ADVANCED
MANAGEMENT ACCOUNTING

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PART A

CHAPTER ONE

NATURE OF MANAGEMENT ACCOUNTING

▶ CHAPTER OBJECTIVES

After this chapter the student will be able to:

- Get some background on management accounting.
- Explain the decision making process.

▶ INTRODUCTION

This chapter begins by distinguishing between accounting, management accounting, financial accounting and cost accounting.

It then touches on information; explains the attributes of good information and the importance of information.

It also explains the management process, decision making process and decision making environment.

▶ DEFINITION OF KEY TERMS

Accounting is the process of identifying measuring and communicating economic information to permit informed judgments and decisions by users of information.

Management Accounting is the process of identification, measurement accumulation, analysis, preparation, interpretation and communication of financial information used by management to plan, evaluate and control within an organization and to ensure appropriate use of and accountability for is resources.

Financial Accounting is the process of measuring, classifying, summarizing and reporting financial information used in making economic decisions. It's also concerned with the preparation of financial statements to be used by the firm's stakeholders.

Cost accounting is the process of cost ascertainment and cost control. It is a formal system of accounting by means of which cost of product and services are ascertained and controlled.

Information is anything that is communicated and is sometimes said to be processed data. It's data processed in such a way as to be of meaning to the person receiving it.

Management process involves planning, organizing, controlling, directing, communicating and motivating.

Decision making is the process of choosing among alternatives.

EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge of Value of information severally.

Students should therefore understand this topic.

INDUSTRY CONTEXT

Decision making process is applied by organizations in making decisions so as to arrive at the best alternative.

Decision making environment helps organizations to keep in mind changes that could affect decisions made in the organization such as risk and competition. This will enable the organization to make the right decision regardless of the circumstances.

1.1 FINANCIAL ACCOUNTING, MANAGEMENT ACCOUNTING AND COST ACCOUNTING

Accounting

Accounting is the process of identifying measuring and communicating economic information to permit informed judgments and decisions by users of information.

It is therefore concerned with providing information that will help decision makers make good decisions.

To understand accounting one must understand:

- The attributes of good information
- Process of measuring and communicating information
- The decision-making process
- Users of information
- The above points are briefly discussed below:

Users of information

The users of information can be divided into two:

- Internal users who are parties within the organization e.g. the management or the employees.
- External users who on the other hand, are parties outside the organisation e.g. the shareholder, creditors, government, customers, etc

From the users point of view accounting can be divided into two:

Management Accounting

What is Management Accounting?

It is the process of identification, measurement, accumulation, analysis, preparation, interpretation and communication of financial information used by management to plan, evaluate and control within an organization and to ensure appropriate use of and accountability for is resources.

Management Accounting also comprises the preparation of financial reports for non-management groups such as shareholders, creditors, regulatory agencies and tax authorities. (Robert E. Malcolm)

Of course this definition will be difficult to swallow and regurgitation of it in an exam will only prove that you had time to cram a paragraph. Have you gotten the underlying concept?

With relevance to a CIMA definition, the above is broken down to facilitate its understanding.

Management is concerned with identifying, presenting and interpretation of information used for:

- Formulating strategy
- Planning and controlling activities
- Decision making
- Optimizing use of resources
- Disclosure to shareholders and others external to the entity
- Disclosure to employees
- Safeguarding assets

Therefore for the above to work, management needs to:

- Formulate plans to meet objectives (Strategy planning)
- Formulate short term operation plans (Budgeting/profit planning)
- Acquire and use finance (financial management) and record transactions (Financial Accounting and Cost Accounting)
- Communicate financial and operating information
- Take corrective action to bring plans and results into line (Financial control)
- Reviewing and reporting on systems and operation (Internal audit)

Management Accounting is concerned with getting data (internal and external sources), analysing, processing, interpreting and communicating resulting information for use within the organization so that management can more effectively plan, make decision and control operations..

Providing information that is relevant for the intended purpose is a key aspect of the management. It's what he's there for. To do this he will, to get data,

- use appropriate techniques
- use appropriate techniques from statistics and operations research
- take into account human element in all activities
- be aware of economic logic in all transactions and activities

A clear distinction must be brought out, at this point, between management accounting and other forms of accounting.

Financial Accounting

It's the discipline concerned with the provision of information to external parties outside the organization. It's the process of measuring, classifying, summarizing and reporting financial information used in making economic decisions. It's also concerned with the preparation of financial statements to be used by the firm's stakeholders.

Key differences between Management Accounting (MA) and Financial Accounting (FA)

	MA	FA
Users	Internal	External
Nature	Future	Historical
Details	More detailed	Summarized
Legality	Not legal	Legal
Format	Not standard	Standard

It is important to define cost accounting at this point.

Cost accounting

It's the process of cost ascertainment and cost control. It is a formal system of accounting by means of which cost of product and services are ascertained and controlled.

1.2 ATTRIBUTES OF GOOD INFORMATION

FAST FORWARD: Information produced for decision making must be of good quality.

Information is anything that is communicated and is sometimes said to be processed data. It's data processed in such a way as to be of meaning to the person receiving it.

A lot of costs go into the production of information. Therefore if information is judged as being poor and ignored by management because of its unworthiness, we experience some waste of resources (time and money). To ensure this does not happen, the following should be considered.

i. Economic reality

The information should correctly reflect the underlying economic realities. This is the prime requirement and may mean adjusting conventionally prepared accounting information to show

more effectively the economic consequences.

ii. Accuracy of information

As stated in the introduction to management accountant, information should always be sufficiently accurate for its intended purpose. Accuracy will be determine e.g. by collection and processing technique. However, there's no such thing as absolute accuracy. This may mean that a realistic, speedily prepared estimate may be more useful than a more precise answer produced some time later.

Inaccuracy can occur as a result of systematic bias or error.

> ***Systematic bias -*** *Inaccuracy due to a feature of the system used for collection and processing data.*
>
> ***Collection bias -*** *it distorts by withholding some information. This could mean that the system had either been deliberately or accidentally designed in such a way to fail to collect relevant data.*
>
> ***Presentation bias -*** *when data is presented in such a way that it only presents one point of view.*
>
> ***Error -*** *usually occurs as a result of the inherent variability in the system used to record data. Other sources include incorrect methods of data collection and measurement, loss of data and failure to process some data.*

iii. Relevance

The information must be relevant for the person and purpose intended. Relevance is the attribute of data which amongst other things is meaningful. In designing the system, planners will define informational requirements and from this, relevant data can be identified.

iv. Timing

The information must be produced in time for it to be used effectively. The age of data is the time that has elapsed since the data was collected.

v. Understandability

The information must be capable of being understood by the recipient. To increase comprehension one can:

- avoid the use of jargon
- use charts and diagrams
- exception reporting and comparative figures

vi. Detail

The amount of detail should be that which is sufficient for the intended purpose. The amount of detail will depend on the recipients' level in the organization as explained earlier.

Note:

Controlling accuracy

- Source reliability

Data may be collected from sources internal and external. Internal sources can be verified e.g. comparison between sales data and finished goods stock records. However other sources e.g. employees' time sheet can't be easily verified because there's no cross references

- Data capture techniques

How data is introduced into the system really determines a lot. Therefore controls should be put in place to ensure integrity of the information being used in the organization.

All information is incomplete and to some extent inaccurate. Much management information is now produced by computer. This has many advantages e.g. speed, accuracy, statistical methods etc. However care should be taken to ensure that information produced is relevant for the purpose intended. Speediness and volume of information are no substitute for relevance.

1.3 ROLE OF THE MANAGEMENT ACCOUNTANT IN THE MANAGEMENT PROCESS

The management accountant has several key areas of work in an organization. They are fully involved the **management process.**

i. Planning

It is deciding what to do, and who, where, when, why and how to do it. (Robert Malcolm)

Here managers decide what goals to be accomplished, how they will be accomplished. It gives the manager some warning of crises that might occur in the future.

The management accountant's role in assisting in formulation of future plans is by providing information to e.g. decide what to sell, in what markets and at what prices.

In budgeting the management accountant provides historical data of past performance to be used as a benchmark.

ii. Control

This process involves a comparison of actual performance with the plan so that deviations from the plans can be identified and corrective action taken.

The management accountant here provides performance reports that compare actual performance with plans for each responsibility centre

Responsibility centre: A unit of the firm where an individual manager is held responsible for the unit's performance (Drury)

Management by exception is applied here where the management accountant draws to the attention of managers any significant deviations of actual performance from the plan.

iii. Organizing

It is the establishment of a framework within which the required activities are to be performed and the designation of who should perform these activities i.e. coming up with the different departments. Each with goals that is congruent to the overall goals of the organization.

iv. Motivation

This involves influencing the human behaviour so that participants can identify with the organizational goals and make decisions that are in harmony with these objectives. It involves, for example, setting goals that are challenging but attainable.

v. Communication

The communication process involves perceiving of information by the **sender**, **encoding** it in a form that is most suitable; **sending** it to a **recipient** who will **decode** it to aid in his understanding of the message. The next stage would be for him to give **feedback** to the sender containing his reaction to the message.

The management accountant aids the communication process by installing and maintaining an effective communication system e.g. **Management Accounting Information System** such as the budgetary system.

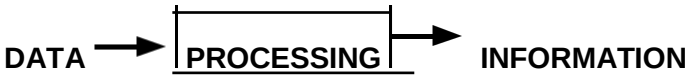
Information systems in management accounting

One major purpose of the management accountant is his use of various techniques, financial accounting, budgeting, statistical and operational research) to provide information to people within the organization to help them make better decisions. It is concerned with the provision and interpretation of the information required by management at all level. Before we go any further, we will go over some issues concerning information generally then move on further.

Data >>> In technical terms, is bits and pieces of non-random symbols which represent

quantities, events, actions and things. On their own, they will not make sense; this means that they are waiting to be processed in order to give it some meaning.

Information >>> It is data that has been processed.



This data in management accounting has been processed into information that will be processed into information that will be provided for the intended purpose such as planning or decision-making.

An organization maybe having different levels of management and just as in a manufacturing firm, information (product) from one level could become data (raw material) for another. This leads to further processing.

Levels of control

Anthony gave 3 levels of control in an organization.

Just as there are different levels of management control, so are there different information characteristics.

i. Strategic planning

"It is the process of deciding on objectives of the organization, on changes in these objectives, on resources to attain these objectives and on the policies that are to govern the acquisition use and disposal of these resources."

It is concerned with setting a course for the future of the organization, including how it will cope with threats and opportunities in its environment.

Information will have an external outlook i.e. it considers the industrial environment, economic and political climate.

Usually the top management will be involved in the use of this information. Information will in most cases have a future orientation. This level has an ad hoc control system and reports will be imprecise and speculative.

The outcomes of this information processing by this level of management will be targets and plans. Involvement of the management accountant at this level will be minimum unless in *strategic management accounting.*

ii. Management control

"The process by which managers ensure resources are obtained and used effectively and efficiently in the accomplishment of the organizations objectives." It is concerned with reaching targets set through strategic planning.

Effectiveness-ensuring goals are reached.

Efficiency- describes a quantity where more output is gotten from a given level of input.

Information may embrace the whole organization and may also involve specific responsibility centres.

Much of the information may be expressed in financial and volumes terms. This is where management accounting plays a big role. Examples of information include productivity measures, budgetary measures, labour statistics, capacity utilization etc.

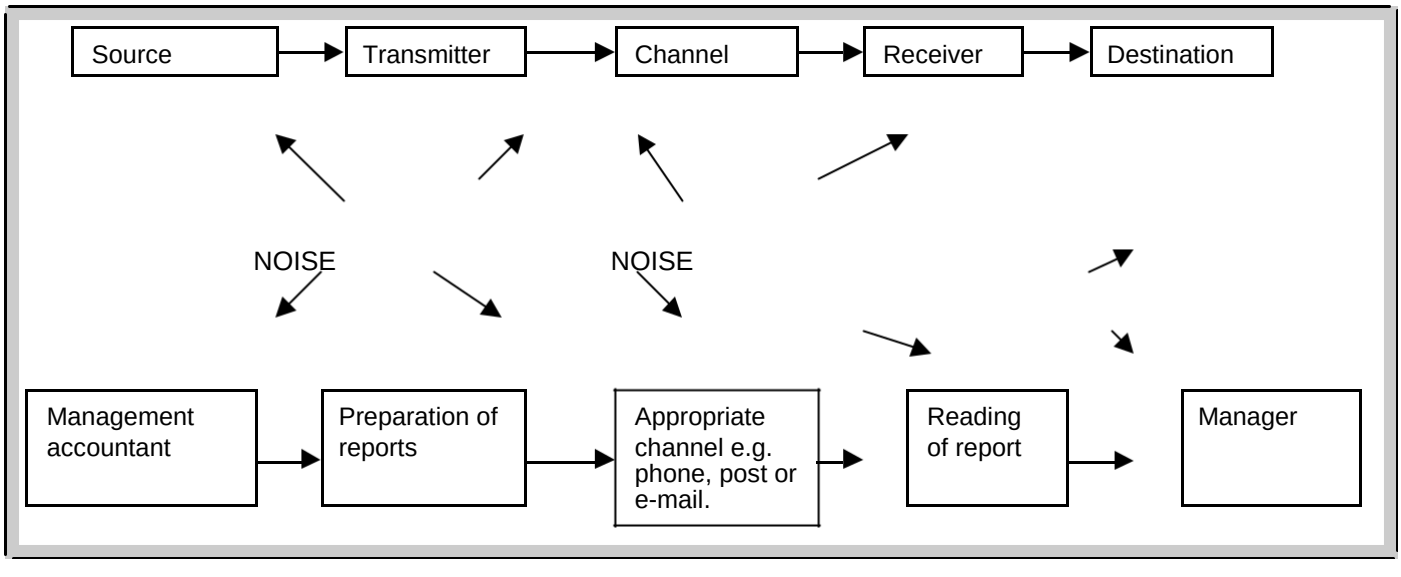
iii. Operational control

"It is the process of assuring that specific tasks are carried out effectively and efficiently." It is mainly concerned with the day to day implementation of the plans of the organization.

These are short-0term control information e.g. transaction data. The information is very detailed in nature. It is less likely to be summarized financially but rather to be in terms of quantity, rates and times.

Communication process

Having defined briefly what information is and how different levels of management use it, we will describe the communication process.



STUDY TEXT

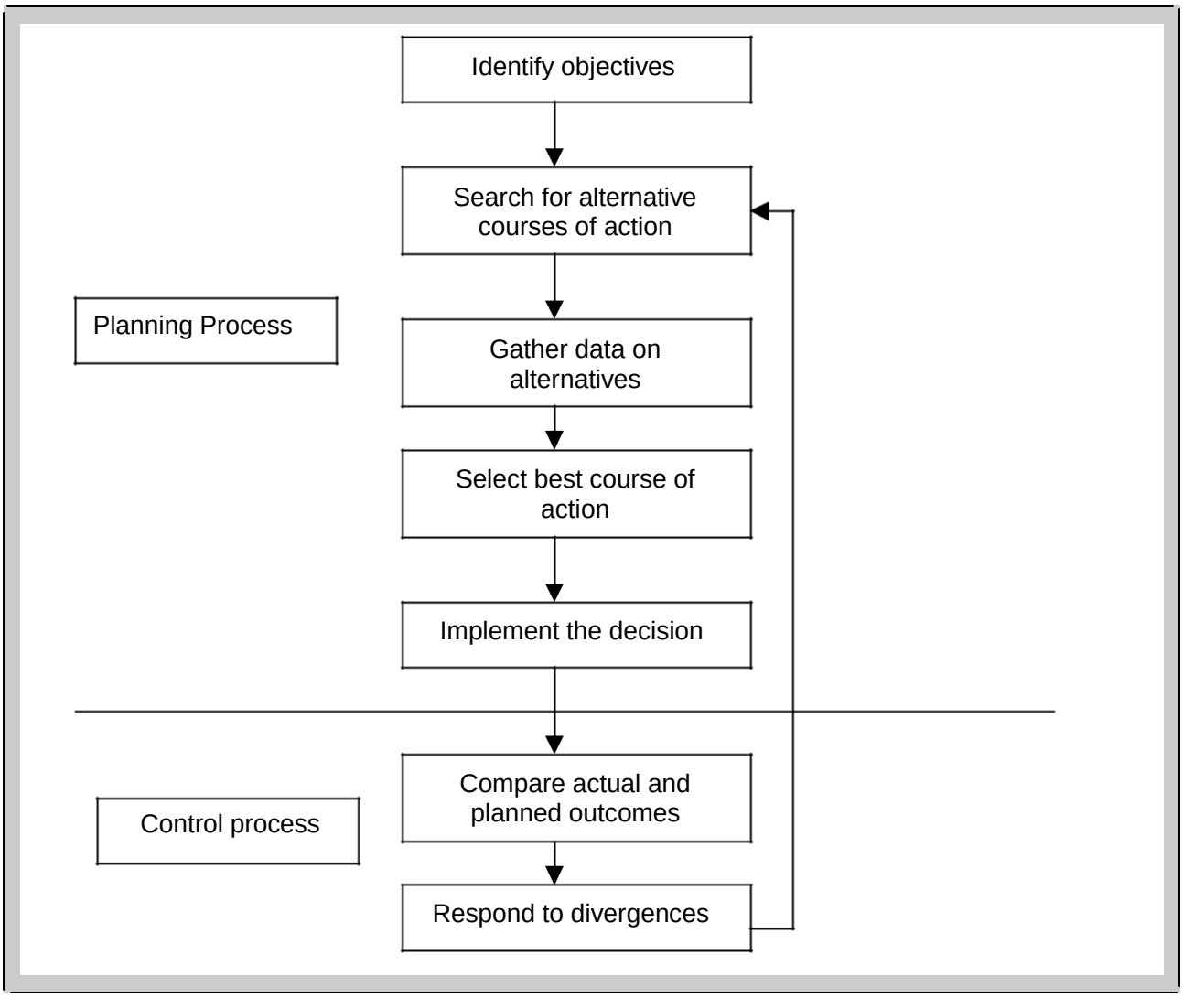
Noise

Term used in communication theory for any influences or factors which cause the message at the receiver being different to the message transmitted i.e. distortion e.g. wrong coding, poor presentation, bad form design, illegible handwriting and technical jargon. “Noise” should be kept at a minimum and it’s up to the management accountant to ensure all processes provide maximum effectiveness.

4.4 DECISION MAKING PROCESS

FAST FORWARD: Underlying all activities of management and therefore all activities of management accounting is decision making

Planning, control system, performance appraisal, resource allocation and all other facets of the managerial tasks, directly or indirectly, involve decision making. There is therefore the need to understand the subject.



As noted from the diagram on the previous page, the first five stages constitute the planning process. Whereas the final two represent the control process i.e. measuring and correcting actual performance to ensure alternatives that are chosen and the plans for implementing them are carried out.

We'll now look at each stage individually.

I. Identifying objectives

Objectives within a decision making context are likely to be to solve a problem although they maybe of planning nature to improve profitability.

II. Search for alternative courses of action

After objectives are identified, the task is now to determine the courses of action that may be used to meet those objectives.

If the management of a company concentrates entirely on its present product range and markets, and market shares and cash flows are allowed to decline, there is a danger that the company will be unable to generate sufficient cash flows to survive in the future. To maximize future cash flows, it is essential that management identifies potential opportunities and threats in its current environment and takes any developments which may occur in the future. In particular, the company should consider one or more of the following courses of action:

1. Developing new products for sale in existing markets;
2. Developing new products for new markets;
3. Developing new markets for existing products.

The search for alternative courses of action involves the acquisition of information concerning future opportunities and environments. It is the most difficult and important stage of the decision-making process. Ideally, firms should consider all alternative courses of action, but, firms will in practice consider only a few alternatives, with the search process being localized initially. If this type of routine search activity fails to produce satisfactory solutions, the search will become more widespread.

III. Gather Data about Alternatives

When potential areas of activity are identified, management should assess the potential growth rate of the activities, the ability of the company to establish adequate market shares, and the cash flows for each alternative activity for various states of nature. Because decision problems exist in an uncertain environment, it is necessary to consider certain factors that are outside the decision-maker's control, which may occur for each alternative course of action. These uncontrollable factors are called states of nature. Some examples of possible states of nature are economic boom, high inflation, recession, the strength of competition, and so on.

The course of action selected by a firm using the information presented above will commit its resources for a lengthy period of time, and the overall place of the firm will be affected within

its environment—that is, the products it makes, the markets it operates in and its ability to meet future changes. Such decisions dictate the firm's long-run possibilities and hence the type of decisions it can make in the future. These decisions are normally referred to as long-run possibilities and hence the type of decisions it can make in the future. They are also normally referred to as long-run or strategic decisions. Strategic decisions have a profound effect on the firm's future position, and it is therefore essential that adequate data is gathered about the firm's capabilities and the environment in which it operates. Because of their importance, strategic decisions should be the concern of top management.

Besides strategic or long-term decisions, management must also make decisions that do not commit the firm's resources for a lengthy period of time. Such decisions are known as short-term or operating decisions and are normally the concern of lower-level managers. Short-term decisions are based on the environment of today, the physical, human and financial resources presently available to the firm.

These are, to a considerable extent, determined by the quality of the firm's long-term decisions.

Examples of short-term decisions include the following:

1. What selling prices should be set for the firm's products?
2. How many units should be produced of each product?
3. What media shall we use for advertising the firm's product?

IV. Select best course of action.

Decision making involves choosing between competing alternatives and selecting one that best satisfies the objectives of the organization. Alternatives could be ranked based on a specific criteria e.g. net cash benefits and the one showing the greatest benefit would be selected.

V. Implementing

This may require management to place orders for plant or equipment or other assets or it may be simply a decision to work overtime or change the product mix. Alternatives should be implemented as part of the budgeting process.

VI. Comparing Actual and Planned Outcomes and Responding To Divergences from Plan

This may be described as a post implementation review or audit. Before results are compared, they must be collected using both quantitative and qualitative measures. These results are compared with original objectives and where necessary a further decision is made to modify the action being taken.

The link between business planning and business control can be seen at the final stage. The process by which actual results are systematically compared with those planned for is the core element in **business control.**

Changing Role of the Management Accountant

Over the years, there have been quantum changes in the industry whereby the environment and industrial conditions have become more volatile. An example has been the application if **IT** in almost all parts of the organization from manufacturing to communication and so forth. This coupled with the increasing and ever changing competitive threats from overseas. The role of the management accountant as the sole provider of information is threatened by information specialists such as system analysts and operational researchers.

To mitigate this, the management accountant is forced to become adaptable with a sufficient knowledge of a range of relevant disciplines so as to be able to provide right information at the right time. He must be prepared to keep up to date and master new concepts, principles and techniques. At all times he must be critical of existing system information and their continuing relevance in the future. The position of management accountants in the future will not be a comfortable one but will be challenging and worthwhile.

1.5 THE DECISION MAKING ENVIRONMENT

There are four main environments within which decisions can be made:

- Certainty
- Risk
- Fundamental uncertainty
- Competition

i. Certainty environment

In this environment complete information is available as to the states of nature will occur. The decision making process just involves picking the best alternative.

ii. Risk

Risk involves situations or events which may or may not occur but whose probability of occurrence can be predicted form past records. In this environment, the states of environment are not certain but probability distribution can be assigned.

iii. Fundamental uncertainty

Uncertain events are those whose outcome cannot be predicted with statistical confidence. In this environment the states of nature are neither known nor are their probability distribution. The decision making process depends on the risk attitude of the decision maker.

iv. Competition

In this environment, the decisions made by the firm are affected by decisions made by other firms with opposing interests.

1.6 DECISION MAKING UNDER RISK AND UNCERTAINTY

FAST FORWARD: Risk attitudes distinguish different decision makers.

The three main risk attitudes are:

Risk seeking

A risk seeker is a decision maker who is interested in the best possible outcome no matter how small the chance that they may occur. I.e. he takes high risks in anticipation of high probability. For such a decision maker, the marginal utility for wealth is positive and increasing.

Risk neutral

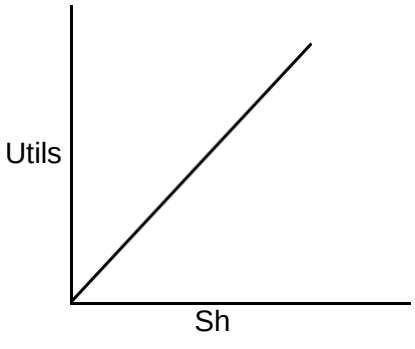
A decision maker is neutral if he is concerned with what will be the most likely outcome i.e. he is indifferent to risk. For such a decision maker the marginal utility of wealth is positive and constant.

Risk averse

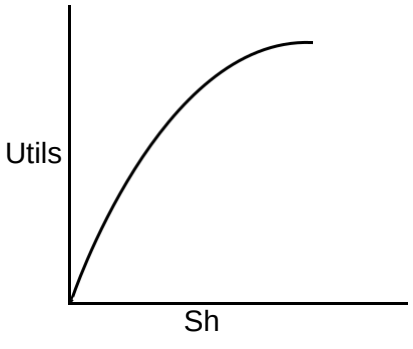
A decision maker is risk averse if he acts on the assumption that the worst possible outcome will occur and chooses the decision with the least risk possible. For such a decision maker, the marginal utility of wealth is positive but decreasing.

These risk attitudes can be illustrated by the diagrams below:

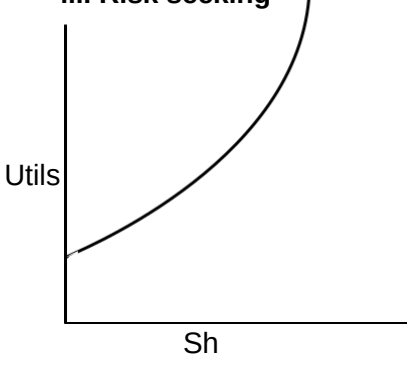
i. Risk neutral



ii. Risk averse



iii. Risk seeking



Measure of risk

Standard deviation (δ)

$$\delta) = \sqrt{\sum_{t=1}^{n} (MV_t - EMV)^2 P_t}$$

Where:

MV_t is the monetary value under condition t.
EMV is the expected monetary value
Pt is the probability of condition t occurring
n is the number of different conditions.

Coefficient of variation

It is a relative measure of risk and it is used to compare alternatives of different magnitudes based on their risk return consideration.

$$CV = \frac{(\delta)}{EMV}$$

$$EMV = \varepsilon\ MV_t\ P_t$$

Methods Of Decision Making Under Uncertainty

To discuss these methods we shall use an illustration

Assume that ABC ltd is trying to set the selling price for one of its products and three prices are under consideration. These are; Sh4, Sh4.30 and Sh4.40

Based on the information given in the table below, please advice the company on the best price to set.

Alternatives:

Conditions	Sh.4.00	Sh.4.30	Sh.4.40
Best possible	16,000	14,000	12,500
Most likely	14,000	12,500	12,000
Worst possible	10,000	8,000	6,000

Fixed costs: = Sh.20, 000

Variable cost per unit = Sh.2.00

STUDY TEXT

Solution

The first step is to prepare a payoff table as shown below:

Payoff matrix (profits in Sh.)

	Sh.4.00	Sh. 4.30	Sh. 4.40
Conditions			
Best possible	12000	12200	10000
Most likely	8000	8750	8800
Worst possible	0	(1600)	(5600)

Decision making criteria

i. Maxi-max decision rule

This decision rule looks at the best possible outcome and it chooses the maximum payoff for each alternative and then the maximum of this maximum.

	4.00	4.30	4.40
Best possible	12000	12200	10000
Most likely	8000	8750	8800
Worst possible	0	(1600)	(5600)
Maximum	**12000**	**12200**	**10000**

The decision is to set the price at sh4.30 since it maximizes the maximum payoff. This criterion appeals to risk takers or optimists who are ready to undertake huge losses if they occurred. Small and new companies should not use this method.

ii. Maxi-min decision rule

Under this criterion, the decision maker looks at the worst possible outcome of each decision alternative and then chooses the alternative that offers the least unattractive (worst) outcome i.e. he chooses the alternative that maximizes the minimum profit.

	4.00	4.30	4.40
Best possible	12000	12200	10000
Most likely	8000	8750	8800
Worst possible	0	(1600)	(5600)
Minimum	**0**	**(1600)**	**(5600)**

The decision is to set a price at sh4.00 since it maximizes the minimum payoff. This criterion appeals to risk averse decision makers since it is a criterion of extreme caution. It can be applied by those firms which cannot be able to absorb huge losses if they occurred.

iii. Laplace Criterion of Rationality

On the basis of this assumption, the expected monetary value for each alternative is calculated and the alternative with the highest monetary value is chosen.

	Probability	4.00	4.30	4.40
Best possible	1/3	12000	12200	10000
Most likely	1/3	8000	8750	8800
Worst possible	1/3	0	(1600)	(5600)
EMV		**6667**	**6450**	**4400**

Workings:

EMV for 4.00 = 1/3 (12000) + 1/3 (8000) + 1/3 (0) =

6667 Others are computed in the same way. **Decision:**

Set the price at sh4.00 since it maximizes the expected monetary value.

iv. Mini-max Regret Criterion

This method tends to minimize the maximum regret that would occur from choosing a particular strategy or alternative. The regret is the opportunity loss that occurs from taking one decision given that a certain contingency occurs.

For each state of nature:

Opportunity loss = maximum payoff – payoff under each alternative

	4.00	4.30	4.40
Best possible	200	0	2200
Most likely	800	50	0
Worst possible	0	1600	5600
Maximum regret	**800**	**1600**	**5600**

Decision:

Set the price of sh4.00 since it minimizes the maximum regret.

Methods of Decision Making Under Risk

In this environment, it is possible to attach probabilities to the various states of nature. The decision criteria would either be:

The expected monetary value or
The expected opportunity loss

The two criteria are similar since the choice that maximizes the expected monetary value also minimizes the Expected Opportunity Loss (EOL).

Illustration:

Assume in the above ABC ltd price decision that the probability of the best possible outcome is 0.2, most likely outcome is 0.6 and the worst possible outcome is 0.2.

You are required to advice the company on the best price to set.

	Probability	4.00	4.30	4.40
Best possible	0.2	12000	12200	10000
Most likely	0.6	8000	8750	8800
Worst possible	0.2	0	(1600)	(5600)
EMV		**7200**	**7370**	**6160**

Decision:

Set the price at sh4.30 since it maximizes the Expected Monetary Value (EMV)

	Probability	4.00	4.30	4.40
Best possible	0.2	200	0	2200
Most likely	0.6	800	50	0
Worst possible	0.2	0	1600	5600
EOL		**520**	**350**	**1560**

Decision:

Set the price at sh4.30 since it minimizes the EOL

Once the EMV has been calculated, the standard deviation and the coefficient of variation can also be computed as shown below:

SD Sh4.00 = $\sqrt{}$ {(12000 -7200)$_2$ 0.2 + (8000-7200)$_2$ 0.6 + (0-7200)$_2$ 0.2}

= 3919

The others are

SD Sh4.30 = 4679

SD Sh4.40 = 5898

Decision:

Set a price of sh4.00 because it minimizes the standard deviation. The assumption here is that the decision maker is risk averse.

CV= - SD

EMV

CV @ sh4.00 = 0.54

CV @ sh4.30 = 0.63

CV @ sh4.40 = 0.96

Decision:

Set the price at sh4.00 since it minimizes the CV (coefficient of variation)

1.7 MULTISTAGE DECISION MAKING UNDER RISK

Sequencing is concerned with the selection of an appropriate sequence or order of performing a series of jobs to be done on a finite number of machines or service facilities in some well defined technological order so as to optimize some measure of performance of the system, such as minimizing overall, total elapsed time etc. **Decision trees** are used in solving sequential problems where there's an element of uncertainty. We use expected values to find the best alternative.

A decision tree is a graphical representation of the decision process indicating decision alternatives, states of nature, associated probabilities and conditional payoffs for each combination of decision alternatives and states of nature. It shows all the possible outcomes for each choice as subsidiary branches on the tree.

A decision tree is beneficial for several reasons including:

It provides a pictorial representation of a sequential decision process.

It makes the expected value calculations easier because these calculations can be performed directly on the tree diagram.

The actions of more than one decision maker can be considered.

The steps involved in making the tree are:

- Define the problem or identify the objectives
- Identify the possible causes of action, (decision alternative)
- Identify the possible states of nature/conditions
- Estimate the probabilities of each state of nature
- Estimate the conditional payoff for each alternative and states of nature
- Draw the decision tree
- Calculate the Expected Monetary Value at each state of nature node using the roll back method

Illustration 1

A company making roof tiles has been considering the likely demand for the roof tiles over the next six years and thinks that the demand pattern will be as follows.

Situation	probability
High demand for 6 years	0.5
Low demand for 6 years	0.3
High demand for 3 years Followed by low demand for 3 years	0.2

There is no possibility of low demand followed by high demand. Enlargement of capacity is required and the following are the available options.

Option A - install fully automatic facilities immediately at a cost of sh5.4 million

Option B - install semi automatic facilities immediately at a cost of sh4 million

Option C - install the semi automatic facilities immediately as in B and upgrade to fully automatic at an additional cost of sh2 million in 3 years time provided demand has been high for 3 years

The returns expected for the various demand and capacity options are estimated to be:

Option	If high demand	If low demand
A	Sh1.6M p.a.	Sh0.6M p.a.
B	Sh0.9M p.a. for 3 years then Sh0.5M for 3 years	Sh0.8M p.a.
C	Sh0.9M p.a. for 3 years, Then sh1.1M for 3 years	Sh0.8M p.a. for 3 years then Sh0.3M p.a. for 3 years

What decisions should the firm take assuming that the objective is to maximize expected value?

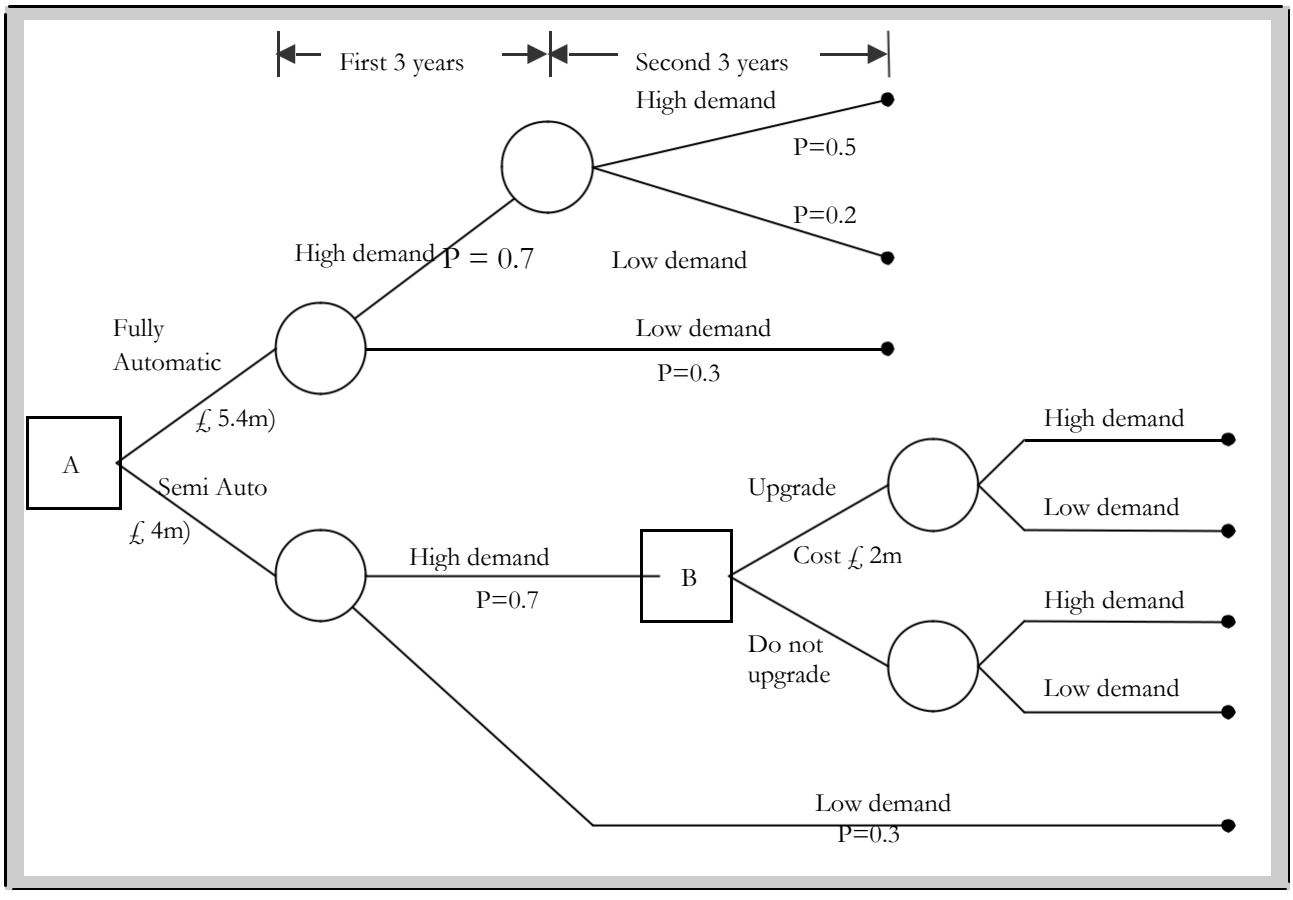
Solution:

We develop the decision tree in two stages:

a) Forward pass (starting from the left moving towards the right)
b) Backward pass (starting from the end and move back ward as illustrated in the solution)

Forward pass:

We draw the decision tree according to the information given in the example.

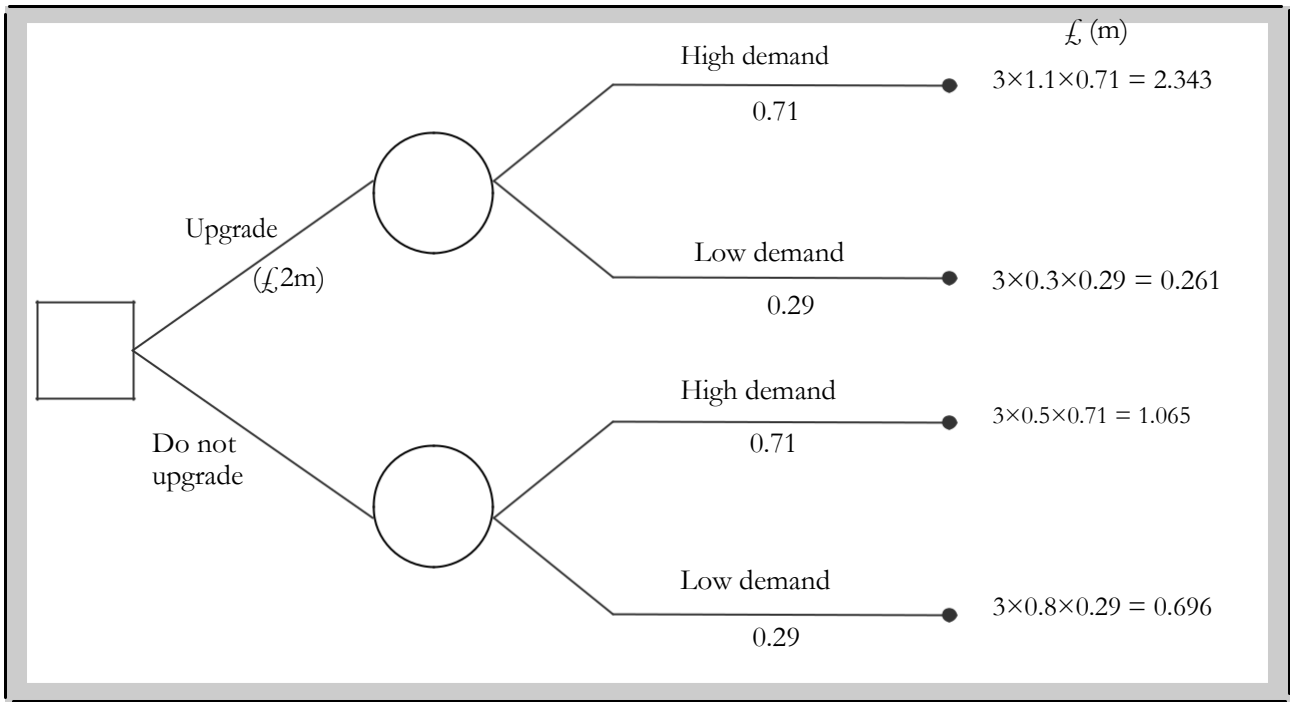


STUDY TEXT

Backward pass

Note that there are two decision points A and B; A at the start and B at the end of the first three years.

To evaluate expected values at A, it is necessary to evaluate expected values at B because the decision at B will affect the decision at A. That why this stage is known as the “backward pass”.



Therefore the expected value of upgrading is:

2.34 + 0.261 = sh0.604M

The expected value of not upgrading is:

1.065 + 0.696 = sh1.761m

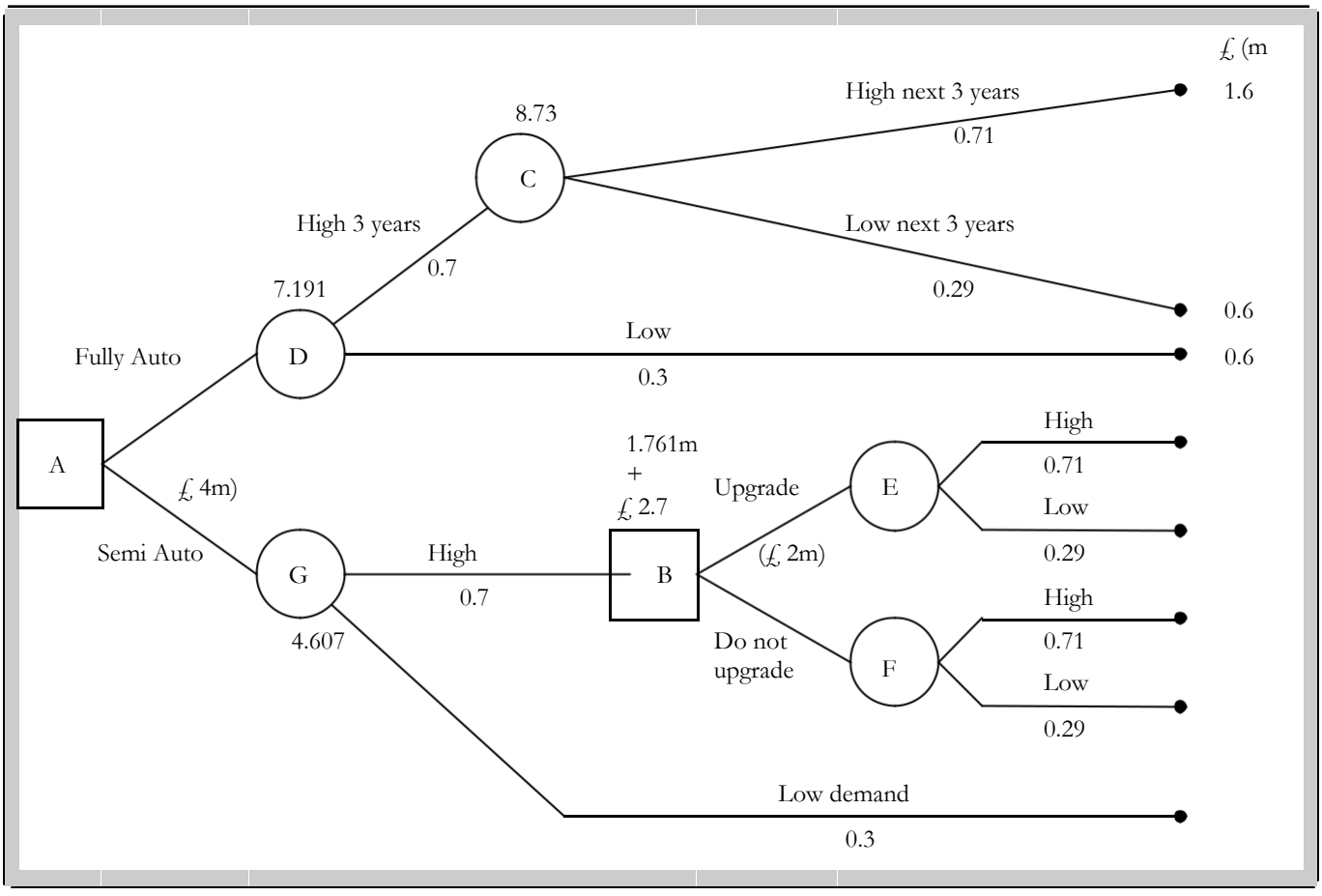
The probability of high during the 2nd 3 years using conditional probability:

0.5/ (0.5+0.2) ≈ 0.71

Decision at B – **do not upgrade**

The final diagram with exported values (overleaf);

STUDY TEXT



Outcome at C

Last 3 years 1.6 * 3 * 0.71 = 3.408

+0.6 * 3 * 0.29= 0.522

3.930

At C, outcome from 1st 3 years = 3*1.6

= 4.8

Total outcome at C = 3.93 + 4.8

= 8.73

Outcome at D

8.73 * 0.7 + 0.6 * 6 * 0.3 = 6.111 + 1.08

= Sh7.191m

STUDY TEXT

Outcome at B

For the last 3 years = sh1.761
Plus 0.9 * 3 sh2.7
Total Sh4.461

Outcome at G

4.461*0.7 + 0.8*0.3*6 = 3.167 + 1.44

= sh4.607

Outcome at A

From fully automatic = (7.191 – 5.4)
= Sh1.791m
From Semi-automatic = (4.607 – 4)
= Sh0.607m

Final decision:

Put in the fully automatic machinery at the outset.

(Please note that these answers have been worked using approximate values for probability)

5/7 = 0.71 and 3/7 = 0.29

Perfect information and imperfect information

The uncertainty about the future outcome from taking a decision can be reduced by obtaining more information first about what is likely to occur.

The information can be obtained from various sources e.g.

- Market surveys
- Conducting pilot tests
- Building a prototype model
- Use of consultants

Information can be categorized depending on how reliable it is likely to be for predicting what would happen in the future and for helping managers make better decisions.

Perfect information (PI) is information that can be guaranteed to predict the future with 100% accuracy, which, although it might be quite good, it could be wrong in its prediction of the future.

Both perfect and imperfect information is costly and its value must be determined

The value of perfect information is:

Value of perfect information (PI) = EMV with PI – EMV without PI

Illustration 2

Consider the ABC pricing decision from illustration 1. And assume that it is possible to obtain ideal information at a cost of sh500.

Required:

Advice the company on whether to acquire the perfect information

EMV with PI = 0.2(12200) + 0.6(8800) + 0.2(0)

Value of perfect information = 7720 – 7370 = sh350

The decision is not to acquire information since it costs more than it is worth.

Imperfect information (IPI)

Market research finding or information from pilot studiesare likely to be reasonably accurate but can still be wrong in prediction. They provide imperfect information.

The value **IPI = EMV with IPI – EMC without IPI**

Ethical Standards Of Management Accountants

Ethics in accounting is of utmost importance to accounting professionals and those who rely on their services. Certified Public Accountants (CPAs) and other accounting professionals know that people who use their services, especially decision makers using financial statements, expect them to be highly competent, reliable, and objective. Those who work in the field of accounting must not only be well qualified but must also possess a high degree of professional integrity. A professional's good reputation is one of his or her most important possessions.

The general ethical standards of society apply to people in professions such as medicine and accounting just as much as to anyone else. However, society places even higher expectations on professionals. People need to have confidence in the quality of the complex services provided by professionals. Because of these high expectations, professions have adopted codes of ethics, also known as codes of professional conduct. These ethical codes call for their members to maintain a level of self-discipline that goes beyond the requirements of laws and regulations.

Codes of Ethics

By joining their professional organizations, people who work in the field of accounting agree to uphold the high ethical standards of their profession. Each of the major professional associations for accountants has a code of ethics. The Code of Professional Conduct of the American Institute of CPAs (AICPA), the national professional association for CPAs, sets forth ethical principles and rules of conduct for its members.

The principles are positively stated and provide general guidelines that CPAs (or any professionals,

for that matter) should strive to follow.

The rules of conduct are much more explicit as to specific actions that should or should not be taken. The Institute of Management Accountants (IMA) Standards of Ethical Conduct applies to practitioners of management accounting and financial management, and the Institute of Internal Auditors (IIA) Code of Ethics applies to its members and to Certified Internal Auditors (CIAs).

Ethical Responsibilities

A distinguishing mark of professions such as medicine and accounting is acceptance of their responsibilities to the public.

The AICPA Code of Professional Conduct describes the accounting profession's public as consisting of "clients, credit grantors, governments, employers, investors, the business and financial community, and others who rely on the objectivity and integrity of CPAs to maintain the orderly functioning of commerce.

"Many, but not all, CPAs work in firms that provide accounting, auditing, and other services to the general public; these CPAs are said to be *in public practice*. Regardless of where CPAs work, the AICPA Code applies to their professional conduct, although there are some special provisions for those in public practice. Internal auditors, management accountants, and financial managers most commonly are employees of the organizations to which they provide these services; but, as professionals, they, too, must also be mindful of their obligations to the public.

The responsibilities placed on accounting professionals by the three ethics codes and the related professional standards have many similarities. All three require:

- Professional competence
- Confidentiality
- Integrity
- objectivity

Accounting professionals should only undertake tasks that they can complete with professional competence, and they must carry out their responsibilities with sufficient care and diligence, usually referred to as *due professional care* or *due care*.

The codes of ethics of the AICPA, IMA, and IIA all require that confidential information known to accounting professionals not be disclosed to outsiders.

The most significant exception to the confidentiality rules is that accounting professionals' work papers are subject to subpoena by a court; nothing analogous to attorney-client privilege exists.

Independence

Maintaining integrity and objectivity calls for avoiding both actual and apparent conflicts of interest. This notion is termed as *independence*.

Being independent in fact and in appearance means that one not only is unbiased, impartial, and objective but also is *perceived* to be that way by others.

While applicable to all accounting professionals, independence is especially important for CPAs in public practice.

The AICPA's rules pertaining to independence for CPAs who perform audits are detailed and technical. For instance, a CPA lacks independence and thus may not audit a company if he

or she (or the spouse or dependents) owns stocks in that company and/or has certain other financial or employment relationships with the client.

Ethics Enforcement

To a large extent, the accounting profession is self-regulated through various professional associations rather than being regulated by the government.

The AICPA, the IMA, and the IIA have internal means to enforce the codes of ethics.

Furthermore, the professional organizations for CPAs in each state, known as *state societies of CPAs*, have mechanisms for enforcing their codes of ethics, which are usually very similar to the AICPA Code.

Violations of ethical standards can lead to a person's being publicly expelled from the professional organization. Because of the extreme importance of a professional accountant's reputation, expulsion is a strong disciplinary measure.

However, ethical violations can lead to even more adverse consequences for CPAs because of state and federal laws.

The state government issues a CPA's license to practice, usually through an organization known as the *state board of accountancy*.

Since state laws governing the practice of accountancy typically include important parts of the AICPA Code, the Code thus gains legal enforceability.

Consequently, ethical violations can result in the state's revoking a CPA's license to practice on a temporary or even permanent basis.

Because a licensed CPA is also likely to belong to the AICPA and the state society of CPAs, investigations of ethics violations may be carried out jointly by the AICPA, the state society, and the state board of accountancy.

CPAs in public practice who audit the financial statements of public corporations are subject to federal securities laws and regulations, including the Securities Exchange Act of 1934.

The Securities and Exchange Commission (SEC), which administers these laws, has broad powers to regulate corporations that sell their stock to the public. One important SEC requirement is that these corporations' financial statements be audited by an independent CPA.

The SEC has the authority to establish and enforce auditing standards and procedures, including what constitute independence for a CPA.

The SEC has largely delegated standard setting to the private sector but retains oversight and enforcement responsibilities. In 1998 the SEC and the AICPA jointly announced the creation of the Independence Standards Board (ISB), a private-sector body whose mission is to improve auditor independence standards. In announcing the formation of the ISB, the SEC reaffirmed the crucial importance of the CPA's independence: "Maintaining the independence of auditors of financial statements is crucial to the credibility of financial reporting and, in turn, to the capital formation process" (SEC Release FRR-50,1998).

STATEMENT OF ETHICAL PROFESSIONAL PRACTICE

Members of IMA shall behave ethically. A commitment to ethical professional practice includes overarching principles that express our values, and standards that guide our conduct.

PRINCIPLES

IMA's overarching ethical principles include: Honesty, Fairness, Objectivity, and Responsibility. Members shall act in accordance with these principles and shall encourage others within their organizations to adhere to them.

STANDARDS

A member's failure to comply with the following standards may result in disciplinary action.

I. COMPETENCE

Each member has a responsibility to:

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

II. CONFIDENTIALITY

Each member has a responsibility to:

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

III. INTEGRITY
Each member has a responsibility to:

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

IV. CREDIBILITY
Each member has a responsibility to:

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

RESOLUTION OF ETHICAL CONFLICT

In applying the Standards of Ethical Professional Practice, you may encounter problems identifying unethical behavior or resolving an ethical conflict. When faced with ethical issues, you should follow your organization's established policies on the resolution of such conflict. If these policies do not resolve the ethical conflict, you should consider the following courses of action:

1. Discuss the issue with your immediate supervisor except when it appears that the supervisor is involved. In that case, present the issue to the next level. If you cannot achieve a satisfactory resolution, submit the issue to the next management level. If your immediate superior is the chief executive officer or equivalent, the acceptable reviewing authority may be a group such as the audit committee, executive committee, board of directors, board of trustees, or owners. Contact with levels above the immediate superior should be initiated only with your superior's knowledge, assuming he or she is not involved. Communication of such problems to authorities or individuals not employed or engaged by the organization is not considered appropriate, unless you believe there is a clear violation of the law.
2. Clarify relevant ethical issues by initiating a confidential discussion with an IMA Ethics Counselor or other impartial advisor to obtain a better understanding of possible courses of action.
3. Consult your own attorney as to legal obligations and rights concerning the ethical conflict.

CHAPTER SUMMARY

Accounting is the process of identifying measuring and communicating economic information to permit informed judgments and decisions by users of information.

Management Accounting is the process of identification, measurement accumulation, analysis, preparation, interpretation and communication of financial information used b management to plan, evaluate and control within an organization and to ensure appropriate use of and accountability for is resources.

Financial Accounting is the discipline concerned with the provision of information to external parties outside the organization. It's the process of measuring, classifying, summarizing and reporting financial information used in making economic decisions. It's also concerned with the preparation of financial statements to be used by the firm's stakeholders.

Cost accounting is the process of cost ascertainment and cost control. It is a formal system of accounting by means of which cost of product and services are ascertained and controlled.

Information is anything that is communicated and is sometimes said to be processed data. It's data processed in such a way as to be of meaning to the person receiving it.

The **management process** involves planning, organizing, controlling, directing, communicating and motivating.

Decision making making" is the process of choosing among alternatives.

Decision Making Environment: There are four main environments within which decisions can be made. These are Certainty, Risk, Fundamental uncertainty, Competition and Certainty environment.

There are three main **risk attitudes** that distinguish different decision makers. These are risk seeking, risk neutral and risk averse.

Coefficient of variation: It is a relative measure of risk and it is used to compare alternatives of different magnitudes based on their risk return consideration.

A **decision tree** is a graphical presentation of the decision process indicating decision alternatives, states of nature, associated probabilities and conditional payoffs for each combination of decision alternatives and states of nature. It shows all the possible outcomes for each choice as subsidiary branches on the tree.

CHAPTER QUIZ

1. What is information?
2. What are the attributes of good information?
3. What is the role of the management accountant in the management process?
4. What are the steps followed in a decision making process?
5. State the four main environments within which decisions can be made.

