost of capital, is considering the purchase of two fertilizer machines: Lexure machine and deluxe machine. Both can produce the same component at identical rates per working hour and the relevant data on the machines, are as follows:

	<u>Lexure machine</u>	<u>Deluxe machine</u>
(i) Capital cost	N380,000	N480,000
(ii) Operating cost per working hours		
Energy	N9	N15
Consumables	N18	N24
Variable overheads	N18	21
(iii) Maintenance costs		
Service intervals	36 p.a	30 p.a
Cost of services	N3,000	N2,400
Random breakdowns	9 p.a	9 p.a
Cost of breakdowns	N6,000	N9,000
(iv) Expected Availability (working hours per annum)	4,500	6,000
(v) Contribution from production per hour	N150	N150
(vi) Expected life	5 years	5 years
(vii) Net salvage value at the end of year 5	N30,000	N75,000

**Required:**

Determine the machine to be bought with reasons.

**SUGGESTED SOLUTION 20 – 4**

	<u>Lexure machine</u>	<u>Deluxe machine</u>
	N	N
Gross contribution	150	150
Less: operating costs	<u>45</u>	<u>60</u>
Contribution per hour	<u>105</u>	<u>90</u>
Hours available	4,500	6,000

	N	N
Total contribution per annum	472,500	540,000
Less: Maintenance cost:		
Service	(108,000)	(72,000)
Breakdowns	<u>(54,000)</u>	<u>(81,000)</u>
Net contribution per annum	<u>310,000</u>	<u>387,000</u>

<u>Lexure machine</u>				<u>Deluxe machine</u>			
Yr	Cash flow	DCF	PV	Yr	Cash flow	DCF	PV
	N		N		N		N
0	(300,000)	1,000	(3,000,000)	0	(480,000)	1,000	(480,000)
1-5	310,000		3.791 +	1-5	1,175,210	+	387,000 3.791 +
			1,467,117				
5	30,000		0.621 +	5	<u>18,630</u>		75,000 0.621 +
			<u>46,575</u>				
	NPV	+	<u>893,840</u>		NPV	+	
			<u>1,033,692</u>				

**Decision:** Deluxe machine would be preferred for the following reasons:

- i. Although having a greater capital cost, it is available for more hours per year for production.
- ii. It has lower servicing costs and greater resale value.
- iii. Over the whole life cycle, it is more cost effective.

### 3.15 KAIZEN COSTING

This is a costing method adopted whenever the issues of cost reduction and management are to be addressed by a company. It involves the enhancement of production activities by little increases in costs rather than substantial increases.

Basically, Kaizen costing is to minimize the cost of parts and goods at a pre-determined rate, whereby each factory is allocated target cost reduction rate which is used in relation to past year's actual costs to ascertain the target cost reduction.

Kaizen costing is workers' friendly because their understanding of the enhancement of production processes and customer welfare are condition for the reduction of costs.

Therefore, significant characteristic of Kaizen costing is that employees have the duty of enhancing processes and reduce costs.

### 3.16 BENCHMARKING

Benchmarking is defined as:

'The establishment, through data gathering, of targets and comparators, through whose use relative levels of performance (and particularly areas of underperformance) can be identified. By the adoption of identified best practices it is hoped that performance will improve'. (CIMA)

Therefore, benchmarking has to do with the comparison of a company with other companies, especially where they are leaders by making use of certain indicators that are financial and non-financial.

CIMA suggests that there are various types of benchmarking:

- (a) Internal benchmarking - a method of comparing one operating unit or function with another within the same industry;
- (b) Functional benchmarking, in which internal functions are compared with those of the best external practitioners of those functions, regardless of the industry they are in (also known as operational benchmarking or generic benchmarking):
- (c) Competitive benchmarking, in which information is gathered about direct competitors, through techniques such as reverse engineering; and
- (d) Strategic benchmarking - a type of competitive benchmarking aimed at strategic action and organizational change.

### **3.17 ENVIRONMENTAL COST MANAGEMENT**

Environmental cost management has evolved as a result of the need for companies to adopt different methods of assessing, summarizing and ascertaining environmental costs. All of these are important because environmental costs can be enormous for some industrial organisations; legal condition may involve substantial times for inability to conform to the rules and regulations in the past years; the public requires that organisations work towards being environmentally compliant especially if the issues of social responsibility and high volume of sales of goods are to be enhanced.