ANSWERS TO QUIZ QUESTIONS

1. Information is anything that is communicated and is sometimes said to be processed data.

2. The attributes of good information are:

   - **Economic reality**
     The information should correctly reflect the underlying economic realities. This is the prime requirement and may mean adjusting conventionally prepared accounting information to show more effectively the economic consequences.

   - **Accuracy of information**
     As stated in the introduction to management accountant, information should always be sufficiently accurate for its intended purpose. Accuracy will be determined e.g. by collection and processing technique. However, there's no such thing as absolute accuracy. This may mean that a realistic, speedily prepared estimate may be more useful than a more precise answer produced some time later.

Inaccuracy can occur as a result of systematic bias or error

Systematic bias: Inaccuracy due to a feature of the system used for collection and processing data.

Collection bias: it distorts by withholding some information. This could mean hat the system had either been deliberately or accidentally being designed in such a way to fail to collect relevant data

Presentation bias: when data is presented in such a way that it only presents one point of view.

Error: usually occurs as a result of the inherent variability in the system used to record data. Other sources include incorrect methods of data collection and measurement, loss of data and failure to process some data.

- **Relevance**
  The information must be relevant for the person and purpose intended. Relevance is the attribute of data which amongst other things is meaningful. In designing the system, planners will define informational requirements and from this relevant data can be identified.

- **Timing**
  The information must be produced in time for it to be used effectively. The age of data is the time that has elapsed since the data was collected.

- **Understandability**

  The information must be capable of being understood by the recipient. To increase comprehension one can
  - avoid the use of jargon
  - use charts and diagrams
  - exception reporting and comparative figures

- **Detail**

  The amount of detail should be that which is sufficient for the intended purpose. The amount of detail will depend on the recipients' level in the organization as explained earlier.

3. The management accountant has several key areas of work in an organization. They are fully involved the **management process.**

   - Planning

     It is deciding what to do, and who, where, when, why and how to do it. (Robert Malcolm)

   - Control

     This process involves a comparison of actual performance with the plan so that deviations from the plans can be identified and corrective action taken.

   - Organizing

     It is the establishment of a framework within which the required activities are to be performed and the designation of who should perform these activities i.e. coming up with the different departments. Each with goals that is congruent to the overall goals of the organization.

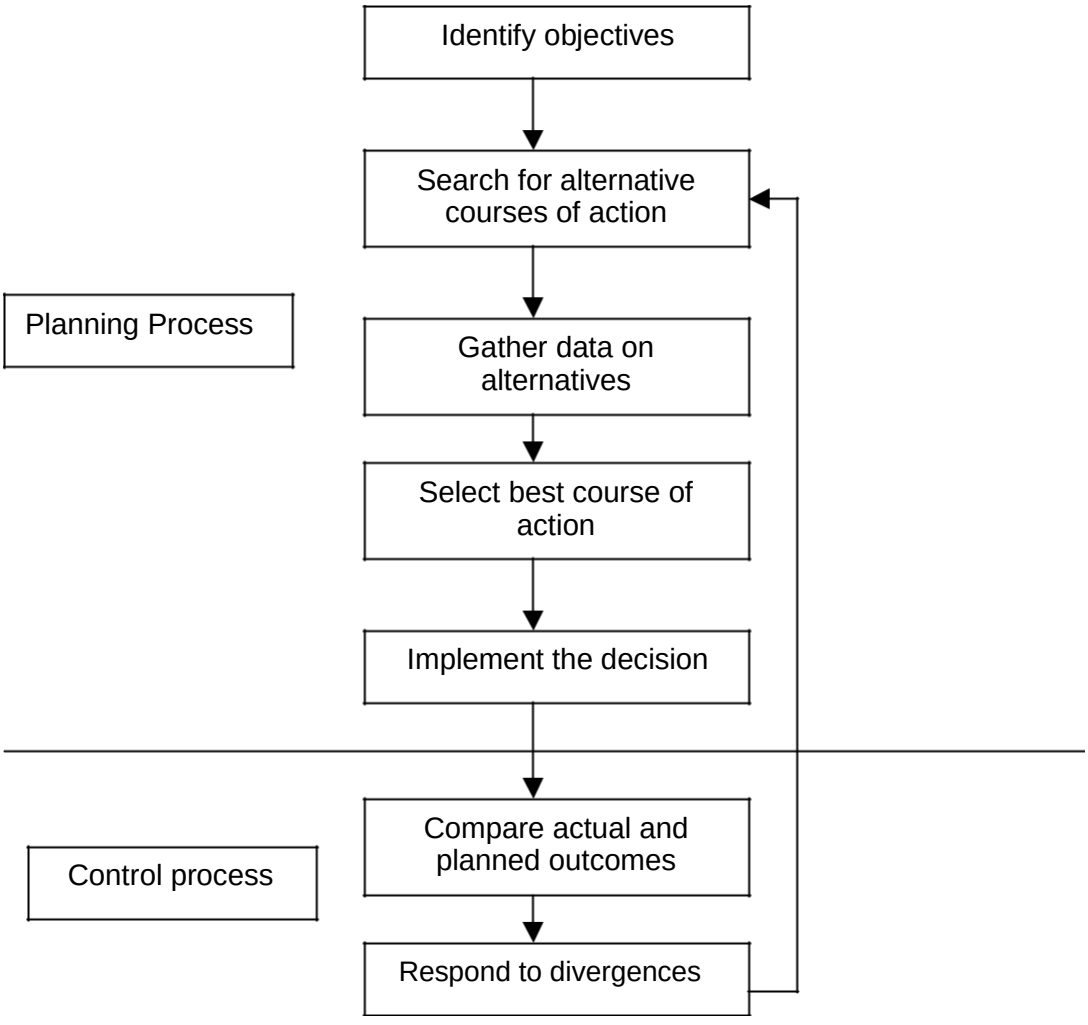
   - Motivation

     This involves the influencing the human behavior so that participants can identify with the organizational goals and make decisions that is in harmony with these objectives. It involves, for example, setting goals that are challenging but attainable.

   - Communication

     The communication process involves the perceiving of information by the **sender**, **encoding** it in a form that is most suitable; **send** it to a **recipient** who will **decode** it to aid in his understanding of the message. The next stage would be for him to give his **feedback** to the sender containing his reaction to the message.

4. The steps followed in the decision making process are illustrated overleaf:



5. The four main environments within which decisions can be made are:
   - Certainty
   - Risk
   - Fundamental uncertainty
   - Competition

PAST PAPER ANALYSIS

Value of information in decision making has been tested in the following examinations:

06/ '03
05/ '02
06/ '01
07/ '00


EXAM QUESTIONS

QUESTION ONE

The Oil Kenya Company currently sells three grades of petrol; regular, premium and regular extra which is a mixture of regular and premium. Regular extra is advertised as being "at least 50% premium". Although any mixture containing 50% or more premium fuel could be sold as regular extra; it is less costly to use exactly 50%. The percentage of premium fuel in the mixture is determined by one small valve in the blending machine. If the valve is properly adjusted, the machine provides a mixture with 50% premium and 50% regular. Assume that if the bulb is out of adjustment the machine provides a mixture that is 60% premium and 40% regular. Once the machine is started it must continue until 100000 liters of 'regular extra' have been mixed.

The following data is available:

	Sh.
Cost per liter – premium	3.20
Cost per liter – regular	3.00
Cost of checking valve	800.00
Cost of adjusting the valve	400.00

Subjective measures of the probabilities of the valve's condition are estimated to be:

Event	**probability**
Valve in adjustment	0.7
Value out of adjustment	0.3

Required

a. The expected cost of checking the valve and adjusting it if necessary (5mks)
b. The conditional cost of not checking the valve when it is out of adjustment. (5mks)
c. Using the criteria of minimum expected cost, calculate the probability at which there will be need to check if the valve is out of adjustment. Comment on the results. (5mks)
d. Comment on the results obtained in (a) and (b) above. (5mks)

(20mks)

QUESTION TWO

(a) Draw a diagram showing the logic of Bayesian statistics. (5 marks)
(b) Discuss the importance of Bayesian statistics in making business decisions. (3 marks)
(c) Agricultural Ltd. has two inter-related industries in the western region; airy and vegetable farming. The final demand for the outputs of dairy and vegetable farming are Sh.4,950 and Sh.8, 250 respectively.

Out of one shilling produced by airy farming, Sh. iis for its own use and Sh.1/3 Is used by vegetable farming. On the other hand vegetable sector uses Sh. While Sh.1/2 is used by the dairy sector from one shilling it produces.

Required:

(i) Determine for Agricultural Ltd. the output for each of the two industries or sectors. (6 marks)

(ii) Interpret the final allocation. (6 marks)

(Total: 20 marks)

CPA JUNE 1997

QUESTION THREE

The financial director of Spinney Electronics is considering the national launch of a new washing machine. The potential sales of the product during its lifetime are classified as being either high, medium or low and the net present value of the machine sales under each of these three conditions is estimated to be sh50 million, sh10million and sh20 million respectively. The marketing director estimates that there is a 0.4 probability that sales will be high, 0.25 probability that they will be medium and a 0.35 probability that they will be low.

Required:

a) Assuming the company's objective is to maximize expected NPV, determine whether or not the new product should be launched. (4 marks)

b) Explain the meaning of 'expected value of perfect information'. Find the expected value of perfect information for this situation. (5 marks)

c) The financial director also has an alternative solution. Instead of proceeding directly with a full national launch the company could test the market for the washing machine in their Midlands sales region. This would delay the national launch, and this delay, together with other outlays associated with testing the market, would lead to costs having a net present value of sh0.25 million. The test marketing in the Midlands sales region would yield information indicating whether the national launch is likely to be successful or unsuccessful. The following table shows the reliability of each of the possible indications.

		Actual national sales		
	Probability	High	Medium	Low
Test marketing indication	Successful	0.6	0.6	0.15	0.25
	Unsuccessful launch	0.4	0.1	0.4	0.5

For example

If the market indicates a successful launch, then the probability of low sales will be 0.25. Also prior to the test market it is thought that the test market has a probability of 0.6 of indicating a successful launch and of 0.4 for an unsuccessful launch.

i. Represent this information in a decision tree and calculate the value of this imperfect information. (7 marks)

ii. Give advice to the financial director as to whether or not the company should test the market in their Midlands region. In your advice, explain why this method of analysis should not be relied upon entirely when making appropriate decision. (4 marks)

(20mks)

CASE STUDY

Combination of Time Series, Decision Tree and Clustering: A Case Study in Aerology Event Prediction

Predictive systems use historical and other available data to predict an event. In this paper we propose a general framework to predict the Aerology events with time series streams and events stream using combination of K-means clustering algorithm and Decision Tree C5 algorithm. Firstly, we find the closest time series record for any events; therefore, we have gathered different parameters value when an event is occurring. Using K-means we add a field to data set which determines the cluster of each record after that by using C5 algorithm we predict events. C5 Decision Tree Algorithm is one of the well-known Decision Tree Algorithms. This framework and time series model can predict future events efficiently. We gathered 1961 until 2005 data of aerology organization for Tehran Mehrabad Station. This data contains some fields such as wet bulb, relative humidity, amount of cloud, wind speed and etc. This data set includes 17 types of events. Time series models can predict next time series parameters value and by using this Framework the closest event can be predicted. The C5 method is able to predict Events with Correct 74.11 percent and Wrong 25.89 percent. But with the aims of K-means clustering algorithm the prediction increase to 85 percent and wrong to 15 percent. 90 percent of data was used for training set and 10 percent for test set. We use 10-fold cross validation to evaluate our prediction rate. This framework is the first estimation in the area of event prediction for a huge data set of aerology and can be extended in many different data sets in any other environments.

Source: www.google.co.ke- *case studies on decision trees*

CHAPTER TWO

STUDY TEXT

COST ESTIMATION AND FORECASTING

CHAPTER TWO

COST ESTIMATION AND FORECASTING

▶ CHAPTER OBJECTIVES

After this topic, the student will be able to:

- know and explain the structure of costs
- determine cost of a product using various methods
- know how costs behave in relation mostly to the level of business activity

▶ INTRODUCTION

As we may have noticed in chapter one, the management accountant is much involved in the organizations management process. Let us take one process; planning. In this chapter, we will examine in some detail the behavior of costs in considering alternative plans. Knowledge of the patterns of cost behavior and ways that future costs and revenues can be predicted is a fundamental requirement for the management accountant in the supply of information.

Process of cost ascertainment is directed towards the establishment of what is actually the cost to produce an article, run a department or complete a job.

The costs involved are called past costs. It is important to know them but the future orientation of management accounting brings out the contrast that exists between it and costing.

Therefore in management accounting, future and revenues are what are relevant; past costs come in (relevant) if they provide a guide to the future.

Therefore, based on this, before a management accountant can fully adopt information from the cost accountant, the assumptions and conventions are critically examined forehand. Therefore adjustments are made for it to be used for management accounting purposes.

▶ DEFINITION OF KEY TERMS

Cost unit is a unit of product or service in relation to which costs are ascertained.

Direct Costs are costs that can be directly identified with a job, a product, or service.

Prime costs are the total of all direct costs.

Indirect Costs include material, labor, expense that cannot be directly identified with a product.

Overheads are the total of indirect costs.

Cost centre is a production or service location, activity or item of equipment for which costs are accumulated.

Cost allocation is the assigning of a whole item of cost, or revenue, to a single cost unit, cost centre, account or time period.

Cost apportionment is the spreading of revenues or costs over two or more cost units, cost centers, accounts or time periods. This is done on a basis that is deemed to reflect the benefits

received.

Fixed costs are costs that remain constant, in total, regardless of changes in the level of activity.

Variable costs are costs that vary, in total, in direct proportion to changes in the level of activity.

High-low method is a method of separating a mixed cost into its fixed and variable elements by analyzing the change in activity and cost between the high and low points of a group of observed data.

Multiple regression analysis is an analytical method required in those situations where more than one causative factor is involved in the behavior of the variable element of a mixed cost

Regression line is a line fitted to an array of points.

Learning curve theory is also referred to as improvement curve theory. It is based on the proposition that as workers gain experience in a task, they need less time to complete the job and productivity increases.

▶ EXAM CONTEXT

In past examinations, the examiner has tested students' knowledge on:

- Activity Based Costing
- Regression Analysis
- High low method

Students should therefore understand this topic.

▶ INDUSTRY CONTEXT

The process of cost ascertainment assists organisations to establish the actual cost to produce an article, run a department or complete a job.

This is important to organizations since having the correct cost figures will mean that revenue computed will be accurate.

Cost allocation and cost apportionment enable organizations to compute department expenses and revenue.

Cost classification enables organizations to make cost predictions. They classify costs as fixed or variable.

Cost forecasting is used by organizations to determine future costs and to plan for them.

Cost estimating relationship is used by organizations to estimate a particular cost or price by using an established relationship with an independent variable or cost driver.

2.1 DIRECT COSTS AND INDIRECT COSTS

Cost unit: Unit of product or service in relation to which costs are ascertained. Unit cost is what is most relevant for activities of the organization.

Units of production-tables, chairs, DVDs.

Units of service-hours, guest nights, passenger miles.

In most organizations, the primary classification of costs to be used would be **direct** or **indirect costs.**

Direct Costs

These are those that can be directly identified with a job, a product, or service. E.g. direct material, direct labor, direct expense

The total of all direct costs is called **prime costs.**

D.M+D.L+D.E=P.C

Indirect Costs

These include material, labor, expense that cannot be directly identified with a product. The total of indirect costs forms the **overheads.** Different organizations classify overheads differently. E.g. in a typical manufacturing firm, classifications into production overheads, administration overheads etc will be common.

Therefore;

Direct costs + Indirect costs = Total cost

2.2 ESTABLISHING OVERHEADS

Overheads are more complex to come up with than direct costs. Before embarking on the different methods, some terminologies have to be explained.

- **Cost centre:** Production or service location, activity or item of equipment for which costs are accumulated.
- **Cost allocation:** Assigning a whole item of cost, or revenue, to a single cost unit, cost centre, account or time period.
- **Cost apportionment:** Spreading revenues or costs over two or more cost units, cost centers, accounts or time periods. This is done on a basis that is deemed to reflect the benefits received.

COST	BASIS
1. Rent, rates, heating, lighting, building depreciation.	Floor area
2. Heating, lighting, building depreciation	Volume or space occupied
3. Canteen, welfare, personnel, general administration, industrial relations, safety	Number of employees
4. Store keeping	Stores requisitions

Note: Apportionment is just but a convention and, as such, its accuracy cannot be tested. Data based on apportionment can give misleading results. This is on point where the management accountant initially examines this and makes appropriate adjustments to data to make it useful for decision making purposes.

From earlier studies you have learnt what overhead absorption is hence we will not delve into much detail but only give an overview of what absorption and marginal costing are, their advantages and disadvantages based on their dissimilarities.

2.3 ABSORPTION COSTING

Its objective is to include the total cost of a product and the appropriate share of the organization's total overheads. Appropriate share means an amount which reflects the amount of time and effort that has gone into producing a unit or completing a job. Since total cost is made up of a variable and a fixed component (as will be seen in chapter 3) total absorption will have implications on stock valuations and performance management and is seriously criticized by some accountants.

Illustration

Suppose company X makes two products A and B. A takes 2 labor hours each to make and B takes 5 labor hours. What is the overhead cost per unit for A and B respectively if overheads are absorbed on the basis of labor hours?

Solution:

Step 1- Estimate overheads for the period.

X estimates it to be $50000

Step 2- Estimate activity level for the period

X estimates a total of 100000 direct labor hours will be worked

Step 3- Divide the estimated overhead by budgeted activity level.

Absorption rate = $\frac{\$50000}{100000}$

= $0.50 per direct labor hours

Step 4- Absorb overhead into the cost unit by applying absorption rate.

	A	B
Labor hours/unit	2	5
A.R	0.5	0.5
Overhead absorbed/unit	1	2.5

Note: The activity level of 100000 hours is the basis over which the overheads will be absorbed. Different bases will used as shown in the table illustration previously.

2.4 MARGINAL COSTING

FAST FORWARD: Marginal costing distinguishes between fixed costs and variable costs.

It excludes fixed costs from the absorption process and charges them in total against the period's result.

Definition; An accounting system where variable costs are charged to cost units and fixed costs of the period are written off in full against the aggregate contribution. Its special value is in recognizing cost behavior and hence assists in decision making.

Marginal cost = Variable cost = D.L + D.M + Variable

overheads Contribution = Sales – Marginal cost

- **Main uses**
  i. Provides basis in producing information to management for planning and decision making. It is particularly appropriate for short-run decisions involving changes in volume or activity and the resulting cost changes.
  ii. Used in the calculation of cost and valuation of stocks. Thus it's also an alternative to total absorption costing.

Absorption Costing Vs Marginal Costing methods

The difference can be clearly brought out using an illustration.

In a period, 20000 units of DVDs were produced and sold. Cost and revenues were

STUDY TEXT

Sales		100000
Production costs	variable	35000
	Fixed	15000
Administration+ Selling Overheads		25000

Operating Statements

	Absorption Costing		Marginal Costing
	$		$
Sales	100000		100000
Less production costs of sales	(50000)	less marginal cost	(35000)
Gross profit	50000		65000
Less admin+selling	(25000)	Less Fixed cost-prod	(15000)
		Admin + Selling	(25000)
Net profit	25000		25000

The main difference despite the same net profit is how the fixed costs are treated. In marginal costing, contribution has to be computed first.

The net profit was the same since there was no stock at the beginning or end of the period. Things could differ in this way.

Assuming data from illustration 1 except that only 18000 of the 20000 units were sold i.e. closing stock of 2000 units:

Operating statements

	Absorption costing			Marginal costing	
	$			$	
Sales (18000*5)		90000	Sales		90000
Less production C.O.S		50000	Less marginal cost		35000
Less closing stock 2000*2.5	(5000)	45000	Less closing stock 2000*1.75	(3500)	31500
Gross profit		45000	Contribution		58500

Less Admin & Selling	(25000)	Less Fixed cost:	
		Production	15000
		Admin	25000 (45000)
	20000		18500

a) Closing stock valuation

Absorption: $\frac{\$50000}{20000} = \$2.5$

Marginal: $\frac{\$35000}{20000} = \$1.75$

b) With fixed costs, absorption costing transfers some of this year's fixed costs into the next period. Marginal costing writes off fixed costs in the periods they are incurred.

c) In period with increasing stocks (greater closing stocks), absorption costing will show greater profits than marginal costing. On the other hand in a period of decreasing stock.

The difference in the net profit can be explained by the fixed cost element in absorption costing.

Fixed costs = Total cost/unit – Marginal cost/unit

= **2.5 – 1.75**

= **0.75**

i.e. 2000*0.75 = 1500

Net profit Absorption	**20000**
Net profit Marginal	**(18500)**
	1500

Arguments for using marginal costing

i. Simple to operate
ii. No apportionments which in most cases are arbitrary.
iii. Under or over absorption is almost entirely eliminated.
iv. Fixed costs are incurred on a time basis e.g. salaries, rent and don't relate to level of activity thus writing off is good
v. Accounts prepared using marginal costs more nearly approach actual cash flow position.

Arguments for total absorption

i. Fixed costs are substantial and increasing proportion of costs in modern industry. It thus forms a significant part of costs of production so it should be included. Marginal costing divorces fixed costs from production.

ii. It is used preferably where stock building is a necessary part of operations e.g. wine making. Otherwise fictitious losses will be shown in earlier periods to be offset eventually by excessive profits when goods are sold.
iii. Relying on marginal costs could lead to management setting prices at below total costs but making slight contribution. This is avoided in absorption costing.
iv. International Financial Reporting Standards suggest that costs and revenues must be matched in the period when revenues arise not when costs are incurred. It also recommends that stock valuation must include production overheads incurred in the normal course of business even if such overheads are time related.

2.5 COSTING METHODS

The various methods of costing have been well covered in your previous studies therefore a brief description is what will be given. Others not covered will be given illustration.

I. Job costing

The main purpose is to establish profit orloss on each completed job and to provide a valuation of incomplete jobs i.e. **W.I.P.** This is done using a job cost card containing:

a. Direct labor costs
b. Direct material costs
c. Direct expenses.

From this, the production department overheads could be calculated based on the times shown and the predetermined overheads rates. A job is normally valued at factory costs until dispatched when an appropriate amount of selling and administrative overheads would be added usually as a %age of the work's cost.

II. Batch costing

It's not always possible to classify cost accumulation systems into job costing and process costing systems. Where manufactured goods have some common characteristics and also some individual characteristics cost accumulation systems may be a combination of both job and process costing systems.

The batch could be treated as a job during manufacture. On completion of the batch, total batch costs would be divided by the number of good articles produced so as to provide average cost per article.

This process is common in industries such as clothing, footwear and engineering components.

III. Process costing

It is appropriate where the product follows a series of sequential, frequently automatic process e.g. paper making.

The essence is the averaging of the total costs of each process over the total throughput of that process (including partly completed units) and charging cost of output of on process as raw material in put to the next process.

Definition: Equivalent units- these are partly completed units at the end of the period.

To remind you, try doing this question as part of your revision.

Process 2 received units from process 1 and after processing transferred them to process 3. The data was as follows

Opening WIP 200 units (25% complete) valued at
$2500 800 units received from process 1 valued at
$4300 840 units transferred to process 3 Closing WIP
160 units (50% complete)
Costs for the period were $16580 and no units were scrapped.

Required:
Prepare process accounts for process 2 using

i. FIFO
ii. Averaging cost method.

2.6 COSTING METHODS IN TODAY'S WORLD

Traditional methods were developed a long time ago. Based on the methods of business back then, they were deemed to be suitable because of the following characteristics:

i. Direct costs were a high proportion of total costs.
ii. The firms then had a limited number of support functions therefore the overheads were low. Support functions include departments such as quality control.
iii. The methods of manufacture were less mechanized and more labor intensive.

In such circumstances therefore, absorption costing can produce fairly reliable information.

In advanced manufacturing technology environment, circumstances are very different. Technology and automation have reduced the need for direct labor substantially so that labor cost forms a small proportion of total cost. Production overheads are much higher coupled with large increases in administration and selling and marketing expenses.

Large expenditure is also done in support functions e.g. set-up costs, production scheduling, inspection costs, costs of logistics, dispatch, order handling, data processing and customer services. All these are not necessarily related in any way to volume production. This leads us to a discussion on a very important and popular form of costing; **activity based costing.**

2.6.1 ACTIVITY BASED COSTING

FAST FORWARD: ABC is more realistic in attributing overheads at the same time it shows the relationship between overhead costs and activities that cause them.

It can be thought of as a method of charging overheads to cost units on the basis of benefits received from the particular indirect activity e.g. ordering, inspection, planning.

Steps in ABC

Step 1- Identify activity.

Activities are composed of the aggregation of units of work or tasks and are described by verbs associated with tasks. The main activities in an organization include, materials handling, purchasing, reception, dispatch, machining, assembly and so on.

Step 2- Selecting appropriate cost drivers.

Some good characteristics of an activity include

- It should provide a good explanation of costs in each activity cost pool.
- It should be easily measurable, data should be relatively easy to obtain and be identifiable with products.

Three types of cost drivers emerge:

i. Pure activity output volume: Where the basic transactions of the activity are identified in terms of their resource demands such as the purchasing of raw materials or similar range of items.
ii. Weighted volume cost drivers: Where basic transaction differ in terms of their resource demands as when purchases are made from different overseas suppliers e.g. if purchases were made both domestically and overseas, the overseas suppliers might require more administrative work. Rather than split the purchasing pool into two parts (overseas and domestic) and have separate cost drivers (overseas, purchase orders, domestic purchases) it maybe more simpler to weight to overseas orders *vis a vis* the home orders. Thus from an assessment of the work undertaken to make the respective orders it might be decided that each overseas order be weighted on volume of cost driver or be used in calculating the appropriate rate.
iii. Situational: Where an underlying factor can be identified as driving the work load of an activity such as the number of suppliers when supplier vetting and liaison were vital components of the cost pool.

Step 3- Application of Cost driver rates.

To complete operation of the system the cost driver rates are applied to the costing of the product (or service) outputs. This costing requires two further conditions.

i. The cost measure must be capable of associating with specific products. Thus e.g. the number of material movements occurring during a period must be monitored, collected and related to the product output. (Data gathering is often an additional cost of ABC).
ii. Unless the exercise is being done in retrospect for a past period, the rates must be pre-determined i.e. based on estimated activity cost levels and cost driver volumes for the current period. To maintain the integrity of the system, these estimates will need monitoring and if necessary, regular adjustments.

Illustrative Example

1. Basic Example.

ABC ltd has the following overhead costs.

	$	**No. of cost drivers**
Quality	90000	450 inspection
Process set up	135000	450 set ups
Purchasing	105000	1000 purchase orders
Customer order processing	120000	2000 customers
Occupancy costs	150000	75000 machine hours

ABC makes a standard product Glaze. The cost details are as follows.

Unit material costs	$0.50
Unit labor costs	$0.40

Total production for the coming year	1000000 units
No. of production run	50
No. purchase order required	50
No. customer orders	10
Units machine time	3 minutes

The product is inspected once at the end of each production run

Required: Calculated standard cost of Glaze.

Solution

>>> i. Calculated the charge at rates for each of the activities.

Quality control 90000/450 = $200 per inspection

STUDY TEXT

Process set up	135000/450 = $300 per set up
Purchasing	105000/1000 = $105 per order
Customer order processing	120000/2000 = $60 per customer
Occupancy cost	150000/75000 = $2 per machine hour

Note: Occupancy cost has been allocated on traditional machine hours. The cost driver here is time and, as such, a conventional ABC method is not applicable. ABC will **never cater 100% for all the overheads.**

>>> ii. We draw up your grid for the overheads.

Functions	Rate*usage	$
Quality Control	$200*50	10000
Process set-up	$300*50	15000
Purchasing	$105*50	5250
Customer orders	$60*10	600
Occupancy	$2*3/60*1000000	10000
		130850

Dividing the total overheads cost by the number of units produced we

get $\frac{\$130850}{1000000}$ = $0.13085 (say 0.13)

Thus the standard unit cost for glaze is

	$
Material	0.50
Labor	0.40
Overheads	0.14
	1.04

Merits of ABC

a. More realistic product costs are provided especially in Advanced Manufactured Technology factories where support overheads are a significant proportion of total costs.
b. More overheads can be traced to the product e.g. non-factory floor activities. This goes beyond traditional costing technique based on factory floor.
c. ABC recognizes that it is activities which cause costs, not products and it is products which consume activities.

d. Focuses attention on the real nature of cost behavior. Helps in identifying non-value adding activities hence reducing costs.
e. ABC recognizes the complexity and diversity of modern production before the use of multiple cost drivers, many of which are transaction based rather than based solely on production volume.
f. ABC provides a reliable indication of long run variable product costs which is relevant to strategic decision making.
g. ABC is flexible enough to trace costs to processes, customers, and areas of managerial responsibility as well as product costs.
h. ABC provides a useful financial measures (e.g. cost driver rates) and non financial measures (e.g. transaction volumes).
i. Principle of using activities can be applied across a range of service industries as well as manufacturing firms.

Criticism of ABC

a. ABC is more complex than traditional systems and will thus be more expensive to administrate.
b. Ahmed and Scapens (Cost allocation: Theory and Practice 1991) warned that ABC was unlikely to relate all overheads to specific activities. It also ignores the potential for conflict especially where there is more than one potential cost driver, common costs, non linearity of cost driver rates etc.

2.7 ACTIVITY BASED PROFITABILITY ANALYSIS

FAST FORWARD: Since resource consumption of a particular customer can measured, activity based profitability analysis will provide very useful information for management.

A. Customer Profitability Analysis. (CPA)

Introduction:

Identification of activities and cost drivers, the classification of costs, distinction between activities that add value and those that do not are equally applicable in service sector. Compared to manufacturing firms, direct costs in service firms are low and overheads tend not to be volume related or capable of being easily attributed to product/ service/customer being supplied.

CPA: Analysis of the revenue streams and service costs associated with specific customer or customer groups.

Say we have two customers A & B, both generate same revenue, both are good debtors and potential for growth for both of them is at par. At face value, the customers might seem of equal value to us. Upon further investigating, we might find the following.

A	B
• Loyal long term customers	• Recently been reacquired as customer for the 5th time offering major price cuts
• Gives us most of his business	• Buy low margin items in a complex mix
• Refers other customer to us	• Varies orders at the last moment
• Pays bills electronically	• Pays by cheque
• Little spread service	• Great deal of special service

Clearly A is more valuable to us than B but this cannot be brought out in conventional cost accounting. A careful ABC exercise would suffice in determining all this.

Illustrative example

XYZ produces a bike branded zoom with a production cost of $40 per unit which is sold to 3 customers.

Sales pattern: Customer X 10000 units p.a.
Y 10000 units p.a.
Z 10000 units p.a.

Selling price $75 per unit

Overheads	$
Delivery	220000
Quality inspection	200000
Salesmen	80000
After Sales Services	100000
	600000

An ABC analysis

Customer	X	Y	Z	Total
No. of deliveries	2500	50	12	2562
No. inspection	10000	500	0	10500
No. of salesmen visits	200	24	6	230
After sales visits	200	100	50	350

Solution

Cost driver rates

Delivery	= 220000/2562	= $85.87 per delivery
Inspection	= 200000/10500	= $19.05 per inspection
Sales men visit	= 80000/230	= $347.83 per visit
After sales service	= 100000/350	= $285.71 per after sale service.

Customer analysis

	X	Y	Z
Revenue	750000	750000	750000
	(400000)	(400000)	(400000)
	350000	350000	350000

Non production overheads

		X		Y		Z
Deliveries	**(2500*85.87)**	214675	**(50*85.87)**	4294	**(12*85.87)**	1030
Inspection	**(10000*19.05)**	190500	**(500*19.05)**	9525	-	
Sales visits	**(200*347.83)**	69566	**(24*347.83)**	8348	**(6*347.83)**	2087
A.S. visits	**(200*285.71)**	57142	**(100*285.71)**	28571	**(50*285.71)**	14286
		(181883)		299262		332597

Conclusion:

The high cost of serving customer X effectively wipes out the profit being made on producing and selling the product.

2.8 COST CLASSIFICATION

To be able to make cost predictions, it should be appreciated that costs can be simply classified as either *fixed* or *variable* (this will be questioned later). Cost behavior is that relationship that exits between costs and the level of activity. Therefore the accounting classifications of costs are:

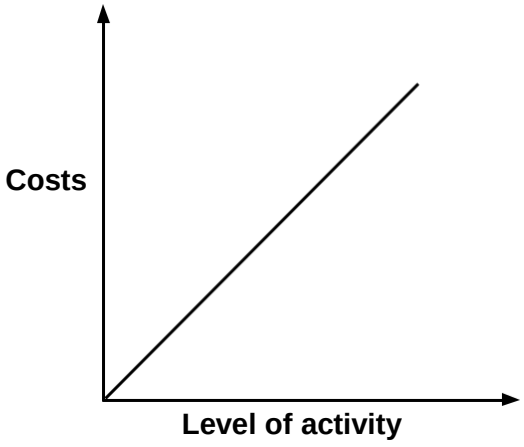
- Fixed costs: Those costs that do not change (within a relevant range) in proportion to the level of activity.
- Variable costs: These costs do change in proportion to the level of activity.

These simplistic classifications will only hold true:

i. When the time period in consideration is relatively short e.g. one year.
ii. When the activity variation being considered is relatively small.
iii. Over the time period being considered, the state of technology, management policies and methods employed are deemed to remain unchanged..

Based on their behavior, the costs tend to form some patterns. Typical cost patterns include:

1) Linear variable cost



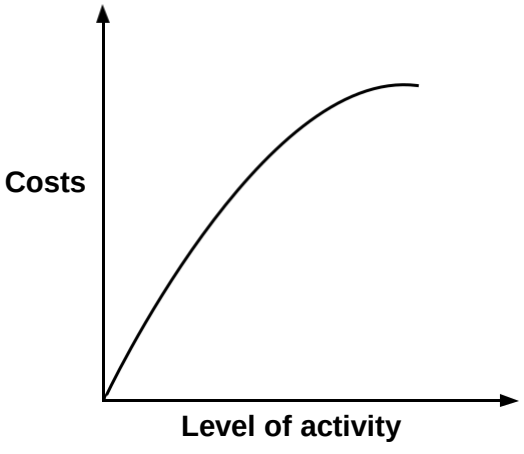
The above is a linear variable cost pattern. It shows that the cost (*y-axis*) is directly affected by the independent variable i.e. the level of activity e.g. number of units, labor hours. The relationship is direct. Examples of such costs include direct materials, direct labor and other direct expenses. The perfect linearity will only hold over a relevant range.

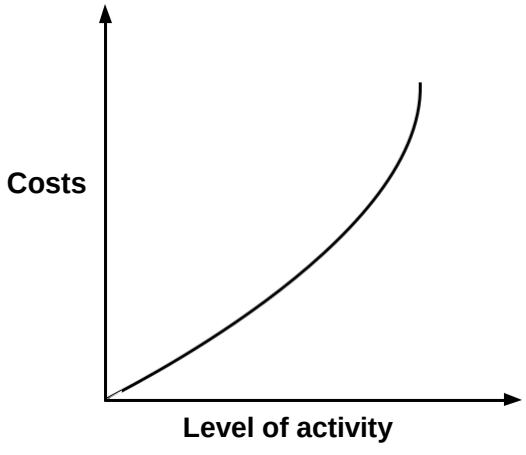
N.B The slope of the line is the variable cost per unit.

The line is expressed as:

Y = bx

Variations of the above pattern will look as follows

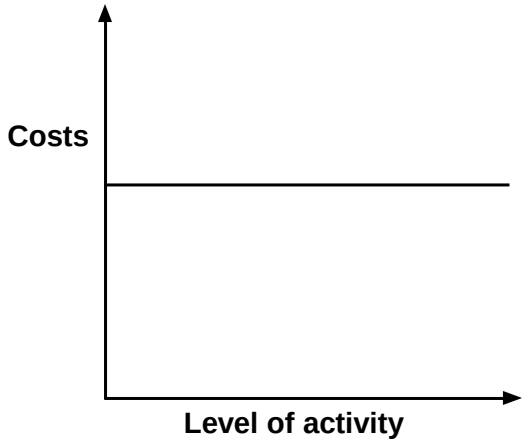




1) This show a less than proportionate change. It could be as a result of economies of scale where for example may qualify for discount following a large purchase.

2) This is a more than proportionate change. It indicates diminishing returns

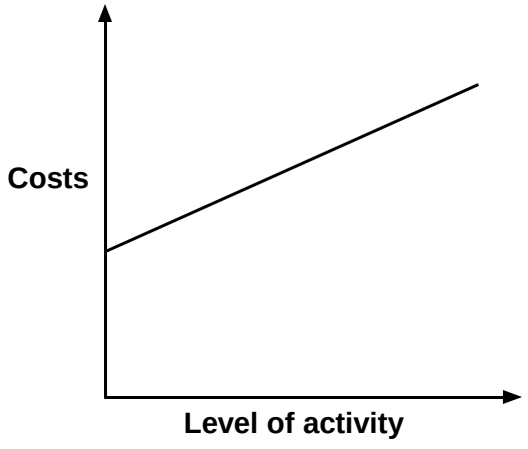
2) Fixed cost pattern



This is a pattern depicted by fixed costs i.e. those that do not vary, over a relevant range, with the level of activity e.g. rates and rent.

It is expressed as: **y = FC**

3) Semi-variable cost pattern



This pattern combines the variable and fixed cost pattern. It shows that the total cost has both a variable component and a fixed component. Examples of such costs include telephone charges, electricity.

It is expressed as **y = a + bx**

2.9 COSTS FORECASTING

i. Engineering method

This method is used when no previous records of costs exist. It is a very detailed method that goes into the nitty-gritty of what constitutes a product in terms of how much material or how much labor. From this a suitable level of activity can be determined. The result of the direct observation of physical quantities is then converted into a cost estimate. This approach can be lengthy and expensive. It adopts the element of motion study from the scientific theory of management.

ii. Account analysis

This method requires a close inspection of all elements of accounts but mostly the expenditure. From this, the management must determine which costs are variable, fixed or mixed. This for some costs can be done directly but others might pose some difficulties when trying to classify them. It suffers setbacks such as it is highly subjective and some costs are treated arbitrarily. The accounts being analyzed are past records and thus do not have much relevance in the future.

Other methods will use past/historical data on the presumption that the past does provide some guidance to the future. For these methods, we must set up a **Cost Estimating Relationship (CER)**

2.10 COST ESTIMATING RELATIONSHIP

CER is a technique used to estimate a particular cost or price by using an established relationship with an *independent variable or cost driver.*

Steps of Developing a CER

Step 1: Define the dependent variable

What will the CER be used to estimate, cost, revenue or price?

Step 2: Select the cost driver

This is the independent variable referred to in the definition. It is a factor whose change causes a change in the total cost of an activity. E.g. direct labor hours, machine hours or number of units. When selecting a cost driver, consider the following

- The variables should be quantitatively measurable

- Data should be easily available

Step 3: Collect data concerning the relationship between independent and dependent variable

A sufficient number of past observations must be obtained to derive an acceptable cost function.

Step 4: Plot data on the graph

The graph (scatter diagram) will indicate the general relationship between the dependent variable and the cost driver and will show some linearity. It will highlight extreme observations also known as outliers.

Step 5: Select the relationship that best predicts the dependent variable

After studying the various relationships, one should select the best. A high *correlation* between a potential independent variable and the dependent variable often indicates that the independent variable is a good predictive tool.

Step 6: Test the reliability of the cost function

Let us look at specific methods.

2.10.1 High-low method

FAST FORWARD: This method estimates fixed and variable costs by comparing the costs of the highest and lowest activity levels and analyzing the difference between them.

- We get the cost information for the highest and lowest level of activity. This is assuming that the total cost line goes through these two points.
- Since fixed costs will remain the same at both levels, the difference in total cost is said to be brought about by the variable costs for the number of units of activity between the highest and the lowest points.
- Now you can calculate the variable cost per unit and use this figure in the expression of either the highest level of activity or low level to determine the fixed costs.

>>> **Illustration**

The inspection of accounts for six months to 31st December 2009 is as follows:

Month	units	$
July	340	2260
August	300	2160
September	380	2320

STUDY TEXT

October		420	2400
November	400	2300	
December	360	2266	

Variable element of cost

Highest level month = October 420 $2400

Lowest level month = August 300 $2160

Variable cost per unit = $\frac{(2400 - 2160)}{(420 - 300)} = \frac{240}{120} = \$2$

Fixed costs:

Total costs = V.C + F.C

(2*420) + F.C = 2400

F.C = 2400 – 840

= $1560

This method is easy to understand and use. At the same time it has some limitations

i. It relies on historical data assuming that activity is the only factor affecting costs and historical costs reliably predict the future costs.
ii. It only uses two values, the highest and lowest which means that results may be distorted because of random variations e.g. if the values are outliers.

2.10.2 Regression analysis

FAST FORWARD: Unlike the high-low method, the regression analysis uses ALL, not just two, past data to calculate the line of best

A regression equation identifies an estimated relationship between a dependent variable (the cost) and one or more independent variables (cost driver).

When the equation includes only one independent variable then it is referred to as simple regression and its form is:

Y = a + bx

Where: Y is the predicted value

a and b are constant

x is the cost driver

When the equation includes 2 or more independent variables, it is referred to as multiple regression and is of the form:

$Y = a + b_1 x_1 + b_2 x_2 + ... + b_n x_n$ for n independent variables.

Simple regression

Regression analysis determines mathematically the regression line of best fit. It is based on the principle that the sums of squares of the vertical deviation from the line established is the least possible

I.e. $!(Y \forall \hat{Y})^2$ is minimized

where Y is the observed value of the dependent

variable $\hat{Y}$ is the predicted value of Y

The equation can be solved by the use of normal equations and these are:

1. $\Sigma y = na + b(\Sigma x)$

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

From these normal equations:

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

$$a = \frac{\Sigma Y}{n} - \frac{b\Sigma x}{n}$$

>>> **Illustration 1**

Ox-heart provides us with the following table showing the number of units of goods produced and total cost incurred.

Units	Total costs
100	40000
200	45000
300	50000
400	65000
500	70000
600	70000
700	80000

STUDY TEXT

Units will be the independent variable (X) expressed in units of hundreds. The total costs will be the dependent variable (Y) expressed in units of thousands.

X	Y	XY	X_2	Y^2
1	40	40	1	1600
2	45	90	4	2025
3	50	150	9	2500
4	65	260	16	4225
5	70	350	25	4900
6	70	420	36	4900
7	80	560	49	6400
28	420	1870	140	26550

n = 7

$$b = \frac{(7*1870) - (28*420)}{(7*140) - (28*28)}$$

$$= \frac{13090 - 11760}{980 - 784} = \frac{1330}{196}$$

b = 6.79

With b now we can calculate a

$$a = \frac{420}{7} - 6.79*\frac{28}{7}$$

= **60 – 27.16**

= **32.84**

The estimated line of best fit will be:

Y = 32.84 + 6.79X

Correctly we say

Y = 32840 + 67.9X

Example, what would be the costs of producing 100 units?

Y = 32840 + 67.9*100 = 39630

>>> Illustration 2

The production manager of XYZ Company, is concerned abut the apparent fluctuation in efficiency and wants to determine how labour costs (in Sh.) are related to volume. The following data presents results of the 12 most recent weeks.

Week No.	Units Produced (X)	Labour Costs (Y)
1	34	340
2	44	346
3	24	287
4	36	262
5	30	220
6	49	416
7	39	337
8	21	180
9	41	376
10	47	295
11	34	215
12	24	275

Solution

We first compute the sum of X, Y, XY, X_2 and Y_2

The table below shows these summations.

Week No.	Units (X)	L.Costs (Y)	XY	X^2	Y^2
1	34	340	11560	1156	115600
2	44	346	15224	1936	119716
3	24	287	8897	961	82369
4	36	262	9432	1296	68644
5	30	220	6600	900	48400
6	49	416	20384	2401	173056
7	39	337	13143	1521	113569
8	21	180	3780	441	32400
9	41	376	15416	1681	141376
10	47	295	13865	2209	87026
11	34	215	7310	1156	46225
12	24	275	6600	576	75625
	430	3549	132,211	16234	1104005

Value of b can be calculated as follows:

$$b = \frac{12(132211) - 430(3549)}{12(16234) - (430)^2} = 6.10$$

$$a = \frac{3549}{12} - 6.10\left(\frac{430}{12}\right) = 77.08$$

Therefore the predicting function is $Y = 77.08 + 6.1X$

b. i. If X = 45 units, then

Y = 77.08 + (6.1 x 45)
= Sh.351.58

ii. If X = 34 units, then

Y = 77.08 + (6.1 x 34)
= Sh.284.48

2.10.3 EVALUATION OF THE REGRESSION MODEL

The regression equation calculated above was based on the assumption that cost varied with the units produced. However, a number of different activity measures exist such as direct labour hours, direct labour cost, number of production runs, etc.

It is important therefore to determine the reliability of the estimated cost function. Various tests of reliability can be applied. These tests can be grouped into 3:

>>> Logical relationship tests:
>>> Goodness of fit tests
>>> Specification tests

>>> Logical relationship tests

These tests, also referred to as economic plausibility test, are used to determine whether there is an expected logical relationship between the independent and the dependent variable.

To carry out this test, it is important to understand the input-output relationship in the company.

For the illustration there is an expected logical relationship between the number of units and the labor cost mainly because the higher the number of units, the higher the number of labor hours

and therefore the higher the labor cost.

>>> Goodness of fit tests

These tests can be divided into two:

Testing the whole model

Testing the slope

Testing the whole model

Tests of the whole model are used to determine the reliability of all the independent variables taken together. The measures used are:

I. Coefficient of determination (r_2)
II. Std error of the estimate
III. F-test

I. Coefficient of Determination (r_2)

If the regression line calculated by the least square method were to fit the actual observations perfectly, then all observed points would lie on the regression line. The coefficient of determination, r_2, explains the amount of variation in Y which is explained by the introduction of X in the model. A perfect linear relationship between X and Y would result in r_2 being equal to 1.

$$r^2 = \frac{\text{explained variation}}{\text{Total variation}}$$

$$= \frac{\Sigma(\hat{Y} - \acute{y})^2}{\Sigma (Y - \acute{y})^2}$$

Where ý is the mean value of Y

For computation purposes r^2 can be given by

$$r^2 = \frac{(n \Sigma xy - \Sigma x \Sigma y)^2}{[n \Sigma x^2 - (\Sigma x)^2] [n \Sigma y^2 - (\Sigma y)^2]}$$

From the illustration 2

$$= \frac{[12(132211) - (430)(3549)]^2}{[12(16234) - (430)^2] \{12(1104005 - (3549)^2\}}$$

$$= 0.565$$

STUDY TEXT

About 56.5% of the variations in labour cost can be explained by variations in units produced while about 43.5% of the variation in labour cost is explained by other independent variables and the error term.

Note

The higher the r_2, the better the function is. As a rule of thumb, r_2 must be at least equal to 0.8.

II. Standard error of estimate (S_e)

The coefficient of determination r_2 gives us an indication of the reliability of the estimate of total cost based on the regression equation but it does not give us an indication of the absolute size of the probable deviations from the line established. This information can be obtained by calculating the standard error of estimate given by the following formula.

$$S_e = \sqrt{\frac{(Y - \hat{Y})^2}{n - 2}}$$

For computation purpose,

$$S_e = \sqrt{\frac{\sum Y^2 - a\sum Y - b\sum XY}{n - k}}$$

Where k is the no. of independent variables

For illustration 2

$$S_e = \sqrt{\frac{1104005 - 7.08 - 3549) - 6.1(13221 - \div}{12 - 2}}$$

$$= 48.95$$

The sample size, n, is reduced by 2 because 2 variables ‘a’ & ‘b’ in the regression equation had to be estimated from the sample observations.

The calculation of the standard error is necessary because the least square line was calculated from sample data. Other samples would probably result in different estimates. Obtaining the least square calculation over all the possible observations that might occur would result in the calculation of the true least square line. The question is “How close does the sample estimate of least square line come to the true least square line?”.

Standard error is similar to standard deviation in normal probability analysis. It is a measure of variability around the regression line. The std error of estimates enables us to establish a range of values of the dependent variable within which we may have some degree of confidence that the true value lies. We can use the following equation to establish this range:

$$\hat{Y} - t_c S_e \leq Y \leq \hat{Y} + t_c S_e$$

From illustration 2, where $\hat{Y}_{34} = 284.48$, the 95% confidence interval can be calculated as follows:

$284.48 - 2.2281(48.95) \leq Y \leq 284.48 + 2.2281 (48.95)$

$175.4 \leq Y \leq 393.6$

We are 95% confident that if X is estimated to be 34 units next period, the true labour cost will lie between 175.4 and 393.6. Note t_c from the student T tables, with 10 degrees of freedom and 5% significance level, is equal to 2.2281.

III. The F –test

The significance of the regression results can be tested by using the F- statistics. The F-statistics is a ratio which compares the explained sum of squares and the unexplained sum of squares.

Therefore F = mean sum of squares due to regression / Mean sum of squares due to residual

For calculation purposes:

$$F = \frac{r_2 / K}{(1 - r_2)/n-k-1}$$

F statistics can then be used to test the hypothesis that the relationship between the dependent variables and all the independent variables is not significant.

The Steps followed in the F- Test are:

State the hypothesis

H_o: Relationship between Y and all Xs is not significant.

H_A: Relationship between Y and all Xs is significant

State the significant level

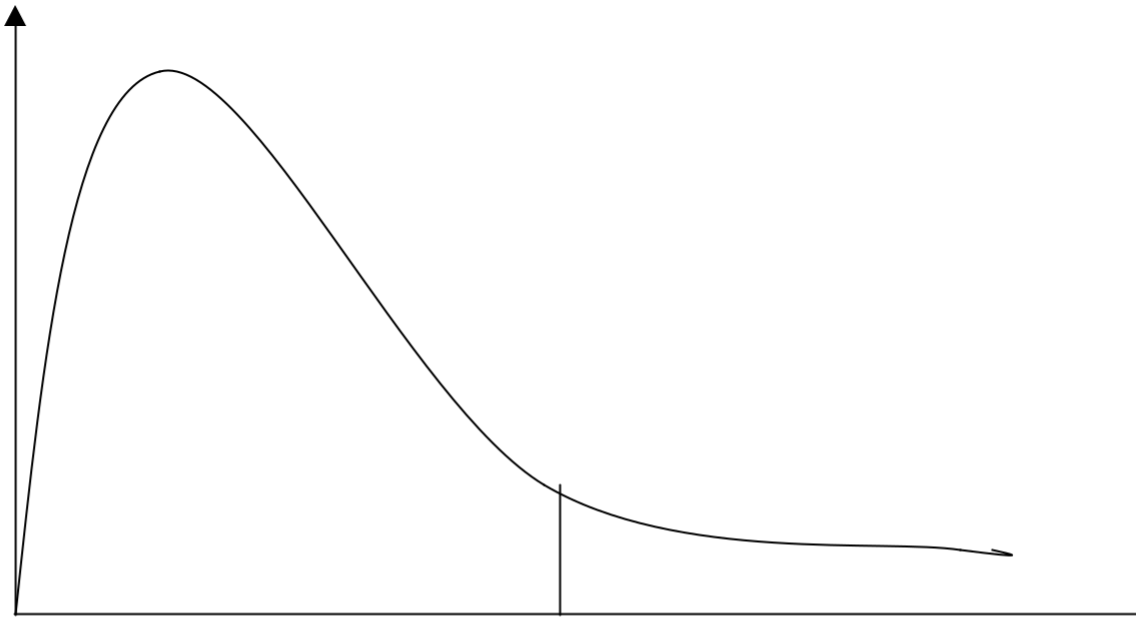
$\alpha = 5\%$

State the test statistics

$$F = \frac{r_2 / K}{(1 - r_2)/n-k-1}$$

STUDY TEXT

State the decision rule



4.965

k = 1
n-k-1 = 10
α = 0.05
F_c = 4.965

Computation of F statistics

$$F = \frac{0.565/1}{(1-0.565)/(12-1-1)}$$

$$= 12.989$$

Conclusion

Since the computed F > F_c then we reject H_o. Therefore the relationship between the labour cost and the number of units is significant.

Testing the Slope

The strength of the relationship between the dependent variable and each of the independent variables can be determined using 3 methods:

>> Correlation coefficient (r)

>> Standard error of the slope (Sb)

>> Z or t statistics.

CORRELATION

FAST FORWARD: Correlation measures how strong the connection is between the two variables.

When the correlation is strong, the estimated line of best fit should be more reliable. When weak, the line of best fit calculated in linear regression might be insufficiently reliable.

A Pearson's correlation coefficient 'r' is defined as:

The correlation coefficient measures the degree of association between two variables such as the cost and the activity level.

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}$$

If the degree of association between two variables is very close then it would be almost possible to plot the observation on a straight line and r will be almost equal to one.

Using our previous example

X	Y	$\sum Y_2$
1	40	1600
2	45	2025
3	50	2500
4	65	4225
5	70	4900
6	70	4900
7	80	6400
		26550

$$\mathbf{r = \frac{(7*1870) - (28*420)}{\sqrt{((7*140) - (28*28)(7*26550) - (420*420)}}}$$

$$\mathbf{\frac{13090 - 11760}{\sqrt{(980 - 784)(185850 - 176400)}}}$$

r = +0.98

STUDY TEXT

Interpretation of coefficient of correlation

The value of 'r' will vary between +1 and -1. If you get a different value of 'r' your calculations are wrong!

If r= -1, then the two variables are said to be perfectly negatively correlated

If r = +1, then the two variables are perfectly positively correlated

If r = 0, then there is no correlation between the two variables.

Std error of the slope (S_b)

The reliability of the estimate of the regression coefficient 'b' (i.e. the variable cost), is important since the analyst usually focuses on the rate of variability rather than the absolute level of prediction. This can be established by the use of the standard error of the slope.

The standard error of 'b' coefficient can be expressed as follows:

$$S_b = \frac{S_e}{\sqrt{\sum x)^2}}$$

SPECIFICATION TESTS

These tests are used to test the validity of the regression assumptions. The necessary assumptions in linear regression are:

The underlying relationship between X and Y is linear.

The independent variable X is assumed to be known and is used to predict the dependent variable Y.

The errors or the residuals given by $(Y - \hat{Y})^2$ are assumed to:

- Be normally distributed.
- Have and expected value (mean) of Zero (0).
- Have a constant variance. This is referred to as homoscedasticity. If not constant we have heteroscedasticity.
- Be independent i.e. they are not serially correlated or there is no autocorrelation.

The Specification tests can be done for illustration 2 as follows:

Week	Units	L. cost (Y)	$\hat{Y}$	$e_i = y - \hat{Y}$	$e_i - e_i$	$(ei - ei)^2$	e^2

1	34	340	28448	55.52	-	-	-	
2	44	346	43.48	0.52	-55	3025	002704	
3	31	287	266.18	20.82	-20.3	4409	433.4	
4	36	262	296.68	-34.68	-55.5	44.09	433.4	
5	30	220	260.08	-40.02	5.4	29.16	1606.41.	
6	49	416	375.98	40.02	-80.1	6416.01	1601.60	
7	39	337	314.98	22.02	18	324	484.88	
8	21	180	205.18	-25.18	47.1	227.84	634.0	
9	41	376	327.18	48.82	-4	5476	2383.39	
10	47	295	363.78	-68.78	117.6	13829.76	4730.69	
11	34	215	284.48	-69.48	1.2	0.44	4897.20	
12	24	275	223.48	51.52	-	121.5	762.25	2654.31
				1.04		49461.6		23641.96

$\hat{Y} = 77.08 + 6.10 x$

$E(e) = \frac{1.04}{12} = 0.08$

This is approximately equal to zero.

To test whether the observation is normally distributed we can construct a histogram of the observation.

Independence of observations

An important assumption for the simple linear regression model is the independence of errors. In many time series models, this assumption is violated because of the correlation of errors in successive observations. This is referred to as **autocorrelation.**

Autocorrelation occurs if a positive error is followed by another positive error and a negative error is followed by another negative error. If autocorrelation occurs then time should be considered as an important independent variable and therefore time varies analysis should be used.

We can use Durbin Watson 'D' statistics to determine whether observations are independent.

$D = \frac{\sum (e_i - e_{i-1})^2}{\sum e_i^2}$

where e_i is the error in time i

e_{i-I} is the error in time i-I

The Durbin Watson statistics provides a measure of association between successive values of the error term. The computed statistics is compared against two tabulated values d_u and d_l that depend on the desired confidence level of the test and the degrees of freedom of the data.

If the computed Durbin Watson "D" statistics is greater than D_u, then we can conclude that there's no positive correlation between error terms.

If $d_l \leq D \leq d_u$ then the test is inconclusive and therefore we can neither accept nor reject the null hypothesis.

Note

A rule of thumb, with uncorrelated errors then D approaches a value of 2. If errors are highly positively correlated, the D would be less than 1.5 and can be very near to zero (0).

For negatively correlated errors, the value of D will be above 2.5 with an upper limit of 4.

For illustration 2

$$D = \frac{\sum (e_i - e_{i-1})^2}{\sum e_i^2}$$

$$= \frac{49461.6}{23641.696} = 2.09$$

From the tables:

$d_l = 0.971$

$d_u = 1.331$

Since the calculated value of D is greater than d_u, then we can accept the null hypothesis, that there is no positive serial correlation.

The error of dependence is caused by:

The omission of an important variable such as the seasonal effect (misspecification error).

The relationship is not linear.

A shift in production process which may be caused by change in equipment that has not been shown in the model.

2.10.4 MULTIPLE REGRESSION

The least square regression equation discussed above was based on the assumption that total cost was determined by only one activity based variable. However, other variables are likely to affect labour costs such as labour hours, material costs, machine hours, etc. These may have an effect on labour costs.

The equation for the simple regression can be expanded to include more than one independent variable as shown below:

$\hat{Y} = a + b_1X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\ldots + b_n X_n$

For two independent variables, the function will be of the form:

$\hat{Y} = a + b_1X_1 + b_2 X_2$

The normal equations can be given by:

$\Sigma y = na + b_1 \Sigma X_1 + b_2 \Sigma x_2$

$\Sigma X_1 Y = a\Sigma x_1 + b_1 \Sigma X_1^2 + b_2 \Sigma X_1 \Sigma X_2$

$\Sigma X_2 Y = a\Sigma x_2 + b_1 \Sigma X 1 \Sigma X_2 + b_2 \Sigma X_2$

Normally computers are used for the solution of multiple regression.

Multi-collinearity

Multiple regression analysis is based on the assumption that the independent variables are not correlated with each other. When the independent variables are highly correlated with each other then it is very difficult to isolate the effect of each one of these on the dependent variables. This occurs when there is a simultaneous movement of two or more independent variables in the same direction and almost at the same time. This condition is called multi-collinearity.

We can use the correlation matrix to determine whether 2 independent variables are highly correlated. If a correlation value of more than 0.8 exists between two independent variables, then the problem of multi-collinearity is bound to occur. Alternatively if the correlation coefficient between the two variables is greater than the multiple correlation coefficient, then multi-collinearity

problem will occur. To remove the problem of multi-collinearity, we drop one of the correlated variables. You can drop any of the variables.

2.11 TIME SERIES AND ANALYSIS

This is the mathematical or statistical analysis on past data arranged in a periodic sequence.

Decision making and planning in an organization involves forecasting which is one of the time series analysis.

Impediments in time series analysis

Accuracy of data in reflecting:

a) Drastic changes e.g. in the advent of a major competitor, period of war or sudden change of taste.
b) For long term forecasting internal and external pressures makes historical data less effective.

1. Moving Average

Periodical data e.g. monthly sales may have random fluctuation every month despite a general trend being evident. Moving average helps in smoothing away these random changes.

A moving average is the forecast for a period that takes the average of the previous periods.

Example:

The table below represents company sales, calculate 3 and 6 monthly moving averages, for the data

Months	Sales
January	1200
February	1280
March	1310
April	1270
May	1190
June	1290
July	1410
August	1360
September	1430
October	1280
November	1410
December	1390

Solution

These are calculated as follows

$$\text{April's forecast} = \frac{\text{Jan} + \text{Feb} + \text{Mar}}{3} = \frac{1200 + 1280 + 1310}{3}$$

$$\text{May's forecast} = \frac{\text{Feb} + \text{Mar} + \text{Apr}}{3} = \frac{1280 + 1310 + 1270}{3}$$

And so on…

Similarly for 6 monthly moving average

$$\text{July forecast} = \frac{\text{Jan} + \text{Feb} + \text{Mar} + \text{Apr} + \text{May} + \text{Jun}}{6} = \frac{1200 + 1280 + 1310 + 1270 + 1190 + 1290}{6}$$

And so on…

	3 months moving average	6 months moving average
April	1263	
May	1287	
June	1257	
July	1250	1257
August	1297	1292
September	1353	1305
October	1400	1325
November	1357	1327
December	1373	1363

Note:

When plotting moving average on graphs the points are plotted as the midpoint of the period of the average, e.g. in our example the forecast for April (1263) is plotted on mid Feb.

>>> **Characteristics of moving average**

1) The more the number of periods in the moving average, the greater the smoothing effect.
2) Different moving averages produce different forecasts.
3) The more the randomness of data with underlying trend being constant then the more the periods should be involved in the moving averages.

>>> **Limitations of moving averages.**

1) Equal weighing with disregard to how more recent data is more relevant.
2) Moving average ignores data outside the period of the average thus it doesn't fully utilize available data.
3) Where there is an underlying seasonal variation, forecasting with unadjusted moving average can be misleading.

2. Exponential smoothing

This is a weighted moving average technique, it is given by:

New forecast = Old forecast + (Latest Observation − Old forecast)

Where = Smoothing constant

This method involves automatic weighing of past data with weights that decrease exponentially with time.

Example

Using the previous example and smoothing constant 0.3 generate monthly forecasts

Months	**Sales**	**Forecasts: = 0.3**
January	1200	
February	1280	1200
March	1310	1224
April	1270	1250
May	1190	1256
June	1290	1233
July	1410	1250
August	1360	1283
September	1430	1327
October	1280	1358
November	1410	1335
December	1390	1357

Solution

Since there were no forecasts before January we take Jan to be the forecast for February.

∴ Feb − 1200

For March;

March forecast = Feb forecast + 0.3 (Feb sales − Feb forecast)

= 1200 + 0.3 (1280 – 1200)

=1224

Note:

- The value lies between 0 and 1.
- The higher the value, the more the forecast is sensitive to the current status.

>>> **Characteristics of exponential smoothing**

- More weight is given to the most recent data.
- All past data are incorporated unlike in moving averages.
- Less data is needed to be stored unlike in periodic moving averages.

Decomposition of time series

Time series has the following characteristics.

a) A long term trend (T) –tendency of the whole series to rise and fall.
b) Seasonal variation (S) – short term periodic fluctuations in values. e.g. in Kenya maize yield is high in November and low in March or matatus have better business on Friday and very low on Sundays.
c) Cyclical variation (C) – These are medium term changes caused by factors which apply for a while then disappear, and come back again in a repetitive cycle. e.g. drought hits Kenya every 7 years.
   Note that cyclic variation has a longer term than seasonal variation e.g. seasonal variation may occur once every year while cyclic variation occurs once every several years.
d) Random residual variation (R) – These are non-recurring random variations e.g. war, fire, coup e.t.c.

For accurate forecasts these aspects are qualified separately (i.e. T,C,S and R) from data. This is known as time decomposition or time series analysis

The separate elements are then combined to produce a forecast.

Time series models:

Additive Model

Time series value = T +S +C +R

Where S, C and R are expressed in absolute value.

This model is best suited where the component factors are independent e.g. where the seasonal variation is unaffected by trend.

Multiplicative Model:

Time series value = T × S× C × R

Where S, C and are expressed as percentage or proportions.

This model is best applied where characteristics interact e.g. where high trends increase seasonal variations. Multiplicative model is more commonly used in practice.

Of the four elements of time series the most important are **trend** and **seasonal variation**. The following illustration shows how the trend (T) and seasonal variation (S) are separated out from a time series and how the calculated T and S values are used to prepare forecast. The process of separating out the trend and seasonal variation is known as *deseasonalising the data*.

There are two approaches to this process: one is based on regression through the actual data points and the other calculates the regression line through moving average trend points. The method using the actual data is demonstrated first followed by the moving average method.

1. Time series analysis: trend and seasonal variation using regression on the data

The following data will be used to illustrate how the trend and seasonal variation are calculated. **Example 1**

Sales of widgets in '000s					
		Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
Year	1	20	32	62	29
	2	21	42	75	31
	3	23	39	77	48
	4	27	39	92	53

It will be apparent that there is a strong seasonal element in the above data (low in Quarter 1 and high in Quarter 3) and there is a generally upward trend.

The steps in analyzing the data and preparing a forecast are:

Step 1:	Calculate the trend in the data using the least squares method.
Step 2:	Estimate the sales for each quarter using the regression formula established in step 1.
Step 3:	Calculate the percentage variation of each quarter's actual sales from the estimates, obtained in step 2.
Step 4:	Average the percentage variations from step 3. This establishes the average seasonal variations.
Step 5:	Prepare forecast based on trend percentage seasonal variations.

Solution

Step 1

Calculate the trend in the data by calculating the linear regression line y = a + bx.

		x (quarters)	x (sales)	xy	x_2
	{	1	20	20	1
		2	32	64	4
Year 1		3	62	186	9
		4	29	116	16
	{	5	21	105	25
		6	42	252	36
Year 2		7	75	525	49
		8	31	248	64
	{	9	23	207	81
		10	39	390	100
Year 3		11	77	847	121
		12	38	576	144
	{	13	27	351	169
		14	39	546	196
Year 4		15	92	1380	225
		16	53	848	256
		∑x=136	**∑y= 710**	**∑xy= 6661**	**∑ x_2 =1496**

Least square equations

$\sum y = an + b\sum x$

$\sum xy = a\sum x + b\sum x_2$

$710 = 16a + 136b$

$6661 = 136a + 1496b$

Therefore $626 = 340b$

STUDY TEXT

b = 1.84 and substituting we obtain

a = 28.74

Trend line = 28.74 + 1.84x

Steps 2 and 3

Use the trend line to calculate the estimated sales for each quarter.

For example, the estimate for the first quarter in year 1

is estimate = 28.74 + 1.84 (1) = 30.58

The actual value of sales is then expressed as a percentage of this estimate. For example, actual sales in the first quarter were 20 so the seasonal variation is

$$\frac{\text{Actual sales}}{\text{Estimate}} \% = \frac{20}{30.58} = 65\%$$

		x (quarters)	y (sales)	Trend	Actual / Trend %
	{	1	20	30.58	65
		2	32	32.42	99
Year 1		3	62	34.26	181
		4	29	36.10	80
	{	5	21	37.94	55
		6	42	39.78	106
Year 2		7	75	41.62	180
		8	31	43.46	71
	{	9	23	45.30	51
		10	39	47.14	83
Year 3		11	77	48.98	157
		12	48	50.82	94
	{	13	27	52.66	51
		14	39	54.50	72
Year 4		15	92	56.34	163
		16	53	58.18	91

Trend estimates and percentage variations table.

Step 4

Average the percentage variations to find the average seasonal variations.

	Q1	Q2	Q3	Q4
	%	%	%	%
	65	99	181	80
	55	106	180	71
	51	83	157	94
	51	72	163	91
	222	360	681	336
÷ 4 =	56%	90%	170%	84%

These then are the average variations expected from the trend for each of the quarters; for example, on average the first quarter of each year will be 56% of the value of the trend. Because the variations have been averaged, the amounts over 100% (Q3 in this example). This can be checked by adding the average and verifying that they total 400% thus:

56% + 90% + 170% + 84% = 400%.

On occasions, rounding of in the calculations will make slight adjustments necessary to the average variations.

Step 5

Prepare final forecasts based on the trend line estimates from "trend estimates and percentages variation table" (i.e. 30.58, 32.42, etc) and the averaged seasonal variations from the table above. (i.e. 56%, 90%, 170% and 84%)

The seasonally adjusted forecast is calculated thus:

Seasonally adjusted forecast = Trend estimate × Seasonal variation%

		X (quarters)	Y (sales)	Seasonally adjusted forecast
	{	1	20	17.12
Year 1		2	32	29.18
		3	62	58.24
		4	29	30.32

STUDY TEXT

	{	5	21	21.24
Year 2		6	42	35.80
		7	75	70.75
		8	31	36.51
	{	9	23	25.37
Year 3		10	39	42.43
		11	77	83.27
		12	48	42.69
	{	13	27	29.49
Year 4		14	39	49.05
		15	92	95.78
		16	53	48.87

Seasonally adjusted forecasts

The forecasts are compared with the actual data to get some idea of how good extrapolated forecasts might be. With further analysis they enable us to quantify the residual variations.

Extrapolation using the trend and seasonal factors

Once the formulae above have been calculated, they can be used to forecast (extrapolate) future sales. If it is required to estimate the sales for the next year (i.e. Quarters 17, 18, 19 and 20 in our series) this is done as follows:

Quarter 17 Basic trend = 28.74 + 1.84 (17)

= 60.02

Seasonal adjustment for a first quarter = 56%

Adjusted forecast = 60.02 × 56%

= **33.61**

A similar process produces the following figures:

Adjusted forecasts Quarter 18 = 55.67

19 = 108.29

20 = 55.05

Notes:

a) Time series decomposition is not an adaptive forecasting system like moving averages and exponential smoothing.

b) Forecasts produced by such an analysis should always be treated with caution. Changing conditions and changing seasonal factors make long term forecasting a difficult task.

c) The above illustration has been an example of a multiplicative model. This is the seasonal variations were expressed in percentage or proportionate terms. Similar steps would have been necessary if the additive model had been used except that the variations from the trend would have been the absolute values. For example, the first two variations would have been

Q1: 20 – 30.58 = absolute variation = -10.58

Q2: 32 – 32.42 = absolute variation = - 0.42

And so on.

The absolute variations would have been averaged in the normal way to find the average absolute variation, whether + or -, and these values would have been used to make the final seasonally adjusted forecasts.

2. Trend and seasonal variation using moving averages

When the correlation coefficient is low the method of calculating the regression line through the actual data points should not be used. This is because the regression line is too sensitive to changes in the data values.

In such circumstances, calculating a regression line through the moving average trend points is more robust and stable.

Example 1 is reworked below using this method and, because there are many similarities to the earlier method, only the key stages are shown.

x	y	3 point moving average (1)	Trend line (2)	$\frac{\text{Actual}}{\text{Trend}}$ %
1	20		34.38	58
2	32	38	35.70	90
3	62	41	37.02	167
4	29	37.3	38.34	76

STUDY TEXT

5	21	30.7	39.66	53
6	42	46	40.98	102
7	75	49.3	42.30	177
8	31	43	43.62	71
9	23	31	44.94	51
10	39	46.3	46.26	84
11	77	54.7	47.58	162
12	48	50.7	48.90	98
13	27	38	50.22	54
14	39	52.7	51.54	76
15	92	61.3	52.86	174
16	53		54.18	98

Trend estimates and percentage variations utilizing moving averages

The first three moving average is calculated as follows:

$\frac{20 + 32 + 62}{3}$ = 38 which is entered opposite period 2

The next calculated:

$\frac{32 + 62 + 29}{3}$ = 41, and so on

The regression line **y = a + bx** of the moving average values is calculated in the normal manner and results in the following:

y = 33.06 + 1.32x

This is used to calculate the trend line:

e.g. For Period 1:y = 33.06 + 1.32(1) = 34.38

For Period 2:y = 33.06 + 1.32 (2) = 35.70

The percentage variations are averaged as previously shown, resulting in the following values:

Average seasonal variation %	Q1	Q2	Q3	Q4
	54	89	170	86

The trend line and the average seasonal variations are then used in a similar manner to that previously described.

For example, to extrapolate future sales for the next year (i.e. quarters 17, 18, 19 and 20) is as follows:

Quarter 17

Forecast sales = (33.06 + 1.32(17)) × 0.54 = 29.97

A similar process produces the following figures:

Quarter 18 = 50.57

19 = 98.84

20 = 51.13

Forecast errors

Differences between actual results and predictions may arise from many reasons. They may arise from random influences, normal sampling errors, choice of the wrong forecasting system or alpha value or simply that the future conditions turn out to be radically different from the past. Whatever the cause(s) management wish to know the extent of the forecast errors and various methods exist to calculate these errors.

A commonly used technique, appropriate to time series, is to calculate the *mean squared error of the deviations* between forecast and actual values then choose the forecasting system and/or parameters which gives the lowest value of mean squared errors, i.e. akin to the 'least squares' method of establishing a regression line.

Longer- term forecasting

Moving averages, exponential smoothing and decomposition methods tend to be used for short to medium term forecasting. Longer term forecasting is usually less detailed and is normally concerned with forecasting the main trends on a year to year basis. Any of the techniques of regression analysis described in the preceding chapters could be used depending on the assumptions about linearity or non- linearity, the number of independent variables and so on. The least squares regression approach is often used for trend forecasting.

Forecasting using least squares

Example 2

Data have been kept of sales over the last seven years

Year	1	2	3	4	5	6	7
Sales (in '000 units	14	17	15	23	18	22	27
It is required to forecast the sales for the 8th year							

STUDY TEXT

Solution

Years **(x)**	Sales **(y)**	**xy**	x_2
1	14	14	1
2	17	34	4
3	15	45	9
4	23	92	16
5	18	90	25
6	22	132	36
7	27	189	49
∑**x**=28	∑**y** = 136	∑**xy**=596	∑ x_2= 140

136 = 7**a** + 28**b**

596 = 28**a** + 140**b**

Therefore b = 1.86

And substituting in one of the equations we obtain

a = **12**

Therefore Regression line = **y** = **12 + 1.86x**

Or, **Sales in ('000s of units) = 12.00 + 1.86 (no of years)**

We use this expression for forecasting, for 8th year sales = 12 + 1.86 (8)

=26.88 i.e. 26,888 units

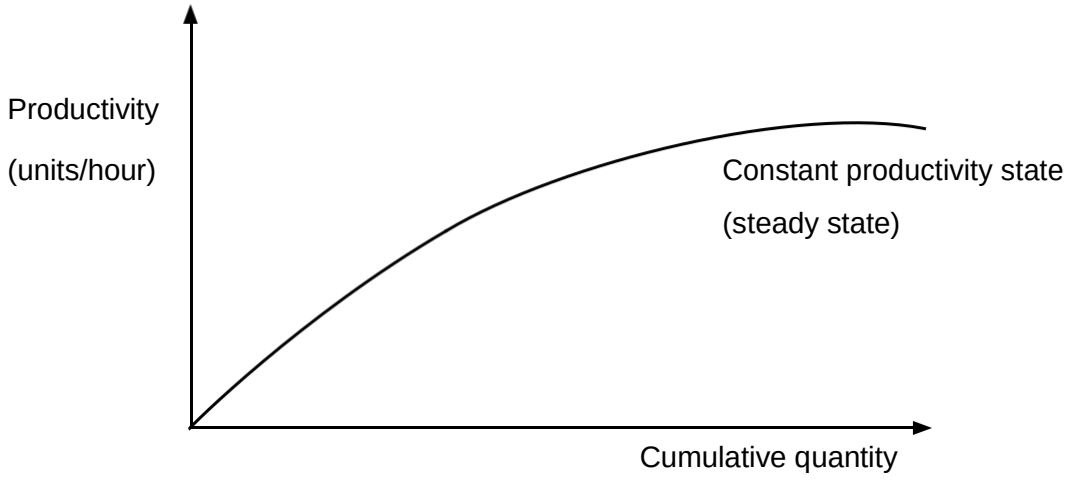
2.12 THE LEARNING CURVE THEORY

The first time a new operation is performed both workers and operating procedures are untried but as the operation is replaced the workers becomes more familiar with the work so that less hours are required. This phenomena is known as the learning curve effect.

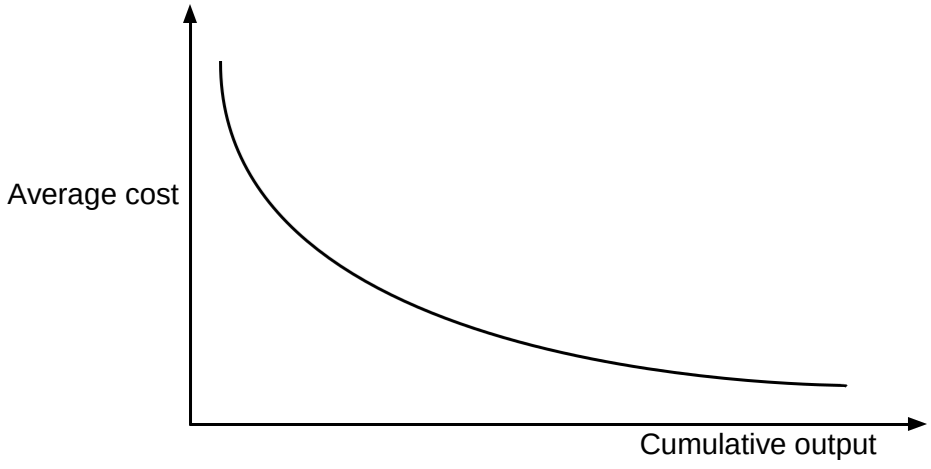
This is also referred to as improvement curve theory. It occurs when new production methods are introduced, new products (either goods or services) are made or when new employees are hired. It is based on the proposition that as workers gain experience in a task, they need less time to complete the job and productivity increases.

The learning curve theory affects not only direct labour costs but also impacts direct labour related costs such as supervision, and direct material costs due to reduced spoilage and waste as experience is gained.

The time to perform many operations begins slowly and speeds up as employees become more skilled. Gradually, the time needed to complete an operation becomes progressively smaller at a constant percentage. Since this rate of improvement has a regular pattern, a learning curve can be drawn (see diagrams below) to estimate the labour hours required as workers become more familiar. These curves are also referred to as progress functions or experience curves.



A learning curve



The effect of experience on cost is summarized by a learning ratio (improvement ratio or learning rate) defined by the following;

$$\text{Learning ratio} = \frac{\text{Average labour cost for the first 2x units}}{\text{Average labour cost for the first x units}}$$

Example 1:

The first 500 units have an average labour cost of sh.12.50 and the average labour cost for the first 1000 units is sh.10.

Required: Calculate the learning ratio.

$$\text{Learning ratio} = \frac{\text{Sh.10}}{\text{Sh.12.50}} \times \frac{80\%}{100} =$$

STUDY TEXT

Interpretation:

Every time cumulative output doubles, average cost declines to 80 percent of the previous amount. Since the average cost of the first 1000 units was sh.10, the average cost of the first 2000 units will be expected to be 20% or sh.8 per unit.

Learning curve equation:

The basic learning curve equation is

$Y = ab_x$

Where: a is the labour cost of the first unit

b is the cumulative production

x is the improvement exponent or an index learning given by:

$x = \frac{\text{logarithm of the learning ratio}}{\text{logarithm of 2}} = \frac{\log (1- \text{proportional decrease})}{\log 2}$ x can take any value

between -1 and zero.

Y is defined depending on whether a cumulative model or incremental model is being applied.

The above equation can be restated in the logarithmic

form $\text{Log } Y = \log a + x \log b$

Cumulative Total Cost

Each of the equations (i) and (ii) defines cumulative average cost. Either of them can be converted easily to a formula for the total labour cost of all units produced up to a given point. Total cost can always be calculated from a known average cost. Hence;

Total cost = $bY = b(ab_x) = ab_{x+1}$

Incremental cost

If producing a second 1000 units is to reduce cumulative average cost from sh.10 to sh.8, the cost of the second 1000 units will have to be only sh.6000, or sh.6 each. Hence;

	Total Cost (Sh.)	No. of Units	Average Cost (sh.)
First 1000 units	10,000	1,000	10
Second 1000 units	6,000	1,000	6
	16,000	2,000	8

Defining the learning curve in terms of this incremental relationship would be more useful but is more difficult to work with. As a result, learning curve improvement ratios are usually stated as

percentage reductions in cumulative average labour cost.

Applications of learning curves to accounting

The learning phenomenon applies to time and it could thus affect any costs which are functions of time. Examples are hourly labour costs, indirect labour, supervision, etc.

Whenever costs are estimated, the potential impact of learning should be considered.

The phenomenon can also affect costs used in inventory valuation, costs used in decision making and costs used in performance evaluation. However, learning curves only apply to the early phases of production. After the steady state is achieved, costs tend to stabilise.

(i) In Inventory valuation- failing to recognise learning effects can have some unexpected consequences. (See example below).

Example 2:

Production of a new product starts in January and continues through the year. Direct material cost is sh.100 per unit through out the year. Because of the learning effect, the labour hours per unit drop from 1 hour (at sh.160 per hour) in January to 0.25 hour in December. Manufacturing overhead is all fixed at sh.80,000. If 1000 units will be produced in January the overhead application rate is sh.80 per hour. This rate is (mistakenly) applied throughout the year.

Unit inventory Value

	January		**December**
	Sh.	Is (Sh.)	Should be (Sh.)
Direct materials	100	100	100
Direct labour	160	40(0.25x160)	40
Overheads applied	80	20(0.25x80)	80
	340	160	220

(ii) Decision making making" – A product newly launched may at a glance appear to be unprofitable, however because of learning effect, the variable costs would drop by the end of the period making the product profitable.

(iii) Performance evaluation. A bank has developed labour time and cost standards of some of its clerical activities. These activities are subject to the learning curve effect. The management has also found that the time on these activities exceeded the standard. On investigation, it was found that there was high personnel turnover meaning the activities were done by inexperienced people. Changes were made in personnel policy and the personnel turnover was reduced. The time spent on clerical activities no longer exceeded standards.

CHAPTER SUMMARY

Cost unit is a unit of product or service in relation to which costs are ascertained. Unit cost is what is most relevant for activities of the organization.

Cost centre is a production or service location, activity or item of equipment for which costs are accumulated.

Cost allocation isassigning a whole item of cost, or revenue, to a single cost unit, cost centre, account or time period.

Cost apportionment is spreading revenues or costs over two or more cost units, cost centers, accounts or time periods. This is done on a basis that is deemed to reflect the benefits received.

Absorption costing: Its objective is to include the total cost of a product and the appropriate share of the organization's total overheads appropriate sharing meaning an amount which reflects the amount of time and effort that has gone into producing a unit or completing a job.

Marginal costing: This distinguishes between fixed costs and variable costs. It excludes fixed costs from the absorption process and charges them in total against the period's result.

Job costing: The main purpose is to establish profit loss on each completed job and to provide a valuation of incomplete jobs i.e. **W.I.P.**

Batch costing: Where manufactured goods have some common characteristics and also some individual characteristics cost accumulation systems may be a combination of both job and process costing systems. The batch could be treated as a job during manufacture.

Process costing: It is appropriate where the product follows a series of sequential, frequently automatic process e.g. paper making. The essence is the averaging of the total costs of each process over the total throughput of that process (including partly completed units) and charging cost of output of on process as raw material in put to the next process.

Activity based costing is a costing method that creates a cost pool for each event or transaction in an organization that acts as a cost driver. Overhead costs are then assigned to products and services on the basis of the number of these events or transactions that the product or service has generated.

Engineering method: This method is used when no previous records of costs exist. It is a very detailed method that goes into the nitty-gritty of what constitutes a product in terms of how much material or how much labor. From this a suitable level of activity can be determined.

Account analysis: This method requires a close inspection of all elements of accounts but mostly the expenditure. From this, the management must determine which costs are variable, fixed or mixed.

Cost Estimating Relationship (CER) is a technique used to estimate a particular cost or price by using an established relationship with an independent variable or cost driver.

High-low method is a method of separating a mixed cost into its fixed and variable elements by analyzing the change in activity and cost between the high and low points of a group of observed data.

A **regression equation** identifies an estimated relationship between a dependent variable (the cost) and one or more independent variables (cost driver).

The **F-statistics** is a ratio which compares the explained sum of squares and the unexplained sum of squares.

Correlation measures how strong the connection is between the two variables.

Specification tests: These tests are used to test the validity of the regression assumptions.

Multiple regression analysis is an analytical method required in those situations where more than one causative factor is involved in the behavior of the variable element of a mixed cost

Regression line is a line fitted to an array of points. The slope of the line denoted by the letter b in the linear equation represents the average variable cost per unit of activity; the point where the line intersects the cost axis, denoted by the letter *a* in the equation above, represents the average total fixed costs.

Learning curve theory is also referred to as improvement curve theory. It occurs when new production methods are introduced, new products (either goods or services) are made or when new employees are hired. It is based on the proposition that as workers gain experience in a task, they need less time to complete the job and productivity increases.

CHAPTER QUIZ

1. Define the following:
   a) Cost unit
   b) Direct cost
   c) Indirect cost
   d) Prime costs
   e) Overheads
   f) Cost centre
   g) Cost allocation
   h) Cost apportionment

2. Distinguish between marginal costing and absorption costing.
3. What is activity based costing? State the steps in activity based costing.
4. What are the steps of developing a cost estimating relationship?
5. A customer has asked your company to prepare a bid on supplying 800 units of a new product. Production will be in batches of 100 units. You estimate that costs for the first batch of 100 units will average sh100 a unit. You also expect that a 90 percent learning curve will apply to the cumulative labour costs on this contract.

Required:

a) Prepare an estimate of the labour costs of fulfilling the contract.
b) Estimate the incremental labour cost of extending the production run to produce an additional 800 units.
c) Estimate the incremental labour cost of extending the production run from 800 to 900 units.

ANSWERS TO QUIZ QUESTIONS

1. Definitions:

   a) Cost unit is the unit of product or service in relation to which costs are ascertained.
   b) Direct Cost is the cost that can be directly identified with a job, a product, or service.
   c) Indirect Cost includes material, labor, expense that cannot be directly identified with a product.
   d) Prime costs are the total of all direct costs.
   e) Overheads are the total of indirect costs.
   f) Cost centre is the production or service location, activity or item of equipment for which costs are accumulated.
   g) Cost allocation is assigning a whole item of cost, or revenue, to a single cost unit, cost centre, account or time period.
   h) Cost apportionment isspreading revenues or costs over two or more cost units, cost centers, accounts or time periods. This is done on a basis that is deemed to reflect the benefits received.

2. Absorption costing includes the total cost of a product and the appropriate share of the organization's total overheads-appropriate share meaning an amount which reflects the amount of time and effort that has gone into producing a unit or completing a job.

   Marginal costing distinguishes between fixed costs and variable costs. It excludes fixed costs from the absorption process and charges them in total against the period's result.

3. Activity based costing is a costing method that creates a cost pool for each event or transaction in an organization that acts as a cost driver. Overhead costs are then assigned to products and services on the basis of the number of these events or transactions that the product or service has generated.

Steps in activity based costing:

Step 1 - Identify activity
Step 2 - Select appropriate cost drivers
Step 3 - Apply cost drivers

4. The steps in developing a cost estimating relationship are:

Step 1: Define (or select) the dependent variable (Y)

Will the CER be used to estimate price, cost, labor hours, material cost, or some other measure of cost? Will the CER be used to estimate total product cost or estimate the cost of one or more components? The better the definition of the dependent variable, the easier it will be to gather comparable data for CER development.

The dependent variable is the cost to be predicted and it is choice depends on the purpose of the cost function. It may also be referred to as response variable.

Step 2: Select the cost driver(s)

This may also be referred to as independent, explanatory or predictor variable. A cost driver can be defined as any factor whose change causes a change in the total cost of an activity.

Step 3: Collect data concerning the relationship between the dependent and independent variables.

Collecting data is usually the most difficult and time-consuming element of CER development. It is essential that all data be checked and double checked to ensure that all observations are relevant, comparable, and relatively free of unusual costs.

Step 4: Plot the data on a graph

The graph (usually referred to as a scatter diagram) will indicate the general relationship between the dependent variable and the cost driver and will give a visual indication as to whether a lineal cost function can approximate the cost behaviour. It will also highlight extreme observations (outliers).

Step 5: Select the relationship that best predicts the dependent variable.

After exploring a variety of relationships, you must select the one that can best be used in predicting the dependent variable. Normally, this will be the relationship that best predicts the values of the dependent variable. A high correlation (relationship) between a potential independent variable and the dependent variable often indicates that the independent variable will be a good predictive tool. However, you must assure that the value of the independent variable is available in order for you to make timely estimates. If it is not, you may need to consider other alternatives.

Step 6: Test the reliability of the cost function

There are three main tests that should always be done. These include:

Logical relationship tests

Goodness of fit test

Specification tests (Tests of the assumptions of the model)

5. Average cost decreases by 10 percent every time the cumulative total production doubles. Therefore:
   Average cost of first 200 units = 0.9 x Average cost of first 100 units
   Average cost of first 400 units = 0.9 x Average cost of first 200 units
   Average cost of first 800 units = 0.9 x Average cost of first 400 units

Combining these, we have;

Average cost of the first 800 units = 0.9 x 0.9 x 0.9 x sh.100 =

sh72.90 Total cost = sh (72.90 x 800) = sh. 58,320

Average cost of the first 1600 units = 0.9 x 72.90 = sh.65.61

Total cost of 1600 units = 1600 x sh65.61 = sh.104,976

Additional cost of second 800 units = sh 104,976 – 58,320 = sh.46,656

Average cost = sh.58.32 /unit.

Because this increase will not increase cumulative production to twice some figure we already have, we need to Use the formula.

Average cost = sh10,000 x 9^x

$x = \frac{-0.0458}{0.301} = -0.15216$

Hence;

Log av. cost = log 10,000 – 0.15216 log 9

Average cost = sh. 71.5833/unit

Total Cost = 900 x sh.71.5833 = sh.64,425

Incremental cost = sh.64,425 – 58,320

Average cost = sh.61. 05/unit

PAST PAPER ANALYSIS

Activity Based Costing is was tested in the following examinations:

06/'07

05/'06

06/'04

12/'00

Regression Analysis was tested in the following examinations:

12/ '04

06/ '03

06/ '01

High low method was also tested in the following examinations:

12/'04

06/'03

EXAM QUESTIONS

QUESTION ONE

Large service organizations such as banks and hospitals used to be noted for their lack of standard costing systems and their relatively unsophisticated budgeting and control systems compared to the practice in large manufacturing organizations. But this is changing any many large service organizations are now reversing their use of management accounting techniques.

Required:

a) Explain which features of large service organizations encourage the application of activity-based approaches to the analysis of cost information. (7 marks)
b) Explain which features of service organizations may create problems for the application of activity-based costing. (7 marks)
c) Explain the uses of activity-based cost information in service industries. (6 marks)

(Total: 20 marks)
(CPA DEC 2002)

QUESTION TWO

A university offers a range of degree courses. The university's organization structure consists of three faculties each with a number of teaching departments. In addition, there is a university administrative/management function and a central services function.

The following cost information is available for the year ended 30 June 2002

1. Occupancy costs total Sh.15,000,000. Such costs are apportioned on the basis of area used which is:
2.

	Faculties	**Teaching Departments**	**Administrative/ Management**	**Central services**
Area (Square feet)	7,500	20,000	7,000	3,000

3. Administration/management costs:
   Direct costs: Sh.17,750,000.
   Indirect costs: an apportionment of occupancy costs.
   Direct and indirect costs are charged to degree courses on a percentage basis.
4. Faculty costs:
   Direct costs: Sh.7,000,000.
   Indirect costs: an apportionment of occupancy and central services costs.
   Direct and indirect costs are charged to teaching departments.
5. Teaching departments:
   Direct costs: Sh.5 5,250,000.
   Indirect cost: an apportionment of occupancy costs and central services costs plus all faculty costs.
   Direct and indirect costs are charged to degree courses on a percentage basis.

6. Central services:
   Direct costs: Sh.10,000,000
   Indirect costs: an apportionment of occupancy costs.
7. Direct and indirect costs of central services have in previous years been charged to users on a percentage basis. A study has now been completed which has estimated what user areas would have paid external suppliers for the same services on an individual basis. For the year ended 30 June 2002, the apportionment of central services costs is to be recalculated in a manner which recognizes the cost/savings achieved by using the central services facilities instead of using external service companies. This is to be done by apportioning the overall savings to user areas in proportion to their share of the estimated external costs.
8. The estimated external cost of service provision are as follows:

		Sh. '000'
Faculties		2,400
Teaching departments		8,000
Degree courses:		
	Business studies	320
	Mechanical engineering	480
	Catering studies	320
	All other degrees	4,480
		16,000

Additional data relating to the degree courses are as follows:

	Business Studies	**Mechanical Engineering**	**Catering studies**
Number of graduates	80	50	120
Apportioned costs (as a % of total)			
Teaching departments	3%	2.5%	7%
Administrative/management	2.5%	5%	4%

Central services are apportioned as detailed in (5) above.

The total number of graduates from the university in the year to 30 June 2002 was 2,500.

Required:

a) Prepare a flow diagram which shows the apportionment of costs to user areas. (No value needs to be shown). (3 marks)
b) Calculate the average cost per graduate for the year ended 30 June 2002, for the university and for each of the degree courses in business studies, mechanical engineering and catering studies (round your values to the nearest Sh.1,000). (13 marks)
c) Suggests reasons for any differences in the average cost per graduate from one degree course to another, and discuss briefly the relevance of such information to the university's management. (4 marks)

(Total: 20 marks)
(CPA DEC 2002)

QUESTION THREE

CB plc produces a wide range of electronic components including its best selling item, the Laser Switch. The company is preparing the budgets for year 5 and knows that the key element in Master budget is the contribution expected from Laser Switch. The records for this component for the past four years are summarized below:

Sales (units)	150000	180000	200000	230000
	$	$	$	$
Sales revenue	292,820	346,060	363,000	488,800
Variable cost	131,080	161,706	178,604	201,160
Contribution	161,740	184,354	184,396	247,160

It has been estimated that sales in Year 5 will be 260,000 units

Required:

As a starting point for forecasting Year 5 contribution, to project the trend, using linear regression, calculate the 95% confidence interval of the individual forecast for year 5 is the standard error of the forecast is $14500 and the appropriate *t* value is 4303 and to interpret the value calculated. To comment on the advantages of using linear regression for forecasting and limitations of the technique.

QUESTION FOUR

Savitt ltd manufactures variety of products at its industrial site in Ruratania. One of the products LT is produced in a specially equipped factory in which no other production takes place. For technical reasons the company keeps no stocks of either LT or the raw material used in their manufacture. The costs of producing LT in the special factory during the past four years have been as follows:

YEAR	1	2	3	4 (Estimated)
	Sh	Sh	Sh	Sh
Raw material	70,000	100,000	130,000	132,000
Skilled labor	40,000	71,000	96,000	115,000
Unskilled labor	132,000	173,000	235,000	230,000
Power	25,000	33,000	47,000	44,000
Factory costs	168,000	206,000	246,000	265,000
Total costs	435,000	583,000	754,000	786,000
Output (units)	160,000	190,000	220,000	180,000

STUDY TEXT

The cost of raw materials and skilled and unskilled labor have increased steadily during the past four years at an annual compound rate of 20% and the costs of factory overheads increased steadily during the past four years at an annual compound rate of 15% during the same period. The power costs increased by 10% on 1st January of Year2 followed by 25% on the 1st January of each subsequent years. All costs except power are expected to increase by a further 20% during year 5. Power prices are due to rise by 25% on 1 January year 5.

The directors of Savitt ltd are now formulating the company's production plan for year 5 and wish to estimate the costs of manufacturing the product LT. The finance director has expressed the view that the full relevant cost of producing LT can be determined only if a fair share of general company overheads is allocated to them. No such allocation is included in the table of costs above.

Required:

Use linear regression analyses to estimate the relationship of total production costs to volume for the product LT for year5 (ignore the general company overheads and do not undertake a separate regression calculation for each item of cost).

Comment on the view expressed by the director.

Ignore taxation.

QUESTION FIVE

(a) A company makes an electronic navigational guidance system that is used for space craft, aircraft and submarines. The direct labour cost is subject to an 80% learning curve. The first unit is estimated to require 1250 direct labour hours.

Required:

Compute the average number of hours required for the first 2, 3, 4, 8 units.

(b) Assume the company estimates the variable cost of producing each unit as shown;

Direct material cost	Sh.40,000 per unit
Direct labour	Sh.20 per hour
Variable production overhead	Sh.1000 + 60% of direct labour cost

Required:

Estimate the total manufacturing cost of 1, 2, 3, 4 units of the product

CASE STUDY

DK Pizza: Cost Behaviour Case Study

Cost and Management
Accounting Home Page

The DK Pizza House has provided you with the following information on its costs at various levels of monthly sales.

Monthly sales units	**3,000**	**6,000**	**9,000**
Cost of food	3,500	5,000	6,500
Supplies	600	1,200	1,800
Utilities	360	420	480
Other operating costs	1,500	3,000	4,500
Building rent	1,000	1,000	1,000
Depreciation	200	200	200

Required

1 Identify each cost as variable, fixed or mixed.
2 Develop an equation to estimate total cost at various levels of activity
3 Project total cost with monthly sales of 8,000 units.

In summary, the graphs obtained tell us the following:

Cost	**Cost Behaviour**
Cost of food	semi variable cost
Supplies	variable cost
Utilities	semi variable cost
Other Operating Costs	variable cost
Building Rent	fixed cost
Depreciation	fixed cost

Source: www.google.co.ke- case studies on cost behavior

CHAPTER THREE

PLANNING AND DECISION MAKING

CHAPTER THREE

PLANNING AND DECISION MAKING

▶ CHAPTER OBJECTIVES

The main objective of this chapter is to examine the paramount Cost profit volume analysis. Later in the chapter we shall also examine the relevant cost decisions that managers make in the short run with the help of management accounting information.

Also, after this chapter the student will be able to discuss what price is and what the process of pricing entails.

▶ INTRODUCTION

As reiterated earlier, the role of the management accountant is to provide relevant information for the intended purpose e.g. planning and decision making. In this lesson we will focus on the latter. Decision making may be applied to solve short term operating problems or be part of the longer term planning process. In this way decision making may be stated to be short term or long term. Short term decision making assumes that decisions previously made concerning fixed plant and equipment cannot be altered. Thus such decisions often involve making **the best use of existing resources.** Resources may not be bountiful thus we will introduce what is called **limiting factors.** We will also see the various applications of the Cost-Profit-Volume (CVP) analysis.

▶ DEFINITION OF KEY TERMS

A **CVP analysis** is a systematic method of examining the relationship between changes in activity (output) and changes in total sales revenue, expenses and net profit.

Relevant revenue is any revenue that differs among alternatives and will influence the final outcome.

Avoidable costs are costs which will not be incurred if a particular decision is made.

Incremental costs are extra costs incurred as a result of a decision.

Opportunity costs are costs that measure the opportunity that is lost or sacrificed when the choice of one course of action requires that an alternate course of action be given up.

Marginal revenue is the increase in total revenue from sale of an additional unit

Marginal cost is the increase in total cost from the production of an additional unit

Break even analysis is mainly used to explain the relationship between the cost incurred, the volume operated at and the profit earned.

The **margin of safety** is the amount by which actual output or sales may fall short of the budget without the company incurring losses.

Demand is the quantity of a good which consumers want and are willing and able to pay for.

Cost plus pricing system is based on costs and adding some profit margin to it to arrive at the selling price for the product.

Full cost plus pricing (absorption) involves the use of conventional techniques to come up with the *total cost* for a product to which is added a *markup* to arrive at the selling price.

Minimum price is the price to charge for a job that will be able to cover the *incremental costs* of producing and selling the item and the *opportunity cost* of resources consumed in making and selling the item.

Market penetration relates to the attempt to break into a market and to establish that market share which will enable the firm to achieve its revenue and profit targets.

Market skimming involves setting a relatively high price stressing the attractions of new features likely to appeal to those with a genuine interest in the products or associated attractions.

Differential pricing is the ability of the firms to split the market into segments based on different characteristics.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on:

- CVP analysis
- Make or buy decisions
- Activity Based Costing

Students should therefore understand these topics.

▶ INDUSTRY CONTEXT

Organizations use short term decision making to determine margin of safety which indicates by how much sales may decrease before loss occurs. The organization will then be able to prepare for this.

Short term decision making helps organizations to determine break-even point which is the level of activity at which an organization neither earns a profit nor incurs a loss.

The break-even point can also be defined as the point where total revenue equals total costs as the point where the total contribution margin equals total fixed costs.

At this point, the firm makes no profit or loss and will therefore ensure that it does not realize a loss.

Pricing is used in organizations to determine price to charge for a product, service, job and so on.

Demand enables organizations to know how much to produce and sell in the market.

This chapter touches on minimum pricing which enables organizations to determine the price to charge for a job that will be able to cover the incremental costs for producing and selling the item and the opportunity cost of resources consumed in making and selling the item.


3.1 CVP ANALYSIS

FAST FORWARD: CVP Analysis is an application of *marginal costing*, (separating costs into fixed and variable). It is more relevant where the proposed changes in activity are relatively small so the established cost patterns and relationships are likely to hold good.

A **CVP analysis** is a systematic method of examining the relationship between changes in activity (output) and changes in total sales revenue, expenses and net profit.

In cost-volume-profit analysis, you:

- Should consider only short-term operations. The short term may be defined as a period too short to permit facilities expansion or contraction or other changes that might affect overall pricing relationships.
- Assume that a straight line can reasonably be used in analysis. While actual price behavior may not follow a straight line, its use can closely approximate actual cost behavior in the short run.
- If purchase volume moves outside the relevant range of the available data, the straight-line assumption and the accuracy of estimates become questionable.
- If you know that product variable costs per unit are decreasing as quantity increases, consider using the log-linear improvement curve concept. Improvement curves are particularly useful in limited production situations where you can obtain cost/price information for all units sold.

In CVP, output is given more attention in the relationship between it and sales, expenses or profits since the knowledge of this will enable management to identify critical output levels such as the level at which neither profit nor loss will occur i.e. **break-even point.** The relationship being analyzed is normally the short-run normally being a period of 1 year or less.

In the short run, costs can be of three general types:

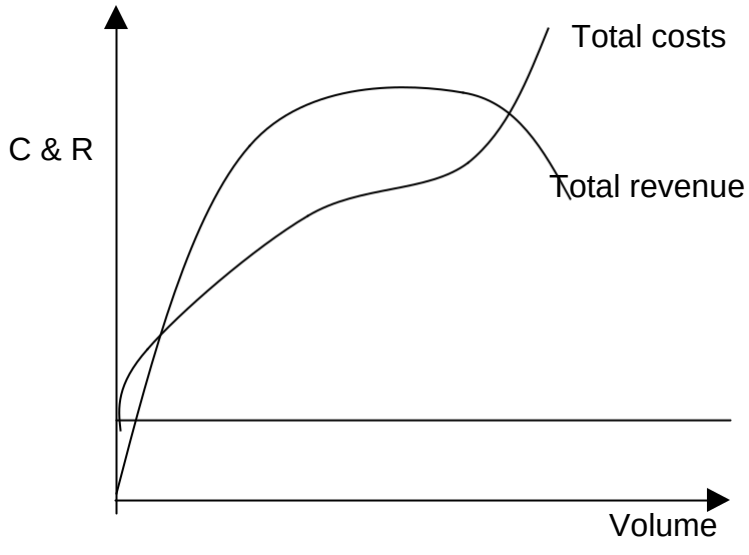
- **Fixed Cost.** Total fixed costs remain constant as volume varies in the relevant range of production. Fixed cost per unit decreases as the cost is spread over an increasing number of units. Examples include: Fire insurance, depreciation, facility rent, and property taxes.
- **Variable Cost.** Variable cost per unit remains constant no matter how many units are made in the relevant range of production. Total variable cost increases as the number of units increases. Examples include: Production material and labor. If no units are made, neither cost is necessary or incurred. However, each unit produced requires production material and labor.
- **Semi-variable Cost.** Semi-variable costs include both fixed and variable cost elements. Costs may increase in steps or increase relatively smoothly from a fixed base. Examples include**:** Supervision and utilities, such as electricity, gas, and telephone. Supervision costs tend to increase in steps as a supervisor's span of control is reached. Utilities typically have a minimum service fee, with costs increasing relatively smoothly as more of the utility is used.

You can use the cost-volume relationship for:

- **Evaluating item price in price analysis.** Cost-volume-profit analysis assumes that total cost is composed of fixed and variable elements. This assumption can be used to explain price changes as well as cost changes. As the volume being acquired increases unit costs decline. As unit costs decline, the vendor can reduce prices and same make the same profit per unit.
- **Evaluating direct costs in pricing new contracts.** Quantity differences will often affect direct costs -- particularly direct material cost. Direct material requirements often include a fixed component for development or production operation set-up. As that direct cost is spread over an increasing volume unit costs should decline.
- **Evaluating direct costs in pricing contract changes.** How will an increase in contract effort increase contract price? Some costs will increase others will not. The concepts of cost-volume-profit analysis can be an invaluable aid in considering the effect of the change on contract price.
- **Evaluating indirect costs.** The principles of cost-volume-profit analysis can be used in indirect cost analysis. Many indirect costs are fixed or semi-variable. As overall volume increases, indirect cost rates typically decline because fixed costs are spread over an increasing production volume.

The CVP relationship can be looked at from two fronts; form the economists' point of view and from the accountants.

Economists point of view



The economist's model can be summarized with reference to the above graph.

Form graph 1, we observe that the *total revenue* line is curvilinear. In economics, the only way you can increase sales output is by decreasing the price per unit. The line rises steeply and begins to decline because the adverse effects of price reduction outweigh the benefits of increased volumes.

The *total cost line*:

- A → B costs rises steeply at low volume levels. Difficulties of efficiently running a plant designed for much larger volumes.
- B → C costs begin to level out, rising less steeply. The firm is able to operate plant within efficient range. Specialization is in labor with smooth production schedules.
- C → D cost rises steeply as cost per unit increases. Output per direct labor hour decline when plant is operated beyond the activity level for which it was designed. Here bottlenecks begin to develop; production schedule begins to be more complex, plant breakdowns. The effect is the cost per unit begins to increase. (the dashed line represents total fixed costs)

Notice that the TR crosses the TC at two points. Does it mean there are two break-even points?

T.C is affected by variable cost in figure 2

- As the volume increases, the variable cost per unit declines as a result of bulk discounts; there's division of labor. This leads to increasing returns to scale.
- Since variable costs/unit is higher in lower volumes, the TC line between A and B rises steeply.
- VC levels between point Q_1 and Q_2. This is the most efficient output level.
- Beyond Q_2. The firm is operating at a higher level. Here there are bottlenecks, plant breakdowns, the direct labor hour output reduces. VC/unit increases leading to decreased returns to scale.

Marginal cost and Marginal revenue

Marginal revenue: it is the increase in total revenue from sale of an additional unit.

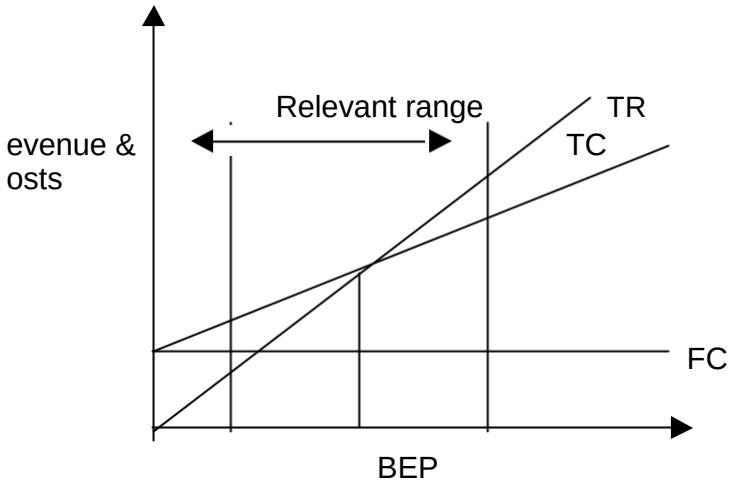
Marginal cost: it is the increase in total cost from the production of an additional unit.

Economists say that maximum profit is where the marginal cost is equal to the marginal revenue. It is actually the point where there is the greatest distance between the TC and TR.

The maximum TR is where MR=0. At minimum MC, the TC changes form concave downwards to concave upwards.

Accountant's point of view

A constant VC per unit and selling price will result in a linear relationship. The result is ONE breakeven point and profits increase with an increase in volume. The most profitable output is therefore at the maximum practical capacity. The economist's point of view however is more superior and more accurate on this point since the TC line is non-linear



Total revenue function; Accountant Vs Economist

For the accountant, the selling price is constant with the TR is a straight line. It is applicable in industries where price is fixed in the short term. The factor supporting fixed selling price is that competition could take the form of **non-price.** The firms will only function within a relevant range hence avoids the chances of reducing prices at higher levels of operation.

The main assumptions required in C-V-P analysis are:

i. All costs can be split into fixed and variable elements.
ii. Fixed costs will remain constant and variable costs will vary proportionately with activity levels.
iii. There is assumed to be no uncertainty.
iv. There are no stock level changes and that stocks are valued at marginal cost only.
v. Total costs and total revenue are linear functions of output.
vi. We are dealing with w single product or a constant product mix
vii. Analysis only applies to a relevant range only
viii. Analysis only applies to a short term time horizon

3.2 ANALYZING THE COST-VOLUME RELATIONSHIP

3.2.1 Algebraic Analysis

The assumption of linear cost behavior permits use of straight-line graphs and simple linear algebra in cost volume analysis.

Total cost is a semi variable cost-some costs are fixed, some are variable and others are semi variable.

In analysis, the fixed component of a semi-variable cost can be treated like any other fixed cost.

The variable component can be treated like any other variable cost. As a result, we can say that:

Total cost = Fixed cost + Variable cost

Using symbols:

C=F+V

Where:
C = Total cost

F = Fixed cost

V = Variable cost

Total Variable cost depends on two elements:

Variable cost = Variable cost per unit × Volume produced

Using symbols:

$V = V_U(Q)$

Where:

V_U = Variable cost per unit

Q = Quantity (Volume) produced

Substituting this variable cost information into the basic total cost equation, we have the equation used in cost-volume analysis:

$C = F + V_U(Q)$

>>> **Illustration**

Fixed cost = Sh.500

Variable cost = Sh.10

Volume produced = 1,000

Required: Calculate the total cost of production.

$C = F + V_U(Q)$

$= 500 + 10\ (1000)$

$=$ Sh.10500

Given total cost and volume for two different levels of production, and using the straight-line assumption, you can calculate variable cost per unit.

Remember that:

- Fixed costs do NOT change no matter what the volume, as long as production remains within the relevant range of available cost information. Any change in total cost is the result of a change in total variable cost.
- Variable cost per unit does NOT change in the relevant range of production.