Epstein and Roy (1997) stated that 'companies cannot identify their total environmental costs, and do not recognize that they can be controlled and reduced'. Therefore, the required association between environmental costs and the respective activities, processes and products can be determined.

From the foregoing, environmental costs should be gathered by using different cost pools and effect given based on the classifications used to find out the products or processes that caused the costs using the Activity Based Costing principles. The issue here is to ensure that the pollution of the environment can be managed more easily by redesigning the process especially where the causes and the types of environmental costs are made available to the managers.

In order to address the issue of costs incurred as a result of the existence of bad environmental quality procedures, Hansen and Mendoga (1999) have advocated that

an 'environmental cost report should be produced at regular intervals, based on the concepts of a cost of quality report to indicate the total environmental costs to the organisation associated with the creation, detection, remedy and prevention of environmental degradation'. They have also classified the environmental costs into four as follows:

- (a) *Environmental prevention costs*- Being the costs of processes involved to avoid the wastes in production which could bring about pollution of the environment. The costs that may be involved included certification for meeting international and national standards, staff training, design and plan to minimise pollution, product recycling etc.
- (b) *Environmental evaluation costs*- Which are the costs associated with ensuring that companies production functions and goods comply with legal laws and local regulations and procedures. The associated costs include verification of goods and production functions to determine compliance with rules, environmental audits and carrying out of pollution tests.
- (c) *Environmental Internal failure costs*- Which are the costs of carrying out production functions that have been finalised but are yet to be released to the environment especially those that involve the elimination or reduction of wastes to the extent of meeting up with legal standards. Good examples include the costs of having scraps reworked and disposal of acidic items that are injurious to human health.
- (d) *Environmental external failure costs* - Which are cost of functions carried out after polluting the environment with wastes. Examples include the costs of reducing degradation of the soil, ensuring the reduction of the spread of oil-spillages, fumigation to reduce bacteria effects etc.

With the effective classification of the costs, the environmental cost report should be framed in such a manner that each class of costs is denoted as a function of turnover (or operation costs) in order to ensure that comparisons with past periods, other companies and subsidiaries of the same company are made possible.

Nonetheless' the Environmental Cost Management Report is more meaningful than the conventional accounting reporting system for various reasons which include:

- (a) It ensures the division of costs and ascertain that they are not of significance which calls for the minimisation of those costs elements.
- (b) It enhances the basis for determining the healthy position of the company.
- (c) The classification of costs as above helps in enhancing the outlook of the company towards the management of costs.
- (c) It ensures effective assessment of the environment and allows everyone involved to be more informed about the activities that are carried out.
- (d) It allows for progress to be evaluated in real terms because the focus is the same within the company.



The main drawback of the environmental cost reports is that they only show or relay the costs that were basically incurred by the company alone without giving effect to those created by the company, However, the society is made to bear the burden of reducing the life span of creatures within the ecosystems as a result of releasing solid wastes to the environment.

The above issues can be addressed by carrying out the environmental effects of goods and this can be done by adopting the life cycle costing technique earlier explained in this chapter and this can be nipped in the board at the planning and design phase where the great percentage of the environmental costs would have been incurred rather than at the production phase.

### **3.18 STRATEGIC MANAGEMENT ACCOUNTING**

#### **What is strategic management accounting?**

*Innes (1998) defines strategic management accounting as the provision of information to support the strategic decisions in organizations. Strategic decisions usually involve the longer-term, having a significant effect on the organization and, although they may have an internal element, they also have an external element'. This definition affirms that strategic management accounting can be used to provide information on mixing of products, initiation and abandonment issues. Cooper and Kaplan (1988) are also of the view that 'strategic accounting techniques are designed to support the overall competitive strategy of the organization principally-by the power of using information technology to develop more refined products and Service costs.*

Of relevance here is the fact that target costing, life cycle costing techniques and activity based costing are all related to strategic management accounting when current trends of management are involved.

*The provision and analysis of financial information on the firm 's product markets and competitors' costs and cost structures and the monitoring of the enterprises' strategies and those of its competitors in these markets over a number of periods*

The Chartered Institute of Management Accountants (CIMA) defines strategic management accounting as:

*A form of management accounting in which emphasis is placed on information which relates to factors external to the firm, as well as nonfinancial information and internally generated information (CIMA Official Terminology 2000: 50)*

The lack of consensus on what constitutes strategic management accounting motivated, Lord (1996) to review the literature and he identified several strands that have been used to characterize strategic management accounting. They include:

- (a) *The extension of traditional management accounting's internal focus to include external information about competitors.*
- (b) *The relationship between the strategic position chosen by a firm and the expected emphasis on management accounting (basis, accounting in relation to*

*strategic positioning).*

- (c) *Gaining competitive advantage by analysing ways to decrease costs and/or enhance the differentiation of a firm's products, through exploiting linkages in the value chain and optimizing cost driver.*

Based on the survey carried out by Guiding (2000), the following represent the twelve (12) areas of strategic management accounting practices:

- (a) Quality costing which entails the adoption of quality reports.
- (b) Life cycle costing which has to do with the forecasting and accumulation of costs over a product's life cycle with respect to the various stages involved and effects of profits earned on every stage concerned.
- (c) Target costing which focuses on the product and cost reduction strategies especially at the planning and design stage.
- (d) Monitoring of competitors strategic marketing position in the industry in terms of sales volume, share of the market, unit costs and sales turnover.
- (e) Pricing strategy as it relates to price elasticity, exposure, reaction to competitors price, growth in the market etc.
- (f) Evaluation of competitors result in order to determine the strength in terms of the competitors key resources which can be ascertained by having a look at the published financial statements.
- (g) Determination of competitors basis for costing such as evaluation of facilities, technological advancement, economies of scale through ex-staff, dealers, inspection, substantive buyers etc.
- (h) Strategic costing procedures evolved in order to ensure competitive advantages as a result of adopting strategic and selling information put in place by the management.
- (i) Value-chain costing which ensures that costs are directly related to function needed to design, buy, manufacture, sell, and make service and goods available at the right time, place and cost.
- (j) Brand value assessment which entails the valuation of brand power elements which includes; leadership; consistency; market trend; support; and guide related to past brand profits.
- (k) Brand value forecasting - whereby managerial efforts in relation to the direct utilization of resources to promote brand position is based on brand value for which management is seen to be responsible.
- (l) Attribute costing with emphasis on the relatedness of the various characteristics of relevance, timeliness, cost effectiveness etc. to the processes, products and services which are required to enhance cost reduction opportunities throughout the entire production functions.

In a nutshell, it was discovered that the three competitors' strategies (d, f and g above) and pricing strategy are rated as being easily adopted. Furthermore, it was also asserted that the term is not popular in organizations and practising accountants have not really valued it as a concept.

### 3.19 THE BALANCED SCORECARD

In the words of Drury (2004), *The need to integrate financial and nonfinancial measures of performance and identify key performance measures that link measurements to strategy led to the emergence of the balanced score card - an integrated set of performance measures derived from the company's strategy that gives top management a fast but comprehensive view of the organizational unit (that is, a division/strategic business unit).*

The balanced scorecard was devised by Kaplan and Norton (1992) and refined in later publications by Kaplan and Norton, (1993; 1996; and 2001).

Therefore, the following discussion is a summary of Kaplan and Norton's writings on this topic.

*The balanced scorecard philosophy assumes that an organisation's vision and strategy is best achieved when the organization is viewed from the following four perspectives:*

- (a) customer perspective (How do customers see us?)*
- (b) internal business process perspective (What must we excel at?)*
- (c) learning and growth perspective (Can we continue to improve and create value?)*
- (d) financial perspective (How do we look to shareholders?)*

The balanced scorecard is a strategic management technique for measuring and disseminating the attainment of the mission and strategy of a company. In order to give effect to the balanced score card, the main reasons for the basis should be put together so that they can be transformed into particular evaluation system whereby one or more reasons can be advanced with various evaluation bases associated with each reason. However, there is a need to reduce the number of basis in order to avoid excess information content.