As a result, we can calculate variable cost per unit (V_U) using the following equation:

$$V_U = \frac{\text{Change in Total cost}}{\text{Change in Volume}} = \frac{C_2 - C_1}{Q_2 - Q_1}$$

Where:

C_1 = Total cost for Quantity 1

C_2 = Total cost for Quantity 2

Q_1 = Quantity 1

Q_2 = Quantity 2

>>> Illustration

You are analyzing an offeror's cost proposal. As part of the proposal the offeror shows that a supplier offered 5,000 units of a key part for Sh.60,000. The same quote offered 4,000 units for Sh.50,000. What is the apparent variable cost per unit?

$$V_U = \frac{C_2 - C_1}{Q_2 - Q_1} = \frac{60000 - 50000}{5000 - 4000}$$

= Sh.10

3.2.2 Graphic Analysis

When you only have two data points, you must generally assume a linear relationship. When you get more data, you can examine the data to determine if there is truly a linear relationship.

You should always graph the data before performing an algebraic analysis.

- Graphic analysis is the best way of developing an overall view of cost-volume relationship.
- Graphic analysis is useful in analyzing cost-volume relationships, particularly, when the cost and volume numbers are relatively small.
- Even when actual analysis is performed algebraically you can use graphs to demonstrate cost-volume analysis to others.

Steps of Graphic analysis

Step 1. Determine the scale to use

Volume is considered the independent variable and will be graphed on the horizontal axis. Cost is considered the dependent variable and will be graphed on the vertical axis. The scales on the two axes do not have to be the same. However, on each axis one block must represent the

same amount of change as every other block of the same size on that axis. Each scale should be large enough to permit analysis and small enough to permit the graphing of all available data and anticipated data estimates.

Step 2. Plot the available cost-volume data.

Find the volume given for one of the data points on the horizontal axis. Draw an imaginary vertical line from that point. Find the related cost on the vertical axis and draw an imaginary horizontal line from that point. The point where the two lines intersect represents the cost for the given volume.

Step 3. Fit a straight line to the data.

All data points will fall on a straight line. All you have to do is fit a straight line that connects the data points. Most analysts use regression analysis to fit a straight line when the points do not fall on the line.

Step 4. Estimate the cost for a given volume.

Draw an imaginary vertical line from the given volume to the point where it intersects the straight line that you fit to the data points. Then move horizontally until you intersect the vertical axis. That point is the graphic estimate of the cost for the given volume of the item.

Example of Graphic Analysis. The four steps of cost-volume-profit analysis can be used to graph and analyze any cost-volume relationship. Assume that you have been asked to estimate the cost of 400 units given the following data:

Units	Cost
200	$100,000
500	$175,000
600	$200,000

Solution

The estimated cost will be $ 150.000.

3.3 BREAK EVEN ANALYSIS

FAST FORWARD: Break even analysis is mostly used to explain the relationship between cost incurred, the volume operated at and the profit earned.

STUDY TEXT

To compute the break-even point we let

S be the selling price per unit

V_U be Variable cost per unit

Q be break-even quantities

F be total fixed costs

At break even point:,

Total revenue (TR) = Total Cost (TC)

Total revenue will be given by SQ while Total Cost (TC) = V_U Q + F

At break even point (BEP) therefore:

$$SQ=V_UQ+F$$

$$Q = \frac{F}{S - V_u}$$

$$BEP_{(\text{in units})} = \frac{F}{S - V_u}$$

>>> Illustration

Assume that you are planning to sell badges at the forthcoming Nairobi Show at Sh.9 each. The badges cost Sh.5 to produce and you incur Sh.2000 to rent a booth in the Show ground.

Required:

a) Compute the breakeven point
b) Compute the margin of safety
c) Compute the number of units that must be sold to earn a before tax profit of 20%
d) Compute the number of units that must be sold to earn an after tax profit of Sh.1640, assuming that the tax rate is 30%.

Solution

a) Break even point

BEP units = 2000/(9-5) = 500 units

BEP Sh. = 500 x 9 = 4500/-

b) Margin of safety

The margin of safety is the amount by which actual output or sales may fall short of the budget without the company incurring losses. It is a measure of the risk that the company might make a loss if it fails to achieve the target. A high margin of safety means high profit expectation even if the budget is not achieved. Margin of safety (MOS) can be computed as follows:

MOS = Expected sales - Break even sales
Expected sales

= 600-500 = 16.7%
600

c) Target before tax profit (Y)

Let X be the number of units to produce

$X = \frac{F+Y}{S - V_u}$

$X = \frac{2000 + 0.2 (9X)}{9 - 5}$

$X = \frac{2000 + 1.8X}{4}$

X = 909.09 approximately 910 units.

d) After Tax profit

Let Z be the after tax profit

$Y = \frac{Z}{I - t}$

Therefore

$X = \frac{F + Z/1-t}{S - V_u}$

$= 2000 + \frac{1640}{\frac{1-0.3}{9-5}}$

X = 1085.71

Approximately 1086 units.

Managers will obtain a clearer understanding of CVP behavior if the information is presented in graphical format. This may be preferred whenever:

STUDY TEXT

- A simple overview is sufficient
- There's need to avoid a detailed, numerical approach when for example the recipients have no accounting background.

Commonly used is the **breakeven chart** although an alternative called the **contribution chart** does exist and we will look at both using a simple example.

Steps in coming up with the breakeven chart.

a. Draw the axes
The horizontal axis show the levels of activity expressed as units of output. The vertical axis shows the values in $ representing costs and revenues.

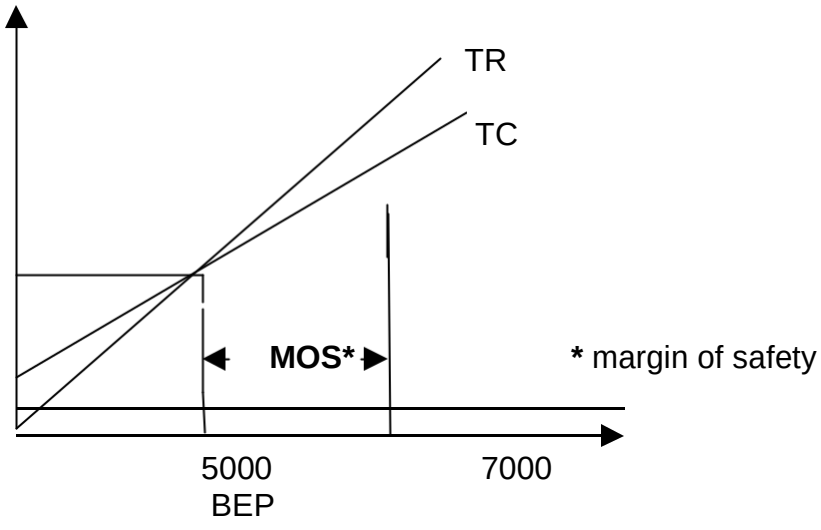
b. Draw the cost lines
The fixed cost is shown as a straight line parallel to the horizontal axis. The total costs will start where the fixed cost line intersects the vertical axis and will be a straight line sloping upward at an angle depending on the proportion of the variable costs on the total costs

c. Draw the revenue line
A straight line from the origin sloping upwards at an angle determined by the selling price

>>>Let us have an illustration

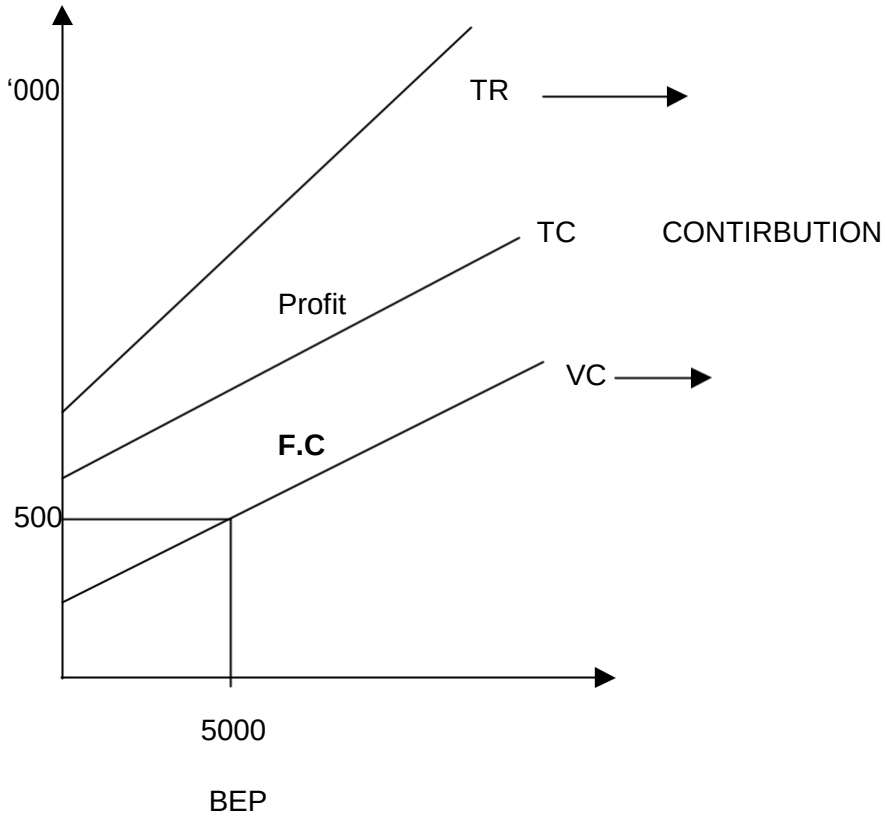
Haddock ltd makes a single product with a maximum capacity of 10000 tons per annum. The selling price per ton is $100 with a variable cost of $80 per ton. The fixed costs are $100000 per annum. Draw the breakeven chart showing likely profit at expected production level of 7000 tons.

It should be noted form both diagrams that the breakeven point is 5000 tons and the margin of safety is 2000 tons



STUDY TEXT

Contribution Break-even chart

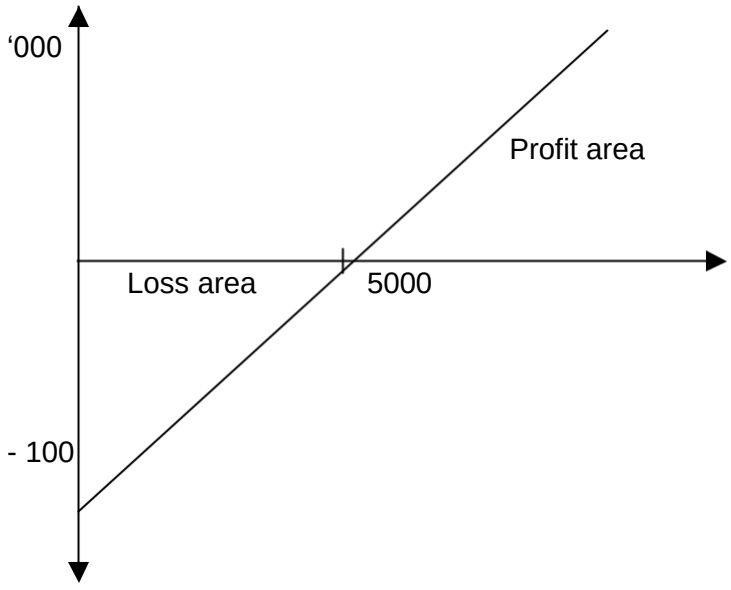


In the alternative (the contribution chart) the variable cost line is drawn first at $80 per ton. The FC is represented by the difference between the TC line and VC line. The advantage of this form of presentation is that the total contribution is emphasized in the graph and is represented by the difference between the total sales line and total VC line.

Profit-volume graph

The two graphs don't show clearly the profit/loss element. They both need further assessment to determine the difference between the TC and TR lines. The PV graph gives a good depiction. The horizontal axis shows the various levels of sales volume and profits/losses are recorded on the vertical scale.

At BEP (zero profit) the sales volume is 5000 tons. With each unit sold, a contribution of $20 is obtained towards the FC. BEP is obtained when the contribution is an exact amount as the fixed cost. With additional units beyond 5000 tons a surplus of $10 is obtained.



Optimizing the level activity

Earlier in the chapter, we had discussed the CVP analysis from the economists'. We have also seen the accountants' view in quite some detail. The economists have given considerable attention to the problems of determining the optimal level of activity of the firm. Given the objective of profit maximization, the optimal level of activity is when the marginal cost is equal to the marginal revenue. As discussed earlier, the cost/revenue function of the economists are non-linear. Therefore to get the optimal level of activity we can either use graphs or **differential calculus**.

Let's look at an illustration:

Given the demand function

P=45–0.5Q

T.C = Q_3 – 39.5Q_2 + 120Q + 150

i. What would be the price, quantity and profits if the objective is revenue maximization?

TR = p * q

= **(45 – 0.5q) q**

= **45q – 0.5q_2**

Maximum revenue: $\frac{\partial TR}{\partial q} = 0$

Therefore $45 - q = 0$

$q = 45$

Price $= 45 - 0.5*45 = 22.5$

Profit/ (loss) $= (45*22.5) - (45^3 - 39.5*45^2 + 120*45 + 150)$

$= (15675)$

ii. As above, but the objective is now profit maximization

At maximum profit: MR = MC

$$MC = \frac{\partial TC}{\partial Q} = 3Q^2 - 79Q + 120$$

$$= 45 - Q = 3Q^2 - 79Q + 120$$

$$0 = -3Q^2 + 78Q - 75$$

$$(-3Q+3)(Q-25) = 0$$

Test the 2nd order conditions

Profit is maximized when -3Q2 + 78Q – 75 = 0

$$\frac{\partial^2 \Pi}{\partial Q^2} = -6Q + 78$$

At Q = 1, $\frac{\partial^2 \Pi}{\partial Q^2} = -6(1) + 78 = 72 > 0$

At Q = 25, $\partial^2 \Pi = -6(25) + 78 = -72 < 0$

Profit is therefore maximized at 25

Price = 45 -0.5*25 = 32.5

Revenue = 25* 32.5 = 812.5

STUDY TEXT

3.4 C-V-P ANALYSIS - MULTIPLE PRODUCTS

So far we have assumed that a firm is only dealing with one product. In reality though, most firms have a number of products that have both direct fixed costs and common fixed costs. Getting the break-even point would seem easy by first using each individual products fixed costs. In the end however, there will be an overall loss equal to the total common fixed costs. A notion would be to allocate the common fixed costs on some basis but this would be wrong as it is quite arbitrary. So how do we get the breakeven point of a firm with multiple products?

$$\text{Total BEP}_{\text{Units}} = \frac{\text{Total fixed cost}}{\text{Average CM}}$$

$$\text{Average CM} = \sum_{t=1}^{n} (S_t - V_t)\pi_t$$

Where π_t is the sales mix of product t

S_t is the selling price of product t

V_t is the variable cost of product t

n is the number of units of products sold

$$\text{BEP}_{\text{t units}} = \pi_t \ (\text{Total BEP}_{\text{Units}})$$

$$\text{BEP}_{\text{t sh.}} = \text{BEP}_{\text{t units}} \times S_t$$

>>> Illustration

Assume that ABC Ltd produces two products, product A and B and the following budget has been prepared.

	A	B	Total
Sales in units	120,000	40,000	160,000
	Sh.	Sh.	Sh.
Sales @5/-, 10/-	600,000	400,000	1,000,000
Variable cost @ 4/-, 3/-	480,000	120,000	600,000
Contribution @ 1/-, 7/-	120,000	120,000	400,000
Total fixed cost			300,000
Profit			100,000

STUDY TEXT

Required:

a) Compute the break-even point in total and for each of the products.
b) The company proposes to change the sales mix in units to 1:1 for products A and B.

Advise the Co. on whether this change is desirable.

Solution

	A	B	
Sales mix mix" (units)	0.75	0.25	1
Sales mix mix" (Sh)	0.60	0.40	1

Average CM = $\sum_{t=1}^{n} (S_t \times V_t) \times t$

= 0.75 (1) + 0.25(7)

= 2.5

Total BEP Units = $\frac{\text{Total fixed cost}}{\text{Average CM}} = \frac{30,000}{2.5}$

= 120,000 units

	BEP (units)	**BEP (Sh)**	
A	120000 x 0.75 = 90,000	(90000 x 5)	= 450,000
B	120000 x 0.25 = 30,000	(30000 x 10)	= 300,000
	120,000		750,000

The question above can be solved by computing the BEP Sh first and then using the Sales Mix in Shs.

Total BEP Sh = $\frac{\text{Total fixed cost}}{\text{C/S ratio}}$

C/S ratio = $\frac{400,000}{1,000,000}$ = 0.4

Total BEP Sh = $\frac{300,000}{0.4}$ = 750,000

STUDY TEXT

			Sh.	Units
A	750000 x 0.6	=	450000	450000/5 = 9000
B	750000 X 0.4	=	300000	300000/10 = 30000
			750000	120000

b) Changing sales mix in units to 1:1 ratio

The budget can be reproduced as follows:

	A	**B**	**Total**	
Sales in units	80000	80000	160000	
	Sh	Sh	Sh	
Sales @ 5/-, 10/-	400000	800000	1200000	
V.c @4/-, 3/-	320000	240000	560000	
Contribution	80,000	560,000	640,000	
Total fixed cost				300,000
Net Profit				340,000

Sales mix mix" in units is 80000/160000 = 0.5

Average CM = 0.5(1) + 0.5(7) = 4

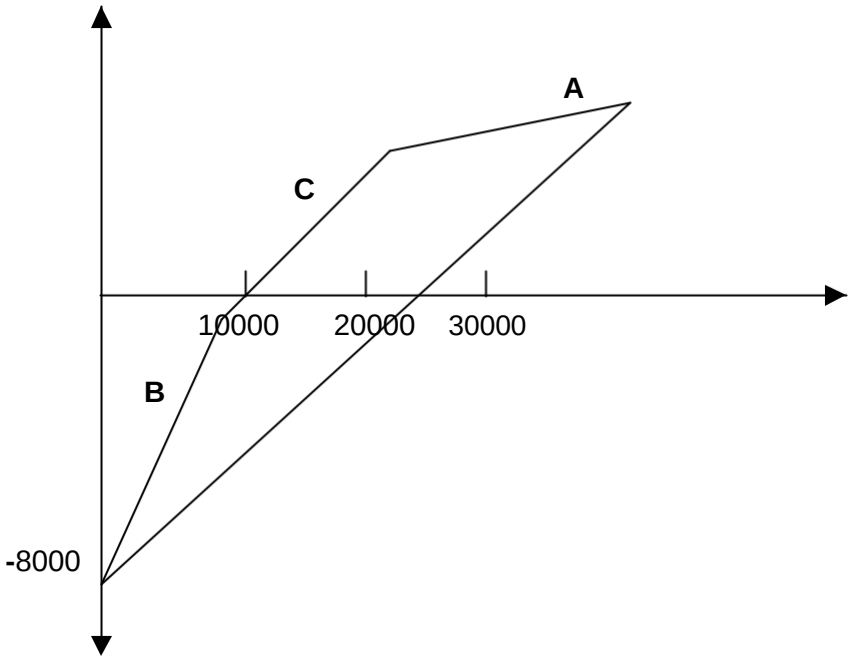
$$\text{Total BEP units} = \frac{300000 \text{ units}}{4} = 75{,}000$$

	BEP_{units}	**BEP_{sh}**
A (0.5 x 75000)	37500	187,500
B (0.5 x 75000)	37500	375,000
	75000	562,500

For manager of product line A, the change is good because he now breaks even at sh.187500 than sh.450000.

But for manager of product B, the change is not good because BEP has risen from sh.300000 to sh.375000.

Multi-product profit volume chart



The total sales of the products are expected to be $32000; total contribution being $11400. The weighted contribution/sales ratio is:

$$= \frac{11400}{32000} = 0.35625\%$$

The BEP in revenue terms can be calculated as follows:

$$= \frac{\text{Fixed costs}}{\text{C/S}}$$

$$= \frac{8000}{0.35625} = \$22456$$

This is approximately what is shown on the graph where the line cuts the horizontal axis.

3.5 C-V-P ANALYSIS UNDER UNCERTAINTY

FAST FORWARD: A major limitation of the basic C.V.P analysis is the assumption that the unit variable cost, selling price and the fixed costs are constant and can be predicted with certainty.

These factors however are variables with expected values and standard deviations that can be estimated by management.

There are various ways of dealing with uncertainty. Examples include:

STUDY TEXT

- Sensitivity analysis
- Point estimate of probabilities
- Continuous probability distribution e.g. normal distribution
- Simulation analysis
- Margin of safety

3.5.1 Point Estimate of Probabilities

This approach requires a number of different values for each of the uncertain variables to be selected. These might be values that are reasonably expected to occur but usually 3 values are selected. These are:

The worst possible outcome
The most likely outcome
The best possible outcome

For each of these 3 values, a probability of occurrence will be estimated.

>>> Illustration

Assume that a management accountant of a Company that makes and sells product X has made the following estimate:

	Selling price Sh.1		**Unit variable cost**		
	Sales demand		Condition		
Condition	Unit	Probability		Cost	Sh.
Worst possible	45000	0.3	Best possible	3.5	0.30
Most likely	50000	0.6	Most likely	4.0	0.55
Best possible	55000	0.1	Worst possible	5.5	0.15

Fixed cost = Sh.240,000

Required:

a. Compute the expected profit
b. Compute the probability that the company will fail to break even
c. If the Company has a profit target of Sh.60,000 what is the probability that the company will not achieve this target

Solution

a) E (Demand) = (45000 x 0.3) + (50000 x 0.6) + (55000 x 0.1) =

49000 E (Variable cost) = (3.5 x 0.3) + (4 x 0.55) + (55 x 0.15) =

Sh.4.075 E (Profit) = (10-4.075) 49000 – 240000 = Sh.50325

This can be worked out differently as shown below:

A	B	C	D	E	F	G	(FxG)		
Demand	Prob	Unit	VC	Prob.	Contr.	Profit	Joint	Weighted Prob.	Profit
45000	0.3	3.5	0.30	292500	52500	0.09	4725		
		4.0	0.55	270000	30000	0.165	4950		
		5.5	0.15	202500	(37500)	0.045	(1687.5)		
50000	0.6	3.5	0.3	325000	85000	0.18	15300		
		4.0	0.55	300000	60000	0.33	19800		
		5.5	0.15	225000	(15000)	0.09	(1350)		
55000	0.1	3.5	0.3	357500	117500	0.33	3525		
		4.0	0.55	330000	90000	0.055	4950		
		5.5	0.15	247500	7500	0.015	112.5		
						Expected profit	50325		

b) The P(Profit < 0) = 0.045 + 0.09

= 0.135

Note: This can be read from the table above

c) P(profit < 60000)

= 0.3 + 0.09 + 0.015

= 0.405

3.5.2 Continuous Probability Distribution (use of normal distribution)

In reality the C-V-P variables might take any values in a continuous range. It could therefore be more appropriate to use a continuous probability distribution such as the normal distribution with an estimated mean and standard deviation. Estimates may be made of the expected sales volume, the expected selling prices, the expected variable cost and the expected fixed costs together with their probabilities.

It would therefore be possible to compute the expected profit and the likelihood that the company would break even or achieve a given target profit.

>>> Illustration

Assume that the selling price of a product is estimated to be Sh.100, the variable cost Sh.60, and budgeted fixed cost is Sh.36000. The demand is normally distributed with a mean of 1000 units and a standard deviation of 90 units

Required

a. Compute the expected profit and standard deviation of profit
b. Compute the probability that the company would not break even
c. Compute the probability that a loss >Sh.1400 will occur

Solution

a) E(profit) = contribution margin x E(D) – F.C
= (100-60) 1000 – 36000
= Sh.4000

$$\sigma_{(profit)} = \sigma_{demand} \times CM = 90 \times 40 = \text{Sh.3600}$$

b) P(profit <0)

$$z = \frac{x - \mu}{\sigma} = \frac{0 - 4000}{3600} = -1.11$$

From the Z tables the value = 0.1335

Therefore P (profit <0) = 0.1335

c) P (profit < -1400)

$$Z = \frac{-1400 - 4000}{3600} = -1.5$$

From the Z tables the value = 0.0668

Therefore P (profit < -1400) = 0.0668

3.6 CVP ANALYSIS AND COMPUTER APPLICATIONS

The output from a CVP model is only as good as the input. The analysis will include assumptions about sales mix, production efficiency, price loads, total fixed costs, variable costs and selling price per unit.

The CVP equation can be used to develop financial planning programs. These programs quickly calculate the effects of changes in price, costs and volume on an organisation's profits. They answer such "what- if" questions as:

How could a 5% increase in the sales price affect operating income?

If Fast Food Co. increases its advertising budget by Sh1 million, how many hamburgers must it sell to cover the increase in fixed expenses?

If the campus bookstore extends its hours, how much additional revenue must it earn to cover the increased operating expense?

If variable production costs are reduced by 7%, how many units of product must be sold to earn Sh200,000 operating profit?

Such programs vary in complexity. Some simple programs can include only those variables discussed while other more complicated ones can include an organisation's complete budget.

Many firms use interactive programs of basic CVP equation on their microcomputers to analyse data they have collected and entered. These interactive capabilities allow managers to enter and change their inputs easily and also make the analysis of the financial effects of various alternatives simpler.

The computers' speed and accuracy in providing information from entered data improve the speed and accuracy with which the manager can select the most profitable actions.

Sensitivity analysis is one approach for coping with changes in the values of the variables. It focuses on how a result will be changed if the original estimates or the underlying assumptions change.

The widespread use of spreadsheet packages which do not require programming expertise has enabled management accountants to develop CVP computerised models. The impact of alternative revised plans is quickly identified and changes only implemented when it is apparent that the original estimates are incorrect.

3.7 RELEVANT COSTS FOR NON-ROUTINE DECISIONS

A relevant cost is a cost that is appropriate to a specific management decision. To be relevant, a cost must be:

1. Future cost – A decision is usually about the future and management not what has already been done. A cost that has already been incurred is therefore irrelevant to any decision being made now e.g. costs already paid or costs committed by decisions made in the past.

2. Relevant costs are cash flows – It is assumed that decisions are taken which would maximize the satisfaction of the company owners and therefore such decisions must not be ignored. Such costs include depreciation, notional rent or notional interest or absorbed O/H.

3. Relevant costs arise as a direct consequence of making a decision. It should be an incremental cost i.e. the difference between the cost with the decision and the cost without the decision.

Relevant and irrelevant data

In the decision making process, any cost that **differs among alternatives** and will influence the outcome is **relevant cost. Relevant revenue** is any revenue that differs among alternatives and will influence the final outcome. Future costs and revenues are relevant in decision making since e.g. planning is concerned with the future. Costs that have already been spent in the past i.e. **sunk costs** are irrelevant for decision making. For example, if a firm buys a special purpose machine for $40000, this is a sunk cost and will not affect future decisions regarding the machine. If the machine has a 10 year useful life and after 1 year of use, a new efficient machine is available at a cost of $60000, the decision on whether to buy the new machine should be based on the cost savings of the newer machine compared to its net assets (60000- sales proceed from selling the older machine) Cost of $40000 and the current book value are sunk costs.

Differential costs and revenues

Only those costs and revenues that alter as a result of a decision are relevant. Where factors are common to all alternatives they can be ignored only the differences are relevant e.g. fixed costs that will exist whether a decision is taken or not. Differential costs are costs that can be **avoided** or revenues foregone if the decision is no taken up.

Avoidable costs: costs which will not be incurred if a particular decision is made. It's usually in the context of a fixed cost e.g. if a fixed cost can be identified to the production of a single product and production is stopped, the fixed cost will not be incurred and therefore avoided.

Incremental costs: an extra cost incurred as a result of a decision e.g. if a decision is made to increase production and to do so an additional machine is to be leased, the lease cost of that machine is an incremental cost thus relevant.

Opportunity costs: A cost that measures the opportunity that is lost or sacrificed when the choice of one course of action requires that an alternate course of action be given up.

STUDY TEXT

>>>Example:

James has an opportunity to obtain a contract to produce a special component. It requires 100 hours of processing on machine X. Machine X is working on full capacity to produce product A and the only way the contract may be fulfilled is by reducing he output of product A leading to a lost contribution of $200. There will also be an additional variable cost of $1000.

Solution

If James takes on the contract, he will sacrifice a profit contribution of $200 from lost out put of product A. This is an opportunity cost and should be included as part of the costs when negotiating for the contract. The contract price should at least cover the additional cost of $1000 plus $200 opportunity cost to ensure that the company will be better off in the short term by accepting the contract.

A brief illustrated example of analysis of relevant cost will sum up our discussion

John has been offered a 1 year contract that will utilize an existing machine that's only suitable

for such a contract work. The machine cost $25000 four years ago and has been depreciated $5000 per year on a straight line basis and thus has a book value of $5000. The machine could be sold now for $10000 or in 1 year's time for $2000. 4 types of material will be needed.

Material	In stock	Required	Purchase price $	Current price $	Current resale price $
A	1200	300	1.80	1.50	1.20
B	200	1100	0.75	2.80	2.10
C	3000	600	0.50	0.80	0.60
D	1800	1200	1.80	2.00	1.90

A and D are used regularly within the firm. B could be sold if not used for the contract and there are no other uses for C, which has been deemed to be obsolete.

Required: What are the relevant costs in connection with the contract?

Solution

Machine costs: The historic costs $25000, is a sunk cost and not relevant. Depreciation details given relate to accounting conventions and are not relevant. The relevant cost is the opportunity cost caused by the reduction in resale value over the reduction is resale value over the 1 year duration of the contract i.e. $10000-$2000=$8000

Material cost:

A - Although there is sufficient in stock, the use of 300 units for the contract would necessitate the need for replenishment at current market price.

Therefore: **R.C = 300*1.50 = $450**

B - If the contract is not accepted, 200 units of B would be sold at $2.10 per unit. The balance of 900 units required would be bought at current buying in price. Of $2.80.

Therefore: **R.C = 200*2.10 = $420**
900*2.80= $2520
$2940

C - If the 600 units were used on the contract, they could not be sold so the opportunity cost is the current resale price of $0.60 per unit.

Therefore: **R.C = 600*$0.60 = $360**

D - Similar reasoning applies to A i.e. replenishment at current buying in price.

Therefore: **R.C. = 1200*$2 = $2400**

NOTE: Recorded historical cost which is the cost using normal accounting conventions is not the relevant value in any of the circumstances considered.

Now we will look at how the management accountant provides information to answer questions in decision making such as 'how many units should we sell to break-even?' or 'what would be the effect of on profits if we reduce our selling price and sell more units?' 'What sales volume is required to meet the additional fixed costs arising from the advertising campaign?' These questions will be better answered using a **CVP analysis.**

Assumptions

The key assumptions made in relevant costing are:

1. The cost behaviour is known.
2. The amount of fixed costs, unit variable costs, selling prices and sales demand are known with certainty.
3. The objective of the decision maker in the short-term is to maximize satisfaction which can be defined as maximization of short-term profit.
4. The information on which the decision is based is complete and reliable.

LIMITING FACTORS

In business situations, only a limited number of business opportunities may be undertaken. Some factors will limit the ability to undertake all the alternatives. These factors are known as **limiting factors.** In decision making, a manager will take the limiting factors into consideration.

For example, consider a situation where there's one limiting factor and more than one product competing for it. The essential elements of the problem are as follows:

- The object is to maximize profits. Therefore only costs and revenues that vary according to the decision are considered. Fixed costs are thus irrelevant.
- This leaves revenues and variable costs which together give us the contribution of each product. The aim should now therefore be to maximize total contribution.
- The real cost of producing product one rather than two is the contribution of product two foregone i.e. the opportunity cost. It must be ensured that the total contribution of product one gained exceeds that of product two lost.
- **Total contribution = units* contribution/unit**, where the number of units is the limiting factor. In the evaluation of alternative products, consideration must be given not only to contribution per unit, but also to number of units that can be produced subject to the limiting factor.
- To take both of these factors together, total contribution is maximized by concentrating on that product which yields the **highest contribution per limiting factor.**

>>> Let us look at an illustration

Company X is able to produce four (4) products and is planning a production mix for the next period. Estimated costs, sales and production data are given below.

	W	X	Y	Z
Selling price/unit	32	38	68	56
Labor @$6/hour	18	12	42	30
Materials @$1/kg	6	18	10	12
Contribution	8	8	16	14
Maximum demand	5000	5000	5000	5000

Labor hours are limited to 50000 for the period

Step 1 – establish whether there is a limiting factor

Hours required

W = 18/6 * 5000 = 15000

X = 12/6 * 5000 = 10000

Y = 42/6 * 5000 = 35000

Z = 30/6 * 5000 = 25000

85000 hours

Yet we are limited to only 50000 labor hours

Step 2 – rank the products in order of contribution per limiting factor.

	W	X	Y	Z
Contribution/unit	**8**	**8**	**16**	**14**
Limiting factor/unit	3	2	7	5
CU/LFU	**2.67**	**4**	**2.29**	**2.8**
Ranking	***3***	***1***	***4***	***2***

Step 3 – establish the product mix

1. X 5000 * 2 = 10000

2. Z 5000 * 5 = 25000

3. W 5000 * 3 = 15000

4.Y 0*7 =00000

50000 hours

No units of Y will be produced.

NB: The above process is only applicable when there's a binding constraint. In reality, it is possible to have more constraints and if we assume linearity; **linear programming** will be used to get us the optimum solution.

STUDY TEXT

Having looked at the limiting factors, there are various decisions managers should make and it's up to the management accountant to advice them.

There are various types of decisions that can be considered in this section, Examples include:

a. Make or Buy decisions
b. Shut down problems
c. Extra shift decisions
d. Joint cost decisions

3.7.1 Make or buy decisions (no limiting factors)

The choice between making or buying a given component is one which is likely to face all businesses at some time. It is often one of the most important decisions for management for the critical effect on profits that may ensue. The choice is critical, too, for the management accountant who provides the cost data on which the decision is ultimately based.

A make or buy problem involves a decision by an organisation about whether it should make a product or carry out an activity with its own internal resources or whether it should pay another organisation to carry out the activity. The make option gives management more direct control over the work, but the buy option may have benefits in that the external organisation has expertise and special skills in the work making it cheaper.

There are certain situations where the make or buy decision is not really a choice at all. There can be no alternative to making, where product design is confidential or the methods of processing are kept secret. On the other hand, patents held by suppliers may preclude the use of certain techniques and then there is no choice other than buying or going without. The supplier who has developed a special expertise or who uses highly specialized equipment may produce better-quality work which suggests buying rather than making. In other cases, the special qualities demanded in the product may not be available outside and so making becomes necessary.

Where technical considerations do not influence the make or buy decision, the choice becomes one of selecting the least-cost alternative in each decision situation. Comparative cost data are necessary, therefore, to determine whether it is cheaper to make or to buy. In general this requires a comparison of the respective marginal costs or, in some cases, the incremental costs of each alternative. Incremental costs are relevant in decisions which include capacity changes. For example, a certain component has always been bought out because the plant and equipment for its manufacture has not been installed in the factory. When considering the alternative to buying, the cost of making comprises all the incremental costs (including additional fixed expenditure) arising from the decision. The incremental cost also includes the opportunity cost of the investment in capital equipment, that is, the expected return from an alternative investment opportunity. A decision to buy a part which has previously been manufactured may release capacity for other uses or for disposal so that the incremental cost of the decision also includes the relevant fixed-cost savings.

>>>Illustration

Assume that ABC Ltd makes four components with the following information:

	W	X	Y	Z
Production (units)	1000	2000	4000	3000
Unit marginal costs				
Direct material	4	5	2	4
Direct labour	8	9	4	6
Variable O/H	2	3	1	2
	14	17	7	12

Attribute Fixed Cost			Sub contractor price	
		Sh.		**Sh.**
TO	W	1000	W	12
	X	5000	X	21
	Y	6000	Y	10
	Z	8000	Z	14

Committed Fixed Costs are Sh.30000

Required

Advise the company on the components to buy or make if any.

Solution

	W	X	Y	Z
Cost of buying per unit	12	21	10	14
Variable Cost of making	14	17	7	12
Extra variable cost of buying	(2)	4	3	2
No. of units	1 000	2000	4000	3000
Total extra costs VC of buying	(2000)	8000	12000	6000
Less attributable FC	(1000)	(5000)	(6000)	(8000)
Net extra costs of buying	(3000)	3000	6000	(2000)

The decision is to Buy W and Z and Make X and Y

3.7.2 Make or buy decisions under limiting factors

One reason for buying products/services from another organisation is the scarcity of resources, so that the company may be able to make all its components. In such a case the company should combine internal resources with buying externally to increase profitability. In situations where a company must sub-contract work to make up for the short-fall in its in-house capability,

then its cost will be minimized where the marginal cost of buying is least for each unit of scarce resource saved by buying externally.

>>> Illustration

Assume that ABC Ltd makes four components with the following information:

	W	**X**	**Y**	**Z**
Production (units)	1000	2000	4000	3000
Unit marginal costs				
Direct material	4	5	2	4
Direct labour	8	9	4	6
Variable O/H	2	3	1	2
	14	17	7	12

	Attribute Fixed Cost		Sub contractor price	
		Sh.		**Sh.**
TO	W	1000	W	16
	X	5000	X	21
	Y	6000	Y	10
	Z	8000	Z	18

Committed Fixed Costs are Sh.30000

Assume that machine hours per unit required to produce the components are:

Machine Hours

W	4
X	5
Y	3
Z	6

The total machine hours available are 27000 hours during the budget period.

Required:

Advise the company on which products to make and the ones to buy externally

Solution

Required machine hours

W	4X1000	=	4000
X	5X2000	=	10000
Y	3X4000	=	12000
Z	6X3000	=	18000
			44000

Available hours	27000
Short-fall	17000

Machine hours is therefore a limited resource.

	W	X	Y	Z
Cost of buying per unit	16	21	10	18
Cost of making VC	14	17	7	12
Extra variable cost of buying	2	4	3	6
No. of units	1000	2000	4000	3000
Total extra V. Cost of buying	2000	8000	12000	18000
Less attributable F C	(1000)	(5000)	(6000)	(8000)
Net extra cost of buying	1000	3000	6000	10000
Divide the no. of mhrs saved	4000	10000	12000	18000
Net extra costs of buying per Machine hours saved	0.25	0.30	0.5	0.56
Priority for buying	1	2	3	4
Priority for making	4	3	2	1

3.7.3 Abandonment decisions

From time to time management will be faced with the problem of deciding to abandon an unprofitable activity. This is really a least-cost alternative decision and so made on the criterion of relative marginal costs.

Ceasing Production of Certain Products

It is sometimes suggested that, where a given product is apparently making a loss, manufacture and/or marketing of this product should cease, to improve the company's overall profit performance.

KENBAR CYCLES LIMITED

PROFIT AND LOSS STATEMENT FOR YEAR ENDED 31.12.19..

	Model A16	Model E35	Model N40	Total
	£'000	£'000	£'000	£'000
Direct materials	110	100	150	360
Direct labour	50	40	80	170
Variable overhead	65	60	100	225
Fixed overhead	45	120	220	385
TOTAL COSTS	270	320	550	1,140
Profit/(loss)	45	65	(50)	60
SALES VALUE	315	385	500	1,200

Model N40 is incurring losses of £50,000 per annum, which is ten per cent of its sales value. The implication of this profit and loss statement is that the withdrawal of Model N40 from the market will avoid losing £50,000 and (by inference) raise profits to £110,000. This is faulty reasoning, but a risk which is inherent in the total cost form of presentation. The marginal presentation of the year's results would avoid the risk and give a more meaningful report.

KENBAR CYCLES LIMITED

PROFIT AND LOSS STATEMENT FOR YEAR ENDED 31.12.19..

	Model A16	Model E35	Model N40	Total
	£'000	£'000	£'000	£'000
Sales value	315	385	500	1,200
Marginal cost	225	200	330	755
Contribution	90	185	170	445
Fixed overhead				385
Profit/Loss				60

Since Model N40 yields an annual contribution of £170,000, the abandonment of this product will lose this contribution and so turn the overall profit of £60,000 into a *loss* of £110,000. (The contribution from A16 and E35 is £275,000 towards the fixed costs of £385,000). The marginal presentation shows that it is better to continue production of Model N40 rather than lose its contribution. As a general proposition it can be postulated that it is more profitable to continue marketing a product which yields some contribution rather than abandon it. (If possible, it would be better still to replace it with another product having a higher P/V ratio).

3.7.4 Temporary closure of factory or department

Here there is a similar situation to that of discontinuance of a product such as Model N40. A factory which is expected to earn some contribution should continue in operation rather than be shut down. However, if the factory is part of a group, the decision is quite different when the output from the closed factory is not lost but transferred to another factory in the group with spare capacity. For example, a temporary fall in the sales volume of a company's products may result in either of two factories being capable of satisfying the expected demand. In this situation the company can optimize its profits by concentrating production in that factory which has the lowest marginal costs. In reaching a decision, consideration should be given to predictable cost changes generated by the decision: such as additional distribution costs, care and maintenance of the closed premises, restarting costs, and any fixed cost savings such as salaries in the closed factory.

3.7.5 Permanent abandonment of premises

A company may find it more profitable to concentrate its output in some factories by closing down others. The decision, in this instance, is made on the basis of incremental costs and will depend on that combination of resources which yields the greater overall group profit. The permanent closure of a factory saves fixed cost s expenditure and also frees capital (by the sale of assets) for alternative investment, as well as providing the opportunity to take advantage of low marginal costs elsewhere. It is possible that the sale of freehold land and buildings could provide considerable investment funds free of interest which would make the abandonment particularly attractive. This has been demonstrated effectively by asset stripping following a successful takeover.

There may be a high social cost in a factory closure which is difficult to evaluate, but in any case it will be borne by the whole community rather than the individual manufacturer. A growing awareness of the social consequences which follow factory closures may persuade politicians that the cost to the community represents a hidden subsidy to the profits of an individual company. A tax or other deterrent for such cases in the future would be an additional cost of abandonment decisions and so make it relatively less profitable to close a factory.

3.7.6 Extra shift decision

These decisions are concerned with whether or not a company should work for 8 hrs, 16hrs, or 24 hrs a day or week day's only or weekends also. The factors to consider are:

i. Whether the work force would be willing to work extra shifts & if so what overtime or shift premium they would accept.
ii. Whether extra hours have to be worked just to remain competitive
iii. Whether extra hours would resort in extra revenue or whether there would be in demand pattern from customers.

>>> Illustration

XYZ currently operates a single production shift which incurs costs and earns revenue stated below:

		£
Sales (10000 units)		360000
Direct material	120000	
Direct labour	100000	
Variable O/Hs	20000	(240000)
Contribution		120000
Fixed Cost		(90000)
Profit		30000
Profit margin		8.36%

Sales demand exists for an extra 6000 units which can be made in a 2nd shift at current selling price. The labor in the 2nd shift will be paid at time & ¼. Additional fixed cost of £10000 will be incurred but due to the increase in purchase of materials a quantity discount of 5% will be given on all materials purchased.

Required:

Advise the company on whether to operate the 2nd shift.

Solution:

Analysis of Second shift

		£	
Sales (6000x36)			216000
Direct labour (1.25x10000)		125,000	
Variable O/Hs (2x6000)		12000	
Direct material			
Purchase 12x6500	72000		
Less discount 5% x 192000	9600	62400	
Additional Fixed Cost		10000	209400
Incremental total			6600
Profit margin			3.1%

Decision

Operate the second shift since it results in incremental profits.

3.7.7 Joint product decisions

When a manufacturing Company carries out a process operation in which 2 or more joint products are made from a common process a number of decision problems can arise. These are:

(1) If the joint product can be sold at existing condition at the split-off point or after further separate processing, then a decision should be made on whether to process further.
(2) If extra demand for a joint product exists and not others then it is necessary to know whether it is worth making more output of the joint product so as to make a profit on one and dispose off the other.
(3) If it is possible to change the input so as to change the product mix, then product mix decisions should be made.

Joint Product further processing decisions

In these decisions the relevant costs are the additional costs of further processing, which should be compared with the incremental revenue of further processing. The joint costs incurred before the split-off points are irreverent.

>>> Illustration

ABC Ltd produces product A&B from the same process. Joint processing costs of $150,000 are incurred up to the split off point where 100,000 units of A and 50,000 units of B are produced. The selling prices for products A and B at the split-off point are $1.25 per unit and $2.00 per unit respectively.

Units of A can be processed further to produce 60,000 units of A_+ which will incur a fixed cost $20,000 and variable cost of $0.3 per unit.

Required

Advice the Company whether to sell product A or product A+

Solution

Incremental revenue $3.25x60,000 -1.25x100,000		$70,000
Further processing costs		
Fixed cost	20,000	
Variable cost $0.3 x 100,000	30,000	50,000
Incremental profit from further processing		20,000

Decision

Process further since incremental profit is positive

STUDY TEXT

Joint product Break-even point of extra Output

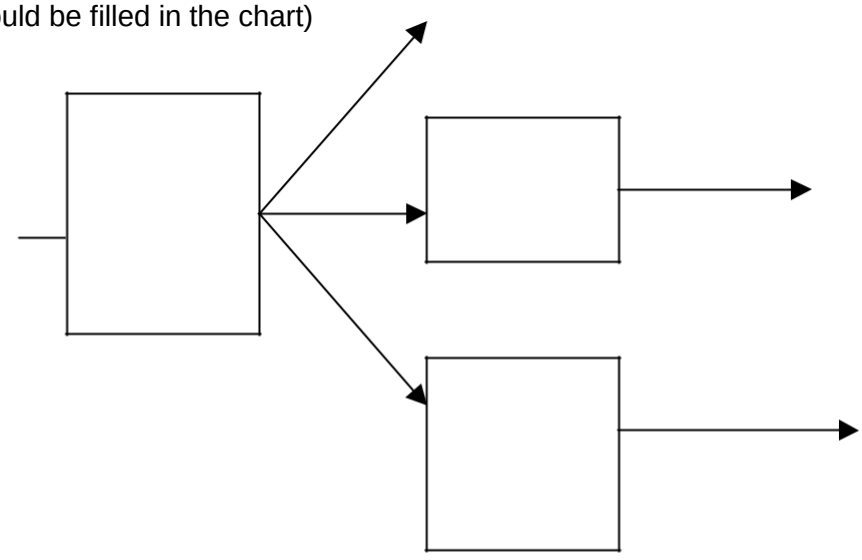
If more output of one joint product is required it would require production of additional units of other joint products. The incremental costs of extra output should include the costs of producing the non-required joint product unless there is revenue generated by disposing off those products.

Illustration

ABC Ltd manufactures 3 products in a series of process as shown below,

Raw materials"

(what should be filled in the chart)



Cost	Process 1	Process 2	Process 3
Raw materialss"	$40,000	-	-
Variable overheads	16,000	3,000	5,000
Fixed overheads	10,000	7000	10,000

Selling prices.

A ----- $3	BX ------ $12
B ------ $10	CX ------ $10
C ------ $6	

Assume all the fixed costs of process 2 $ 3 are

avoidable **Required**

(a) Determine whether the Co. is maximizing its profit by further processing product B to BX and C to CX.

(b) Calculate the break-even selling price if the Co. was to receive an order for an extra 1000Kgs of product CX, which would incur extra delivery costs of $1800

i. Assume that the extra output of A $ B would be disposed of at scrap value which covers their disposal cost.

ii. Assume that there would be extra demand at the current prices for product A$B.

Solution

Further processing of Product B to BX and C to CX

Incremental selling price - B= 12- 10 =$2

C= 10- 6 =$4

Therefore total sales increase = 2 x 4000 = $8000

4 x 5000 = $20,000

	B	C
Incremental revenue	$8,000	20,000
Incremental cost		
Variable costs	3,000	5,000
Fixed costs	7,000	10,000
	10,000	15,000
Incremental profit/loss	(2,000)	5,000

Decision

The Co. is making a good decision to further process C to CX since incremental profit is positive but it is not making a good decision to further process product B to BX because incremental profit is negative.

(b) (i) Assumption 1

Incremental units = 1000 x100=20%

5000

Extra Variable Cost of 1000kg of CX.

Process 1 –	material (20% x 40000)	$8000
	Variable overheads(20%x16000)	3200
Process 2 –	Variable overheads (20%x 5000)	1000
		12200
Extra fixed costs of delivery		1800
Total extra costs		14000

Break-even price = 14000 = 14 per kg.

1000

STUDY TEXT

b) (ii) Assumption 2

Extra cost of A&B

Total extra costs (as in (i) above)		14,000
Less revenue of:		
A: 200kg @$3	600	
B: 8000kg @ $10	8000	8600
Net extra costs		5400

Break-even price = 5400 / 1000 Kg. = $5.40 per

Product mix decision

A manufacturing Company may be faced with a decision about whether to change the product mix in its process so as to produce a greater proportion of one product and less of another e.g. if a process produces product X and Y in the ratio of 2:1, it may be possible to change the ratio to 3:2 but such a decision requires consideration of the relevant costs and relevant revenue of the change.

>>> Illustration

XYZ Ltd produces 2 joint products P&Q in the ratio of 2:1. After the split off point the products can be sold for industrial use and/or taken to mixing plant for blending and refining. The following information is given for a specific week:

Sales	**P**	**Q**
	2000 litres	1000litres
Price per litre	$35	$60
Sales revenue	$70,000	$60,000
Joint process cost	$30,000	$15,000
Blending & refining	$25,000	$25000
Other separable cost	$5,000	$1000
	60,000	41,000
Profits	$10,000	$19000

Joint process costs (which are allocated on volume) are 75% fixed and 25%variable, whereas the mixing plants costs are 40% fixed and 60% variable. There are only 40 hrs available in the mixing plant (usually 30hrs are taken up to processing of product P&Q equally and 10 hrs are used for other work that generates a contribution of $2000 per hr)

It has been suggested that it might be possible to change the mix of the joint process to 3:2 for P&Q respectively at a cost of $5 for each additional litre of Q produced by the process.

Required

Advise the Co. on whether to change the mix

Solution

Proposed mix		
P = 3/5 x 3000 = 1800 litres		
Q =2/5 x 3000 = 1200 litres		
Cost Benefit Analysis		
Incremental revenue of Q 200@ $60		12000
loss of revenue of P 200 @$35		7000
Net incremental revenue		5,000
Incremental Costs		
Joint processing costs 200@ $ 5		1000
Blending and refining		
Extra costs of Q 25000/1000*.6*200	3000	
Savings of P 25000/2000*.6*200	(1500)	1500
Other separable costs 200(1-2.5)	(300)	
Opportunity costs (3-1.5)x2000	3000	(5700)
Net Incremental profit		(200)

Decision

The Company should not change the mix because it results in an incremental loss of $200.

3.8 PRICING DECISIONS

3.8.1 Factors affecting pricing decisions

Several factors underlie all pricing decisions and effective decisions will be based on careful consideration of the following:

i. **Organizational goals and objectives.**
Is the firm a profit or revenue maximier or is it pursuing satisficing objectives? Is the objective cash maximizing; if so the selling price should reflect the intention of the firm.

ii. **Product mix.**
When producing a range of different products, affirm is faced with the problem of setting a selling price to obtain the optimum mix; that which will maximize cash inflows generated form sale of the product.

iii. **Price and demand relationship.**
For most products, there exists a relationship between the quantity demanded and the price tolerable at that level. Product quality will also tend to affect the price-demand relationship. Setting product prices to high or too low will 'chase away customers'. Knowledge of price elasticity of demand for the product is also important.

iv. **Competitors and markets.**
Is the market perfect, imperfect competition or oligopolistic or monopolistic conditions? What is the extent and nature of competition? The organization's competitors will always react in some way to changes to the selling price structure.

v. **Product life cycle**
At what stage is it; introduction, growth, maturity or decline. Each stage will influence the firms pricing policy.

vi. **Marketing strategy**
Product design and quality, advertising and promotion, distribution methods etc are likely to influence the sales pricing decisions.

vii. **Cost**
In the long-run, all operating costs must be fully covered by the sales revenues.

>>>Other factors include:

- Relative position of the firm
  Is the firm dominant enough to be a price maker or is it a price taker?
- Level of activity
  Will the firm be working at full or below capacity? What positions are the competitors?
- Government restrictions or legislation.
- Inflation
- Availability of substitute products.

3.8.2 DEMAND AND ITS DETERMINANTS

Demand is the quantity of a good which consumers want and are willing and able to pay for. Several factors will affect the quantity of product demanded:

i. Price
ii. Income of consumers
iii. Price of substitute goods
iv. Price of complimentary goods
v. Tastes and preferences of consumers
vi. The market size
vii. Advertising

If a company raises the price of a product, unit sales of a normal good will ordinarily fall. It is important for a firm therefore to consider the reactions of consumers to alterations in price. This sensitivity of unit sales to changes in price is called **the price elasticity of demand.**

Price elasticity of demand (PED)

The basic formula:

P.E.D = %age change in quantity demanded

%age change in price

OR

For a straight line demand curve:

$$= \frac{(Q_2 - Q_1)/Q_1}{(P_2 - P_1)/P_1} * 100$$

NB: It is the percentage change in the quantity in price that are used and not the absolute changes. Price elasticity elasticity" is the normally negative but, by convention, the minus sign is omitted.

Let us have an example to explain some issue concerning price elasticity of demand.

1. Calculate the price elasticity at point (I).

For a straight line demand curve, we select another point on the same line (II).

Therefore

P(I)=90 P (II) = 20

Q (I) = 5000 Q (II) = 30000

Applying the equations:

$$\textbf{P.E.D} = \frac{(30000 - 5000)/5000 * 100}{(20-90)/90 * 100} = \frac{500}{-77.78} = -6.43$$

The PED at point (I) is -6.43.

Interpretation:

- We usually ignore the negative sign and say that the price elasticity of demand of the product at point (I) is 6.43.
- What does 6.43 means anyway? It shows us that for example, if the price goes up by 10%, the increase will cause the demand to fall by 64.3%.
- The negative element will always remain due to the inverse relationship that exists between price and quantity for a "normal" good.

STUDY TEXT

The measurement of price elasticity will range from zero to infinity i.e. from perfect elasticity to imperfect elasticity. Three important ranges are described below:

i. Elasticity greater than 0 but less than 1:
This indicates an inelastic demand i.e. a fall in price would lead to a less than proportionate increase in quantity demanded.

ii. Elasticity of demand = 1:
Here, elasticity is termed as *unitary.* It indicates that a percentage fall in price is equal to the percentage increase in demand hence revenue remains constant.

iii. Elasticity of demand greater than 1 but less than infinity:
Here demand is said to be *elastic*. The quantity demanded changes by a much greater proportion than change in price. Therefore the total revenue would rise with a fall in price. The greater the elasticity, the greater will be the effect of price reduction on total revenue.

3.8.3 Profit and profit maximization

Micro-economic theory suggests that firms should seek the price that maximizes profits and will thereby obtain the most efficient use of economic resources held by the firm. The price set will be where the additional revenue by increasing output by one unit (*marginal revenue MR*) is equal to the additional cost incurred by increasing quantities by one unit (*marginal cost MC*).

The highest selling price at which the optimum output can be sold determines the optimal selling price. If demand and cost schedules are known, it is possible to get the selling price through the use of *differential calculus.*

E.g. Assume that ABC ltd has the following demand and cost functions.

$P = 200 - 0.004Q$

$T.C. = 700000 + 70Q$

Required:

What is the optimal price to maximize profits? What is the maximum profit and sales revenue at that point?

Solution:

i. Maximum profit: **M.C = M.R**

$$M.\mathbf{C}. = \frac{\partial T.C.}{\partial Q} = 70$$

$$M.R. = \frac{\partial T.R.}{\partial Q}$$

Total revenue = P * Q

= (200 – 0.004Q) * Q

= $200Q – 0.004Q_2$

M.R. = 200 – 0.008Q

Therefore:

M.C = M.R.