The balanced scorecard could be measured from two angles, thus;

- (a) Lagging measures which are financial results based on past financial action detailing the financial effects on decisions as they occur which are usually after the decisions might have been made.
- (b) Leading measures are those that are related to future financial results which are non-financial in nature especially as they relate to process within an enterprise as well as the learning perception.

*Kaplan and Norton (1996) describe how innovative companies are using the measurement focus of the scorecard to accomplish the following critical management processes:*

- (a) clarifying and translating vision and strategy into specific strategic objectives and identifying the critical drivers of the strategic objectives;*
- (b) Communicating and linking strategic objectives and measures Ideally once all*

- the employees understand the high level objectives and measures, they should establish local objectives that support the business unit's global strategy;*
- (c) *Plan, set-targets and align strategic initiatives. Such targets should be over a 3-5 year period broken down on a yearly basis so that progression targets can be set for assessing the progress that is being made towards achieving the longer-term targets;*
  - (d) *Enhancing strategic feedback and learning so that managers can monitor and adjust the implementation of their strategy, and, if necessary make fundamental changes to the strategy itself.*

### **3.19.1 Advantages and Drawbacks of the Balanced Scorecard Technique**

The advantages of the balanced scorecard techniques are

- (a) It ensures that the various competitive objectives of a company which include reduction of lead time, enhancement of quality, promotion of team spirit, consumer consciousness etc are reflected in a single report such that the various perceptions of company results are reflected.
- (b) It is used to transform the firm's strategic objectives into understandable means of evaluation systems used to develop the main objectives for the perspective and ensuring that these objectives are turned to particular evaluation systems,
- (c) It assists managers to determine whether enhancement in one perspective is at the detriment of another one.
- (d) It enhances the ability to link performance measures with strategic business units through effective communication as well as formulation and implementation of corporate strategy.

The drawbacks include the cause and effect relationships which are assumed despite their being empirically or theoretically deficient and not clear in meaning. *The empirical studies that have been undertaken have failed to provide evidence on the underlying linkage between non-financial data and future financial performance (American Accounting Association Financial Accounting standards Committee, 2002).*

Another short coming is that the perspectives in which it is based may not be all that can be used to assess its impact especially where the staff perspective and public perspective are not recognised.

It should, nevertheless, be realised that perspectives must be limited, even though there is a need to meet various demands.

## **4.0 CONCLUSION**

Advanced Manufacturing Technology (AMT) is altering the way manufacturing takes place and the manner it is organised. It consists of Computer Aided Design and Manufacture, Flexible Manufacturing Systems and also included: Material Requirement Planning (MRP) and Just-In-Time (JIT) systems.

Of relevance here also are Total Quality Control (TQC); Activity Based Costing;

Target Costing; Life-Cycle or Tetrotechnology Costing; Kaizen Costing; Backflush Costing; Throughput Costing, Strategic Management Accounting and Balanced Scorecard techniques of managing processes, products and manufacturing efforts in the modern day era.

## **5.0 SUMMARY**

This unit has delved into modern way of treatment of account using the Advanced Manufacturing Technology (AMT) as an umbrella word used to capture automated production technology, computer assisted design and manufacturing systems (CAD/CAM), flexible manufacturing systems (FMS), robotics, total quality control (TQC), advances in production management including materials requirement and manufacturing resources planning systems (MRP), just-in-time (JIT) systems etc., which are considered to be the new developments in the area of management accounting due to technological advancement.

## **6.0 TUTOR MARKED ASSIGNMENT**

1. What is a Manufacturing Cycle Efficiency?
2. Explain the differences between lag measures and lead measures.
3. State two benefits attributed to the balanced scorecard approach.
4. Evaluate the various types of environmental costs.
5. A term used to describe a situation where all business functions are involved in a process of continuous quality improvement is known as\_\_\_\_\_
6. Distinguish between Target costing and Kaizen costing.
7. The examination of competitor's product in order to identify opportunities for product improvement and/or cost reduction is called\_\_\_\_\_
8. "A management accounting system which focuses on ways by which the maximum return per unit of bottleneck activity can be achieved" is known as\_\_\_\_\_
9. Define Advance Manufacturing Technology (AMT).

## **7.0 REFERENCES/FURTHER READINGS**

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