= 200 – 0.008Q

0.008Q = 200 – 70

0.008Q = 130

Q = 16250 units

ii. Highest selling price

P = 200 – 0.004 * 16250 = $135

iii. Maximum profit

Profit = T.R – T.C

= **(16250*135) – (700000 + 70 * 16250)**

= **2193750 – 1837500 = $356250**

Limitations of the economic theory

a. The economic theory suggests that a firm has perfect knowledge of all the factors involved e.g. demand curve for its product. There are inherent practical difficulties in obtaining such information since for example some firms have hundreds of different products and varieties some with very complex interrelationships. It becomes more difficult when competitor action is also taken into account.

b. It assumes that it is only price that influences the quantity demanded disregarding other factors such as advertising and sales promotion, income changes that are known to be non-price factors that affect demand

c. Economic theory assumes a single maximizing objective with the firm acting with complete economic reality. Rather than maximizing, most firms will be involved in satisficing behavior.

d. Economic theory suggests that rational decision making is guided by purely economic factors. In reality, other factors of moral, social and political nature will also be taken into account.

Nevertheless, marginal analysis (economic) theory will give managers a better insight into the relationship between price and demand. This is despite the fast that these relationships cannot be accurately measured. How? In a scenario where products with inelastic demand are discovered, management can add higher margins on them without fear of losing market. In another scenario where goods have an elastic demand, price changes to them will be a crucial activity.

3.8.4 Pricing in practice

FAST FORWARD: Among the three main influences in the setting of prices; *costs, customers and competitors*, it is usually the cost that represent that starting point for pricing decisions.

From the above limitations of economic theory, it has been noted that it is virtually impossible to obtain perfect information of cost and revenue functions. Trying to get this information will involve a lot of costs and it may be unreliable in the end.

Cost plus pricing system

Generally it has been noted that most firms apply some form of formula based on costs and adding some profit margin to it to arrive at the selling price for the product. This method of pricing would be adopted by firms who are considered to be price setters in an industry.

Full cost plus pricing (absorption)

This mode of pricing involves the use of conventional techniques to come up with the *total cost* for a product to which is added a *markup* to arrive at the selling price. By total cost we mean both variable cost plus an apportioned fixed costs based on a forecast activity level and product mix.

Why would a firm choose this method of pricing?

i. The price, in the long-run, should be able to cover all costs and a normal profit margin. This will ensure that indirect costs are recovered in the sales of the product so long as the *quantity forecasted is attained.* The marginal approach, that excludes fixed costs in getting the cost base, would force management to set a high margin which at some point may not be able to cover the fixed costs. In the long-run, failure of the business might be the end result. Striving to cover the fixed costs first indicates some “break-even” emphasis of this method and is consistent with risk averseness and satisficing objectives rather than profit maximization.

ii. This method provides a justifiable price that will be seen as reasonable by all parties involved. The public do understand that from the price, the company would want to

cover their costs and also to make a profit in order to stay in business. On the same point, the firm will be able to earn a reasonable rate of return only if the market will bear the price.

iii. If the company's competitors have similar operations and cost structures, this method of pricing may give management an idea of how their competition sets their prices.

iv. Absorption cost information will be provided by a firm's cost accounting system as it is required for external financial reporting under GAAPs. Since this information is readily available it would be "cheap" to use it for pricing for other wise it would require one to prepare separate special product- cost data for pricing decisions. This could be cumbersome especially for a form with hundreds of products.

v. The system ensures that at no one times will the firm's pricing under-price or over-price products. These controls will ensure that the organization is earning a satisfactory level of profit.

Setting a target selling price under full cost plus pricing

Price = Cost + (Markup %age * Cost)

Let's look at an illustration.

A department has produced the following cost information for product X.

	Per unit	**Total**
Direct material	9	
Direct labor	5	
Variable manufacturing o/heads	3	
Fixed manufacturing o/heads		100000
Variable selling o/heads	4	
Fixed selling overheads		80000

The company has a general policy of marking-up unit product costs by 50%

Step1: Compute the unit product costs

	$
Direct materials	**9**
Direct labor	**5**
Variable manufacturing	**3**
Fixed manufacturing	**5***
Unit product cost	**22**

* Fixed overheads are based on 20000 units thus: 10000/20000

NB. Selling and other non-manufacturing costs are not included in the cost base. The markup is supposed to cover all these other expenses.

Step2: Get the price quotation sheet.

	$
Direct material	9
Direct labor	5
Variable manufacturing	3
Fixed manufacturing	5
Unit product cost	22
Mark up 50%	11
Target selling price	33

How does the company come up with the mark-up percentage?

At some point, one may think that this is just an arbitrary figure but some considerations have to be made.

Assume that the company from our example invests $300000 in operating assets and markets 10000 units of product each year. If ROI is 20%, the mark-up will be calculated as follows.

$$\text{Mark-up \%} = \frac{\text{(ROI*Investment) + Total costs not included in cost base}}{\text{Annual volume * Unit product cost (cost base)}}$$

$$= \frac{(20\% * 300000) + (80000 + 4*20000)}{20000 * 22}$$

$$= 50\%$$

The 50% mark-up will lead to a target price of 33. The ROI of 20% will only be achieved only if the company manages to sell the 20000 units in that year. If they sell more than 20000 units, the ROI will go higher than 20%. If they sell less, it will go lower than 20%.

What other factors affect the size of the mark-up?

From above we have seen that the mark-up has been derived through the use of a formula. There are however, other factors that may affect the value of the plus 'element' that may force an organization to come up with a *modified mark-up.*

i. Stage in the product's life cycle

A large markup for a new product may need to be reviewed in the early stages to ensure the product is established and thereafter, during maturity and decline towards obsolescence, the price ca be adjusted accordingly. Life cycle costing will be discussed further in a later chapter.

ii. Type of customer

It may be affected in situations where prices relate to individual customers. Example would relate to the preparation of a quotation for a contract for an individual customer where the markup would depend more on knowledge of the competition of the competition and longer term considerations such as repeat orders.

iii. Bulk purchases

The size of mark-up would be altered in a bid to distinguish between different types of purchasers. Some would qualify for quantity discounts due to bulk purchases while other who dint will pay the full price. In the long run, the integrity of the system is maintained.

iv. Nature of the market

The firm may be able to segment the total market based on the homogeneity of the characteristics of customers in a particular segment. Rather than have a 'blanket' mark-up that is predetermined form the master budget, different markups could be applied for different segments

This method of pricing might seem simple and straight forward but a lot of criticisms have been put forward concerning its use

- The system does not take demand into consideration. It assumes that price is solely determined by cost by adding a mark-up that company wishes. It assumes that customers will bear any price that is put forward.
  In reality, customers have a choice and if the price they are being charged is too high, they will move their business to the competition who will be offering 'better prices'.
- It is assumed to be a safe route in costing a product since it provides a 'floor' under which a price cannot be set. Some managers assume that so long as all the prices are set above the total cost the organization will remain profitable. They are forgetting that the fixed cost allocated was based on an activity level previously forecasted and if they don't achieve it, the company will make losses. How? Say a company has fixed costs amounting to $10000 and assume the product cost of $10 is derived from an estimated volume of 1000. The selling price is gotten after marking up the $10 by 30% to $13. If actual sales were 700, the sales revenue would be $9100 compared to costs of $10000. The firm would end up making a loss of 900 even though the price of $13 is greater than the product cost.
- The cost plus system tends to ignore the inherent arbitrariness of fixed cost allocation and absorption procedures and apportionment of capital employed in a multiple product organization. The levels of activity used in the absorption rate and markups are based on budgeted volumes of activity. Looking at it differently, the volume of activity may itself depend on product prices and unless one assumes a volume, the final price cannot be determined with accuracy.
- The use of the full cost formula is too inflexible and too restrictive in its total cost recovery goal.

In our discussion, we have assumed that only conventional absorption costing has been used to arrive at the product cost that is to be marked up. Can cost plus pricing be used in ABC? The answer is yes. 'ABC plus pricing' can be used to overcome the limitation of absorption costing which over-cost high volume products and under-cost low volume products. The result is, using conventional cost plus pricing, low volume product will have lower selling prices than they should have. More discussion will be done in the next chapter.

Marginal cost plus pricing

FAST FORWARD: The principle behind this mode is that it is the variable (marginal) costs that can be clearly identified with the product unit. This provides a better justification for the price charged.

To avoid blurring the effect of cost behavior on profit, variable cost plus pricing is a preferred method.

It is preferable since in decision making only the variable costs are relevant. Therefore pricing decisions should be based on marginal costs since full cost plus methods will include a lot of absorbed fixed overheads that aren't relevant in decision making.

Why use marginal cost plus pricing?

i. It doesn't obscure cost behavior patterns by making fixed costs appear variable. Marginal cost plus pricing is in line with the CVP analysis used by firms to see the effects of changes in price and volume
ii. It does not require allocation of common fixed costs to individual product lines. Arbitrary allocation of fixed costs is avoided.
iii. It would be advisable to set a selling price which is only a little above marginal cost e.g. during market penetration are to make use of idle capacity. For a price that yields some contribution is better than no sales at all!

Marginal cost plus pricing should only be used in the short term. Application in the long term could spell disaster for in the long run the company would reach a level where it is unable to cover its fixed costs. Therefore when using this system, it is important for managers to see the importance of setting a high mark-up in order for all costs to be covered.

3.8.5 PRICING II

The previous section has looked at pricing in general. The classical view as given by the economic theory and how prices are set using cost plus pricing systems, both full cost and marginal. This chapter will look at some modern approaches to pricing in the modern management accounting systems. The discussions will not be all exhaustive therefore a little further reading will be required from the student.

Activity Based Costing Pricing

This was covered extensively in **chapter 2** and its superiority over conventional methods of costing (absorption and marginal methods) was discussed. Please refer to the chapter if a refresher is required.

The main difference comes in the allocation of indirect costs in coming up with the cost base on which to markup. ABC allocates costs to products/departments based on the number of specific *activities* the product/department required form the support function whereas conventional methods apportion and allocate on a predetermined basis that is arbitrarily determined.

>>> Let's look at an illustration.

X ltd has two products A and B with the following cost patterns.

	A	**B**
	$	**$**
Direct material	27	24
Direct labor @ $5/hr	20	25
Variable production overheads @	3	6
$6/hr	50	55

Fixed overheads are $300000 per month absorbed on the basis of direct labor hours. The budgeted direct labor hours are 25000 per month.

The manager have been told of the superiority of ABC and decided to investigate it. Activity analysis produced the following results.

Activity	**Cost driver**	**A**	**B**	**Total**
Set ups	Production runs	30	20	40000
Material handling	production runs	30	10	150000
Inspection	inspections	880	3520	110000
				300000

Budgeted production is 1250 units of A and 4000 units of B

Required:

Given a markup of 20%, what prices should be charged for product A and B under;

i. Full cost pricing
ii. ABC pricing

Solution:

i. Full cost plus pricing

	A	**B**
	$$	
Variable costs	50	55
Fixed overheads		
(300000/25000 = $12 per hour)	48	60
Product cost	98	115
Markup @ 20%	19.60	23
Selling price	117.60	138.0

ii. ABC pricing

	A	**B**	**Total**
	$	**$**	**$**
Set ups (30:20)	24000	16000	40000
Material handling (30:20)	90000	60000	150000
Inspections (880:3520)	22000	88000	110000
Total costs	136000	164000	300000
Budgeted units	1250	4000	
Overheads per unit	$108.80	$41.00	

Therefore

	A	**B**
Variable costs	50	55
Overheads	108.80	41.00
Product costs	158.80	96.00
Markup (20%)	31.76	19.20
Selling price	190.56	115.20

Discussion

It would seem that the company has been making 'crazy' losses on each unit of product A sold and thus the need for a price increase. However if the customer wont accept the price, steps must be taken to either control the costs (activities) to reduce it or as a last resort cease production of A altogether. On the other hand they have bee making profits form B and hence, with the 20% markup intact, there's still room to reduce the price. This move would be welcome especially if the demand for the good is *elastic*.

In the modern manufacturing environment, variable costs form a relatively small proportion of the total cost. Therefore, the use of conventional cost plus methods of pricing will eventually have to be dropped in favor of the more superior ABC.

Special products and new products

Special products are one off revenue earning opportunities. They may arise:

i. When operating normally, getting regular income and still the company may be having some spare capacity allowing it to take on some extra work..
ii. When the company may not be having a regular source of income and relies exclusively on its ability to respond to demand. A good example would be a construction firm.

>> *Minimum pricing*

This is the price to charge for a job that will be able to cover the *incremental costs* of producing and selling the item and the *opportunity cost* of resources consumed in making and selling the item. This price would leave the firm at a *status quo* whether they take up the contract or not.

N.B:

- It is based on relevant cost only
- It wont actually be charged since the company wont make any profit although:
  - it shows the limit under which the price cannot be set
  - it shows the incremental profit form any price above it

With no scarce resources and spare capacity, minimum price will actually be the *incremental* cost of making it. Any price in excess of the minimum would provide *incremental contribution.* With scarce resources in a form that has more than one product, the minimum price would include an allowance for *opportunity cost*.

New products

This is an especially challenging decision problem. The newer the concept of the product, the more difficult the pricing decision is. Pricing a new product is harder than pricing a mature product because of the magnitude of the uncertainties e.g. what problems will be encountered during production? Will anyone want to buy the product?

Management is charged with the responsibility of coming up with the estimates of cash flows and expected return on investment. This information would be very useful in pricing the new product. Having the timings of the cash flows and cost of capital, it would be possible to use *discounted cash flow techniques* to estimate whether a product will yield good returns given that price. It could also determine which combination of sales price and volume would yield the best return for the product over its lifecycle.

>>> Illustration

Homecare ltd is about to launch a new product into the market with a marginal cost of $10 per unit. A market research to test feasibility of the launch was carried out at a cost of $20000. The results were as follows.

Selling price	**Demand**
15	30000
25	25000
30	20000

Its current capacity is 20000 units but additional capacity can be made available using resources of another product line. If this is done, the lost contribution form the other products will be $15000 for each additional 5000 units of capacity.

Required:

What would be the best launch price?

S.P	Demand	V.C	O.C	T.C	Revenue	Contribution
	'000	'000	'000	'000	'000	
15	30000	300	30	330	450	120
25	25000	250	15	265	625	360
30	20000	200	-	200	600	400

Optimum launch price would be $30.

One major disadvantage is that it only considers a limited range of prices. What of a price of $26?

In the pricing of a new product, two situations might exist:

i. The product would be a first of its kind in the market. At this point the firm might be, for a while after the launch, a monopoly and would have a great say to what the price should be. Their main objective would be maximizing profits.
ii. The company might be launching a product that could already be existent in the market i.e. they would be following the competitors. Owing to, say higher quality the launched product could be charged at a premium price, higher than that charged by competitors or they could charge at the going rate. Otherwise trying to undercut the competitors' prices could lead to a price war and a general decrease in the price of the product in the market.

Having considered the two situations, a pricing strategy exists for each situation:

i. Market penetration

This relates to the attempt to break into a market and to establish that market share which will enable the firm to achieve its revenue and profit targets.

If they wish to achieve sufficient penetration, the firm must come with a lower price than the competitors. Of course not too low to start a price war or create an impression that the product is of low quality (inferior).

A penetration policy would work well:

- If the firm wishes to discourage new entrants into the market
- If they want to reach the growth and maturity stage quickly, lower prices would shorten the introductory period.
- If there are significant economies of scale to be gained for high volume output
- If the demand is elastic and would respond well to low prices.

Having achieved penetration, the next stage would be trying to achieve loyalty i.e. reduce the elasticity both price and cross. Successful penetration should lead to market share consolidation and improvement in profitability.

ii. Market skimming

This approach involves setting a relatively high price stressing the attractions of new features likely to appeal to those with a genuine interest in the products or associated attractions. This will be in a bid to maximize the short term profitability of the product.

What happens is that initially, there's a lot of 'hullabaloo' about the product and its features coming form heavy advertising and sales promotion and as the product progresses over its lifecycle, the price of the product starts to come down.

One great risk is that, the high prices charged would attract competitors who see this venture as a goldmine resulting in them stealing away some market share. Nevertheless this market would be appropriate:

- When the new product has new features that customers are willing, ready and able to pay any high price for. This is so they could be seen as the few who have 'it'.
- In situations where elasticity of demand is unknown. It is better to come into the market with high prices to test the demand. If it is low, adjust the prices accordingly. This would be rather than coming in with low prices and attempt to raise prices and attempt to raise it upon discovery of demand inelasticity.
- It is a preferable strategy for companies who are in liquidity problems as it might generate high initial cash flows.
- It is suitable for products with shot lifecycles e.g. mobile phones, computers, video games etc hence the need to quickly recover the research and development and make profits quicker.

Pricing short life products

These products have the characteristics of both special orders and new products. Any cost incurred in developing the product must be recovered that short life span. They include goods for

special occasions e.g. Olympics, promotion products, diaries and calendars. With high demand, the products maybe lowly priced but when it is limited, a market skimming strategy may be adopted with a high price to recover the costs.

A dilemma that managers face would be deciding just how many units of the product must be produced to both satisfy demand and ensure that no stock is lest at the end of the lifecycle.

Differential pricing

This is the ability of the firms to split the market into segments based on different characteristics. The members in that segment are homogeneous and will all react in the same way to different marketing strategies. On what basis would differential pricing be applied?

- By time:- off peak and peak time
- Place:- different geographical regions being charge different prices
- Product version

Pricing for competitive advantage

FAST FORWARD: Michael Porter is the one who came up with the generic strategies of pricing that could be used in a competitive environment.

Two aspects are considered, the competitive scope and just how will one gain competitive advantage:

i. Cost leadership:

- Costs and their reduction are given high priority
- Firms look for technology to improve efficiency of operations
- They charge low costs but still ensure quality parity with competitor products
- They strive to get acknowledgement as lowest cost producers in the industry

ii. Differentiation:

- It is applied in an industry where there are similar products the difference being only the brand names
- To be able to steal loyalty, competitors may be tempted to engage in price cutting
- With differentiation, competition is about the product and not the price. Does the product have the value for which the customer is willing to pay for?

iii. Focus (niche):

- Focus on the cost and differentiating factors in response to customer needs in a specific market segment which have been ignored by bigger competitors who have a much wider scope trying to fulfill the needs of all is not possible hence on might overlook any special needs from a section of the market.
- Higher profits will be experienced in short term before they are ‘discovered by other large competitors.

Competitive advantage

	Lower cost	**Differentiation**
	Cost leadership	Product Differentiation
	At or below market	Premium price
	Focus strategy - Low cost	Focus strategy - Differentiation
	Take level set by wider market	Premium price
	Broad Competitive scope	Narrow Competitive scope

3.9 TARGET PRICING

This is a pricing method whereby the selling price of a product is calculated to produce a particular rate of return on investment for a specific volume of production.

Essentially, the selling price is calculated according to the following formula:

Selling price= Target Cost
(1-%profit margin)

Target pricing is not useful for companies whose capital investment is low because, according to this formula, the selling price will be understated. Also the target pricing method is not keyed to the demand for the product, and if the entire volume is not sold, a company might sustain an overall budgetary loss on the product.

Target pricing method involves:

(1) Identifying the price at which a product will be competitive in the marketplace,
(2) Defining the desired profit to be made on the product, and
(3) Computing the target cost for the product by subtracting the desired profit from the competitive market price. The formula

Target Price - Desired Profit = Target Cost

The target pricing method is used most often by public utilities, like electric and gas companies, and companies whose capital investment is high, like automobile manufacturers.

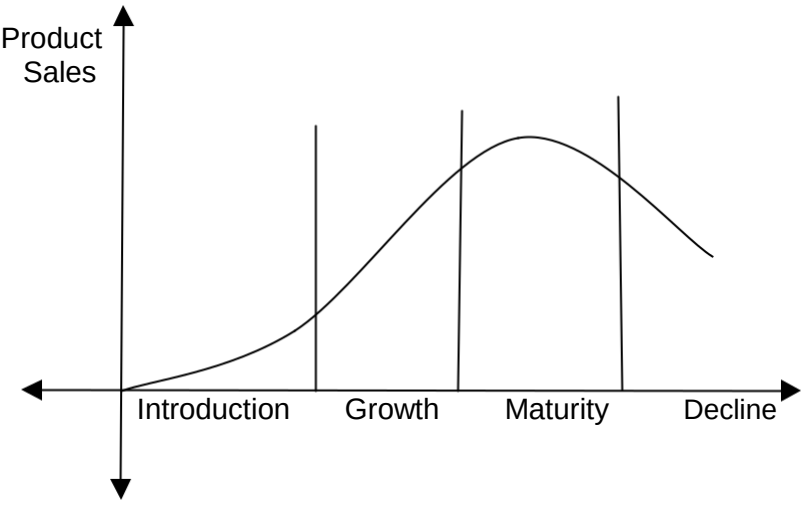
Target cost is then given to the engineers and product designers, who use it as the maximum cost to be incurred for the materials and other resources needed to design and manufacture the product. It is their responsibility to create the product at or below its target cost.

3.10 PRODUCT LIFE CYCLE

A new product progresses through a sequence of stages from introduction to growth, maturity, and decline. This sequence is known as the **product life cycle** and is associated with changes in the marketing situation, thus impacting the marketing strategy and the marketing mix.

The product revenue and profits can be plotted as a function of the life-cycle stages as shown in the graph below:

Product Life Cycle Diagram



Introduction Stage

In the introduction stage, the firm seeks to build product awareness and develop a market for the product. The impact on the marketing mix is as follows:

- **Product** branding and quality level is established and intellectual property protection such as patents and trademarks are obtained.
- **Pricing** may be low penetration pricing to build market share rapidly, or high skim pricing to recover development costs.
- **Distribution** is selective until consumers show acceptance of the product.
- **Promotion** is aimed at innovators and early adopters. Marketing communications seeks to build product awareness and to educate potential consumers about the product.

Growth Stage

In the growth stage, the firm seeks to build brand preference and increase market share.

- **Product** quality is maintained and additional features and support services may be added.
- **Pricing** is maintained as the firm enjoys increasing demand with little competition.
- **Distribution** channels are added as demand increases and customers accept the product.
- **Promotion** is aimed at a broader audience.

Maturity Stage

At maturity, the strong growth in sales diminishes. Competition may appear with similar products. The primary objective at this point is to defend market share while maximizing profit.

- **Product** features may be enhanced to differentiate the product from that of competitors.
- **Pricing** may be lower because of the new competition.
- **Distribution** becomes more intensive and incentives may be offered to encourage preference over competing products.
- **Promotion** emphasizes product differentiation.

Decline Stage

As sales decline, the firm has several options:

- Maintain the product, possibly rejuvenating it by adding new features and finding new uses.
- Harvest the product - reduce costs and continue to offer it, possibly to a loyal niche segment.
- Discontinue the product, liquidating remaining inventory or selling it to another firm that is willing to continue the product.

The marketing mix decisions in the decline phase will depend on the selected strategy. For example, the product may be changed if it is being rejuvenated, or left unchanged if it is being harvested or liquidated. The price may be maintained if the product is harvested, or reduced drastically if liquidated.

CHAPTER SUMMARY

A **CVP analysis** is a systematic method of examining the relationship between changes in activity (output) and changes in total sales revenue, expenses and net profit.

In the decision making process, any cost that **differs among alternatives** and will influence the

outcome is **relevant cost.**

Relevant revenue is any revenue that differs among alternatives and will influence the final outcome.

Costs that have already been spent in the past i.e. **sunk costs** are irrelevant for decision making.

Differential costs are costs that can be **avoided** or revenues foregone if the decision is no taken up.

Avoidable costs are costs which will not be incurred if a particular decision is made. It's usually in the context of a fixed cost e.g. if a fixed cost can be identified to the production of a single product and production is stopped, the fixed cost will not be incurred and therefore avoided.

Incremental costs are extra costs incurred as a result of a decision e.g. if a decision is made to increase production and to do so an additional machine is to be leased, the lease cost of that machine is an incremental cost thus relevant.

Opportunity costs are costs that measure the opportunity that is lost or sacrificed when the choice of one course of action requires that an alternate course of action be given up.

Marginal revenue is the increase in total revenue from sale of an additional unit

Marginal cost is the increase in total cost from the production of an additional unit

Break-even analysis is mainly used to explain the relationship between the cost incurred, the volume operated at and the profit earned.

The **margin of safety** is the amount by which actual output or sales may fall short of the budget without the company incurring losses.

The **CVP equation** can be used to develop financial planning programs.

In business situations, only a limited number of business opportunities may be undertaken. Some factors will limit the ability to undertake all the alternatives. These factors are known as **limiting factors.**

A **make or buy problem** involves a decision by an organisation about whether it should make a product or carry out an activity with its own internal resources or whether it should pay another organisation to carry out the activity.

Demand is the quantity of a good which consumers want and are willing and able to pay for.

If a company raises the price of a product, unit sales of a normal good will ordinarily fall. It is important for a firm therefore to consider the reactions of consumers to alterations in price. This sensitivity of unit sales to changes in price is called **the price elasticity of demand.**

Cost plus pricing system is based on costs and adding some profit margin to it to arrive at the selling price for the product.

Full cost plus pricing (absorption) involves the use of conventional techniques to come up with the *total cost* for a product to which is added a *markup* to arrive at the selling price.

Marginal cost plus pricing: The principle behind this mode is that it is the variable (marginal) costs that can be clearly identified with the product unit. This provides a better justification for the price charged.

Minimum price is the price to charge for a job that will be able to cover the *incremental costs* of producing and selling the item and the *opportunity cost* of resources consumed in making and selling the item.

Market penetration relates to the attempt to break into a market and to establish that market share which will enable the firm to achieve its revenue and profit targets.

Market skimming involves setting a relatively high price stressing the attractions of new features likely to appeal to those with a genuine interest in the products or associated attractions.

Differential pricing is the ability of the firms to split the market into segments based on different characteristics.

CHAPTER QUIZ

1. Define the following:
   a) Differential costs
   b) Incremental costs
   c) Opportunity costs

2. What is CVP analysis?
3. Distinguish between marginal cost and marginal revenue.
4. What are limiting factors?
5. State and explain seven factors affect pricing decisions.
6. What is demand? State seven factors that affect quantity demanded.

ANSWERS TO QUIZ QUESTIONS

1. Definitions:
   a) Differential costs are costs that can be **avoided** or revenues foregone if the decision is no taken up.
   b) Incremental costs are extra costs incurred as a result of a decision e.g. if a decision is made to increase production and to do so an additional machine is to be leased, the lease cost of that machine is an incremental cost thus relevant.
   c) Opportunity costs are costs that measure the opportunity that is lost or sacrificed when the choice of one course of action requires that an alternate course of action be given up.

2. CVP analysis is a systematic method of examining the relationship between changes in activity (output) and changes in total sales revenue, expenses and net profit.

3. Marginal revenue is the increase in total revenue from sale of an additional unit.
   Marginal cost is the increase in total cost from the production of an additional unit.

4. In business situations, only a limited number of business opportunities may be undertaken. Some factors will limit the ability to undertake all the alternatives. These factors are known as **limiting factors.**

5. Factors affecting pricing decisions are:
   - Organizational goals and objectives.
     Is the firm a profit or revenue maximiser or is it pursuing satisficing objectives? Is the objective cash maximizing; if so the selling price should reflect the intention of the firm.
   - Product mix.
     When producing a range of different products, affirm is faced with the problem of setting a selling price to obtain the optimum mix; that which will maximize cash inflows generated form sale of the product.
   - Price and demand relationship.
     For most products, there exists a relationship between the quantity demanded and the price tolerable at that level. Product quality will also tend to affect the price-demand relationship. Setting product prices to high or too low will 'chase away customers'. Knowledge of price elasticity of demand for the product is also important.
   - Competitors and markets.
     Is the market perfect, imperfect competition or oligopolistic or monopolistic conditions? What is the extent and nature of competition? The organization's competitors will always react in some way to changes to the selling price structure.
   - Product life cycle
     At what stage is it; introduction, growth, maturity or decline. Each stage will influence the firms pricing policy.
   - Marketing strategy

Product design and quality, advertising and promotion, distribution methods etc are likely to influence the sales pricing decisions.

- Cost

In the long run, all operating costs must be fully covered by the sales revenues.

6. Demand is the quantity of a good which consumers want and are willing and able to pay for. Factors that affect the quantity of product demanded are:
   - Price
   - Income of consumers
   - Price of substitute goods
   - Price of complimentary goods
   - Tastes and preferences of consumers
   - The market size
   - Advertising

PAST PAPER ANALYSIS

CVP analysis is a course content that was tested in the following examinations:

06/'05

06/'03

Make or buy decisions was tested in 07/'00.

Activity Based Costing was tested in the following examinations:

06/'07

05/'06

06/'04

12/'00

EXAM QUESTIONS

QUESTION ONE

Sniwe plc intends to launch a commemorative product for the 1992 Olympic Games onto the UK market commencing 1st August 1990. The product will have variable costs of $16 per unit. Production capacity available for the product is sufficient for 2000 units per annum. Sniwe plc has made a policy decision to produce to the maximum available capacity during the year to 31st July 1991. Demand for the period during the year 31st July 1991 is expected to be price dependent as follows.

Selling price per unit	Annual sales
$	Units
20	2000
30	1600
40	1200
50	1100
60	1000
70	700
80	400

It is anticipated that in the year 31 July 1992, the availability of similar competitor products will lead to a market price of $40 per unit for the product during that year.

During the year to 31 July 1992, Sniwe plc intend to produce only at the activity level required to enable them to satisfy demand with stocks being run down to zero if possible. The policy is intended as a precaution against a sudden collapse of the market for the product by 31 July 1992.

Required:

a. Determine the launch price at 1st August 1990 which will maximize the net benefit to Sniwe plc during the two year period to 31 July 1992 where the net demand potential for the year is estimated at (i) 3600 units and (ii) 1000 units.
b. Identify which of the launch strategies detailed in (a) (i) and (a) (ii) above will result in unsold stock remaining at 31 July 1992. Advise management of the minimum price at which such unsold stock should be sold in order to alter the initial launch price strategy which will maximize the net benefit to Sniwe plc over the life of the product.
c. Comment on any other factors which might influence price strategy where the demand in the year to 31 July 1992 is estimated at 1000 units.

QUESTION TWO

Multiple CVP

A company sells two products A and B with contribution margin ratios of 40 and 30 per cent and selling prices of sh 5 and sh.2.50 per unit. Fixed costs amount to sh.72000 a month. Monthly sales average 30000 units of product and 40000 units of product B.

Required:

a. (i) Assuming that three units of product A are sold for every four units of product B, calculate the sales volume necessary to breakeven, in shillings and in units.
   (ii) Calculate the margin of safety in sales shillings

b. If the company spends an additional sh9700 on advertising, sales of product A can be increased to 40000 units a month. Sales of product B will fall to 32000 units a month if

this is done. Should this proposal be accepted?

c. Recalculate the breakeven point in shillings based on figures in (b)
d. State the condition that would have to hold true for the company to earn a zero profit at the breakeven volume you calculated in (c).

QUESTION THREE

Thunder manufacturing company produces a toxic product, 'coros' that must be sold in the month produced or else discarded. Thunder can manufacture 'coros' itself at a variable cost of Sh40 per unit or they can purchase it from an outside supplier at a cost of Sh70 per unit. Thunder can sell 'coros' at Sh80 per unit. Production levels must be set at the start of the period and cannot be changed during the period. The production process is such that at least 9,000 units must be produced during the period. Thunder management must decide whether to produce 'coros' or whether to purchase it from the outside supplier.

The possible sales of 'coros' and their probabilities are:

Demand	**Probability**
(units)	
4,000	0.4
7,000	0.5
11,000	0.1

Required:

a) Expected demand
b) Expected profit from purchasing 'coros' from an outside supplier and selling it
c) Expected profit from manufacturing and selling
d) Standard deviation of profits from purchasing and selling.
e) Standard deviation of profits from manufacturing and selling.
f) Coefficient of variation for each alternative

CASE STUDY

Newcastle Division

Topic: CVP, Probabilities and Target profits

A meeting of senior managers at the Newcastle Division has been called to discuss the pricing strategy for a new product. Part of the discussion will focus on the problem of forecasting sales volume. In the last year a significant number of new products have failed to achieve their forecast sales volumes. The financial accountant has already stated that the profit for the year-end will be lower than budget and the main reason for this is the disappointing sales of new products.

A new technique for estimating the probability of achieving target sales and profits will be discussed.

This requires managers to estimate demand for the new product and assign probabilities. The management accountant is in favour of this approach as she wants to avoid having a single estimate for sales.

Source: www.google.co.ke- *case studies on CVP*

PART B

CHAPTER FOUR

BUDGETARY CONTROL

CHAPTER FOUR

BUDGETARY CONTROL

▶ CHAPTER OBJECTIVES

After this chapter the student will have learnt among, other things, what budgeting is, how it is used, its advantages and disadvantages and different forms of budgets.

▶ INTRODUCTION

In the general public at large, the subject of accounting is not one that is discussed with much enthusiasm and zeal like sports. On the same point, within the accounting fraternity, budgeting is often considered to be the pits of dullness. This view is such a shame as budgeting would in any case near the top of a list of important services provided by management accounting. Many companies with good ideas have in the past succeeded and appear well outwardly without budgets but with time they are toppled over form their positions by competitors. These competitors will be using effective and efficient budgeting systems. Although budgeting will not guarantee that a business will not fail, it will tell us “to look before we leaped”. It serves as a warning for danger that may lay ahead a decision being taken/not taken up.

In general terms, the words planning and control are often confused and may be misconstrued to mean the same thing. In business, they mean two totally different things

- Planning- Developing objectives and preparing various budgets to achieve those objectives.
- Control- involves steps taken by management to increase the likelihood that the objectives set down at the planning stage are attained and that all parts of the organization are working together towards that goal.

A good budget therefore must incorporate both the planning and control aspects.

▶ DEFINITION OF KEY TERMS

Budget - A detailed plan for the future, usually expressed in formal quantitative terms.

Budget period is conventionally one year. The budget is divided into either 12 monthly or 13 four weekly periods for control purposes. It could also be divided into four quarters; 1st quarter subdivided into months to form monthly budgets. As the year progresses, the 2nd quarter is divided into months and so on and so forth.

Planning - Developing objectives and preparing various budgets to achieve those objectives.

Control - involves steps taken by management to increase the likelihood that the objectives set down at the planning stage are attained and that all parts of the organization are working together towards that goal.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on:

- Activity based budgeting
- Incremental budgeting

Students should therefore understand this chapter.

▶ INDUSTRY CONTEXT

Firms prepare budgets for the following reasons:

- To plan for the year.
- To communicate ideas and plans to everyone in the fi rm.
- To co-ordinate the activities of different departments or sub-units in the Firm.
- To provide the framework for responsibility accounting whereby managers of budget centers are made responsible for the achievement of budget targets for the operations under their personal control.
- To establish a system of controls by setting up targets against which actual results will be compared.
- To motivate employees to improve performance.

For example, a manufacturing fi rm will prepare a budget or budgets so as to plan for its production so as to produce enough products for market demand and meet its profi t target.

4.1 BUDGET

"A quantitative statement, for a defi ned period of time, which may include planned revenues, expenses, assets, liabilities and cash fl ows. A budget provides a focus for the organization aids the coordination of activities and facilitates control. Planning is achieved by means of a fi xed master budget, whereas control is generally exercised through the comparison of actual costs with a fl exible budget." *T. Lucey Management Accounting*

4.1.1 Types of Budgets

There are three general types of budgets. This classifi cation will be based in their purposes.

The Planning budget

It is a fi nancial plan detailing what to do and in what order to do it in order to achieve organizational goals. Many possible budgets will be created and vetted before choosing one as a target for an organization.

Appropriation budget

It is a fi nancial plan specifying how much spending is authorized as appropriate. It is mostly used in government agencies e.g. “how much will appropriate to welfare spending?” The appropriation fi gure is the maximum amount that it may legally spend during the **budget period.**

Budget period: *conventionally it is one year. The budget is divided into either 12 monthly or 13 four weekly periods for control purposes. It could also be divided into four quarters; 1st quarter subdivided into months to form monthly budgets. As the year progresses, the 2nd quarter is divided into months and so on and so forth.*

The maximum amount will obviously, according to human nature, be the amount that will actually be spent. To mean that, if for example one is given $40000 shopping limit on anything she wants, she will make sure that she spends it all.

Appropriation budgets will also be used for some departments or units especially for areas where it is diffi cult to fi nd direct relationships between the area and the profi t for the period e.g. research spending, advertising and contributions to charity.

Control budgets

These are fi nancial plans where purpose is to enable organizations to carry out their activities in the most effective and effi cient manner. Generally what we plan and expect to happen will actually not happen. It’s this area where the comparison between actual and budgeted is done.

4.2 BUDGETARY CONTROLS

Control in a business is the process of guiding organisation into viable patterns of activity in an environment. The main objective of a control system is to make sure that the right things get done. A system such as a big organisation must be controlled to keep it steady or to enable it to change safely. Control is therefore required because unpredictable disturbances might enter the system so that actual results deviate from the expected results or goals. Examples of such disturbances are entry of a powerful competitor in the market, unexpected increase in cost, a decline in quality standards, failure of a supplier to deliver promised raw material, or the tendency of employees to stop working in order to gossip.

To have an effi cient control process there has to be a plan, a budget, or a target towards which the system as a whole will be aiming. Control is dependent on the receipt and the processing of information both to plan and to compare actual results to the plan so as to judge what control measures, if any, are needed.

There are two types of control systems:

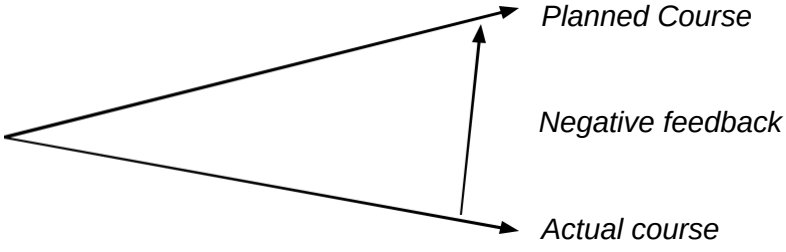
Feedback control system

Feed-forward control system

Feedback is information about actual achievements or actual results produced within the organisation (e.g. management control reports) with the purpose of helping with the control decisions. Feedback is internal in that, it is concerned with measuring the output of the system itself. Most common types of control systems in a business such as budgetary control, stock control and the production control system are based on feedback control cycles. Feedback can be either positive or negative.

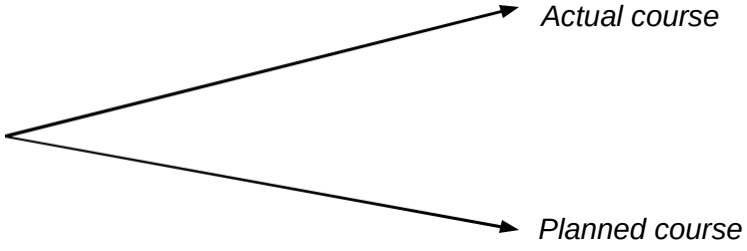
4.2.1 Negative feedback

This is information which indicates that the system is deviating from its planned or prescribed course and that some re-adjustment is necessary to bring it back on course. It is referred to as negative since the control action would need to reverse the direction/movement of the system towards its planned course. This can be shown as follows:



4.2.2 Positive feedback

Positive feedback results in control action that causes actual results to maintain or increase their path of deviation from planned results as shown below:



Feed-forward control system

Feed-forward control system describes a system in which deviations in the system are anticipated in a forecast of future results, so that corrective actions can be taken in advance of any deviation actually occurring. Examples of feed forward control systems include:

>>Critical Path Analysis

>>Cash budget

4.3 CONDITIONS NECESSARY IN A CONTROL CYCLE

There are four necessary conditions that must be satisfied before any system can be said to be controlled. These are:

- Objective of the process being controlled must exist
- The output of the process must be measurable in terms of the dimensions defined by the objective.
- A predictive model of the process being controlled is required so that causes for the non-attainment of objective can be identified and proposed corrective action analyzed.
- There must be capability of taking action so that deviation of attainment from objective can be reduced.

Budgetary control is the establishment of budgets relating the responsibility of executives to the requirements of a policy and the continuous comparison of actual and budgeted results either to service by individual action the objectives of that policy or to provide a basis for its revision.

Budgetary controls are used for the following reasons:

- To define the objectives of the organisation as a whole
- To reveal the extent by which actual results have exceeded or fallen short of the budget.
- Budgetary control helps in indicating why actual results differ from the budgeted results.
- It is important as a basis for the revision of the current budget or the preparation of future budgets.
- To ensure that resources are used as efficiently as possible.
- To see how well the activities of the organisation have been co-coordinated
- To provide some central control especially where activities are decentralized.

4.4 HUMAN BEHAVIOUR AND BUDGETARY CONTROL

FAST FORWARD: An important feature of control in business is that control is exercised by managers over people. Their attitudes and response to budgetary planning and control will affect the way in which it operates.

In 1953 Chris Argyris identified the following four perspectives of budgetary control:

The budgets are seen as a pressure device used by management to force lazy employees to work harder. The intention of such pressure is to improve performance but the unfavorable reaction of sub-ordinates against it seems to be at the core of the budget problem.

Budget men want to see failure. The accounting department is usually responsible for recording actual achievements and comparing this against a budget. Accountants are therefore budget men and their success is to find significant adverse variances and identify the managers responsible. The success of a budget man is the failure of another manager and this failure causes loss of interest and declining performance.

The accountant, on the other hand, fearful of having his budget criticized by management deliberately makes it hard to understand.

Target and goal congruence. The budget usually sets targets for each department. Achieving the departmental targets becomes of paramount importance regardless of the effect this may have on other departments and the overall company performance. This is the problem of goal congruence.

Management style. Budgets are used by managers to express their character and patterns of leadership on sub-ordinates. Sub-ordinates resentful of their leader's styles blame the budget rather than the leader.

4.5 CONTINGENCY THEORY

Some researchers have argued that the context in which budgetary control is used is as important as the style in which it is implemented and used. This is known as the contingency theory. The contingency approach to management accounting is based on the assumption that there is no universally appropriate accounting system applicable to organisations in all circumstances. Rather, contingency theory attempts to specific aspects of an accounting system that are associated with certain defined circumstances and demonstrate an appropriate matching.

Major factors identified are:

Environmental factors such as:

- Its degree of predictability
- The degree of competition faced in the market
- The number of different product in the markets
- The degree of hostility exhibited by competition

Organisational Structure Factors including:

- Size of the organisation
- Interdependence of the parts or sub-units
- The degree of decentralization
- Availability of resources

Technological Factors such as:

- The nature of the production process
- The routineness or complexity of the production process
- How well the relationship between inputs and outputs is understood
- The amount of variety in each task that has to be performed

4.6 ADMINISTRATION OF THE BUDGETING PROCESS

FAST FORWARD: It is important that suitable administrative procedures be introduced to ensure that the budget processes works effectively.

Procedures should be there for approval of budgets and qualified accounting staff be available for assisting managers in preparing their budgets.

4.6.1 The budget committee

It should consist of high level executives who represent the major segments of the business. It is usually responsible for the overall policy relating to the budget program and coordinating the preparation of the budget itself. The committee, among other things ensures that budgets are realistically established.

Normally the functional heads present their budgets to the budget committee for approval. If rejected, the functional head will be forced to revise it and resubmit it for second approval. The motivational aspect (to be discussed later in the chapter) will be enhanced if the budgetee would agree with the committee that the revised budget is now achievable. The budgetee at all times must feel that they were given a fair hearing during the submissions.

Disputes can (and will) erupt over budget matters. The budget process will in most cases determine which department gets more resources and which ones get less. The budget will also set benchmarks on which managers will be partially evaluated. Due to stiff competition for resources therefore, the budget program could degenerate into an inter-office brawl that could lead to goal incongruence due to the disunity. Running a successful budget program will require on to have, in addition to technical skill, considerable interpersonal skills.

The committee shall appoint a budget officer, normally the accountant, to coordinate the individual budgets into a budget for the whole organization. With that, both the committee and the budgetee could see the impact of an individual budget on the organization as a whole.

4.6.2 The accounting staff

They normally assist managers in budget preparation.

They will:-

- Circulate and advice on instructions about budget preparation.
- Provide past information that may be useful for preparing the present budget
- Ensure managers submit their budgets on time.

4.6.3 Stages in the budgeting process

1. Communicating details of the budget policy

Any budgeting decision must be done with reference to the long-term plan of the organization i.e. budgets are there to facilitate the effectiveness and efficiency of longterm organizational goals.

Before budgets are made, it is up to management to ensure that all information with regards to the long-term plan of the organization is communicated to the functional heads. Policy effects include change to the sales mix or expansion or contraction of certain activities. Important guidelines to be communicated include:

- Allowances to be made for price and wage increases.
- Expected changes in productivity
- Expected changes in industry demand

2. Determining the factor that restricts performance

The principal budget factor (or limiting factor or key factor) is a factor which at any given time is an overriding planning limitation on the activities of the organization.

It may be *production capacity, shortage of labor, materials, finance* or commonly *the level of demand.* Due to the high importance of the limiting factor, the various budgets have to be prepared having regard to the expected limitations. This factor will determine the point at which the annual budgeting process should begin. Having one limiting factor is too simplistic. In reality, organizations may be having multiples of limiting factors and care should be taken to optimize contribution rather than maximize contribution relating to any one limiting factor which could lead to sub optimism. When faced with multiple linear programming will in this case be applied.

3. Preparation of the sales budget

The sales budget is prepared first since in most organizations, the level of demand is selected as the most important limiting factor. Being the most important budget it is also the most difficult to come up with because sales revenue levels depend mostly on the action of the customers or they may be influenced by the state of the economy or actions of the competitors.

4. Initial preparation of budgets

Responsibility accounting suggests that a manager should be held responsible for those items-and only those items-that he actually control to a significant extent.

Therefore it is up to the functional manager to prepare a budget for areas of their jurisdiction. A bottom up approach is mostly adopted where budgets develop form the lowest level to the highest level of management, (this will be looked at later in the chapter). Its main advantage is that it enables managers to participate in the preparation if the budget and increases the chances of it organizational acceptance.

Initial preparation could adopt the use of past data although carefully since budgets are there to prepare for the future and dependence on past data should only there just as guidance. Managers should therefore focus more on thefuture and changes in future conditions in preparing budgets. For example, for production activities, standard costs may be used as a basis for costing activity volumes which are planned in the budget.

5. Negotiation of budgets

As noted above, a bottom up approach is preferred in most cases. The higher managers will receive budgets from lower managers for approval. If approved, they incorporate the budgets with those they have received from other lower managers. After which, they also submit theirs to their superiors. This manager also becomes a budgetee. At each stage as the budget moves up and incorporated with other budgets at a higher level, what goes on is negotiation between the budgetees and their superiors. Eventually after much bargaining, the budget will at some point be agreed.

It is important that the budgets are agreed and changes without consultation should not be done by superiors as this will lead to demotivation of lower employees and a lack of trust and commitment to the budgeting process. It is also important the budgetees do not under budget in order to set lower targets. At the same time, superiors should not impose too tough a target to achieve maximum out put form subordinates. For in the short_run desired results will be achieved but only at a cost of the loss of morale and increased labor turnover in the future. The negotiation process is very important. If superiors can establish a position of trust and confidence with their subordinates the process will be fruitful.

6. Coordination and review of budgets

As the different budgets are incorporated into one and move up the hierarchy, they must be examined in relation to each other. One may find that some budgets are off balance with other and need to be modified so that they may be compatible with other conditions, constraints and plans that are beyond the managers' knowledge or control. For example, a production manager might require the purchase of a new piece of machinery and looking at the finance budget, funds might not be available at the moment. These inconsistencies are there and need to be reported to the manager responsible. This may require further modification until the budgets are all coordinated and acceptable by all the parties involved.

A budgeted profit and loss account, a balance sheet and cash flow statement must be prepared to ensure that all the parts combine to produce an acceptable whole.

7. Final acceptance of the budget

A *master budget* is produced when all budgets are coordinated; summarized into a profit and loss, balance sheet and cash flow statement. If the budgets are finally approved, they are passed down to the appropriate responsibility centers. It is this final approval of the master budget that gives the manager the go ahead.

8. Budget review

Periodically the actual results shall be compared with the budgeted results. The comparisons should be done regularly and reports sent to the appropriate budgetees so that the maximum motivational impact is felt. Here the managers can identify variances and investigate the reasons for the differences. It the differences are within the control of the manager, corrective action can be taken to avoid similar inefficiencies occurring again in the future. On the other hand the difference could be because the budget was unrealistic or that the actual conditions during the budget year were different from those anticipated. If such changes are noticed the budget should be adjusted.

N.B. the budgeting process does not end for the current year once the budget has begun; budgeting should be seen as a continuous and dynamic process.

4.7 STATIC AND FLEXIBLE BUDGETS

4.7.1 STATIC BUDGETS

A **static budget** is a budget that remains unchanged regardless of the volume of output or sales made.

The master budget that is prepared before the beginning of the budget period is known as the **static budget.**

The overall budgeting process and the various budgets could be explained using illustrations:

X limited manufactures and sell a product that has a seasonal variation on demand with [peak sales coming in the 3rd quarter. The following information shows operations for year 2, the coming year, and the 1st two quarters of year 3.

a) Selling price per unit $8.00.

	Year 2 quarter			Year 3		
	1	2	3	4	1	2
Budgeted sales (Units)	**40000**	**60000**	**100000**	**50000**	**70000**	**80000**

b) Sales are collected in the following pattern

75% in the quarter the sales were made. The remaining 25% collected in the following quarter. On 1st January year 2, the company's balance sheet showed $65000 in accounts receivable all of which will be collected in the 1st quarter of the year. Bad debts are negligible and can be ignored.

c) The company desires an ending inventory of fi nished units on hand at the end of each quarter equal to 30% of the budgeted sales for the next quarter. On 31st December year 1, the company had 12000 units on hand.

d) 5 pounds of material are required to complete one unit of product. The company requires an ending inventory of raw materials on hand at the end of each quarter equal to 10% of production needs of the following quarter. On December 31st Year 1, the company had 23000 pounds of raw materials on hand.

e) Raw materials cost $0.80 per pound. Purchases of raw material are paid for in the following pattern.

On January 1 year 2, the company's balance sheet showed $81500 in accounts payable for raw material purchases, all of which will be paid in the 1st quarter of the year.

Required:

1) A sales budget.

	Year 2 quarter				
	1	2	3	4	Total
Budgeted sales	40000	60000	100000	50000	250000
Selling price	8	8	8	8	8
	$320000	$480000	$80000	$400000	$2000000

2) A production budget

This budget is expressed in quantities only and is the responsibility of the production manager. The objective is to ensure that production is suffi cient to meet sales demand and the economic stock levels are maintained.

STUDY TEXT

Based on the budgeted sales units, the production budget is prepared as follows.

Year 2 quarter						**Year 3 quarter**
	1	2	3	4	Year	1
Budgeted sales units	40000	60000	100000	50000	250000	70000
Add Ending inventory*	18000	30000	15000	21000**	21000	24000
	58000	**90000**	**115000**	**71000**	**271000**	**94000**
Less beginning inventory	12000	18000	30000	15000	12000	21000
Required production	**46000**	**72000**	**85000**	**56000**	**259000**	**73000**

*** 30% of the following quarters budgeted sales in units ** 30% of the budgeted year # 1st quarter sales**

3) Direct material purchase budget.

This budget is the responsibility of the purchasing manager since it will be he or she who is responsible for obtaining the planned quantities of raw materials to meet production requirements. The objective is to purchase these materials at the right time at the planned purchase price plus it is necessary to take into account the planned raw material stock levels.

Year 2 quarter						**Year 3 quarter**
	1	**2**	**3**	**4**	**Year**	**1**
Required production	46000	72000	85000	56000	259000	73000
Raw material per unit	5	5	5	5	5	5
Production needs	230000	360000	425000	280000	1295000	365000
Add desired ending inventory	36000	42500	28000	36500*	36500	
Total needs	**266000**	**402500**	**453000**	**316500**	**1331500**	
Less beginning inventory	23000	36000	42500	28000	23000	
Raw material to be purchased	243000	366500	410500	288500	1308500	
Cost per unit	0.8	0.8	0.8	0.8	0.8	
	194400	**293200**	**328400**	**230800**	**1046800**	

End of this particular example.

4) Direct labor budget.

This budget is the responsibility of the respective mangers. They will prepare estimates of the department's labor hour required to meet the planned production. Where different grades of labor exist, this should be specifi ed separately on the budget.

Let's look at an illustration on direct labor budget.

A department X has budgeted that the following year's production will be as follows.

Quarter	1	2	3	4
Production	8000	6500	7000	7500

Each unit requires 0.35 direct labor hours and direct laborers are paid $12.00 per hour.

Required:

Construct the companies direct labor budget.

Department X's annual direct labor budget

Quarter	1	2	3	4
Production	8000	6500	7000	7500
Hours/unit	0.35	0.35	0.35	0.35
Total budgeted hours	2800	2275	2450	2625
Budgeted wage rate	12	12	12	12
Total wages	**33600**	**27300**	**29400**	**31500**

By knowing in advance how much labor will be needed throughout the budget year, the company can develop plans to adjust the labor force as the situation requires. If not, companies will run the risk of labor shortages or having to hire or fi re workers at awkward times. Erratic labor policies lead to insecurity, low morale and ineffi ciency.

5) Manufacturing overhead budget.

This budget provides a schedule of all costs of production other than direct materials and direct labor. Usually fi xed costs are costs of supplying capacity to do things like that actual making of the product, processing purchase orders etc. the expected level of activity will directly determine what capacity is required. If the expected level is greater than the company's capacity, the fi xed costs have to be increased. The opposite will also be applied; when expected level is lower than the company's capacity the fi xed costs have to be lowered. The overheads must be analyzed according to whether they are controllable or non-controllable for purposes of costs control. To determine an appropriate level of fi xed costs at budget time, an activity based costing system can be of much assistance.

Let us look at an example.

X ltd has the following information with regards to budgeted direct labor hours.

Quarter	1	2	3	4
Labor hours	7000	7200	7500	6800

Variable manufacturing overheads are $3.25 per direct labor hour.

The company's fi xed manufacturing overhead is $48000 per quarter. The only non-cash item included in it is depreciation which is $16000 per quarter.

a) Construct the company's manufacturing budget for the upcoming year
b) Compute the company' manufacturing overhead rate (including both variable and fi xed manufacturing overhead) for the upcoming fi scal year. (Round off to the nearest whole cent.

The Manufacturing overhead budget

Quarter	1	2	3	4	Total
Labor hours	7000	7200	7500	6800	28500
VOH rate	3.25	3.25	3.25	3.25	3.25
Variable overheads	**22700**	**23400**	**24375**	**22100**	**92625**
Fixed overheads	48000	48000	48000	48000	48000
Total overheads	**70750**	**71400**	**72375**	**70100**	**284625**
Less depreciation	16000	16000	16000	16000	16000
Cash disbursement for overheads	**54750**	**55400**	**56375**	**54100**	**220625**

Total manufacturing overheads are **$284625**

Budgeted direct labor hours **28500**

Manufacturing overhead rate = **$284625 = $9.99 per direct labor hour**

28500

6) Selling and administration overheads.

In practice, these two budgets are usually separated. That is the sales manager will be responsible for the selling budget, the distribution manager responsible for the distribution expenses and the chief administration manager responsible for the administration budget.

Example:

X ltd has the following as its budgeted unit sales for the year.

Quarter	1	2	3	4
Unit sales	14000	15000	13000	12000

The company's variable selling and administration expense per unit is $2.50

Fixed selling and administration expense include advertising expenses of $8000 per quarter, executive salaries of $35000 per quarter and depreciation of $20000 per quarter. In addition the company will make insurance payments of $5000 in the 1st quarter and $5000 in the 3rd quarter. Finally, property taxes of $8000 will be paid in the 2nd quarter.

Required:

A selling and administration expense budget for the coming year.

Quarter	1	2	3	4	Total
Unit sales	14000	15000	16000	17000	18000
Variable selling and admin cost	2.5	2.5	2.5	2.5	2.5
Budgeted variable expense	**35000**	**35000**	**35000**	**35000**	**35000**
Budgeted fixed selling expense					
Advertising	8000	8000	8000	8000	32000
Depreciation	20000	20000	20000	20000	80000
Insurance	5000		5000		10000
Taxes		8000			8000
Total selling and admin costs	**68000**	**73500**	**65500**	**58000**	**265000**
Less depreciation	20000	20000	20000	20000	80000
Cash disbursement	**48000**	**53500**	**45500**	**38000**	**185000**

7) Cash budget

The objective of this budget is to ensure that suffi cient cash is available at all times to meet the level of operations that are outlined in the various budgets. In practice monthly or weekly budgets are prepared.

The cash budget is composed of four major sections:

- Receipts section
- Disbursements section
- Cash excess or defi ciency section
- Financing section

The receipts section has the listing of all the cash infl ows, except for fi nancing, expected during the budget period. The cash fl ows are mainly from sales.

The disbursement section has all the cash payments planned for the budget period. They include raw material purchase, direct labor payments, overheads, plant purchase and dividend payment etc.

Cash budgets can help avoid cash balances that are surplus to the requirements by enabling management to take steps in advance to invest the surplus cash in short term investments. On the other hand, cash deficiencies could be identified in advance and the company manager might need financing and borrowing .

The format of a cash budget would be as follows.

	1	2	3	4	Total
Beginning balance	XX	XX	XX	XX	XX
Add receipts	XX	XX	XX	XX	XX
Total available	XX	XX	XX	XX	XX
Less disbursement	XX	XX	XX	XX	XX
Surplus/deficiency	XX	XX	XX	XX	XX
Financing					
Borrowing	XX	XX	XX	XX	XX
Repayment	XX	XX	XX	XX	XX
Interest	XX	XX	XX	XX	XX
Total financing	XX	XX	XX	XX	XX
Cash balance	XX	XX	XX	XX	XX

Budgeted income statement

A budgeted income statement can be prepared form the data developed in all schedules and budgets. It's one of the key schedules in the budget process. It shows the company's planned profit for the upcoming budget period and stands as a benchmark against which subsequent company performance can be measured.

Budgeted balance sheet

It is developed by beginning with the balance sheet from the beginning of the budget period and adjusting it for data contained in other budgets.

It is all the above budgets that form the **master budget** that are submitted accompanied by some financial ratios. With the consideration of both the above, the budget will either be accepted or rejected and sent back for further adjustments.

4.7.2 FLEXIBLE BUDGETS

What we have been dealing with to this point are *static budgets;* those that are set at the beginning of the budget period and are valid only for the planned level of activity. It is suitable for planning, yes, but not very useful for control purposes. The question is "it fair for a manager's per performance to be measured against targets that were set with no regards to uncontrollable factors arising form circumstances not envisaged then?" It is important therefore, to create budgets whereby the uncontrollable volume effects of cost behavior are removed. These budgets are called *flexible budgets.*

When a flexible budget is used in performance evaluation, actual costs are compared to what the costs should have been for actual level of activity during the period rather that to the budgeted cost from the original budget.

>>>Here is a brief illustration:

Budgeted direct labor hours	60000 (100% capacity)
Direct labor hourly rate	$3.75
Variable indirect labor cost	$0.75 per direct labor hour
Variable consumable suppliers cost	$0.375 per direct labor hour
Variable canteen costs	6% of direct and indirect labor cost

Semi variable costs are expected to relate to the direct labor hours in the same manner as for the last five years. They consist of a fixed element of 20p per hour.

Fixed costs	$
Depreciation	18000
Maintenance	10000
Insurance	4000
Rates	15000
Management salaries	25000

Required:

Prepare budgets for the period for direct labor costs and overhead expenses of a production department at 80%, 90% and 100% level

	80%	90%	100%
	(48000)	(54000)	(60000)
	'000	'000	'000
Direct labor	180	202.5	225
Other variable costs			
Indirect labor	36	40.5	45

STUDY TEXT

Consumable supplies		18	20.25	22.5
Canteen		12.96	14.58	16.2
Total variable cost	($5.145)	246.96	277.83	308.7
Semi variable costs*		17.60	18.80	20.00
Fixed costs				
Depreciation		18.00	18.00	18.00
Maintenance		10	10	10
Insurance		4	4	4
Rates		15	15	15
Management salaries		25	25	25
Budgeted costs		336.56	368.63	400.7

* 60000 hours (60000*0.20) + $8000 = 20000
54000 hours (54000*0.20) + $8000 = 18800
48000 hours (48000*0.20) + $8000 = 17600

What budget cost allowance should be there for 57000 direct labor hours?

Variable costs	(57000*$5.145)	293265
Semi variable cost	(8000 + (57000*0.20))	19400
Fixed costs		72000
		384665

Purpose of Budgetary Control

Budgetary control is the process of ascertaining several budgeted figures for the future of a business enterprise and then making comparison of these budgeted figures with the actual results for finding out discrepancies, if any.

The comparison of budgeted and actual figures will allow the management to take curative actions at a proper time.

Budgetary control can be defined as, “A means of achieving the financial control of an entity whereby the actual results for a defined period of time are compared with the budgeted results, any differences (or variances) being noted, and some corrective action taken to bring the actual activities back into line with the budgeted ones if such variances need to be dealt with.”

The budgetary control is a continuous process that helps in planning, coordination and controlling of business decisions. A budget is a means and budgetary control is the end-result. The budgetary control system assists an organization in setting up the goals and efforts are made for its achievements. It enables economies in the enterprise.

The main objectives of budgetary control are as follows:

- It is essential for planning, controlling and also acts as an instrument of coordination.
- It coordinates the actions of various departments.
- Budgetary control helps in eliminating wastes and raises the profitability position of a business enterprise.
- It makes a prediction about capital expenditure for future.
- It helps in amending deviations from the established standards.
- It centralizes the control system.
- Budgetary control operates various cost centres and departments with efficiency and economy.

Budgetary control compels business administration to think about the future that is most likely the crucial characteristic of this system. It coerces management to look into future, to outline thorough plans for attaining the objectives for each department, operation and each manager, to predict and grant the organization purpose and direction.

INSTALLING A BUDGETARY CONTROL SYSTEM

Having understood the meaning and significance of budgetary control in an organization, it will be useful for you to know how a budgetary control system can be installed in the organization. This requires, first of all, finding answers to the following questions in the context of an organization:

· **What is likely to happen?**
· **What are the objectives to be achieved?**
· **What are the constraints and to what extent their effects can be minimized?**

Having found answers to the above questions, the following steps may be taken for installing an effective system of budgetary control in an organization:

Organization for Budgeting

The setting up of a definite plan of organization is the first step towards installing budgetary control system in an organization a budget manual should be prepared giving details of the powers, duties, responsibilities and areas of operation of each executive in the organization.

1. Budget Manual: “A document which setout, inter alias, the responsibilities of the persons engaged in, the routine of, and the forms and records required for, budgetary control.”
2. Web for obtaining the necessary approval of budgets, the authority of granting approval should be stated in explicit terms. Whether one, two or more signatures are to be required on each document should also be clearly stated.
3. Timetable for all stages of budgeting.
4. Reports, statements, forms and other records to be maintained.
5. The accounts classification to be employed. It is necessary that the framework within which the costs, revenues and other financial amount are classified must be identical both in accounts and the budget department.

There are many advantages attached to the use of budget manual. It is a formal record defining the functions and responsibilities of each executive.

The methods and procedures of budgetary control are standardized. There is synchronization of the efforts of all which result in maximization of the profits of the organization.

The responsibility for preparation and implementation of the budgets may be fixed as under:

Budget Controller

Although the chief executive is finally responsible for the budget programme, it is better if a large part of the supervisory responsibility is delegated to an official designated as Budget Controller or Budget Director. Such a person should have knowledge of the technical details of the business and should report directly to the president or the Chief Executive of the organization.

Fixation of the budget period

Budget period mean the period for which a budget is prepared and employed. The budget period depends on the nature of the business and the control techniques. For example, a seasonal industry will budget for each season while an industry requiring long periods to complete work will budget for four, five or even larger number of year. However, it is necessary of control purposes to prepare budgets both for long as well as short periods.

Budget Procedures

Having established the budget organization and fixed the budget period, the actual work or budgetary control can be taken upon the following pattern:

STEPS IN BUDGETARY CONTROL

1.Organization for budgeting
2. Budget manual + Theory

"A document which sets out, inter alias, the responsibilities of the persons engaged in, the routine of and forms and records required for budgetary control."

The budget manual is a written document or booklet that specifies the objectives of budgeting organization and procedures. Following are some of the important matters covered in a budget manual:

1. A statement regarding the objectives of the organization and how they can be achieved through budgetary control.
2. A statement regarding the functions and responsibilities of each executive by designation both regarding preparation and execution of budgets.
3. Procedures to be followed for obtaining the necessary approval of budgets.
4. The authority of granting approval should be stated in explicit terms.

5. Whether one, two or more signatures are to be required on each document should also be clearly stated.
6. Timetable for all stages of budgeting.
7. Reports, statements, forms and other records to be maintained.
8. The accounts classification to be employed. It is necessary that the framework within which the costs, revenues and other financial amount are classified must be identical both in accounts and the budget departments.

There are many advantages attached to the use of budget manual. It is a formal record defining the functions and responsibilities of each executive.
The methods and procedures of budgetary control are standardized.
There is synchronization of the efforts of all which result in maximization of the profits of the organization.

Making a forecast

Consideration of alternative combination of forecasts:
Alternative combinations of forecasts are considered with a view to contain the most efficient overall plan so as to maximize profits. When the optimum -profit combination of forecasts is selected, the forecasts should be regarded as being finalized.

4.8 ROLLING BUDGETS

A rolling (continuous) budget is a budget that is continuously updated by adding a period, say a month or quarter, when the earlier accounting period has expired. When making budgets, we are actually planning for the future but no one is ever certain of tomorrow. The future is dynamic and this dynamism could be caused by the following:

a. Organizational changes:
   - change in organizational structure
   - new arrangements with labor force on working terms
   - changing of power structures

b. Changes in competitor tactics
c. Changes in technology
d. Changes in the economic environment; boom or recession, inflation etc
e. Level of activities

With this in mind, it would be necessary to adjust the original plans in budgets through the use of rolling budgets.

The targets and plans in a rolling budget are more realistic and certain, more so with price levels, by shortening the periods between preparing budgets. Instead of having a full budget, there would be smaller monthly or quarterly budgets. Each of these budgets would plan for the next twelve months so that current budget is extended by an extra period as the current period ends.

What distinguishes a rolling budget?

They differ from flexible budgets in several ways:

- fl exible budgets are based on 'feedback control' which compares achievements for the period with budget targets that have been adjusted for unforeseen events beyond the control of the responsible manager.
- rolling budgets are 'feed forward control' which adjusts subsequent month targets for changes in circumstances
- rolling budgets tend to rise from a management philosophy which accepts that change is inevitable and forecasts are always imperfect.
- organizations with rolling budgets tend to put less emphasis on budgetary control than those that do not.

Advantages of rolling budgets

i. Management can concentrate on short term accuracy. There's no use of deriving detailed targets over long periods which will probably not happen.
ii. It will force the reappraisal of the budget to ensure it is up to date.
iii. Planning and control functions will be done with reference to up to date information.
iv. It could also be used to communicate changes in the organization strategy to management.
v. Rolling budgets provide management with more realistic plans hence will be more motivating.

Disadvantages of rolling budgets

i. A lot of time and effort will be put into budgeting.
ii. Contrary to (v) above, the constantly changing targets may make managers cynical or dispirited.
iii. It may lead to careless budgeting if management knows that targets can always be changed later.
iv. Rolling budgeting may slip into incremental budgeting rather than be linked to strategic objectives.
v. It may reduce control and increase bargaining if managers know they can hide poor performance behind changed targets.
vi. Revisions to targets may require revision to standard costs too which in turn would led to revisions to stock valuations. This could place large administrative effort from the accounts department every time a rolling budget is being prepared.

4.9 ALTERNATIVE APPROACHES TO BUDGETING

There are two main approaches to budgeting. These are:

1. Incremental budgeting

This system is based on the previous year's activity which is then adjusted for volume and price effects.

It is concerned mainly with the increments in costs and revenues which will occur in the coming period. It is very reasonable to use this if current operations are as effective, effi cient and economical as they can be. It is also appropriate for costs such as staff costs that may be estimated on basis of current salaries plus an increment for infl ation and hence are administratively quite easy to prepare.

Incremental budgeting is criticized for encouraging slack and wasteful spending to creep into budgets. Past ineffi ciencies are perpetuated because cost levels are rarely subjected to close scrutiny.

2. Zero-Base Budgeting (ZBB)

FAST FORWARD: The principle behind ZBB is that the budget for each cost centre should be made form 'scratch' or 'zero'.

This method emerged in an attempt to overcome limitations of *incremental budgeting.*

ZBB refl ects the assumption in incremental budgeting that this year's activities will continue at the same level or volume next year and that next year's budget can be based on this year's costs plus an extra amount may be incorporating infl ation.

ZBB requires that every item of expenditure be ***justifi ed*** in its entirety in order to be included in next year's budget. Besides adopting a zero based approach, ZBB also focuses on programs or activities instead of functional departments based on line items which is a feature of traditional budgeting.

Implementing ZBB

a) Definition of the Mission and Goals of the Organization

Usually the organization has already established mission and goal statements. However, it may be necessary to redefi ne the ones that are already in existence and/or create new ones. This redefi nition is particularly useful when there have been major changes in the internal and external environment.

b) Identification of the Organization's Decision Units and Decision Packages

A ZBB decision unit is an operating division for which decision packages are to be developed and analyzed. It can also be described as a cost or a budget center. Managers of each decision unit are responsible for developing a description of each program to be operated in the next fi scal year or years. In ZBB these programs are referred to as decision packages and each decision package usually will have three or more alternative ways of achieving the decision package's objectives. Briefl y, each decision package alternative must contain, as a minimum, goals and/or objectives, activities, resources and their dollar costs. Also, the decision package should contain a description of how it contributes to the mission and goals of the organization.

c) Analysis of Each Decision Package

This analytic process allows the manager of the decision package and its alternatives to assess and justify its operation. Several questions should be asked and answered during the analytical process.

Does this decision package support and contribute to the goals of the organization?

What would be the result to the organization if the decision package is eliminated?

Can this decision package's objectives be accomplished more effectively and/or effi ciently? This question will require creative planning by the person(s) developing the decision package.

d) Ranking of Decision Packages

The ranking process is used to establish a rank priority of decision packages within the organization. During the ranking process managers and their staff will analyze each of the several decision package alternatives. The analysis allows the manager to select the one alternative that has the greatest potential for achieving the objective(s) of the decision package. Ranking is a way of evaluating all decision packages in relation to each other. Since, there are a number of ways to rank decision packages, managers will no doubt employ various methods of ranking. The main point is that the ranking of decision packages is an important process of ZBB.

e) Acceptance and Allocation of Resources

Managers, following a review and analysis of all decision packages, will determine the level of resources to be allocated to each decision package. Managers at different levels of responsibility in the organization usually perform the review and analysis. Sometimes, the executive levels of management may require the managers of the decision packages to revise and resubmit their decision packages for additional review and analysis.

f) Budget Preparation

The organization's budget is prepared following the acceptance and approval of the decision packages. Once the organization's budget has been approved managers of the decision units will place in operation all approved decision packages during the next fi scal year.

g) Monitoring and Evaluation

The last major process of ZBB is monitoring and evaluation. The processes of planning, analysis, selection and budgeting of decision packages prepare the organization for operation during the next year. However, what managers plan to happen in the next fi scal year may or may not occur. Adjustments may be essential during the year in order to achieve the decision package objectives. Also, there is a need to know whether or not the organization did accomplish what it set out to achieve and what level of achievement was obtained. The monitoring and evaluation process of ZBB requires that the following be included in the overall design and implementation of decision packages.

>> **Advantages of ZBB**

i. It is possible to identify and remove ineffi cient or obsolete operations.
ii. It forces employees to avoid wasteful expenditure.
iii. It can increase motivation if participation into the process is allowed.
iv. It responds to changes in the business environment.
v. ZBB documentation provides an in depth appraisal of an organization's operations.
vi. ZBB creates a questioning attitude rather than one that assumes that current practice represents value for money.
vii. ZBB focuses attention on outputs in relation to **value for money.**

>> **Disadvantages of ZBB**

A major disadvantage is the volume of extra paperwork created. Others include:

i. Short term benefi ts might be emphasized to the detriment of long term benefi ts.
ii. It might give the impression that all decisions have to be made in the budget. This might limit what management can or cannot do thus lowering motivation by watering down initiative. The limits are created if their ideas were not incorporated in the budgeting process.
iii. Management may not be having the skills to perform the techniques required by ZBB. Thus their training is required.
iv. The organization's information system may not be capable of providing suitable information.
v. The ranking process could be diffi cult; so many decision packages, others of equal importance while others may be having only qualitative benefi ts.

To offset the massive use of management time and paperwork, ZBB could be applied selectively. Instead of annually for all activities, ZBB could be performed, say; marketing this year, payroll next year or fi nance this year. This way all activities will be thoroughly scrutinized in the long run.

Conclusion

ZBB is particularly useful for budgeting for discretionary costs and support activities and for rationalization purposes. Discretionary costs are costs over which management has some discretion on how much to spend. That is, there isn't a direct relationship that exists between the inputs (costs) and revenues (outputs) e.g. research, advertising, training and development. These expenses make up a large proportion of the total expenditure and are less quantifi able by conventional methods.

ZBB can be applied to service industries and non-profi t making organizations such as local and central governments.

Decision package content should include:

- Measurable performance objectives
- Appropriate activities as means for achieving the performance objectives
- Resource allocation essential for conducting the activities
- Methods for carrying out the activities as planned
- Evaluation of objective achievement during and at the end of the program of activities
- Procedures for reporting objective achievement to managers of the organization.

4.10 ACTIVITY BASED BUDGETING

ABB is merely the use of costs determined using ABC as a basis for preparing budgets. ABB involves defi ning the activities that underlie the fi nancial fi gures in each function and using the level of activity to decide how much resource should be allocated, how well it is being managed and to explain variances from the budget.

Here in contrast with traditional budgeting, costs are grouped according to their *purpose* rather than according to their *nature.*

Traditional	$	Activity based	$
Wages	XX	Sweeping	XX
Material	XX	School cleaning	XX
Vehicles hire	XX	Park cleaning	XX
Equipment hire	XX	Repainting	XX
	XXX		XXX

The use of ABB will assist in the comparison of costs with the activities which they achieve. This should lead to a greater accuracy in the costs predicted and thus better management control. The approach is more modern as there's is more focus on **outputs** and less on **inputs.**

Results of using ABB:

a. Different activity levels will provide a foundation for the base package and incremental packages of ZBB.
b. The organization's strategy and any actual or likely changes in that strategy will be taken into account because ABB attempts to manage the business as a sum of its interrelated parts.
c. Critical success factors will be identifi ed and performance measures devised to monitor progress towards them.

Roles of budgets

i. Authorization

Once a budget has been agreed, it is not merely a go ahead for managers to spend "up to the budget" but spending the budget. There's an under-spend attitude that creeps in during the year form managers for fear of budget cuts in the next budget period. This will be followed by unnecessary spending towards the end of the period.

ii. Planning

A budget provides a formal coordinated approach to short-term planning throughout the organization. The budgets give managers the framework within which to operate and plan for his area of responsibility.

iii. Communicating and coordinating

Information about objectives, strategies and policies has to be communicated down form the top management and all the individual budgets in an organization need to be coordinated in order to arrive at the master budget. This ensures goal congruency.

iv. Motivation

If budgets are 'agreed' they should be able to motivate individual managers towards their achievement which in turn should assist the organization in attaining the longer term objectives.

v. Evaluation of performance

Comparison between the predetermined budget and the actual results is the most common way in which individual managers' performance is judged on a regular basis.

ENTERPRISE RESOURCE PLANNING

(Source-www.netessence.com.cy)

What is ERP?

Enterprise Resource Planning software, or ERP, doesn't live up to its acronym. Forget about planning—it doesn't do that—and forget about resource, a throwaway term. But remember the enterprise part. This is ERP's true ambition. It attempts to integrate all departments and functions across a company onto a single computer system that can serve all those different departments' particular needs.

That is a tall order, building a single software program that serves the needs of people in fi nance as well as it does the people in human resources and in the warehouse. Each of those departments typically has its own computer system, each optimized for the particular ways that the department does its work. But ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other.

That integrated approach can have a tremendous payback if companies install the software correctly. Take a customer order, for example. Typically, when a customer places an order, that order begins a mostly paper-based journey from in-basket to in-basket around the company, often being keyed and re-keyed into different departments' computer systems along the way. All that lounging around in in-baskets causes delays and lost orders, and all the keying into different computer systems invites errors. Meanwhile, no one in the company truly knows what the status of the order is at any given point because there is no way for the fi nance department, for example, to get into the warehouse's computer system to see whether the item has been shipped. "You'll have to call the warehouse," is the familiar refrain heard by frustrated customers.

How can ERP improve a company's business performance?

ERP automates the tasks involved in performing a business process—such as order fulfillment, which involves taking an order from a customer, shipping it and billing for it. With ERP, when a customer service representative takes an order from a customer, he or she has all the information necessary to complete the order (the customer's credit rating and order history, the company's inventory levels and the shipping dock's trucking schedule). Everyone else in the company sees the same computer screen and has access to the single database that holds the customer's new order. When one department finishes with the order it is automatically routed via the ERP system to the next department. To find out where the order is at any point, one need only log into the ERP system and track it down. With luck, the order process moves like a bolt of lightning through the organization, and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting.

That, at least, is the dream of ERP. The reality is much harsher.

Let's go back to those inboxes for a minute. That process may not have been efficient, but it was simple. Finance did its job, the warehouse did its job, and if anything went wrong outside of the department's walls, it was somebody else's problem. Not anymore. With ERP, the customer service representatives are no longer just typists entering someone's name into a computer and hitting the return key. The ERP screen makes them business people. It flickers with the customer's credit rating from the finance department and the product inventory levels from the warehouse. Will the customer pay on time? Will we be able to ship the order on time? These are decisions that customer service representatives have never had to make before and which affect the customer and every other department in the company. But it's not just the customer service representatives who have to wake up. People in the warehouse who used to keep inventory in their heads or on scraps of paper now need to put that information online. If they don't, customer service will see low inventory levels on their screens and tell customers that their requested item is not in stock. Accountability, responsibility and communication have never been tested like this before.

How long will an ERP project take?

Companies that install ERP do not have an easy time of it. Don't be fooled when ERP vendors tell you about a three or six month average implementation time. Those short (that's right, six months is short) implementations all have a catch of one kind or another: the company was small, or the implementation was limited to a small area of the company, or the company only used the financial pieces of the ERP system (in which case the ERP system is nothing more than a very expensive accounting system). To do ERP right, the ways you do business will need to change and the ways people do their jobs will need to change too. And that kind of change doesn't come without pain. Unless, of course, your ways of doing business are working extremely well (orders all shipped on time, productivity higher than all your competitors, customers completely satisfied), in which case there is no reason to even consider ERP.

The important thing is not to focus on how long it will take—real transformational ERP efforts usually run between one to three years, on average—but rather to understand why you need it and how you will use it to improve your business.

What will ERP fix in my business?

There are three major reasons why companies undertake ERP: To integrate financial data. —As the CEO tries to understand the company's overall performance, he or she may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own versions of how much they contributed to revenues. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system. To standardize manufacturing processes—Manufacturing companies—especially those with an appetite for mergers and acquisitions—often find that multiple business units across the company make the same widget using different methods and computer systems. Standardizing those processes and using a single, integrated computer system can save time, increase productivity and reduce headcount. To standardize HR information. —Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employee time and communicating with them about benefits and services. ERP can fix that.

In the race to fix these problems, companies often lose sight of the fact that ERP packages are nothing more than generic representations of the ways a typical company does business. While most packages are exhaustively comprehensive, each industry has its quirks that make it unique. Most ERP systems were designed to be used by discreet manufacturing companies (who make physical things that can be counted), which immediately left all the process manufacturers (oil, chemical and utility companies that measure their products by flow rather than individual units) out in the cold. Each of these industries has struggled with the different ERP vendors to modify core ERP programs to their needs.

Will ERP fit the ways I do business?

It's critical for companies to figure out if their ways of doing business will fit within a standard ERP package before the checks are signed and the implementation begins. The most common reason that companies walk away from multimillion dollar ERP projects is that they discover that the software does not support one of their important business processes. At that point there are two things they can do: They can change the business process to accommodate the software, which will mean deep changes in long-established ways of doing business (that often provide competitive advantage) and shake up important peoples' roles and responsibilities (something that few companies have the stomach for). Or they can modify the software to fit the process, which will slow down the project, introduce dangerous bugs into the system and make upgrading the software to the ERP vendor's next release excruciatingly difficult, because the customizations will need to be torn apart and rewritten to fit with the new version.

Needless to say, the move to ERP is a project of breathtaking scope, and the price tags on the front end are enough to make the most placid CFO a little twitchy. In addition to budgeting for software costs, financial executives should plan to write checks to cover consulting, process rework, integration testing and a long laundry list of other expenses before the benefits of ERP

start to manifest themselves. Underestimating the price of teaching users their new job processes can lead to a rude shock down the line. So can failure to consider data warehouse integration requirements and the cost of extra software to duplicate the old report formats. A few oversights in the budgeting and planning stage can send ERP costs spiraling out of control faster than oversights in planning almost any other information system undertaking.

What does ERP really cost?

Meta Group recently did a study looking at the Total Cost of Ownership (TCO) of ERP, including hardware, software, professional services, and internal staff costs. The TCO numbers include getting the software installed and the two years afterward, which is when the real costs of maintaining, upgrading and optimizing the system for your business are felt. Among the 63 companies surveyed—including small, medium and large companies in a range of industries— the average TCO was $15 million (the highest was $300 million and lowest was $400,000). While it's hard to draw a solid number from that kind of a range of companies and ERP efforts, Meta came up with one statistic that proves that ERP is expensive no matter what kind of company is using it. The TCO for a "heads-down" user over that period was a staggering $53,320.

When will I get payback from ERP — and how much will it be?

Don't expect to revolutionize your business with ERP. It is a navel gazing exercise that focuses on optimizing the way things are done internally rather than with customers, suppliers or partners. Yet the navel gazing has a pretty good payback if you're willing to wait for it—a Meta group study of 63 companies found that it took eight months after the new system was in (31 months total) to see any benefits. But the median annual savings from the new ERP system was $1.6 million per year.

James MCCullough remembers back when he had a $500 million IT budget and teams of IT professionals. By last year, though, all of that was a distant memory.

McCullough, the former CIO of Delta Air Lines, found himself reshaping his new company's IT infrastructure without the benefit of a large budget or staff. As CIO of eCompanyStore, an Alpharetta, Ga.-based company that builds online stores to fill promotional product needs for its clientele, he had to figure out how to deploy big-company technology—specifically, ERP applications—without spending big-company money. "We knew we were going to have to go [the ERP] route if we were going to become scalable," McCullough says. "We didn't want to come back in 18 months or two years and say we can't handle [transaction] volume."

McCullough decided to explore a relatively new option in enterprise applications: fast-track ERP. Fast-track ERP gives smaller businesses (with revenues between $200 million and $500 million) access to functionality similar to what their Fortune 500 counterparts have had for years. When all goes well, fast-track ERP implementations are measured in thousands of dollars instead of millions, and months instead of years. The vendors promise up-front, guaranteed agreements on schedule and price, fully functioning applications and a lot fewer headaches than traditional ERP.

The fast track isn't without its speed bumps, however. First, there is a greater need to stick to the plain vanilla version of the package, with as little customization as possible. There are also unexpected costs that pop up outside the scope of the fixed-price contract. Although they are simpler than their bigger brethren, the systems are still at the mercy of people—it's essential to

manage expectations and resistance to change, and provide thorough training.

McCullough started down the fast-track ERP path with Walldorf, Germany-based SAP. He and his team of 20, composed of SAP consultants and eCompanyStore employees, installed the R/3 system with modules for materials management, function planning and finance, and an online store to replace the Pandesic application. They started in mid-December 2000 and applied the finishing touches in early January 2001. They did it without spending big-company money or time. “I’m sitting on an engine that’s capable of taking our company into the stratosphere with the same suite of applications,” McCullough says.

As ERP implementations falter and fail, many people think the answer is more training. They’re wrong.

Unless you’ve been as out-of-touch as the Mars Polar Lander, you’re doubtlessly aware that the ERP industry hasn’t been performing like the marvel it was first made out to be.

First came the ERP vendors’ pre-Y2K plunging sales revenues and falling stock values. Second came the realization that all that hard work implementing an ERP system didn’t actually guarantee business benefits—or even a positive payback. Take Meta Group’s damning finding, for instance: The average ERP implementation takes 23 months, has a total cost of ownership of $15 million and rewards (so to speak) the business with an average negative net present value of $1.5 million. And the news gets worse.

An alarmingly long list of top-drawer integrators have fallen flat on their faces. Compared to these disasters, merely spending a lot of money on an ERP implementation that achieves very little is a consummation devoutly to be wished.

Hershey, Pa.-based Hershey Foods, for example, issued two profit warnings in as many months in the run-up to last Christmas. Why? Massive distribution problems following a flawed implementation of SAP’s R/3 ERP system, which affected shipments to stores in the peak Halloween and pre-Christmas sales periods. In a booming stock market, Hershey shares ended the year down 27 percent from its year’s high.

And Hershey wasn’t alone in its misery. In November 1999, domestic appliance manufacturer Whirlpool of Benton Harbor, Mich., also blamed shipping delays on difficulties associated with its SAP R/3 implementation. Like Hershey, Whirlpool’s share price dove south on the news, falling from well over $70 to below $60. While these two have (so far) been the highest-profile implementation debacles, companies as diverse as Scottsdale, Ariz.-based trash processor Allied Waste Industries; Newark, Del.-based high-tech fabric maker W.L. Gore & Associates; and industrial supplies distributor W.W. Grainger of Lake Forest, Ill., have all reported serious difficulties.

And if “serious difficulties” sounds bad, rest assured it can get much, much worse. After Carrollton, Texas-based pharmaceutical distributor FoxMeyer Drug actually collapsed following an SAP R/3 implementation, its bankruptcy trustees filed a $500 million lawsuit in 1998 against the German ERP giant, and another $500 million suit against co-implementer Andersen Consulting. (Both cases were unresolved at the time of writing.)

So what’s going on? The good news—if that’s the right word—is that most experts agree that such failures are not systemic. “Very rarely are there instances when it’s the ERP system itself—the actual software—that fails,” says Jim Shepherd, senior vice president of research at Boston-based AMR Research. Public pronouncements by both SAP and Hershey, he notes, have acknowledged that the software does what it is supposed to and that no big fixes or patches are planned. What’s more, he adds, the prudent observer will differentiate between real implementation failures and not-so-real failures. “Blaming the failure on a system implementation has become a convenient excuse for companies that have missed their quarter-end [earnings] target.”

As for blame, it is evenly spread. SAP implementations are no more likely to go down the tubes than ERP systems from other vendors: W.L. Gore's system, for example, came from Pleasanton, Calif.-based PeopleSoft. "When an ERP project unravels, or is seen not to perform well, one of the suppliers is usually chosen as the culprit," says David Duray, London-based global partner responsible for the SAP implementation business at PricewaterhouseCoopers. "In my experience, this is usually more of a political decision than a proper problem-source identification exercise— and SAP, over the last few years, has been a popular target."

Furthermore, adds Roger Phillips, an IT analyst at specialist investment bank Granville in London, which tracks the global ERP market, there is no evidence that geography is a significant differentiator in the success stakes. Disasters, he believes, "simply go with the ERP territory." There are, he says, "no cultural or managerial foibles that make American ERP implementations any more predisposed to disasters than any other country's implementations."

So what does lie behind ERP disasters? And behind the rather longer list of costly-but-underwhelming implementations typified by that now-infamous Meta Group report? Increasingly, experts reckon that they've found the smoking gun: poor training. Not the technical training of the core team of people who are installing the software, but the education of the broad user community of managers and employees who are supposed to actually run the business with it.

A few things to ponder when planning for ERP

- Which processes are most important now and why?
- Does this system meet our needs or go beyond them?
- Who will be the change champion(s)?
- Who are the stakeholders?
- What is the business culture at our company and what are its strengths?
- What subcultures do we have and what are their strengths?
- How can we apply those strengths to business change?
- What cultural attributes are weak or will interfere with the change?
- What will be the toughest changes, and how will we address them?
- Who will be responsible for change management?

Material resource planning

The practice of calculating what materials are required to build a product by analyzing a bill of material data, inventory data and the master production schedule. Enterprise resource planning (ERP) is an outgrowth of MRP.

Enterprise resource planning

The practice of consolidating an enterprise's planning, manufacturing, sales and marketing efforts into one management system.

Enterprise relationship management

The practice of analyzing customer data from sales, marketing, service, fi nance and manufacturing databases in order to relate effi ciently to customers.

Enterprise resource management

The practice of providing users with effi cient access to an organization's network resources. ERM enables the enterprise to control and track the systems and resources that each user has access to and provides consistent standards for creating and changing passwords.

The Hidden Costs of ERP

Although different companies will fi nd different land mines in the budgeting process, those who have implemented ERP packages agree that certain costs are more commonly overlooked or underestimated than others. Armed with insights from across the business, ERP pros vote the following areas as most likely to result in budget overrun:

1. Training

Training is the near-unanimous choice of experienced ERP implementers as the most elusive budget item. It's not so much that this cost is completely overlooked as it is consistently underestimated. Training expenses are high because workers almost invariably have to learn a new set of processes, not just a new software interface.

2. Integration and Testing

Testing the links between ERP packages and other corporate software links that have to be built on a case-by-case basis is another often underestimated cost. A typical manufacturing company may have add-on applications for logistics, tax, production planning and bar coding. If this laundry list also includes customization of the core ERP package, expect the cost of integrating, testing and maintaining the system to skyrocket.

As with training, testing ERP integration has to be done from a process-oriented perspective. Instead of plugging in dummy data and moving it from one application to the next, veterans recommend running a real purchase order through the system, from order entry through shipping and receipt of payment-the whole order-to-cash banana-preferably with the participation of the employees who will eventually do those jobs.

3. Data conversion

It costs money to move corporate information, such as customer and supplier records, product design data and the like, from old systems to new ERP homes. Although few CIOs will admit it, most data in most legacy systems is of little use. Companies often deny their data is dirty until they actually have to move it to the new client/server setups that popular ERP packages require. Consequently, those companies are more likely to underestimate the cost of the move. But even clean data may demand some overhaul to match process modifi cations necessitated—or inspired—by the ERP implementation.

4. Data analysis

Often, the data from the ERP system must be combined with data from external systems for analysis purposes. Users with heavy analysis needs should include the cost of a data warehouse in the ERP budget—and they should expect to do quite a bit of work to make it run smoothly. Users are in a pickle here: Refreshing all the ERP data in a big corporate data warehouse daily is diffi cult, and ERP systems do a poor job of indicating which information has changed from day to day, making selective warehouse updates tough. One expensive solution is custom programming. The upshot is that the wise will check all their data analysis needs before signing off on the budget.

5. Consultants Ad Infinitum

When users fail to plan for disengagement, consulting fees run wild. To avoid this, companies should identify objectives for which its consulting partners must aim when training internal staff. Include metrics in the consultants' contract; for example, a specifi c number of the user company's staff should be able to pass a project-management leadership test—similar to what Big Five consultants have to pass to lead an ERP engagement.

6. Replacing Your Best and Brightest

It is accepted wisdom that ERP success depends on staffi ng the project with the best and brightest from the business and IS. The software is too complex and the business changes too dramatic to trust the project to just anyone. The bad news is, a company must be prepared to replace many of those people when the project is over. Though the ERP market is not as hot as it once was, consulting fi rms and other companies that have lost their best people will be hounding yours with higher salaries and bonus offers than you can afford—or that your HR policies permit. Huddle with HR early on to develop a retention bonus program and to create new salary strata for ERP veterans. If you let them go, you'll wind up hiring them—or someone like them—back as consultants for twice what you paid them in salaries.

7. Implementation Teams Can Never Stop

Most companies intend to treat their ERP implementations as they would any other software project. Once the software is installed, they fi gure, the team will be scuttled and everyone will go back to his or her day job. But after ERP, you can't go home again. You're too valuable. Because they have worked intimately with ERP, they know more about the sales process than the salespeople do and more about the manufacturing process than the manufacturing people do. Companies can't afford to send their project people back into the business because there's so much to do after the ERP software is installed. Just writing reports to pull information out of the new ERP system will keep the project team busy for a year at least. And it is in analysis—and, one hopes, insight—that companies make their money back on an ERP implementation. Unfortunately, few IS departments plan for the frenzy of post-ERP installation activity, and fewer still build it into their budgets when they start their ERP projects. Many are forced to beg for more money and staff immediately after the go-live date, long before the ERP project has demonstrated any benefi t.

8. Waiting for ROI

One of the most misleading legacies of traditional software project management is that the company expects to gain value from the application as soon as it is installed; the project team

expects a break, and maybe a pat on the back. Neither expectation applies to ERP. Most don't reveal their value until after companies have had them running for some time and can concentrate on making improvements in the business processes that are affected by the system. And the project team is not going to be rewarded until their efforts pay off.

9. Post-ERP Depression

ERP systems often wreak cause havoc in the companies that install them. In a recent Deloitte Consulting survey of 64 Fortune 500 companies, one in four admitted that they suffered a drop in performance when their ERP systems went live. The true percentage is undoubtedly much higher. The most common reason for the performance problems is that everything looks and works differently from the way it did before. When people can't do their jobs in the familiar way and haven't yet mastered the new way, they panic, and the business goes into spasms.

ERPS (Source-www.collegiateproject.com)

CONSTRUCTING THE MANAGING-LEVEL BUDGET

Following are three types of budgets typically involved in an ERP implementation:

(1) The Rough Order of Magnitude budget,
(2) The Planning-Level budget
(3) The Managing-Level budget.

In part one, we outlined how these three types of budgets vary in purpose, detail, accuracy, and the time it takes to complete. In part two, we focus on the fi nal Managing-Level Budget.

Purpose of a Managing-Level Budget

A managing-level budget should be as comprehensive and as detailed a budget as possible in order to effectively manage the costs of an ERP implementation.

The managing-level budget contains the most detail of the three types of budgets, and can take several weeks to fi nalize. In fact, the managing-level budget is not fi nished until after contract negotiations with the various vendors have been concluded and the planning phase of the implementation project has ended. If prepared properly, the managing-level budget will be accurate to within fi ve percent of the fi nal project costs, given no major scope changes occur during the implementation.

Developing the Managing-Level Budget

The development of a managing-level budget is simply the refi nement of the planning- level budget based on more current and accurate information for each of the ten ERP budget categories.

Refinements based on vendor negotiations

Since the managing-level budget is produced after contract negotiations with the various ERP vendors, the institution now will have exact costs (not estimated costs) for various budget categories. For example, at this point in the budgeting process the institution should know the following costs:

- Software licensing and annual software maintenance costs
- The various third-party (ancillary) software licensing and maintenance costs
- The database licensing and maintenance costs
- The hardware costs and maintenance
- Any reporting solutions that were part of the total ERP package for the institution

After all negotiations have been completed, the institution will also have better estimates of the implementation costs. In fact, if the institution has negotiated a “fixed price” contract, the institution will know exactly what the training and consulting costs will be. Even if certain elements of the implementation services are variable, rather than fixed, institutions sometimes negotiate for fixed travel costs. For example, often times the institution will negotiate a fixed rate for travel expenses, usually in the form a fixed dollar amount per consulting hour.

Another source of budget refinements is scope changes that may be made during the negotiation process. For example, the institution may decide to delete certain pieces of the vendor proposal. To illustrate, the institution may decide to drop the document imaging part of the ERP package, or perhaps drop a third-party room scheduling solution, both of which had been included in the original planning-level budget.

Also during the negotiation phase, the institution could decide to add components not originally planned. For example, perhaps a misunderstanding occurs related to what was included in the RFP response. After reading the RFP response the institution believed that certain functionality was available, but during negotiations they discovered the functionality was not available. As a result, the institution might add to the contract a particular third-party software solution that will supply the functionality.

Refinements after the planning phase

Final refinements in the managing-level budget will also occur during and shortly after the planning phase of the ERP implementation. An example is housing for hardware. Prior to the planning phase, the institution believed that new hardware would be housed in a known central location. After planning, the institution might discover that additional space will have to be built or rented. Another example is after planning the institution discovers that more staff will be required in one or more departments to handle the service level requirements during the implementation.

Reducing the contingency

Once the managing level budget is assembled, institutions should make one final refinement in cost estimates. This refinement involves reducing the size of the contingency that was used in the planning-level budget. In many cases the planning-level budget will have ten to fifteen percent

contingency while the managing-level budget might only have a five percent contingency.

Developing a Cash Flow Budget

Knowing the total costs of each of the various ERP budget categories is extremely important from a cost management standpoint. However, to manage the budget properly, an institution should now develop a cash flow budget for the project. This involves developing a budget expenditures model over time.

From a cash flow standpoint, most institutions will at least break out the budget expenditures by year.

Some institutions break out expenditures semi-annually or even quarterly. From our experience, we recommend that institutions break out predictions of cash outlay for *each and every month* of the implementation for budget tracking purposes.

Producing a cash flow model by month is fairly simple for some of the budget categories, but more difficult for others. In the end institutions must make some assumptions about cash flow and later adjust based on actual expenditures.

Easy categories for cash flow estimates

The easy categories for a cash flow budget include the software licensing costs and maintenance costs from the various ERP vendors, as well as the hardware, database, and reporting solution costs. These amounts and payment terms are specified by contract allowing easy cash flow predictions. Further, staffing costs (including new hires or “backfills” and third party project management) are fairly easy to estimate on a project timeline.

A difficult category for cash flow estimates

The most difficult budget category to estimate from a cash flow basis will be the implementation costs, including travel. These costs comprise the consulting and training services that will be needed to implement the software over the life of the project. These professional services are usually the single biggest cost category in the budget.

Help from the implementer

We have found that the best approach to develop the cash flow budget is to enlist the help of the ERP implementer in getting monthly consulting estimates (including travel) over the life of the contract. These monthly estimates must reflect as much as possible the realities of the effort required at different points on the timeline. In other words, you should not simply divide the total implementation costs by the number of months of the project. Generally the implementer should know *a priori* when more effort will be expended at certain points in the timeline than at others. For instance, we know institutions will incur substantial consulting costs at start up, at times when more than one module is being implemented simultaneously, and before certain milestone dates, such as “go-lives.”

Thus the fi rst step is to sit down with the implementer fi rm and fi nd out the module sequencing, the total number of months for implementation, the number of months in which more than one module will be implemented, and the various key milestone dates.

Predicting monthly consulting expenditures is often more of an art than science. Our advice is to get the best information you can, and then make educated guesses. You can always begin to adjust the budget expenditure model as situations change during the implementation.

Implementer resistance

We have found that vendors will resist this exercise for one or more reasons. Thus it is important to make sure you include this monthly cash fl ow exercise as a contract requirement for ERP implementers.

Tracking the Cash Flow Budget

An important element for staying within budget is to put in place a monitoring and feedback process to provide the institution constant information concerning budget expenditures against plan. These expenditures should be broken down by the various ERP budget categories.

Once you have a monthly budget expenditures model, you can easily compare actual expenditures to expected expenditures each month. And as the project progresses, you will focus on the cumulative dollars spent compared to the predicted cumulative dollars spent, separately for the various ERP budget categories.

A Final Note

Once you develop a managing-level budget and a monthly expenditures model based on this budget, your institution has the information it needs to effectively manage ERP costs.

However, staying on budget is more than having a good budget in place. You must have a strong dose of management skills to keep the project on budget. In the ongoing management of your ERP budget, the best way to avoid unwanted costs and stay within budget is to follow the fi ve principles below.

1. Keep the project on schedule

Schedule delays invariably lead to increased project costs.

2. Manage project scope

Scope creep always increases project costs. Manage scope aggressively according to a pre-established management process.

3. Limit software modifications

Limiting software modifi cations is an off-shoot of managing project scope. Software modifi cations not only drive up project costs, but they also increase ongoing costs during periodic software upgrades. Limit and aggressively challenge software modifi cation requests.

4. Manage vendor hours

Unmonitored vendor hours will drive up implementation costs.

5. Frequently publish a budget expenditures dashboard

Feedback through frequent dashboard reporting raises the budget awareness level for all project participants

MOTIVATION

Motivation is what makes people behave the way they do. It comes for the individual attitudes or group attitudes. Individual will be motivated by personal desires and interests. This may or may not be in line with the business objectives. Some people will 'live' for their jobs while others will feel that coming to work is such a great chore for them. This brings in an aspect called *goal congruence* whereby strides are taken to ensure that the individual's interests are in line with those of the organization. It is possible to design and run a budgetary control system which will go some way towards ensuring that goal congruence is achieved. Managers and employees must therefore be favorably disposed towards the budgetary control system for it to operate effi ciently.

Research has shown that although, theoretically, budgeting systems gave positive motivational effects, all too often, they produced negative reactions. Some poor attitudes or hostile behavior towards the budgetary control system will begin to emerge.

At planning stage managers may:

- build slack unnecessarily
- complain of lack of time for budgeting
- argue that a formal budget is too restrictive and that they should be allowed more fl exibility in making operational decisions
- not coordinate their budgets with those of other budget centers.
- base future plans purely on past results with no examination of alternative options and new ideas.
- set out to show that the budget is unworkable especially if they have not been connected with the budget preparation and it has been decided for them by senior management.

At implementation stage managers may:

- not cooperate and coordinate with other budget holders
- put in just enough effort to achieve budget targets without trying to beat those targets.
- tolerate poor inaccurate recording and classifi cation of costs
- ensure that they spend up to their budget, even if not necessary, to ensure it is not tightened in the future
- concentrate on short term factors to the detriment of more important longer term consequences.
- seek to blame the budgeting system for any problems which occur.

To foster motivation, acceptance by managers concerned of the budgets and of the levels of performance contained in the budgets is absolutely vital. Studies have shown that there are positive gains in motivation when the reward-penalty system of the organization is consistent with the control system. Motivation will also be enhanced if participation of budget holders in the budget setting is allowed.

Participation in budgeting

This means that before budgets are fi nalized, there are discussions with managers who are thus in a position to infl uence the levels of their budgets and targets. It has been argued that participation in the budgeting process will improve motivation and so will improve the quality of budget decisions and the efforts of individuals to achieve their budget targets. This although will depend on the individual's personality, nature of task (defi ned or fl exible) and the organizational culture.

4.11 BUDGETARY STYLES

There are two ways in which a budget can be set.

a. Imposed style (top down)

Here, top management prepares budgets with little or no input from the operating personnel which is then imposed upon the employees who have to work to the budgeted fi gures.

It is suitable:

- In a newly formed organization
- In very small businesses
- During times of economic hardship.
- When operational managers lack budgeting skills
- When the organization's different units require precise coordination.

Advantages

i. Strategic plans are included into planned activities.
ii. Coordination between plans and objectives of individual divisions is enhanced.
iii. They use senior management's awareness of total resource availability.
iv. They decrease the input form inexperienced or uninformed lower level employees
v. They decrease the period of time taken to draw up the budgets.

Disadvantages

i. Dissatisfaction, defensiveness and low morale amongst employees.
ii. The feeling of team-spirit might disappear.
iii. Acceptance of organizational goals and objectives would be met with diffi culties.

iv. The budget would be seen as a punitive devise
v. Initiative of lower level management would be stifl ed.

b. Participative style of budgeting (bottom)

Here, the budgets are developed by lower level managers who then submit the budgets to their superiors. What the lower level managers feel is achievable and the associated necessary resources are incorporated into the budgets.

It is suitable:

- In well established organizations
- In very large organizations.
- During economic boom
- When strong budgeting skills are fully inculcated in the managers.
- When the organization is well decentralized.

Advantages

i. They are based on information form employees most familiar with the department.
ii. Knowledge spread among several of management is pulled together.
iii. Morale and motivation is improved.
iv. They increase operational managers' commitment to organizational objectives.
v. In general, they are more realistic.
vi. Coordination between units is improved.
vii. Specifi c resource requirements are included.
viii. Senior manager's overview is mixed with operational level details.

Disadvantages

i. They consume more time
ii. Changes implemented by senior management may cause dissatisfaction.
iii. Budgets may be unachievable if managers are not qualifi ed to participate.
iv. They may cause managers to introduce budgetary slack.
v. An earlier start to the budgeting process could be required.

The two styles are on a continuum. What lies in between is actually what happens in practice; negotiation. Final budgets should lie between what top management would really like and what junior managers believe is feasible. The budget process could be taken to be a bargaining process.

4.12 BUDGETS AND PERFORMANCE EVALUATION

Budgets are one of the accounting measures which are used to assess a manager's performance. In most cases, the reward schemes in organizations are often linked to the achievement of certain levels of performance.

A very important source of motivation to perform well is being kept informed about how actual results are progressing and how actual results compare with target. Information fed back about actual results should have qualities of good information:

- reports should be clear and comprehensive
- significant variances should be highlighted for investigation
- reports should be timely enough to allow the individual to take control action before adverse results get much worse.

Unfortunately, research evidence suggests that all too often accounting performance measures lead to a lack of goal congruence. Managers will seek to improve performance based on the indicator used even though this is not in the best interests of the firm as a whole. For example a production manager may be encouraged to achieve high levels of production and reduce costs, particularly if his bonus is linked to these factors. High motivation thus follows, but the need to maintain high production levels could lead to high levels of slow moving stock resulting in an adverse effect in the company's cash flows.

Hopwood found 3 distinct ways of using budgetary information to evaluate managerial performance

a. Budget constrained style evaluated (B.C)

The manager's performance is primarily evaluated upon the basis of his ability to meet the budget continually on a short term basis. Adverse cost variances would be used to censure a budget holder regardless of performance elsewhere.

b. Profit conscious style of evaluation (P.C)

Manager's performance is evaluated on the basis of his ability to increase the general effectiveness of his unit's operations in relation to the long term purposes of the firm. In this case the minimization of long run costs was seen as the most desirable.

c. Non-accounting style of evaluation (N.A)

The budgetary information plays a relatively unimportant part in the superior's evaluation of the manager's performance.

Here is a summary of effects of the three styles.

	Style of evaluation		
	B.C	P.C	N.A
Involvement with costs	High	High	Low
Job related tension	High	Medium	Low
Manipulation of A/ctng results	Extensive	Little	Little
Relationship with supervisor	Poor	Good	Good
Relationship with colleagues	Poor	Good	Good

4.13 BUDGETARY SLACK (BIAS)

It is the difference between the minimum necessary costs and costs built into the budget or actually incurred. It is the common process of building room for maneuver when setting a budget by overstating the level of budget expenditure or by understating the level of budgeted sales.

Why would budget holders create budget slack?

i. It should lead to the most favorable result when actual is compared with budget. Such a result should lead to the optimization of personal gain for the individual manager.
ii. Bias can help influence the outcome when the reward structures are based on comparisons of actual Vs budgeted.
iii. In certain business environments, it is a way of relieving some of the pressures of a tight situation. Bias will allow some leeway when things don't go as planned.
iv. Some managers may find creating and achieving slack as a motivating factor for them for they say that they have "beaten" the system.

Is budget slack good or bad?

It depends on how the budget is used. If bias has the effect of motivating a manager to his best actual performance, this would appear to be a good reason for having it. However if budgets are used to make forecasts and consequent major decisions then, to the extent hat budgets are biased, there will be errors in the forecasts being made beyond the budget period.

4.14 GENERAL ROLES OF BUDGETS

In this chapter we have looked extensively at what budgeting is and what it entails and some aspect of it such as its effect on behavior. In summary therefore let us look at the roles of budgeting:

i. Planning

The annual budgeting process leads to the refinement of long term plan since managers must produce detailed plans for the implementation of the long range plan. Without the annual budgeting process, pressures of day to day operating problems may tempt managers not to plan for future operations. The budgeting process ensures that management plan for future operations and that they consider how conditions in the next year might change and what steps they should take now to respond to these challenged conditions.

ii. Coordination

Through a budget, the actions of the different parts of an organization can be brought together

and reconciled into a common plan. Without a common plan, divisional managers may each make their own decisions believing that they are working in the best interests of the organization. Budgeting reconciles these differences for the good of the organization as a whole. Budgeting compels managers to examine the relationship between their own operations and those of other departments in the process identify and resolve conflicts.

iii. Communication

All parts should be kept fully informed of the plans and the policies to which the organization is expected to conform. Everyone should be fully aware of the role they have to play in achieving the annual budget.

iv. Motivation

The budget can be a useful motivating devise; useful enough to encourage management to perform well in line with the organizational goals. Budgets provide management with some form of target which they should work their level best to attain. However this will only work if they were incorporated in the budget making process i.e. participation for if the budget was imposed on them, the opposite would occur. The budget would be seen as a punitive devise rather than a challenge and would be resisted.

v. Control

Budgets have both planning and control functions. The manager could at some point compare the actual results with the budgeted amounts for the different expenses and ascertain which costs do not conform to the original plan and this require attention i.e. management by exception.

This means that the managers' attention should be directed towards those parts of the organization where plans are not working for one reason or another. Upon noticing significant deviations, management must investigate what the causes are and take necessary actions to stop and prevent a future repeat of that distortion.

vi. Performance evaluation

In part, a manager's success will be determined by how well he did when it comes to attaining the targets in the budget. His ability to attain them is often an important determinant of whether he'll receive the promotion or bonus etc. This fact of the budget therefore influences the attitudes of the manager towards the budgeting process.

In closing let us look at a summary of some of the benefits and problems associated with budgeting.

Benefits:

a. Budgets give instructions to managers on how the day to day, month to month activities will be conducted. These instructions are actually translated from the organization's long term plan.

b. Whether imposed or participatory, budgets are a very good medium of communication. Information regarding organizational plans and objectives and of progress towards meeting these objectives will be communicated using a budget.
c. Properly developed budgets will help achieve coordination within the organization. Each department will function having considered the consequences of its actions on other departments.
d. A participatory and all inclusive budgeting system will help promote a coalition of interest and to increase motivation.
e. Through management by exception, time and resources will be saved if management will only investigate on significant deviations and not be really concerned a lot with areas that are “running smoothly”.
f. Investigation of operations and procedures and monitoring of expenditure may lead to reduced costs and greater efficiency.
g. At the control stage, where actual results are compared to the budget, information will be provided on whether to adjust current operations to bring it in line with plans or make adjustments to targets if they are found to be unrealistic.
h. Using a master budget (where all budgets are integrated) cash and working capital management and stock buying policies will be made more realistic

Problems:

a. Budgeting may be relied on too much as a technique at the expense of good management.
b. Research has it that an imposed budget could lead to antagonism and demotivation.
c. Budgets are created around existing organizational structures and departments which may be inappropriate for current conditions and may not reflect the underlying economic realities.
d. Having static budgets will lead to inertia and the organization may not be flexible enough in the moments of change.

CHAPTER SUMMARY

Budget: A detailed plan for the future, usually expressed in formal quantitative terms.

Planning - Developing objectives and preparing various budgets to achieve those objectives.

Control - involves steps taken by management to increase the likelihood that the objectives set down at the planning stage are attained and that all parts of the organization are working together towards that goal.

A **good budget** must incorporate both the **planning** and **control** aspects.

Planning budget is a financial plan detailing what to do and in what order to do it in order to achieve organizational goals

Appropriation budget is a financial plan specifying how much spending is authorized as appropriate. The appropriation figure is the maximum amount that it may legally spend during the **budget period.**

Budget period is conventionally one year. The budget is divided into either 12 monthly or 13 four weekly periods for control purposes. It could also be divided into four quarters; 1st quarter subdivided into months to form monthly budgets. As the year progresses, the 2nd quarter is divided into months and so on and so forth.

Control budgets are financial plans where purpose is to enable organizations to carry out their activities in the most effective and efficient manner.

Negative feedback is information which indicates that the system is deviating from its planned or prescribed course and that some re-adjustment is necessary to bring it back on course. It is referred to as negative since the control action would need to reverse the direction/movement of the system towards its planned course.

Positive feedback results in control action that causes actual results to maintain or increase their path of deviation from planned results.

Budgetary control is the establishment of budgets relating to the responsibility of executives to the requirements of a policy and the continuous comparison of actual and budgeted results either to service by individual action the objectives of that policy or to provide a basis for its revision.

The budget committee: It should consist of high level executives who represent the major segments of the business. It is usually responsible for the overall policy relating to the budget program and coordinating the preparation of the budget itself. The committee, among other things ensures that budgets are realistically established.

Budgeted income statement: It shows the company's planned profit for the upcoming budget period and stands as a benchmark against which subsequent company performance can be measured.

A **rolling (continuous)** budget is a budget that is continuously updated by adding a period, say a month or quarter, when the earlier accounting period has expired.

Budgetary slack (BIAS): It is the difference between the minimum necessary costs and costs built into the budget or actually incurred. It is the common process of building room for maneuver when setting a budget by overstating the level of budget expenditure or by understating the level of budgeted sales.

CHAPTER QUIZ

1. What is a budget?

2. State and explain three types of budgets.

3. What are flexed budgets?

4. What is zero based budgeting?

ANSWERS TO QUIZ QUESTIONS

1. Budget

"A quantitative statement, for a defined period of time, which may include planned revenues, expenses, assets, liabilities and cash flows. A budget provides a focus for the organization 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." *T. Lucey Management Accounting*

2. Types of budgets:

>> The Planning budget

It is a financial plan detailing what to do and in what order to do it in order to achieve organizational goals. Many possible budgets will be created and vetted before choosing one as a target for an organization.

>> Appropriation budget

It is a financial plan specifying how much spending is authorized as appropriate. It is mostly used in government agencies e.g. "how much will appropriate to welfare spending?" The appropriation figure is the maximum amount that it may legally spend during the **budget period.**

>>Control budgets

These are financial plans whose purpose is to enable organizations to carry out their activities in the most effective and efficient manner. Generally what we plan and expect to happen will actually not happen. It's this area where the comparison between actual and budgeted is done.

3. **Flexed budgets** are budgets whereby the uncontrollable volume effects of cost behavior are removed.

4. **Zero based budgeting (ZBB)** is a method of budgeting in which mangers are required to start at zero based levels every year and to justify all costs as if the programs involved were being initiated for the first time.

PAST PAPER ANALYSIS

Activity based budgeting was tested in the following examinations:

06/'07

05/'06

06/'03

Incremental budgeting was tested in 06/'03.

EXAM QUESTIONS

QUESTION ONE

a) Differentiate between a feedback control system and a feed forward control system. (4 marks)

b) In his study of: the impact of budges on people" C Argyris reported the following comment by a financial controller on the practice of participation in setting budgets in his company:
"We bring in the supervisors of budget areas, we tell them that we want their frank opinion, but most of them just sit there and no their heads. We know they are not coming out with exactly what they feel. I guess budget scares them".
Explain why managers may be reluctant to participate fully in setting budgets, indicating the negative side effects, which may arise from the imposition of budgets by senior management. (10 marks)

c) A critic has suggested that budgets should be abolished because they introduce rigidity and hamper creativity. Discuss. (6 marks)

(Total: 20 marks)
CPA DEC 2000

QUESTION TWO

"It is now fairly and widely accepted that conventional cost accounting, distorts management's view of business through unrepresentative overhead allocation and inappropriate product costing. This is because the traditional approach usually absorbs overhead costs across products solely on the basis of the direct labour involved in their manufacture. As direct labour cost expressed as a proportion of total manufacturing cost continues to fall, this leads to more an more distortion and misrepresentation of the impact of particular products on total overhead costs" (from Financial Times)

Required:

a) Briefly discuss the above statement and state what approaches are being adopted by management accountants to overcome such criticism. (8 marks)

b) Traditional budgeting systems are incremental in nature and tend to focus on cost centres. Activity based budgeting (ABB) links strategic planning to the overall performance measurement aimed at continuous improvement.
   i Explain the weaknesses of traditional incremental budgeting systems. (4 marks)
   ii Describe the main feature of activity based budgeting system and comment on its advantages. (8 marks)

(Total: 20 marks)
CPA JUNE 2003

CASE STUDY

There are clearly established budgeting rules within the accounting industry. Typically, budgets are used to filter and analyze information throughout the organization, not necessarily to create more information for dissemination. The budgeting process utilizes what information is already available. The focus of budgets and the planning process are often based on the drivers of sales, profits and expenses, relying on historical performance and demand data to forecast future monetary requirements. It is an imprecise activity at best, yet an important action for the successful tactical operation of a business. On a strategic level, budgeting clarifies its competitive priorities, advantages and strategies for the future, employing cost forecasts and demand limits to quantitatively measure the feasibility of capital expansion projects (The Controller's Report, 2001).

For tactical purposes, budgets provide useful information tools and control mechanisms to company leaders, as well as partitioning decision rights with those holding specific knowledge about the operation.

Source: www.google.co.ke- case studies on budgeting

CHAPTER FIVE

STUDY TEXT

STANDARD COSTING AND VARIANCE ANALYSIS

CHAPTER FIVE

STANDARD COSTING AND VARIANCE ANALYSIS

▶ CHAPTER OBJECTIVES

After this topic, the student will be able to discuss what a standard cost is and why it exists. Who and what is involved in the standard setting process. Later we will see its application in the variance analysis.

▶ INTRODUCTION

In the previous chapter we looked at budgeting as a control tool where the budget is compared with actual results to determine whether there's a variance.

In this chapter we shall consider a financial control system that enables the deviations form the budget to be analyzed in detail, thus enabling costs to be controlled more efficiently. These are standard costing and variance analysis.

▶ DEFINITION OF KEY TERMS

Standard cost can be defined as the planned unit cost of the products, components or services produced in a period.

Variance is the difference between an actual result and expected results.

Variance analysis is the process by which the **total difference** between standard and actual results is analyzed.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on Variance analysis analysis" .

Students should therefore understand this topic.

▶ INDUSTRY CONTEXT

Firms use standard costing to determine an average expected unit cost of producing an item.

It is therefore particularly appropriate for manufacturing businesses producing large numbers of identical items, especially where the same operations are combined in different ways to produce different products. It also has applications in service businesses that involve repetitive operations.

For example, a firm like the Nairobi Bottlers will use standard costing to determine the cost of producing one bottle of soda.

Variance analysis analysis" will be used by firms to determine any deviations from budgeted figures and hence correct those deviations.

5.1 STANDARD COSTING

FAST FORWARD: Standard costing basically tries to establish a predetermined cost for products or services with which actual costs will be composed to establish whether there are any variances.

It is one of the most important techniques used in management accounting. The predetermined cost is an estimated unit cost *built up of standards for each cost element (standard resource price and standard usage)*

The standard cost can also be defined as the planned unit cost of the products, components or services produced in a period. An illustration of how a standard cost is built up could give a clearer picture when shown in a **standard cost card**

Standard cost card

Product XYZ

	Cost	Requirement	$	$
Direct material				
A	$3/kg	4kgs	12	
J	$4/litre	5litres	20	32
Direct labor	$10/hour	5hours		50
Variable o/heads	$7.5/hour	4hours		30
Fixed o/heads	$3/hours	12hours		36
Standard full cost of production				**148**

The standard cost uses standard quantities of resources at their standard prices. It is therefore for management to estimate

- *the expected prices of materials, labor and expenses*
- *the efficiency levels in the use of materials and labor*
- *the budgeted overhead costs and budgeted volumes of activity.*

The uses of standard costing

Basically standard costing has two major uses:

i. To value stocks and cost of production for cost accounting purposes. It could be seen as an alternative for FIFO and LIFO methods of costing.
ii. It is standard costs that are used as targets in the control function to be compared with actual results to highlight variances.

Furthermore standard costing could be used:

- to provide a formal basis for assessing performance and effi ciency
- in the setting of budgets and evaluating managerial performance.
- To enable the principle of a management by exception to be practiced.
  A standard cost is an average expected unit cost. Being only an average, deviation of actual costs form it should be expected. Only extreme variations from it will be inspected.
- To assist in assigning responsibility for non_standard performance in order to correct defi ciencies or capitalize on benefi ts.
- To provide predictions of future costs to be used in decision\n making situations
- To motivate staff and management
- To provide guidance on possible ways of improving effi ciency and performance.

Can standard costing be used universally?

It is a detailed process requiring considerable accounting and technical development work before it can be used effi ciently. Although it can be used in a variety of costing situations (batch and mass production, process manufacture, jobbing manufacture) the greatest benefi t form its use can be gained if there is a degree of repetition in the production process so that average or expected usage of resources can be determined.

Can it be used in the service industry?

There is no reason why it shouldn't provided that a realistic cost unit can be established e.g. in a restaurant, a cost unit could be a standard meal.

5.1.1 Standard setting

FAST FORWARD: The responsibility for setting standards should be shared between managers able to provide the necessary information about levels of expected effi ciency, prices and overhead costs.

There are two approaches that can be used to set standard costs:

- Past historical records can be used to estimate labor and material usage.
- Engineering studies- here a detailed study of each operation is undertaken based on careful specifi cations of materials, labor and equipment and the controlled observations.

Just who sets these standards?

Line managers who have to work with and accept the standards must be involved in establishing them. This really affects the attitudes of the managers in terms of motivation due to the participatory nature of the process. Work study staff, engineers, accountants and other specialists provide technical assistance and information but line managers must be involved in the critical part of standard setting, that of agreeing the level of attainment to be included in the standard.

Let us now consider how standards are established for each operation for direct labor, direct material and overheads using engineering studies approach,

N.B. standard cost= standard quantity*standard price

i. Setting standards for material costs

These are based on product specifi cations derived from an intensive study of the input quantity necessary for each operation the. The material content of the product: raw material, sub assemblies, piece parts, fi nishing materials etc, constitute the material quantity standards that are usually recorded on a **bill of materials.**

The intensive study should establish most suitable material for each product and also the optimal quantity that should be used after allowing for inevitable wastage or loss. The study is important as savings and alternative materials and ways of using materials are usually discovered.

When it comes to *standard price,* the onus is on the purchasing department. They estimate direct material cost per unit on the knowledge of the following:

a. Purchasing contracts already agreed
b. Pricing discussions with regular suppliers
c. Forecast movement of prices in the market
d. Availability of bulk purchase discounts
e. Quality of material required
f. Carriage and packaging charges

The cost ought to include allowance for bulk discounts and it could be weighted average if different suppliers are used.

ii. Setting standards for direct labor

To set labor standards, a time motion study has to be performed for an activity. This is in a bid to establish, at effi ciency level, how many labor hours will be needed to complete an activity having removed all the unnecessary elements.

Standard hour: amount of work achievable at standard effi ciency levels in an hour or minute.

Unavoidable delays such as machine breakdowns and routine maintenance are included in the standard time.

The standard wage rate will be set by reference to the payroll and to any agreements on pay rises with trade union representatives of the employees.

N.B. the learning effect must be incorporated in setting the standard times

>>> Standard hours produced explained

It is not possible to measure output in terms of units produced for a department making several different products or operations.

If a department produces 100 units of X, 200 of Y and 300 if Z, it is not possible to add their production since they **aren't homogeneous.**

What would solve this is the use of standard hours that act as a common denominator for adding together the production of unlike items.

That is, assume that the unit standard times are as follows.

X - 5 std hours

Y - 2 std hours

Z - 3 std hours

The production for the department will be calculated in standard hours as follows.

	STD hrs/ unit	Actual output	STD hrs produced
X	5	100	500
Y	2	200	400
Z	3	300	900
			1800

From the illustration we expect the output of 1800 standard hours to take 1800 direct labor hours of input if the department works at the present level of effi ciency.

iii. Setting standards for overheads

In setting standard overhead costs we apply what we have learnt in our earlier chapter (in absorption costing). The predetermined overhead absorption rates become the standards for overheads for each cost center using the budgeted standard labor hours as the activity base or planned production volume.

Production volume will depend on two factors:

- Production capacity (or volume capacity) measured in standard hours of output which in turn refl ects direct production labor hours
- Effi ciency of costing by labor or machines, allowing for rest times and contingency allowances

STUDY TEXT

Separate rates for fi xed and variable overheads are essential.

Standard variable OAR = Budgeted Variable overheads for cost centre

Budgeted standard labor hours for cost centre

Standard fixed OAR = Budgeted fixed overheads for cost centre

Budgeted standard labor hours for cost centre

N.B: The level of activity adopted will be assumed as 100% capacity and for control purposes and will be the base for the master budget.

An Illustration on standard hours:

A department has a workforce of 20 men working a 30 hour week making standard units, each unit has a standard time of 2 hours to make. The expected effi ciency of the workforce is 125%.

a. Budgeted capacity of indirect labor hours = 20*30= 600 production hours per week
b. Budgeted effi ciency is 125%, so that the workforce would take only 1 hour of actual production time to produce 1.25 standard hours of output
c. This means that budgeted output is 600*1.25=750 standard hours with each requiring 2 standard hours, the production activity or volume of 375 units per week.

iv. Setting standards for sales price and margin

Setting of product selling price is a top level decision that is based on factors such as:

- anticipated market demand
- manufacturing costs
- competing products
- infl ation estimates

After much discussions and deliberation, a price for the product is set; this is the standard selling price. The standard sales margin is the difference between the standard cost and the standard selling price.

5.1.2 Types of standards

Determination of standard costs raises the problem of how demanding the standards should be. Should they represent ideal or faultless performance or should they represent easily attainable performance?

Four types of standards will therefore arise:

a. Ideal standards standards”

They represent perfect performance. Ideal standard costs are the minimum costs that are possible under the most effi cient operating conditions; no wastage, no ineffi ciencies, no idle time.

Ideal standards standards" would be adjusted periodically to reflect improvements in materials, methods and technology. Ideal standards are not achievable and are only standards to be aimed at rather than performance that can currently be achieved.

b. Attainable standards

This is by far the most commonly achievable standard. It is a standard that can be attained if production is carried out efficiently, machines are properly operated and/or materials are properly used. Here allowances are made for normal spoilage, machine breakdowns and lost time.

The fact that these standards represent a target that can be achieved under efficient conditions but which is also viewed as being neither too easy to achieve nor impossible to achieve, provides the best norm to which actual costs should be compared.

c. Current standards

A standard which is set for use over a short period to reflect current conditions (current wastage; current inefficiencies). When conditions are stable; the current standards will be equal to attainable standards in the short term. Use of current standards will be seen, for example, during high inflation. They can be set in a month by month basis.

d. Basic standard

It's a long term standard which remains unchanged over the years and is used to show trends. They could also be used as a basis for setting current standards. Although when changes occur in methods of production, price levels or other relevant factors, basic standards are not very useful since they do not represent current target costs, hence they are seldom used.

Impact of the type of standards in human behavior

Type		Impact
Ideal	-	one school of thought says that they provide employees with incentive to be more efficient even though they are unattainable
	-	others say that they are demotivating since the variance will always be adverse and they see as impossible and decide not to work so hard.
Attainable	-	they are motivating. Realistic but a challenging target to achieve
Current	-	they have no effect on motivation
Basic	-	may have an unfavorable impact on motivation. Over time they become easily achievable; employees become bored and lose interest since they have nothing to aim for.

Should standards be revised?

Standards should be revised whenever there are changes of a permanent and reasonably long term nature. Standards are created based on past and current data but managers should also consider technical and current factors expected for the period in which they are to be applied. Standards which are right up to date provide a better target and are more meaningful to managers. Standards must evolve to reflect an organization's changing methods and processes.

In modern business, firms are focused on a continuous improvement and cost reduction but can they co-exist with the standard costing system? Why do we ask this?

- in an effort to increase efficiency, firms may need to alter product quantities and prices but a requirement for standard costing to prevail is a stable environment
- Predetermined standards conflict with the philosophy of continuous improvement.
- standards cost incorporate scrap and wastage but businesses are now more on zero defect policies.

With this in mind therefore, standard costs need to be reviewed regularly. Some argue that standards should be revised as soon as there are any changes in the basis upon which they are set. If an existing standard is not correctly set, the use of the incorrect standard is pointless. Others say that frequent changes to standard costs hamper motivation as the goal posts are always shifting. In addition the process is also a time consuming one although this last point could be sorted by use of computers.

Minor changes in rates, prices and usage are frequently ignored for a time, but once the cumulative effect is felt, they need to be changed. All standard costs are revised together at regular, periodic intervals such as six or twelve months. Revision should only be done when changes of *permanent* and reasonably *long-term* nature occur but not in response to temporary blips in price or efficiency.

5.2 STANDARD COSTING AND BUDGETARY CONTROL

FAST FORWARD: In practice, the terms standard cost and budgeted cost might be used interchangeably. Whereas it is possible to have budgeting without standard costs, it is not possible to have a standard cost system without a total cost budgeting system.

Standard costing and budgetary control are interlinked items. Once standard cost have been determined it is relatively easy to compute budgets for production costs and sales and, when actual figures differ from expected standards, to calculate variances, to provide a basis for control reporting.

A standard cost is an average expected unit cost. It is set using the best available estimates and cannot be expected in practice that actual results will conform to standard. Variances should

therefore be expected to fluctuate randomly within normal limits. Such random fluctuations need no investigation and tolerance limits are set (investigate only those variances which exceeds Sh.x or y% of the standard cost).

Standard costing is appropriate in any situation where the same resources are used over and over again in the same way. It is therefore particularly appropriate for manufacturing businesses producing large numbers of identical items, especially where the same operations are combined in different ways to produce different products. It also has applications in service businesses that involve repetitive operations.

Installing a standard costing system entails designing an information system that can collect and analyse details about activities in such a way that the standards can be set and applied. In effects this means collecting quantitative data about the use of resources.

The advantages of standard costing

The advantages for controlling having a standard costing system in operation can be summarized as follows:

- Carefully planned standards are an aid to more accurate budgeting
- Standard costs provide a yardstick against which actual costs can be measured.
- The setting of standards involves determining the best materials and methods which may lead to economies.
- A target of efficiency is set for employees to reach and cost-consciousness is stimulated
- Variances can be calculated which enable the principle of management by exception to be operated. Only the variances which exceed acceptable tolerance limits need to be investigated by management with a view to control action.

The disadvantages of standard costing include the following.

- It is difficult to set accurate standards
- The collection and analysis of data to run a standard costing system may be very time-consuming
- Standards may be seen as a pressure device

5.3 VARIANCE ANALYSIS

A variance is the difference between an actual result and expected results. It arises from differences between standard and actual quantities, efficiencies and proportions and/or differences between standard and actual rates or prices. The reasons for the differences have to be established by investigation.

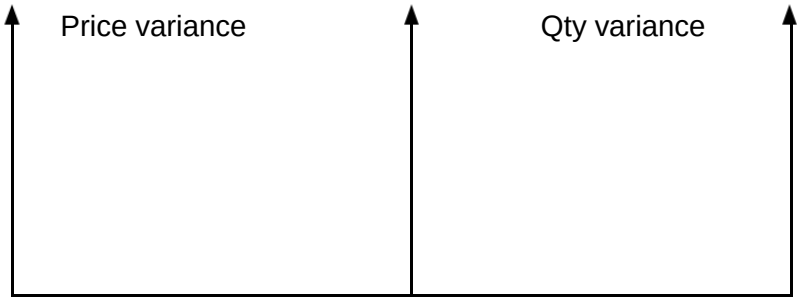
Variance analysis is the process by which the *total difference* between standard and actual results are analyzed

When actual > expected = favorable variance (F)

When actual < expected = adverse variance (A)

Here is general model for variance analysis.

(1)	(2)	(3)
Actual qty of	actual qty of	STD qty
Input at actual	input at STD price	allowed for actual
Price		output at STD price
(AQ*AP)	**(AQ*SP)**	**(SQ*SP)**



A. MATERIAL VARIANCES

This can be subdivided into direct material price variance and direct material usage variance. A material price variance is extracted at the time of receipt of material and not at the time of usage.

Example

Product N16 has standard direct material cost of 15 liters of material X at $10 per liter (15*10= $150 per unit). During the year, 2000 units of X were manufactured using 293400 liters of material X which cost $295000.

Calculate

1. Material total variance
   The difference between what 2000 units should have cost and what they did cost.

2000 units should have cost (*150)	**300000**
But they cost	**295000**
Material total variance	**5000 (F)**

Variance favorable as units cost less than they should have cost.

2. Material price variance

23400 liters should have cost (*10)	**234000**
But they cost	295000
Material price variance	61000 (A)

The variance is adverse as the materials cost more than it should have.

3. Material usage variance
   This is the difference between how many liters of X should have been used to produce

2000 units and how many liters were used.

2000 units should have used (*15)	**300000 liters**
But they used	**293400 liters**
	6600 (F)
Standard cost per liter	**$10**
Usage variance in $	**$66000 (F)**

4. Summary

Price variance	61000 (A)
Usage variance	66000 (F)
Total variance	5000 (F)

>>> Possible causes

Material price variances (S.P – A.P) * A.Q

- Actual prices may exceed standard prices because of a change in market conditions that causes a general price increase for the material. This may be out of the control of management.
- Adverse price variance might be out of failure of the purchasing manger to seek the most advantageous sources of supply.
- Favorable variance could be due to purchase of inferior quality material leading to inferior products and wastage
- An adverse variance could also be caused by shortage, special rush orders to suppliers forcing him to incur additional handling costs thus charging a higher price.

Material usage variance (S.Q – A.Q) * S.P

Usage of material is controlled by the manager of the appropriate production responsibility center.

- careless handling of material by workers
- purchase of inferior quality material
- theft
- changes in quality control requirements
- changes in methods of production

B. LABOR VARIANCES

Direct labor variance can be subdivided into the direct labor rate variance and direct labor efficiency variance. It there is idle time, separate idle time variances will be calculated and the efficiency variances will only be calculated based on active hours (when labor actually worked) only. Idle time variances are always adverse.

Example

During the year, 3000 units of product F15 were made at a labor cost of $35000 for 6160 hours. There was a slump during the year in demand and 200 hours were recorded as idle time. Standard labor cost is 2hours @$5/hr = $10 per unit

Calculate

1. labor total variance

3000 units should cost (*$10)	**30000**
But they cost	**35000**
Labor total variance	**5000 (A)**

2. labor rate variance
   The comparison of what hours paid should have cost and what they did cost

6160 hours of labor should cost ($5)	**30800**
But it actually cost	**35000**
	$4200 A

3 Idle time variance
The hours of idle time valued at standard rate per hour. It is always adverse.

Idle time variance = 200hours (A) * $5 = $1000 A

4 Labor efficiency variance efficiency variance"
This considers the hours actively worked (difference between hours paid for and idle time) and is calculated by taking the amount of output produced and comparing the time it should have taken to make them.
Actual time taken in making the product (**6160 – 200) = 5960 hours**

3000 units of product should take		**6000hours**
But they took		**5960hours**
Labor efficiency variance efficiency variance"	**in hrs**	**40 hours (F)**
@ std rate per hour		**5**
		$200 (F)

5. Summary

Labor rate variance	**4200 (A)**	
Idle time variance	**1000 (A)**	
Labor efficiency variance efficiency variance"		**200 (F)**
Labor total variance	**5000 (A)**	

Possible causes

Labor rate variance (S.R – A.R) * A.H

- negotiated increase in wage rates have not yet been reflected in the standard wage rate; on this point the variance is not controllable
- unexpected overtime
- it could arise where a standard is used to represent a single average for a given operation

performed by workers who are paid at several different rates; it arises e.g. by assigning skilled labor to work that is normally performed by unskilled labor
- it could also arise generally due to wage rate standards not being kept in line with changes in actual wage rates.

Labor efficiency variance efficiency variance" (S.H – A.H) * S.R

It is normally controllable by the manager of the appropriate production responsibility center.

- use of inferior quality materials
- different grades of labor
- failure to maintain machinery in a proper condition
- the introduction of new equipment or tools and changes in the production process will all affect efficiency of labor. This point makes it uncontrollable.
- it could arise due to poor production scheduling by planning department or to a change in quality control standards.

C. VARIABLE PRODUCTION OVERHEAD VARIANCES

A total variable overhead variance is calculated in the same way as the total direct labor and material variances. The total variance can be subdivided into *variable production overhead expenditure variance* and *variable production overhead efficiency variance* (based on active hours).

Example

Variable production overhead cost of product X is 2hours @ $1.50 ($3 per unit). During the year 800 units of the product were made. The workers worked for 1640 hours of which 120 hours were recorded as idle time. Variable overhead costs was $2460

Calculate

1. Variable production overhead total variance

800 units should cost ($3)	**2400**
But they cost	**2460**
	$60 (A)

2. Variable production overhead expenditure variance.

(1640 – 120)* = 1520hrs @ $1.5/hr	2280
But it cost	2460
	$180 (A)

*****it is assumed that variable overhead costs are incurred during active hours and not during idle time.

3. Variable production overhead efficiency variance.

800 units should take (2hrs)	1600hrs
Workers worked (1640-120)	1520hrs
Variable overhead efficiency variance hrs	80 hrs (F)
Standard rate per hour	$1.5
	120 (F)

STUDY TEXT

4. Summary

Variable overhead expenditure variance	**180 (A)**
Variable overhead efficiency variance	**120 (F)**
Variable overhead total variance	**60 (A)**

Possible causes

Variable overhead expenditure variance:

Variable overheads represent the aggregation of a large number of individual items e.g. indirect labor, indirect material, electricity, maintenance etc.

The variance could arise because of changes in the price of individual items

It is affected by how efficiently the individual variable items were used

Variable overhead efficiency variance:

This variance is assumed to vary directly with direct labor hours of input; it's identical to the labor efficiency variance. Therefore reasons for the variance are the same as those described previously for labor efficiency.

D. FIXED PRODUCTION OVERHEAD VARIANCE

This variance can be subdivided into an *expenditure variance* and a *volume variance.* Volume variance can be subdivided into *efficiency variance* and *capacity variance.*

1. Fixed overhead total variance

The total difference between the fixed overhead *absorbed* by the actual production and the *actual* fixed overhead for the period i.e. under or over absorption of overheads.

= S.C – A.C

Total fixed overhead variance is not of much help on its own. A further analysis would therefore be required in order to seek answers for the variance.

2. Fixed overhead expenditure variance

The difference would come between the budgeted fixed overheads for the period and the actual fixed costs.

= (B.F.O – A.F.O)

It is not very useful on its own. Any meaningful analysis of this variance requires a comparison of the actual expenditure for each item of fixed overheads expenditure against the budget. The difference could be due to:

- changes in salaries of supervisors
- the appointment of additional supervisors.

Only by individual investigation of each variance can one determine whether they

are controllable or not. This variance although is generally uncontrollable in the short term.

3. **Fixed overhead volume variance**
The difference would come between the budgeted fi xed overheads for the period and fi xed overhead absorbed by actual production.

= (A.P. – B.P) * S.R

I.e. where the actual volume produced differs from the budgeted volume anticipated. Volume variances refl ect the fact that fi xed overheads don't fl uctuate in relation to output in the short term. When actual production is *less* than budgeted production, fi xed overhead charged to production is less than budgeted cost and volume variance will be adverse.

The volume variance could be explained by further analysis.

a. Fixed overhead efficiency variance

The effi ciency variance measures whether the workforce took more or less time expected in producing their output for the period

= (S.H. – A.H) * S.R

It is the difference between the standard hours of production achieved and the actual labor hours valued at *fi xed overhead absorption rate*.

A possible cause would be that the labor force worked at a different level of effi ciency from that anticipated in the budget.

N.B. The physical content of the variance is the measure of effi ciency of labor and is identical to the labor effi ciency variance we discussed earlier. Thus reason for the volume effi ciency variance are similar to those discussed in the labor effi ciency variance.

b. Fixed overhead capacity variance

The capacity variance measures whether the workforce worked more or less hours than budgeted for the period.

= (A.H – B.H) * S.R

It is the difference between the budgeted hours and the actual hours valued at fi xed overhead absorption rate.

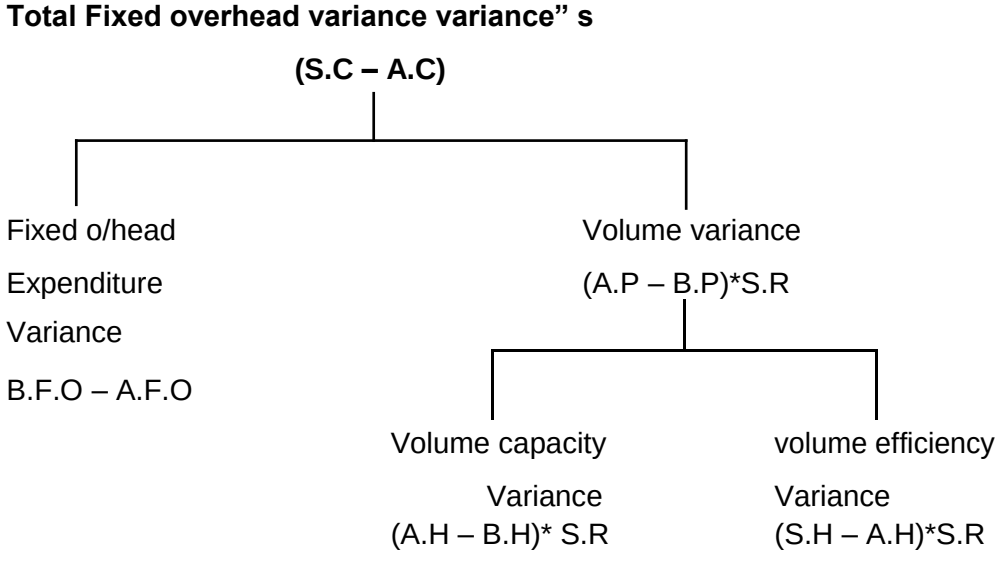
Whereas the volume effi ciency variance indicates whether capacity was utilized *effi ciently,* the volume capacity variance indicates a failure to utilize capacity at all.

Possible causes include:

- machine breakdowns,
- poor production planning,
- shortage of raw materials,
- disputes between workers and management,
- decline in demand for the product.

The last two sub-variances explain why the level of activity was different from that budgeted i.e. they combine to give the fixed overhead volume variance.

Here is a diagram explaining fixed overhead variances.



Now let us have a comprehensive example.

Budget for X Ltd

For year 1

Fixed overheads	$16360
Variable overheads	$21480
Labor hours	6544
Standard hours of production	6544

Actual for the period	
Fixed overheads	$16850
Variable overheads	$22220
Labor	6100
Standard hours produced	6050

Absorption rate based on standard hours

F.O.A.R = budgeted fixed overheads = $16360 = $2.5

Budgeted activity (STD hrs) 6544

1. Total fixed overhead variance

(S.C – A.C)

Absorbed= 2.5 * 6050=	**15125**
Actual	**16850**
Total variance	**1725 (A)**

2. Fixed overhead expenditure variance.

(BFO – AFO)

Budgeted fixed overhead	**16360**
Actual fixed overheads	**16850**
Expenditure variance	**490**

3. Fixed overhead volume variance

(A.P – B.P) * FOAR

(6050 – 6544) * 2.5 = 1235 (A)

a) Volume capacity variance

(A.H – B.H) * S.R

(6100 – 6544) * 2.5 = 1110 (A)

b) Volume efficiency variance

(S.H – A.H) * S.R

(6050 – 6100) * 2.5 = 125 (A)

Summary

Fixed overhead expenditure variance		**490 (A)**
Volume capacity variance	1110(A)	
Volume efficiency variance	125(A)	
Fixed overhead volume variance		**1235(A)**
Total fixed overheads variance		**1725 (A)**

STUDY TEXT

The absolute variances could be given relative values in variance analysis.

The ratios are calculated using the same data of budgeted and actual labor hours and standard hours produced. They are used as an alternative more so for the overhead efficiency and volume variances. The three ratios are:

Activity ratio = Standard hours of actual output * 100

Budgeted hours of output

= 6050 = 92.45%

6544

Production efficiency ratio = Standards hours of actual output *100

Actual labor hours worked

= 6050 = 99.18%

6100

Capacity usage ratio = Actual hours worked * 100

Budgeted hours of output

=6100 = 93.22%

6544

E. SALES VARIANCES

These can be used to analyze the performance of the sales function or revenue centers.

N.B. Sales variance calculations are calculated in terms of profit or contribution margin rather than sales values. It sales values are used (actual sales compared to budgeted) there's the risk of ignoring the impact of the sales effort on profit. When we say profit margins, we assume absorption costing and contribution margin when we are marginal costing.

1. Total sales margin variance

It is the total difference between the actual margin and the budgeted margin form sales when cost of sales is valued at standard cost of production.

A.C – B.C

2. Sales margin price variance

It is that portion of total sales margin variance which is the difference between the

standard margin per unit and actual margin per unit for the number of units sold in the period.

(A.M – S.M) * A.Q

3. Sales margin volume variance.

It's the difference between the actual sales volume and the budgeted volume multiple by the standard margin per unit.

(A.V – B.V) * S.M

Ideally the above variances are assuming that there's only one product being sold. In reality, organizations will have a portfolio of different products each with different prices and costs and consequently profits or contributions.

The sales margin volume variance could therefore be further analyzed into

a. Sales mixture variance
The portion of sales margin volume variance that's the difference between the total number of units at the actual mix and the actual total number of units at standard mix valued at standard margin per unit.

b. Sales margin volume variance.
The portion of sales margin quantity variance which is the difference between the actual total quantities of units sold and the budgeted total number of units at standard mix valued at standard margin per unit.

Criticisms of sales margin variances

The purpose of variance analysis is actually to see if there are any deviations for the budget. If there are and it is within the control of the manager, he is to take steps to correct the situation to avoid further deviations.

The manager has very little control over the sales and thus some writers would find the usefulness of the variances doubtful.

However they could be useful in a situation where the organization has some control over the sales price. It could also be useful where; a manager is in charge of two substitute products where he can use the mix variances.

Writers such as Gibson (1990) argue that, mix and quantity variances provide useful information only when there's an identifiable relationship between the products sold. If there's no relationship, sales variance analysis should be done on the separate products. He argues that providing managers with mix and quantity variances for products that have no relationship is misleading as it implies that the possible cause of sales volume variance is change in the mix. He gave examples of where relationships might exist.

- Similar products differentiated by single characteristics e.g. size where sales of individual products are expected to vary proportionately with total sales.
- From the sale of complementary products where sales of one product are expected

to result in increased sales in another.
- From the sale of substitute products where the increased sales of one product leads to a decrease in sales of another.
- Sale of heterogeneous products quantities of which are limited by factors of production e.g. sale of product with lower contribution margins per limiting factor is made only if products with higher margins cannot be sold

5.4 MIX VARIANCES

In the previous paragraphs, we have been looking at variances where we assume that we onyx have one product. When it came to sales variances we've also looked at mix variances to a degree.

This part will take a closer look at material variances where there's more than one type of material input.

N.B. Mix and yield analysis will only give meaningful results where there's some degree if interchangeability between materials and products.

Mix variances will be appropriately used where the production process involves mixing different material inputs to make the required output e.g. fertilizers and food products. These processes are characterized by process losses through impurities, evaporation, breakages, machine failure and other factors that affect output.

Three variances will be observed in a scenario:

i. **Material price variance**
   This would arise where the materials have been bought at different prices for the standard
ii. **Mix variance**
   This arises where the materials have been used in different proportions from the standard.
iii. **Yield variance**
   This arises where a different total quantity of materials from standard (for actual output) have been used.

The sum of the mix variance and yield variance make up the total usage variance.

Formulae

Price variance	Actual quantity @actual mix @actual prices	-	Actual quantity @actual mix @STD prices

Mix variances	Actual quantity		Actual quantity
	@actual mix	-	@STD proportion
	@STD prices		@STD prices
Yield variances	Actual quantity		STD quantity
	@STD mix	-	@STD mix
	@STD prices		@STD price

The above variances will be explained well using an example.

Standard material cost for 990 tons of production

Material	in Tons	Price/ton	Total
X	550	$6.00	3300
Y	330	$5.00	1650
Z	220	$4.50	990
Total	1100		5940
Normal loss	110		-
(10%)	990		5940

The average material cost per ton = $\frac{\$5940}{990} = \$ 6.00$

The actual production of 990 tons used materials at prices as follows.

Material	**Tons**	**price/ton**	**Total**
X	444	$7.5	3330
Y	446	$6.0	2676
Z	240	$4.5	1080
	1130		7086
	140		-
	990		7086

i. Material price variance

Actual Quantity	X	444*6 = 2664
@actual mix	Y	446*5 = 2330
@STD prices	Z	240*4.5= 1080
		1130 5974
Actual quantity		
@actual mix		
@actual prices		7086
		1112 (A)

ii. Material mix variance

Actual quantity			
@actual mix			5974
@STD prices			
Actual quantity	X	565*6 = 3390	
@STD mix	Y	339*5 = 1695	
@STD prices	Z	226*4.5=1017	6102
			128 (F)

iii. Material yield

Actual quantity	
@STD mix	6102
@STD prices	
STD quantity	
@STD mix	
@STD prices	5940
	162 (A)

Usage variance = Yield variance + mix variances

128 (A) + 162 (A) = $34 (A)

Why do these variances arise?

a) Mix variances

128 (F) arises because less of more expensive material X has been used and more of the cheaper materials Y and Z

b) Yield variance

With a total input of 1130 with a 10% normal process loss allowed, we should expect an output of 110*90% = 1017. What we actually was lower (990) by 27 tons. This is an adverse variance which at that standard product cost of $6 would cost 27*6 = 162 (A).

The change to a cheaper mix of material has resulted in the drop in yield of good production in relation to the standard. Combining the two variances we get the usage variance of $34.

The material mix variance could be further analyzed to splitting and getting the variances for the individual products.

Actual		Actual quantity In STD mix	Variance	STD price	Mix variance
X	444	565	121 (F)	6	726 (F)
Y	446	339	107 (A)	5	535 (A)
Z	240	226	14 (A)	4.5	63 (A)
					128 (F)

The total mix variance is made up of a series of favorable and adverse variances. Using smaller quantities of the more expensive material gave us a favorable variance whereas the more use of the cheaper material gave an adverse variance.

So how would manager use this broken down variance? Without further analysis he might conclude that using more of material X is good an increasing the levels of Y and Z quit detrimental in terms of adverse variances.

There's a danger in simply looking at mix variances in isolation from yield variances.

5.4.1 Problems in using conventional mix and yield variances

Conventional mix and yield variances are based on assumptions some of which might be considered absurd or impracticable. The reliance, however, on mix and yield variances should be done together with a good understanding of principles and objectives of variance analysis and not just the mechanical application of a few formulae.

The variances just show the effect of changes from the original standard but doesn't show whether the results were optimal given relative prices, qualities and availability of materials. Where materials can be substituted, where characteristics of material are variable and where there are relative price changes, the optimal mix may be continually changing and static conventional variance calculation is unlikely to be appropriate. Getting the optimal mix requires one that gives us the maximum contribution based on a limiting factor and where limiting factors are many, linear programming is usually applied on a continuous basis.

It also assumes a constant correlation between physical inputs and outputs regardless of the mix of output i.e. if the mix of output changes, some relationship is assumed between the new mix and output as between original standard mix and output.

Technical acceptability of the output is ignored as it is assumed that output is acceptable regardless of the input mix of materials.

Linear substitutability of material is ignored. For example, if they reduce A by one unit, they should increase B by one unit. Further substitution would result in a mix consisting of one material only; the cheapest.

Assuming the technical acceptability of the output based on the premise that the standard represents the optimum position, we should never get a favorable mix variance because the lower standard cost of actual mix means that it should have been the original standard in the first place.

In addition to the variances, technical and commercial factors affecting the process being considered should be done. This could include:

- Relative prices, availability and technical characteristics of input material at time of the mix,
- The extent of technical substitutability of material.
- Planned yield form ant given actual mix of material not merely the yield form standard mix.
- Interdependencies between material variances and other process inputs e.g. what effect does it have on labor costs?

5.5 PLANNING AND OPERATIONAL VARIANCES

Traditional variance analysis, which we have been studying up to now, has been noted to have a major weakness. There is the implicit assumption that the whole variance is due to *operational* deficiencies and that the *planning* associated with setting the original standard was perfectly accurate which is hardly realistic.

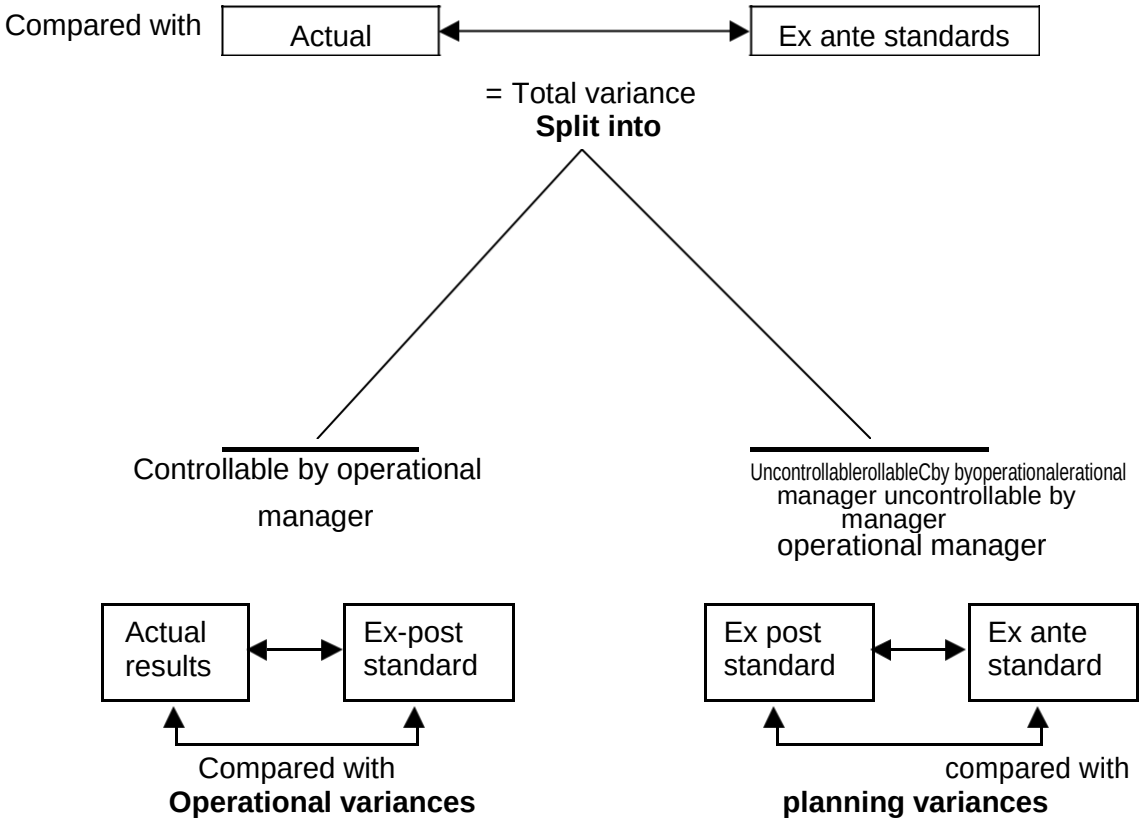
The planning process could have been wrong and if the standards are found to be unrealistic, they can be revised with hindsight and performance compared with the revised standards. The standards set could be unrealistic due to volatile conditions not envisaged during the preparation of the original budget. In order to prevent blaming variances on operations alone, the total variances could be split into *planning variances* and *operational variances.*

- *Planning variances:* these ones try to show us by how for should the original budget be adjusted to reflect the changes in conditions between that that was forecasted and that that is currently i.e. the budget is updated to make it more relevant in current conditions.

- *Operational variances.* These are found by comparing actual performance with the revised more realistic standards.

With the separation of the variances, we now get to see a clearer definition of what is an attainable current target. The planning and operational variances could be further subdivided into price and usage or rate and efficiency. The original budget is known as *ex-ante* budget while the revised one is the *ex-post* budget.

Diagrammatically they can be described as follows (opposite page)



The following example illustrates the calculation of planning and operational variances

Comic ltd manufactures chemical F9 in batches that is estimated to require 4kg of material X at $20 per kg. In quarter 4, only 250 batches were produced although budgeted production was 300 batches. 900kgs were purchased and used in the quarter at a total cost of $10200. It was later found that the standard did not allow for a 10% price increase throughout the material X suppliers' industry. The company does not hold stocks.

Required:

1. Traditional variance analysis.
2. Planning and operational variances.

Solution

Traditional analysis:

Material price (900*20) – 10200	**=**	**7800 (F)**
Material usage ((250*4) – 900)* 20	**=**	**2000 (F)**
Total variance		**9800 (F)**

STUDY TEXT

Planning and operational analysis

Here one needs to come up with 3 items:

1. Original flexed budget
2. Revised flexed budget
3. Actual results

The total variance will now be split into planning and operational by:

Total variance = (1) – (3)

Planning variance = (1) – (2)

Operational variance = (2) – (3)

Workings:

Original flexed budget

250 batches at 4kg/batch for $20/kg = 20000

Planning

Revised flexed budget

250 batches at 4kg/batch for $22/kg = 22000

Operational

Actual results

900kgs for 10200

Planning variance	20000 - 22000 =	2000 (A)
Operational variance	22000 - 10200 =	11800 (A)
Total variance		9800 (F)

Operational variances could be further analyzed into price and usage. Where the price variance is calculated by reference to the new *ex-post* standard the usage variance is recalculated in terms of the *ex-post* price standard.

Operational price variance

= **(Actual materials used * revised STD price) – Actual cost of actual materials used**

= (900*22) – 10200 = 9600 (F)

Operational usage variance

= **(revised STD materials used – actual materials used) * revised STD price**

= (250*4) – 900) * 22 = 2200 (F)

Planning and operational variances sales variances example:

X ltd has a sales budget of 200000 units for its upcoming year based on 12.5% of the total market. The contribution margin on each unit of X is $3. Actual sales for the year were 225000 but industry reports show that the total market volume had been 1.7 million.

Required:

1. Traditional variance analysis
2. Planning and operational analysis.

Traditional sales volume variance

= **(actual units – budgeted units) * STD margin per unit**

= (225000 – 200000) * 3 = $75000 (F)

Planning and operational variances

Original budget (*ex-ante*)

200000 at $3 per unit 600000

Planning (market volume)

Revised budget

12.5% * 1.7 million at $3 per unit 637500

Operational (market share)

Actual results

225000 at $3 per unit 675000

Planning variance	=	637500 – 600000	37500 (F)
Operational variance	=	675000 – 637500	37500 (F)
			75000

The favorable sales volume variance can be attributed equally to both the increase in the market volume and effort of the sales force that have increased the market share for 12.5% to:

$$\frac{225000}{1700000} = 13.24\%$$

Benefits and problems of planning and operational variances

Benefits

i. The variances used are more useful and relevant especially in changing environments that are volatile.

STUDY TEXT

ii. Using operational variances, we are provided with an up to date guide to the levels of operating activities since the standards have been revised using up to date information.
iii. Managers are more likely to accept the variances and be motivated by the reports which provide a better measure of their performance.
iv. It emphasizes the importance of the planning function and the relationship between planning and control and helps to identify planning defi ciencies.
v. The analysis helps in standard setting learning process which will hopefully result in more useful standards in future.

Problems

i. There's a high degree of subjectivity involved in setting the *ex-post* budget. This subjectivity would cause political pressures within the organization and the managers whose performance is reported to be poor using such a budget are unlikely to accept them.
ii. The process involves more clerical and managerial time in fi rst analyzing the traditional variances and then to decide which ones are controllable and which ones are not.
iii. Analysis tends to exaggerate the inter-relationship of variances providing managers with a "pre-packed" list of excuses for below standard performance e.g. badly set budgets.
iv. If planning and operating functions are carried out in the same responsibility center, there's also the tendency of placing much fault on outside and uncontrollable factors rather than internal controllable actions.

To investigate or not to investigate?

The standard costing system involves setting the standards, comparing the actual with standard performance, analyzing and reporting on the variances, investigating signifi cant variances and taking appropriate corrective action.

The question will arise; which variances will we investigate and how signifi cant is signifi cant? Before we continue, let us fi rst look at some causes of variances after which we will determine which of them, through analysis, has contributed towards the variance isolated by means of an investigation.

Causes of variances

i. Measurement errors

Any inaccuracies in measuring or recording results will defi nitely have an effect on reported variances. Unless investigation leads to an improvement in the accuracy of the recording system, it is unlikely that any benefi t will be obtained where the cause is found to be due to measurement errors. Care must be taken when measuring:

- activity achieved: including adjustments for Work in Progress
- resources used: including adjustments for materials in production stores
- cost of resources: including adjustments for accruals and prepayments

ii. Out of date standards

In a volatile environment with frequent price changes, there's the chance that standard prices set will be rendered obsolete. That investigation into variances will only reveal general change in market prices for example, rather than effi ciency/ineffi ciency of the purchasing department. Obsolescence in standards could also occur due to changes in technology of process or failing to take into account the learning curve effect. Ideally, standards have to be reviewed frequently and where appropriate, updated in order to minimize variances being reported that are due to standards being out of date.

iii. Out of control operations

The variances may result from ineffi cient operations due to a failure to follow prescribed procedures, faulty machinery or human error.

iv. Random factors

A standard is an average target for a period of time. It is therefore expected that actual; results will fl uctuate randomly about the target i.e. variances are bound to arise. The variances caused by random factors occur when a particular process is performed by the same worker under the same conditions yet performance varies. It is not possible for the same result to appear each time the worker performs the same activity. In standard setting, one summary reading has been chosen to represent the standard when in reality a rage of outcomes is possible when the process is *under control.*

Investigation into variances 'caused' by random factors will only involve costs (no benefi t) as no assignable cause for the variance has been identifi ed.

When then, should a variance be investigated?

Factors to consider when deciding whether or not to investigate a variance include the following:

I. Size of variance

Investigating larger variances is assumed to bring more cost saving especially if they are signifi cant enough to affect a manager's performance report.

II. Favorable or adverse?

In most cases, adverse variances will be investigated more keenly. However investigation in to favorable variances would:

- remove the effect of budget padding when assessing performance.
- produce more realistic budgets in the future
- establish ways in which performance might be improved still further in future.

III. Cost Vs benefits

Using decision theory (discussed later) one might determine whether it is worthwhile, monetary wise, to eliminate the cause of the variance.

IV. Past pattern of variances

If variance is as a result of random or uncontrollable factors, no amount of remedial action will bring about a cost saving.

V. Reliability of budgets

Total variances, as discussed earlier, would be more useful if it is split into the planning and operational components. If a variance is due to a badly set budget, there will be no major cost savings following the investigation.

A. Simple rule of thumb investigation (size of variance)

In this case, managers apply simple methods based on arbitrary criteria e.g.

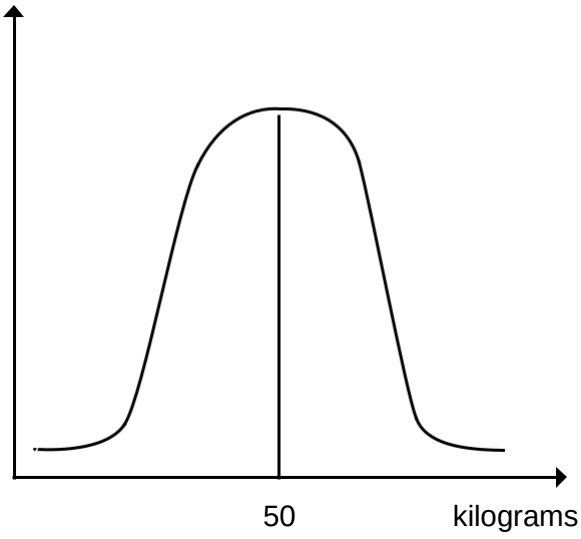
a. Fixed size of variance
Investigation is done if the absolute size of the variance is greater than, say 5000. The main disadvantage of using an absolute fi gure is that a variance of $5000 in a total cost of $20000 would be considered more signifi cant than a variance of $5000 in $200000.

b. Fixed percentage rule
This comes as a remedy for point (a). That a variance will be investigated if it is more than, say 10% of the standard cost. That if a standard output of 1000 is determined, outputs of between 900 and 1100 will nit be investigated.

The main advantage of these simple methods is their simplicity and ease of implementation. The disadvantages include, they do not adequately take into account the statistical signifi cance of the reported variances. They also do not consider the costs and benefi ts of an investigation. They only rely on managerial judgment and intuition when selecting cutoff values.

B. Statistical models not incorporating costs and benefits of investigation

Consider a manufacturing process that requires 50kgs of material X with a standard deviation of 10kgs. In statistics, the pattern of actual material used in an *'in control"* state is likely to form a normal distribution about the average.



The past observations are used to estimate the population mean and the population standard deviation. Assuming a normal distribution as above;

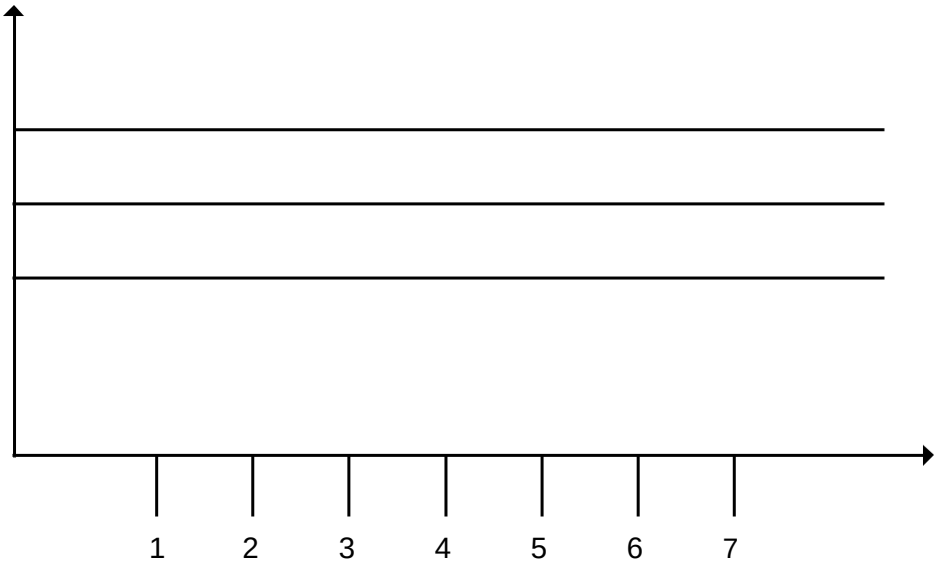
68.27% of observations will fall within the range + 1 standard deviation from the mean

95.45% of observations will fall within the range + 2 standard deviations form the mean

99.8% of observations will fall within the range +3 standard deviations from the mean

The above information will be used to create a statistical control chart. The mean forms the standard. Control limits are set a give number of standard deviations from the mean.

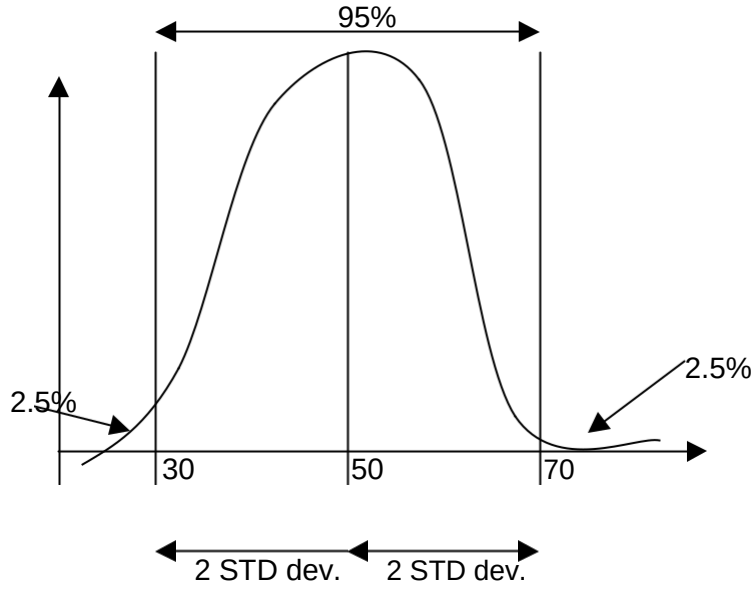
From our initial example assume that control limits are set at 30 and 70kgs and actual amount of material are recorded as follows on a *statistical control chart.*



If actual materials and fall between the bands, the variance is not considered significant.

How are control limits set and what actions should be taken if results fall outside the limits?

In setting control limits, our aim is to ensure that there's only a small chance of a random fluctuation falling outside the limits.



If the control limits are based on two standard deviations from the mean, like form our example, it would indicate that (100% - 95%) 5% of the observations would be as a result of pure chance when process is *under control.* If more than 5% of the observed results lie outside the control limits, then the system may be referred to being statistically *out of control.* Form here, management must decide on the next course of action.

C. Decision models with costs and benefits of investigation.

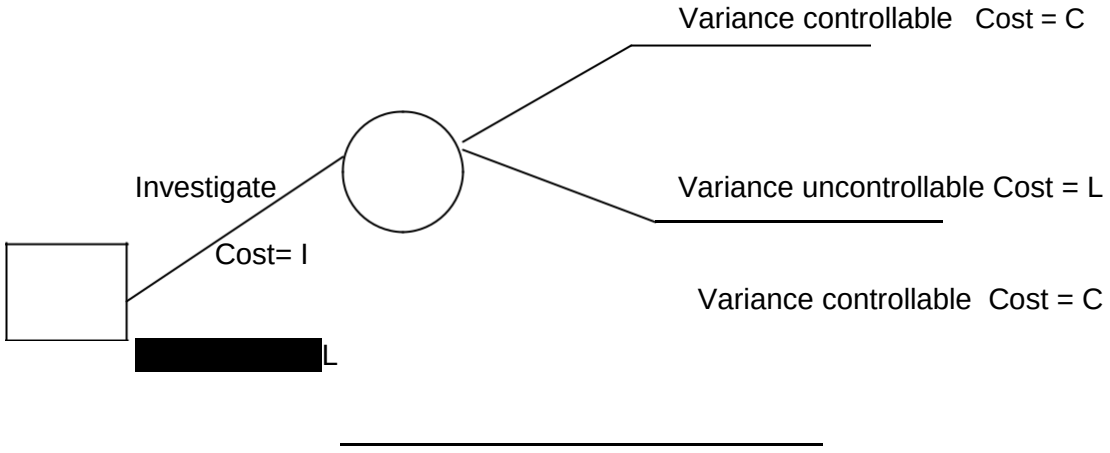
The method will involve the application of decision theory. That a variance will only warrant investigation if it costs less than expected benefits involved. This simple decision theory single period model was advocated by *Bier man et al (1977).* It assumes existence of mutually exclusive states.

i. Assumes system is *in control* and variance is due to a random fluctuation around the expected income.

ii. System is somehow *out of control* and corrective action can be taken to remedy this situation

That if investigation is undertaken when process is out of control, the cause can be found and corrective action undertaken to avoid future re-occurrence.

The cost-benefit analysis can be shown using a decision tree as follows



I = Cost of investigation
C = Cost of correcting the variance
L = Cost incurred if variance is not corrected
P = Probability that variance is controllable

>>> Example:

In quarter 3 an adverse labor efficiency variance of $10000 arose. Over the years, it has been established that cost if investigating a variance is $3000 and if the situation is controllable, corrective action will cost $2000. After corrective action, it is estimated that that the net present value of the expected savings form it will be $10000. The probability of uncontrollability of a variance is 30%.

Required: prepare calculation to show whether the variance should be investigated.

Cost of investigating = 3000 + 2000*0.3 +10000*0.7 =	10600
Cost of not investigating	10000

Form the figures it is clearly not worth investigating.

Applying sensitivity analysis, management will be able to determine the point of indifference between investigate and don't investigate in terms of the value of:

i. P i.e. probability of variance being controllable.

ii. N.P.V of the expected savings; L

Sensitivity to P:

3000 + P*2000 + ((1-P) * 10000) = 10000

3000 +2000P + 10000 – 10000P = 10000

13000- 8000P = 10000

$P = \frac{13000 - 10000}{8000}$

P = 0.375

Therefore, the estimate for probability that variance is uncontrollable could rise form 0.30 to 0.375 before the decision could change.

Sensitivity to L:

3000 + (2000*0.7) + (L* 0.3) = L

3000 + 1400 + 0.3L = L

4400 = 0.7L

L = 6286

With the probability estimate unchanged, the NPV of the expected savings could fall from $10000 to $6286 before the decision could change.

This chapter has looked at standard costing and variance analysis in depth. But before winding up, let us look at, in summary at some benefi ts and problems in the use of standard costing.

Benefits

i. It is an important aid in the principle of *management by exception.* Managers by looking at variances will only consider those that are not proceeding according to plan.
ii. The process of setting, revising and monitoring standards encourages reappraisal of methods, materials techniques so leading to cost reductions.
iii. Standard costs show what the parts and products should cost. They aren't just averages of past performance and they are more superior to historical costs. They also provide a simpler basis of inventory valuation.
iv. With proper participation, standard costing systems will create a positive cost effective attitude through all levels of management thus ensuring goal congruence and increased motivation.

Standard costing has, however been criticized at various levels

Problems

i. It uses a lot of resources, fi nancial and time, to install and keep up to date.
ii. It is very easy for standards to be considered obsolete especially when functioning in a volatile environment with frequent price changes. This could be solved through the use of planning and operational variances but then their own disadvantages of too much

clerical work and subjectivity come in.

iii. Standard costing involves predictions into the future and subjectivity the inherent possibilities of error and argument.

iv. The usefulness of a number of variables relating to overheads, sales margin, mix and yield is questionable.

v. Variance analysis gives information concerning the past. In reality what happens in the past cannot be changed. Therefore variances will only provide a guide for management if identical or similar circumstances occur in the future. This implies stable repeating situations which is not always a reflection of reality.

vi. The philosophy behind standard costing i.e. predetermined costs and if that actual performance is satisfactory if it meets the standard in question. It is inappropriate in modern manufacturing where there is a continual drive for improvement. Conditions for standard costing, long runs of repetitive production do not apply where production is rapidly changing and small batches are the norm.

Other criticisms include:

Changes in the cost structure:

In recent times, it has been seen that overhead costs have become the dominant factory costs. Direct labor costs have diminished in importance and most costs have become fixed in the short term. Direct materials and variable overheads are now the only short term variable costs. Thus standard costing for variance analysis for control purposes would appear to be only appropriate for direct materials and variable overheads. Given that standard costing is a method suited to control direct and variable costs, and not fixed and indirect costs, its usefulness has been questioned.

Delayed feedback reporting:

Performance reports often arrive too late to be of value in controlling production operation. Weekly or monthly reports provide a lengthy time lag that is not helpful for the daily control of operations. For operational control purposes, labor and material quantity variances should be reported in physical terms in “real time”. Companies have now adopted computers for this so that variances are reported and fed into the system instantaneously.

5.6 INTERPRATATION OF VARIANCE

Trend, materiality and controllability

The point of comparing flexed budget and actual figures is to see what corrective action, if any, is needed to ensure that the plan will be successfully completed. Thus every variance needs to be considered to see whether it should prompt control action.

Three important points should be kept in mind:

Materiality

Small variations in a single period are bound to occur occasionally and are unlikely to be significant. Obtaining an explanation is likely to be time consuming and irritating for the manager concerned. The explanation will often be 'chance', which is not helpful in any case. For such variations further investigation is not worthwhile.

Trend

However, small variations that occur consistently may need more attention. Variance trend is more important than a single set of variances for one accounting period. Trend analysis analysis" provides information which gives an indication as to whether a variance is fluctuating within acceptable control limits or is moving into an out of control situation'. Trend is discussed further below.

Controllability

Controllability must also influence the decision whether to investigate further. If there is a general worldwide price increase in the price of an important raw material there is nothing that can be done internally to control the effect of this. If a central decision is made to award all employees a 10% increase in salary, staff costs in a division will increase by this amount and the variance is not controllable by a division's manager. Uncontrollable variances call for a change in the plan, not an investigation into the past

Variance trend

If, say, an efficiency variance is Sh.1,000 adverse in month 1, the obvious conclusion is that the process is out of control and that corrective action must be taken. This may be correct, but what if the same variance is Sh.1,000 adverse every month? The trend indicates that the process is in control and the standard has been wrongly set.

Suppose, though, that the same variance is consistently Sh.1,000 adverse for each of the first six months of the year but that production has steadily fallen from 100 units in month 1 to 65 units by month 6. The variance trend in absolute terms is constant, but relative to the number of units produced, efficiency has got steadily worse.

>>> Illustration

Assume that one unit takes ten hours to produce. The standard labour cost is Sh.5 per hour. In period one 100 units are produced in 1,200 hours. In period six 85 units are produced in 850 hours. What is the best way of presenting this information to management?

Solution

The labour efficiency variance can be calculated in the normal way.

	Period 1		Period 6
	Hours		Hours
100 units should take	1,000	65 units should take	650
But did take	1,200	but did take	850
Efficiency variance in hours	200	Efficiency variance in hours	200
x standard rate per hour	xSh.5	x standard rate per hour	xSh.5
	Sh.1,000		Sh.1,000

The absolute measures, whether in hours or shillings, do not convey what is happening at all. What is needed is a relative measure.

In physical terms, one unit takes 12hrs to make in period one, but more than 13 hours (850/65) in period six.

In monetary terms the variance can be related to standard cost and expressed as a percentage. In period one Sh.1,000 represent 20% of the standard cost for 100 units of Sh.5,000. In period six Sh.1,000 represents over 30% of the standard cost for 65 units of Sh.3,250

The conclusions that may be drawn from this are as follows.

Single period variances are not necessarily a good indication of whether or not a process is in control

Absolute measurement may disguise some of the significance of variance. It is helpful to supplement this information by measurement over time in % terms against an appropriate base.

Management signals

Variance analysis analysis" is a means of assessing performance, but is only a method of signaling to management areas of possible weaknesses where control action might be necessary. It does not provide a ready-made diagnosis of faults, nor does it provide management with a ready-made indication of what action needs to be taken. It merely highlights items for possible investigation.

Individual variances should not be looked at in isolation. As an obvious example, a favourable sales price variance is likely to be accompanied by an adverse sales volume variance: the increase in price has caused a fall in demand. We now know in addition that sets of variances should be scrutinized for a number of successive periods if their full significance is to be appreciated.

Here are some of the signals that may be extracted from variance trend information:

Material price variances may be favourable for a few months, then shift to adverse variances for the next few months and so on. This could indicate that prices are seasonal and perhaps stock could be built up in cheap seasons, if not inconsistent with JIT policy.

Regular, perhaps fairly slight, increase in adverse price variances usually indicates the workings of general inflation. If desired, allowances could be made for general inflation when flexing the budget.

Rapid large increases in adverse price variances may suggest a sudden scarcity of a resource. It may soon be necessary to seek out cheaper substitutes.

Gradually improving labour efficiency variances may signal the existence of a learning curve, or the motivational success of a productivity bonus scheme. In either case opportunities should be sought to encourage the trend.

Worsening trends in machine running expenses may show up that equipment is deteriorating and will soon need repair or even replacement.

Uncertainty in variance analysis

Horngren identifies seven principal sources of variances, most of which ultimately derive from the fact that it is not possible to know what is going to happen in advance These sources are:

Inefficiencies in Operations: such problems as spoilage and idle time will be very familiar from typical examination questions on variances.

Inappropriate standards (or targets):

This is a problem arising from deficiencies in *planning*. If not enough time and resources are devoted to setting accurate standards in the first place, and if they are not kept up to-date, subsequent performance is highly likely to deviate from what was expected.

Mis-measurement of actual results:

Scales may be misread, the pilfering of wastage or materials may go unrecorded, items may be wrongly classified (as material X3 say, when material X8 was used in reality), or employees may make 'cosmetic' adjustments to their records to make their own performance look better than it really was.

Implementation breakdown:

This means that for a variety of causes employees will not always implement the plan in the way that was intended. The classic example is the purchase of raw materials at a lower than budgeted price, causing quality problems for production. Such problems may arise whether employees act with the best intentions or whether they deliberately take their own course because they do not agree with the plan. They may also be caused by poor communications or inadequate training.

Parameter prediction error:

This is another aspect of faulty *planning.* As Hongren says, 'planning decisions are based on predictions of future costs, future selling price, future demands and so on. In many cases there will be a difference between the actual value and the predicted value'. Such differences are not only due to uncertainty about the future: the predictions may not have taken proper accounts of conditions existing at the time when it was made, like a recently agreed pay rise, or an agreement to increase wages in three months time.

Inappropriate decision models:

Variance can arise when chosen decision model fails to capture important aspects affecting the decision. The solution to a linear programming model can be used when setting standards for direct material purchase prices. These standards, however, may be inappropriate if the LP solution is not feasible because the LP models fail to recognize a constraint on labour availability or storage capacity'. (It is the relationship between the variables that causes the problem here, not the failure to predict accurately.)

Randomness of operating processes:

A standard is an *average* figure: really it represents the mid-point of a range of possible values and therefore individual measurements taken at specific times will deviate *un*predictably within this predicable range.

5.7 STANDARD COSTING IN THE MODERN ENVIROMENT

Standard costing has traditionally been associated with labour-intensive operations, but it can be applied to capital-intensive production too. With the shift to an 'advanced manufacturing technology' environment we have seen the following:

- The introduction of robotics
- The introduction of flexible manufacturing systems (FMS).
- Computer aided design/computer aided manufacture (CADCAM) systems.
- Job flexibility, with workers capable of being moved from one aspect of work to another. The traditional one-man-one-machine manufacturing system does not apply.

It is quite possible that with manufacturing technology variable overheads are incurred in relation to machine time rather labour time, and standard costs should reflect this where appropriate.

With CADCAM systems, the planning of manufacturing requirements can be computerized, with the useful spin-off that standard costs can be constructed by computer, thus saving administrative time and expense while providing far more accurate standards.

However, as mentioned earlier, it has been argued that traditional variance analysis is unhelpful and potentially misleading in the modern organization, and can make managers focus their attention on the wrong issues, for example over-producing and stockpiling finished goods, because higher production volumes mean that overheads are spread over more units. Standard costing concentrates on quantity and ignores other factors contributing to .Ineffectiveness In a total quality environment, for instance, quantity is not an issue, however; quality is. Effectiveness is such an environment therefore centers on high quality output (produced as a result of high quality input and the elimination of non-value adding activities) and the cost of failing to achieve the required level of effectiveness is measured not in variances, but in terms of internal and external failure costs, neither of which would be identified by a traditional standard costing analysis.

Standard costing system might measure, say, labour efficiency in terms of individual tasks and level of output. In a total quality environment, labour is more likely to be viewed as a number of multi-task teams who are responsible for the completion of a part of the production process. The effectiveness of such a team is more appropriately measured in terms of re-working required, returns from customers, defects identified in subsequent stages of production and so on.

CHAPTER SUMMARY

Standard costing is one of the most important techniques used in management accounting. It tries to establish a predetermined cost for products or services with which actual costs will be composed to establish whether there are any variances.

The standard cost can also be defined as the planned unit cost of the products, components or services produced in a period.

The **responsibility for setting standards** should be shared between managers able to provide the necessary information about levels of expected efficiency, prices and overhead costs.

There are two approaches that can be used to set standard costs:

- Past historical records can be used to estimate labor and material usage.
- Engineering studies- here a detailed study of each operation is undertaken based on careful specifications of materials, labor and equipment and the controlled observations.

Standards should be revised whenever there are changes of a permanent and reasonably long term nature. Standards are created based on past and current data but managers should also consider technical and current factors expected for the period in which they are to be applied. Standards which are right up to date provide a better target and are more meaningful to managers. Standards must evolve to reflect an organization's changing methods and processes.

A **variance** is the difference between an actual result and expected results. It arises from differences between standard and actual quantities, efficiencies and proportions and/or differences between standard and actual rates or prices.

Variance analysis is the process by which the **total difference** between standard and actual results is analyzed.

CHAPTER QUIZ

1. State five uses of standard costing.

2. Explain four types of standards.

3. State four possible causes of material price variances.

ANSWERS TO QUIZ QUESTIONS

1. Uses of standard costing:

- To value stocks and cost of production for cost accounting purposes. It could be seen as an alternative for FIFO and LIFO methods of costing.
- It is standard costs that are used as targets in the control function to be compared with actual results to highlight variances.
- To provide a formal basis for assessing performance and efficiency
- In the setting of budgets and evaluating managerial performance.
- To assist in assigning responsibility for non standard performance in order to correct deficiencies or capitalize on benefits.
- To provide predictions of future costs to be used in decision making situations
- To motivate staff and management
- To provide guidance on possible ways of improving efficiency and performance.

2. Types of standards:

a) Ideal standards standards"

They represent perfect performance. Ideal standard costs are the minimum costs that are possible under the most efficient operating conditions; no wastage, no inefficiencies, no idle time. Ideal standards standards" would be adjusted periodically to reflect improvements in materials, methods and technology. Ideal standards are not achievable and are only standards to be aimed at rather than performance that can currently be achieved.

b) Attainable standards

This is by far the most commonly achievable standard. It is a standard that can be attained if production is carried out efficiently, machines are properly operated andor materials are properly used. Here allowances are made for normal spoilage, machine breakdowns and lost time.

The fact that these standards represent a target that can be achieved under efficient conditions but which is also viewed as being neither too easy to achieve nor impossible to achieve, provides the best norm to which actual costs should be compared.

c) Current standards

A standard which is set for use over a short period to reflect current conditions (current wastage; current inefficiencies).when conditions are stable; the current standards will be equal to attainable standards in the short term. Use of current standards will be seen, for example, during high inflation. They can be set in a month by month basis.

d) Basic standard

It's a long term standard which remains unchanged over the years and is used to show trends. They could also be used as a basis for setting current standards. Although when changes occur in methods of production, price levels or other relevant factors, basic standards are not very useful since they do not represent current target costs, hence they are seldom used.

3. Possible causes of material price variances:

- Actual prices may exceed standard prices because of a change in market conditions that causes a general price increase for the material. Thai may be out of the control of management.
- Adverse price variance might be out of failure of the purchasing manger to seek the most advantageous sources of supply.
- Favorable variance could be due to purchase of inferior quality material leading to inferior products and wastage
- An adverse variance could also be caused by, due to shortage, special rush orders to suppliers forcing him to incur additional handling costs thus charging a higher price.

PAST PAPER ANALYSIS

Variance analysis analysis" was tested in the following examinations:

12/'04

12/'02

05/'02

EXAM QUESTIONS

QUESTION ONE

a. Describe the extent to which standard costing and variance may be interrelated
b. Explain how you would determine whether or not a standard should be investigated.
c. Should variances occur in a TQM environment?
d. Why may variance analysis give rise to poor decisions in JIT manufacturing environment?

QUESTION TWO

The budgeted and standard data for a product include the following:

Direct labor:

Ten employees work a 45 hour week. The standard rate of pay is $4 per hour. Output per hour is 40kg of the product.

Direct material:

Material	Quantity (KG)	Price per KG
X	60	2.00
Y	40	1.00
Z	100	1.40

From this standard matrix, 180kg of product is expected.

Actual data for the first week in April were as follows:

Hours worked	45
Rate of pay	$4 per hour
Overhead incurred	$5400
Output	1980kg

Production and consumption of materials were as follows:

Material	Quantity (kg)
X	700
Y	440
Z	1120

Required:

a. Calculate the following direct material variances for each material; i) Total ii) price iii) Usage iv) mix v) Yield

b. Calculate the direct labor efficiency variance

QUESTION THREE

Basic analysis ltd produces and sells one product only, the BBT, the standard cost for one unit being as follows:

	Sh.
Direct material A- 10 kg at Sh.20 per kg	200
Direct material B- 5 litres at Sh.6 per litre	30
Direct wages- 5hrs at Sh.6 per hour	30
Fixed production overhead	50
Total standard cost	310

The fixed overhead included in the standard cost is based on an expected monthly output of 900 units

During April Year 1 the actual results were as follows.

Production	800 units
Material A	7,800 kgs used, costing Sh.159,900
Material B	4,300 units used costing Sh.23,650
Direct wages	4,200 hrs worked for Sh.24,150
Fixed production overhead	Sh.47,000

Required

Calculate price and usage variances for each material
Calculate labour rate and efficiency variances
Calculate fixed production overhead expenditure and volume variances

CASE STUDY

Greenwich Engineering

Greenwich Engineering is a typical manufacturing company. Over the last decade there has been an increase in product diversification and factory automation and a reduction in the direct labour hours worked each year. Competition has increased and the company wants to build a reputation as a global leader in implementing modern manufacturing methods. To be successful the senior managers recognize that they must improve existing management accounting systems.

The Charlton Division has a **standard costing system** that was first introduced in the 1960s. Recently the managing director asked all managers for their comments on the existing management accounting system and to identify what changes they would like to see in the future. One group of managers stated their concerns that the management accounting system has failed to evolve in a manner compatible with a changed technological and competitive environment. Several of the senior managers are now predicting that the standard costing system will have a less important role in the future and it will not be used to judge managerial performance. This implies that variance analysis is less relevant compared to 20 years ago.

Another group of managers still believe there is a need for a **standard costing system**. In their view variance analysis has been important for many years and will continue to be important for judging managerial performance.

Source: www.google.co.ke- case studies on management accounting

CHAPTER SIX

STUDY TE

INVENTORY CONTROL

CHAPTER SIX

INVENTORY CONTROL

▶ CHAPTER OBJECTIVES

After this chapter the student will have knowledge of a detailed examination of the inventory control process.

▶ INTRODUCTION

Inventory is one of the very major investments in cost investment and commercial organizations. It is important therefore that stocks are efficiently managed to ensure their proper use and no loss through wastage or pilferage etc.

Management has the important task of ensuring that:

- There's enough stock of material necessary for production
- The material should be bought within the time required
- Holding of surplus stocks is avoided to keep holding costs at minimum and reduce risk of obsolescence.

This chapter will look at just how management uses techniques to ensure the above are fulfilled among other issues concerning inventory.

▶ DEFINITION OF KEY TERMS

Inventory is described as assets held for sale in the ordinary course of business; assets in the process of production for such a sale and assets in the form of materials or supplies to be consumed in the production process or in the rendering of services.

Raw material: materials, components, fuels etc used in the manufacture of the product.

Work in progress (WIP)*:* partly finished (semi-processed) goods that are waiting further processing.

Finished goods: these are the completed products ready for sale or distribution.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on:

- The EOQ model
- Just-in –time system

Students should therefore understand these topics.

▶ INDUSTRY CONTEXT

Organisations use the EOQ model to determine the quantity of materials to order that will incur less ordering and carrying costs.

The reorder point helps organizations to know when to replenish stock.

For example, a firm making sheets will use the EOQ model to determine when to order for more material for the sheets and what amount to order to avoid stock out and minimize costs.

6.1 WHAT IS INVENTORY?

According to International Accounting Standards (IAS 2), inventory is described as assets:

- Held for sale in the ordinary course of business
- In the process of production for such a sale
- In the form of materials or supplies to be consumed in the production process or in the rendering of services.

From the above definitions we see that inventory can be classified into three:

i. *Raw material:* materials, components, fuels etc used in the manufacture of the product
ii. *Work in progress WIP:* partly finished (semi-processed) goods that are waiting further processing.
iii. *Finished goods:* these are the completed products ready for sale or distribution.

These are not steadfast definitions for what would be considered finished goods by one firm

would be seen as raw material for another. All in all, they are all inventory.

6.2 MATERIAL CONTROL

It is said that "any fool can sell"—it is buying at the right price that is more critical to the achievement of a satisfactory return on capital employed. Buying price is important of course, but buying the right materials, are equally important if production targets are to be achieved and investment in inventories to be minimized.

What to order

This is governed by product specifications, but an efficient buyer will always have his ear to the ground to discover new and substitute materials and components of advantageous quality and price. Other economies can be realized by reducing the variety of materials purchased by *standardization*, e.g. reducing the variety of colours of paint stocked, or by introducing value analysis into the decision process.

Value analysis

Is a formalized technique involving a rigorous analysis of products at the design stage or at any time during the saleable lives, to determine their value characteristics. These are the attributes that a customer looks for in a product and include its use value (functional qualities), appeal value (colour, style etc.) and second-hand value (e.g. trade-in-price). The object of value analysis is to build into the product the optimum of desired value at minimum cost, by introducing the most up-to-date designs, materials and methods of manufacture. No more value need be built into the product than is desired by the customer. For example, moulded plastic bumper bars are now fitted to many cars, because they are cheaper than and equally as functional as chromium-plated steel ones.

How much to order

Supposing the estimated annual usage of a component by Harambee Agricultural Machinery Ltd is 20,000 units. Usage is even throughout the year and only one order per annum is placed with the supplier. Because only one delivery is made, average stock will be high, i.e. 20,000 ⎪2 = 10,000 and consequently stockholding costs will be very high. On the other hand, the costs of ordering will be negligible. If two orders are placed there will be less in stock (i.e. average 5,000), which will reduce holding costs, but ordering costs will increase. Thus, the higher the number of orders placed, the lower are stockholding costs, but the higher are ordering costs.

Stockholding costs include interest on the capital invested in stocks, storage, insurance, rates, security, building maintenance, heating, etc. Ordering costs include buying-department staff costs, receiving and handling.

Assuming that the cost of each Harambee component is £10, that holding cost is 10% of stock value and the cost of placing an order is £1, the total annual cost of stockholding and ordering when different numbers of orders are placed, is as follows:

Number of orders	4	20	50	100	200	400
Size of order	5,000	1,000	400	200	100	50
Average Stock (50% order)	2,500	500	200	100	50	25
Holding cost	£2,500	£500	£200	£100	£50	£25
Ordering cost (£1 per order)	£4	£20	£50	£100	£200	£400
Total Annual Cost	£2,504	£520	£250	£200	£250	£425

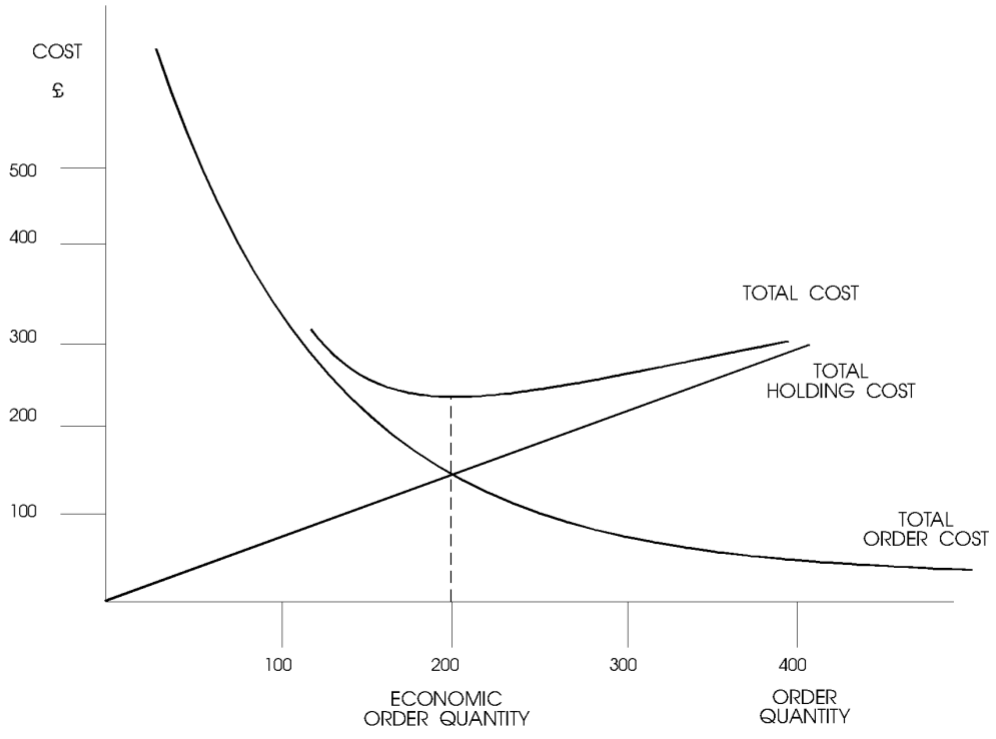


Figure 1 Economic Order Quantity

Placing 100 orders a year results in the lowest of ordering and holding cost of £200, therefore the economic order quantity is 200 units.

The same information is graphed in *Figure 1* above, showing that the *economic order quantity* (EOQ) is the point where ordering and holding costs are equal, and total £200.

As costs of ordering and holding stock are equal at the EOQ point, we can build a simple mathematical model to solve the problem, as follows:

$$\frac{Q}{2} \times H = \frac{A}{Q} \times P$$

Where Q = EOQ

H = holding cost per unit

A = annual demand

P = cost of placing an order

$$finally\ Q = \sqrt{\frac{2AP}{H}}$$

Using the data in the previous example:

$$EOQ = \sqrt{\frac{2 \times 20{,}000 \times 1}{1}}$$

$$= \sqrt{40{,}000}$$

$$= 200$$

Although the model assumes that holding and ordering costs are fixed, this simplification is acceptable given a relatively unchanging level of production activity. In addition, because the total cost curve in the *Figure 1* is relatively flat either side of the EOQ, minor errors and approximation in the variables used in the calculation may not affect the end result significantly.

Practical constraints on the use of the model include restrictions on the available storage space, the availability of quantity discounts (though the model can be modified in this respect), the seasonal nature of supplies, the shelf-life of products and delivery schedules imposed by suppliers.

When to order

If deliveries from suppliers normally take two weeks to arrive, then replenishment orders should be placed with them when the level of stocks represents two weeks' supply. For example, if usage is 200 units a week, an order (the EOQ) will be placed when the stock level falls to 400 units. Figure 6(a) illustrates that, with *certain* knowledge of usage and lead time, delivery takes place just as stock is exhausted.

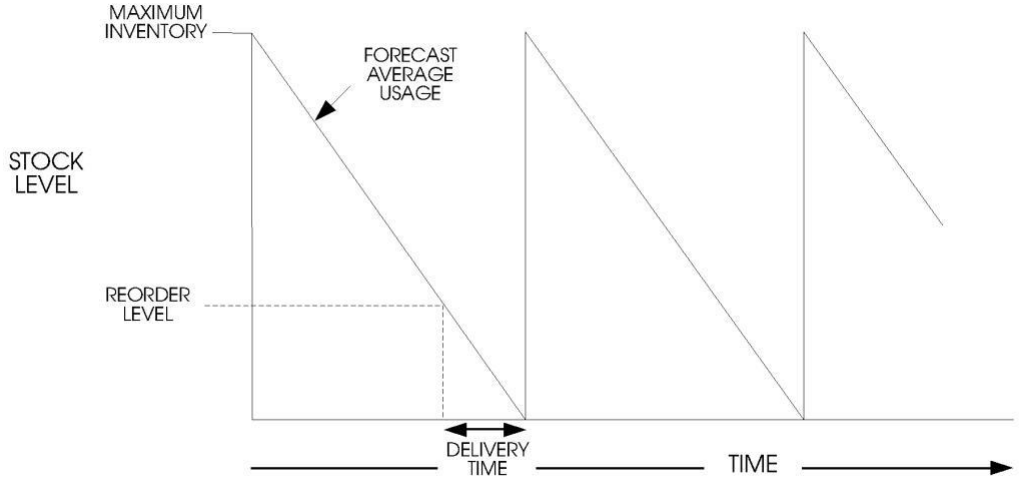


Figure 2(a) Stock levels when usage and replenishment times are known

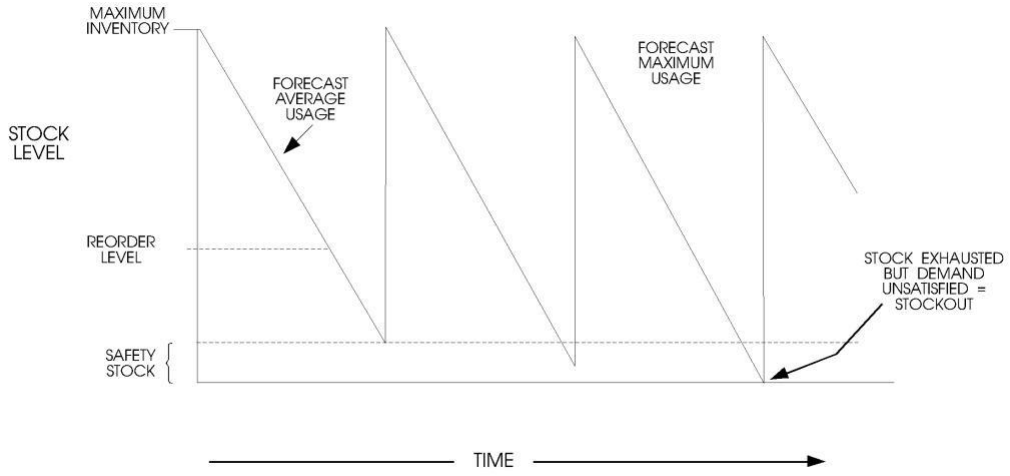


Figure 2(b) Stock levels when usage and replenishment are uncertain

Lead times and usage may not be stable and provision against running out of stock then becomes necessary *(Figure 2 (b))*. *Safety stocks* have a cost, however, and this has to be balanced against the cost of running out of stock. `Stock outs' may cause loss of customers and the probability of this happening at various levels of safety stock must be estimated. The point at which the cost of carrying safety stocks plus the cost of `stock outs' is lowest indicates the safety stock level. Notice that uncertainty causes the reorder level to be at a higher level to include the required safety stock.

Controlling material flow

Figure 3 outlines the progressive stages in purchasing, issuing and recording materials in a manufacturing concern. An efficient system of documenting and recording is vitally necessary, not only for accounting purposes, but to ensure that the right materials arrive at the right place at the right time.

The *purchase requisition* submitted to the buyer may be triggered automatically if the system is computerized, by a message from the stores ledger that the reorder level has been reached. Other requests to purchase may be raised by the production planning department for new product materials not yet carried in stock, and also by any departmental head for supplies and equipment of any kind.

The buyer, ideally after making *enquiries* of several suppliers, sends a *purchase order*, and eventually the material is received, checked by the good-inwards department as to quality and quantity, and is detailed on a *goods-received note* (GRN). One copy of the GRN goes to the buyer to write off the outstanding order record; one to the accounts department for checking against the order and invoice—the latter authorizing payment to the supplier; and one to the stores department with the materials.

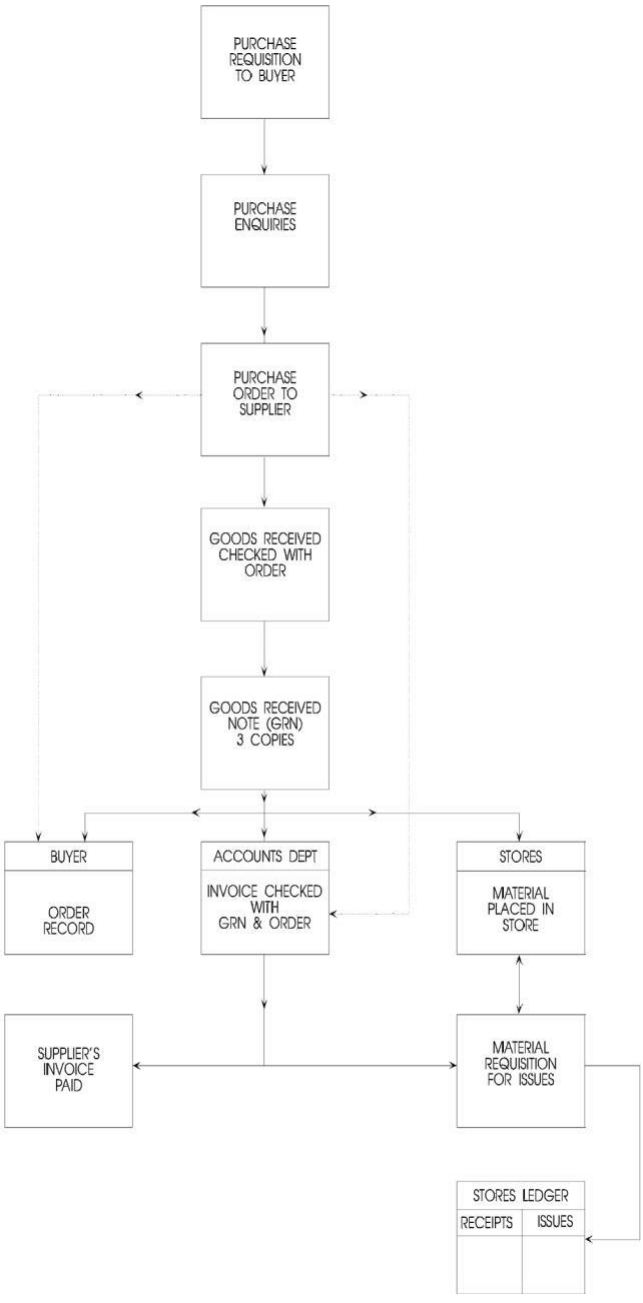


Figure 3 Procedure of material acquisition, recording and issue

A *stores record* is maintained into which the quantity and value of materials received is entered. Issues of materials to production are made by authorized materials requisitions which are also entered into the stores ledger to keep that record up to date continuously, and also into the appropriate job or process const record.

As already indicated, all the above procedures may be integrated into a computerized stock record which can provide information at the press of a button to the storekeeper, buyer, production planner, financial manager or any other person authorized to key into it. For example, information on slow-moving stock items can be obtained automatically and without delay.

Material storage

Sophisticated mathematical models to control economic buying, and systems control the flow of material may all be for naught if the obvious—efficient storekeeping—ignored. Good practice in this respect implies:

- the employment of a well-trained stores staff
- Use of the most efficient equipment—for storage and handling
- Easy access to items—stored in logical order
- sitting of stores convenient to users
- Security against theft and fire
- Protection against deterioration
- A system of continuously checking physical with recorded stocks.

6.3 FURTHER CONSIDERATIONS OF INVENTORY CONTROL DECISIONS

6.3.1 INTRODUCTION

Factories, workshops, engineering departments handle raw materials used in the manufacture of products. The main objectives in handling these materials are:

a. Maximum customer's service
b. Minimum possible investment on materials, handling costs etc.
c. Avoid shortages as far as possible so that production is not stopped or customer's goodwill is not lost.

Some of these objectives are basically in conflict and require a scientific approach to get an optimal solution in order to earn maximum profit for a given investment. Inventory control is the study involving `Material Management' and the associated costs in such a way that the total cost is kept minimal for a given investment.

6.3.2 INVENTORY PLANNING AND CONTROL

FAST FORWARD: The major goal of "inventory control" is to discover and maintain the optimum level of investment in all types of inventories, from raw materials and supplies to finished goods that helps to maximize long-run profits.

Two limits must be imposed in controlling inventory levels, because there are two danger points that management usually wants to avoid. They are:

i. That inadequate inventories, disrupts production and may lose sales.
ii. That excessive inventories, introduces unnecessary carrying costs and obsolescence risks.

What motives do firms have in holding stocks?

i. Transaction motives: this is where a fi rm would be holding stocks to ensure that suffi cient goods are available to meet anticipated demand.
ii. A fi rm may hold additional stocks to cover the possibility that it may have underestimated its future production and sales requirements or supply of raw material may have been unreliable because of uncertain events affecting the supply of materials.
iii. It may provide a buffer between production processes. This is applicable to work in progress stocks which effectively decouple operations.
iv. Holding stocks especially in bulk would help the fi rm qualify for quantity discounts.
v. The form may have precautionary motives when they foresee a shortage in the future.
vi. Holding stocks will enable the production process to fl ow smoothly and effi ciently.
vii. Holding stocks may be a necessary part of the production process e.g. maturing of whiskey.
viii. Holding of stocks may also be dependent, to an extent, on expected price movements e.g. if future prices are expected to go up, a fi rm may decide to buy more stocks to take advantage of the lower prices now.

6.3.3 CHOOSING ORDER QUANTITY (SIZE—PROBLEM)

FAST FORWARD: The objective of inventory decisions is usually to minimize total inventory costs to the company.

Costs are ascribed to all elements which are of interest in reaching its inventory decisions (e.g. purchasing costs, stock out costs etc.), and solutions, are derived based on these costs.

Several inventory planning models exist. These models can be classifi ed into two basic classifi ed into two basic groups:

i. Deterministic Models:—whereby all parameters are known with certainty, e.g. lead-time, annual demand, etc.
ii. Stochastic Models:—in which parameters (particularly demand and lead time) are not known with certainty, but follow known probability distributions (i.e. risks)

A. THE DETERMINISTIC MODELS

>>>>> 1. THE BASIC EOQ MODEL

This is the simplest of all the models discussed. In addition to the general assumptions which relate to all deterministic models (i.e. certainty of all parameters) it is further assumed that::

a. Demand is continuous and constant over time.
b. That suppliers lead time is zero i.e. stocks are delivered immediately on the day the order is made.
c. That stock-outs are not allowed.
d. There are *no* bulk quantity discounts.
e. Holding costs per unit, ordering costs per order and costs per unit are constant.

Relevant costs of basic EOQ model

The relevant costs that should be considered when determining optimum inventory levels can be classified into two categories:

- Ordering costs.
- Holding (Carrying) Costs.

i.e. TC = Ordering Costs + Holding Costs

>> i. Ordering Costs

These are incurred in getting purchased items into the company's inventory or stores, and usually consist of:

a) Clerical costs of:
   1. Making the purchase requisition.
   2. Issuing of a purchase order
   3. Follow-up action
   4. Receiving the goods
   5. Inspection for quality control
   6. Placing goods in stores
   7. Paying vendors (Suppliers)

b) Transport costs
c) Production runs costs. This is for inventory that is produced internally rather than purchased from external sources.

Note:

The basic EOQ model assumes that these costs are fixed constant for each order made.

>> ii. Carrying costs of inventory

These costs are also known as holding costs. These are costs incurred because the firm has decided to maintain inventories. Normally holding costs are expressed as a percentage rate per pound of the purchase price.

They usually consist of:

1. Stock-out costs: These are costs associated with running out of stock. They are caused by:
   a) Last contribution form lost sales
   b) Loss of future sales due to disgruntled customers who will take their businesses elsewhere

c) Loss of customer goodwill
d) Cost of production stoppages
e) Labor frustrations over stoppages
f) Extra costs associated with urgent often small quantity replenishment orders.

2. Insurance costs
3. Warehouse and storage costs
4. Material handling costs
5. Costs of obsolescence

Total Ordering Cost = Total demand for period x Ordering Costs per period Quantity Ordering

$$= \frac{DO}{Q}$$

Total Holding Costs = Quantity Ordered x Holding Costs per unit

$$\frac{}{2}$$

$$= \frac{Q\,H}{2}$$

Therefore total relevant costs (TC) for any order quantity can be expressed as:

$$TC = \frac{DO}{Q} + \frac{QH}{2}$$

We can determine a minimum of this total cost function by:

i. Differentiating the above formula with respect to Q and setting the derivative (1st) equal to zero.

$$\frac{d_{TC}}{} = \frac{-DO}{} + \frac{H}{} = 0$$

$$\frac{dQ}{} \qquad Q^2 \quad 2$$

$$\frac{H}{2} = \frac{DO}{Q^2}$$

$$Q^2 = \frac{2DO}{H}$$

$$Q = \sqrt{\frac{2DO}{H}}$$

STUDY TEXT

ii. Equating ordering costs to holding costs.

$$\frac{DO}{Q} = \frac{Q}{2} H$$

$$Q_2 = \frac{2DO}{H}$$

$$Q = \sqrt{\frac{2DO}{H}}$$

The formula is a widely used method. However for it to be applied, we must make some assumptions:

- The stock holding costs are known with certainty.
- The ordering costs are known and constant
- The demand is known, is continuous and constant over time.
- There's a constant price per unit
- The suppliers lead time is zero i.e. stock are delivered immediately on the day the order is made.
- Stock outs are not allowed

1. EOQ Model with quantity discounts

Circumstances frequently occur where firms are able to obtain quantity discounts for large purchase orders. Buying in bulk has some advantages and disadvantages.

Advantages

i. (A saving in purchase rule) Decreases in unit cost, which consists of the total amount of discount for the period.
ii. A reduction in the total ordering costs because fewer orders are placed to take advantages of the discounts.

Disadvantages

Increased holding cost arising from higher stock levels when large quantities are purchased.

Such as:

i. Stock out cost
ii. Insurance.
iii. Deterioration
iv. Security etc.

Broadly there are two types of discount structures:

i. Fixed discount on "all units" when the order placed is for a minimum quantity.
ii. Variable discounts for given ranges.

i. The case of a fixed discount

When evaluating inventory decisions when a fixed discount rate exists, the appropriate procedure is to compare the total costs of the EOQ with the total costs when discounts are taken. The option giving lower costs is then chosen.

Note:

The Unit (variable) cost (i.e. Purchase Price) behave in the following manner:

$$C = \begin{cases} Co & \text{if } 0 \delta Q \delta Q_b \\ Co\,(1 - P) & \text{if } Q \varepsilon Q_b \end{cases}$$

Where Co = basic unit cost without a discount

P = Discount rate allowed.

Q_b = Break-point (Quantity)—where discounts become operational.

In order to determine the optimal ordering quantity, it is necessary to include the costs of the inventory with the carrying ordering costs.

Total costs of Inventory = Total Purchase cost + Total order cost + Total carrying cost

$$TC = DC_o + \frac{Q^*}{2} H + \frac{D}{Q_2} o \qquad \text{If } 0 \delta Q \delta Q_b \quad \text{(i)}$$

$$TC = DC.(1-P) + \frac{Q}{2} H + \frac{D}{Q} o \qquad \text{If } Q \varepsilon Q_b \quad \text{(ii)}$$

Note:

Equation (ii) i.e. with discounts will give a lower TC than equation (i) for the same. The decision whether to go for the discount lies on a trade-off between extra carrying costs vs a reduction in acquisition costs.

>>> **Illustration**

1. Assume X Ltd purchases a raw material from an outside supplier at cost of Sh 70 per unit.
2. Assume total annual demand for the product is 9,000 units.
3. Assume the holding cost is Sh 40 per unit and the ordering cost is Sh 50 per order.
4. Assume a quantity discount of 3% of the purchase price is available for orders in excess of 1,000 units.

STUDY TEXT

Required:

a. Calculate the EOQ and the associated costs.
b. Calculate the total costs if the company purchased in batches of 1,000 units (N.B. It is not wise to buy in batches with more than 1,000 units because of the increase rate in carrying exceed the rate at which ordering costs decline).
c. Advise the management on the appropriate inventory policy.

Solution $EOQ = \sqrt{\frac{2 \times 9{,}000 \times 50}{40}}$

a. i.

$= \sqrt{22{,}500} = \sqrt{225 \times 10^2}$

= 150 units

ii. TC = $\frac{9{,}000}{150}(50) + \frac{150}{2}(40) + 9{,}000\,(70)$

= 3,000 + 3,000 + 630,000

= Sh 636,000

b. Q = 1,000

TC = $\frac{9{,}000}{1{,}000}(50) + \frac{1{,}000}{2}(40) + 9{,}000\,(70)(1 - 0.03)$

= 450 + 20,000 + 611,100

= Sh 631,500

Note: Discount price = 70 (1 - 0.03) = Sh 67.90

c. Decline in inventory costs = 631,550 - 636,000

= Sh 4,450

Decision

The firm saves Shs 4,450 by taking the quantity discount.

6.3.4 THE CASE OF VARIABLE QUANTITY DISCOUNTS

In practice, suppliers may offer different discounts for different quantities purchased. For example:

Segment	Quantity Purchased	Unit Price
1	0—500	Sh 100
2	501 — 1,000	Sh 90
3	1001 — 1,500	Sh 80
4	over — 1,500	Sh 70

The best approach to the solution in this case is to apply the price-breaks theorem. This works as follows:

1. For each segment an EOQ is calculated. There are two possible requests:

   i. The EOQ is within the quantity segment (i.e. valid)
   In this case, the EOQ is used as the minimum cost quantity for that segment.

   ii. The EOQ is outside the quantity segment (i.e. invalid)
   In this case the minimum cost quantity will be the quantity within the segment closest to the EOQ as calculated.

2. Select the quantity that leads to the lowest total inventory costs (i.e. Purchase, Ordering & Carrying).

>>> **Illustration:**

1. Assume a manufacturer uses 3,300 drums of a certain chemical per year.
2. Assume delivery costs incurred per order are Sh 40 and inventory carrying costs are estimated to be 30% of stock value.
3. Assume the normal cost per drum is Sh 22 but the supplier offers discount of 1.5% on orders for 500 drums or more, and 3% on orders for 1,000 drums or more.

Required:

Determine the order quantity the manufacturer should adopt to minimise total costs.

Solution:

Note:

There are 3 discount levels (0, 1.5% & 3%) and hence 3 segments.

STUDY TEXT

Steps

1. Calculating the EOQ for each segment.

a. For Segment 1 (0 - 499 drums)
C = Sh 22

EOQ = 200 drums
7

$$EOQ = \sqrt{\frac{2 \times 3{,}300 \times 40}{0.3\,(22)}}$$

$$= \sqrt{\frac{264{,}000}{6.6}} = \sqrt{40{,}000}$$

= 200

b. For Segment 2 (500 - 999 drums)

C = 22(1 - 0.015)
C = 22(0.985)
C = Sh 21.67

$$EOQ = \sqrt{\frac{2 \times 3{,}000 \times 40}{0.3\,(21.67)}}$$

$$= \sqrt{\frac{264{,}000}{6.50}} = \sqrt{40{,}615}$$

= 201.5 drums (can round to 202 drums)

c. For Segment 3 (1,000 or more) C = 22(1 - 0.03)

C = Sh 21.34

$$EOQ = \sqrt{\frac{264{,}000}{0.3\,(21.34)}}$$

$$= \sqrt{\frac{264{,}000}{6.40}} = \sqrt{41{,}237}$$ = 203 drums

STUDY TEXT

Price Segment	Unit Break Quantity	Valid Price	EOQ	Quantity	
1	0–499	Sh 22	200	200	(Valid)
2	500 - 999	Sh 21.67	202	500	(Invalid)
3	over 1000	Sh 21.34	203	1,000	(Invalid)

2. Calculate total costs

Segment	Units ordered		Total costs
1	200	(3,300 x 22) + (200 |2 x 6.6) + (3,300 |200 x 40)	= Sh 73.920
2	500	(3,300 x 21.67) + (500 |2 x 6.5) + (3,300 |500 x 40)	= Sh 73.400
3	1,000	(3,300 x 21.34) + (1,000 |2 x 6.4) + (3,300 |1000 x 40	= Sh 73.754

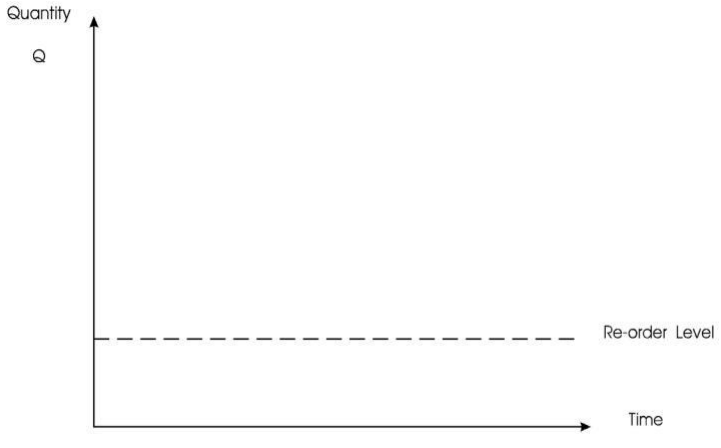
Decision:

The firm should order 500 drums per order per annum and incur Sh 73.400 total costs.

6.4 NON-ZERO LEAD TIME (DETERMINING REORDER POINT)

This basic EOQ model assumes that the suppliers lead time is zero (i.e. goods are delivered immediately on the day the order was made). In reality, however, supplies are rarely ordered and received on the same day. Accordingly, orders must be placed some time before stocks reach zero. In world of certainty (when demand is continuous and constant) the reorder point will be the number of days/weeks lead time multiplied by the daily/weekly usage during the period.

i.e. Reorder point = Average daily usage x Lead time in days.



STUDY TEXT

Note:

The reorder point has no cost implications, since it does not affect the EOQ.

Illustration:

1. Assume X Ltd uses 50,000 kg of a raw material annually.
2. Assume ordering costs are Sh 160 per order and stock holding costs are Sh 0.25 per kg per annum.
3. Assume the purchase price is Sh 20 per kg and no quantity discounts are offered.
4. Assume lead time for delivery of orders is 4 weeks.
5. Assume working time is 50 weeks a year.

Required:

a. Calculate the EOQ
b. Calculate the inventory reorder level.
c. Calculate the total costs per annum.

Solution

$$EOQ = \sqrt{\frac{2 \times 50{,}000 \times 160}{0.25}}$$

a.

$$= \sqrt{\frac{16{,}000{,}000}{0.25}} \quad = \sqrt{64{,}000{,}000}$$

EOQ = 8000 kgs

Make 6.25 orders (50,000 ⎮8,000) per annum.

b. Reorder level = Demand per week x Lead time.

$$= \frac{50{,}000}{\div \times 4}$$

$$= 50$$

= 1,000 x 4
= 4,000 units.

c. Total costs = (50,000 x 20) + (8,000 ⎮2 x 0.25) + 50,000 ⎮8,000 (160)
= 1,000,000 + 1,000 + 1,000
= Sh 1,002,000

6.5 INVENTORY PLANNING & CONTROL UNDER UNCERTAINTY

The basic EOQ model assumes that all the parameters (elements) in the model are certain (i.e. can be predicted accurately in advance). These parameters are:

i. Demand or usage of stocks
ii. Lead times.
iii. Holding costs per unit, ordering costs per order and costs per unit.

In reality however, stock demand, supplies lead times and cost date are not known with certainty. Accordingly to make the models applicable to real situations we must consider uncertainty when planning for inventory levels.

To protect itself from conditions of uncertainty, a firm will maintain a level of safety stocks for raw materials, work-in-progress and finished goods stocks. Thus safety stocks are the amount of stocks that are carried in excess of the expected use during the lead time to provide a cushion against running out of stocks. Thus the reorder point is computed as safety stock plus the average usage during the lead time

I.e. reorder point = Average usage during lead time + safety (buffer) stock.

6.5.1 DETERMINING THE SAFETY STOCKS LEVEL

1. Uncertainty of demand

Demand is the most troublesome variable to predict accurately. Actually, demand may fluctuate from day to day, from week to week or from month to month. Thus, the firm takes the risk of running out of stocks if there are sudden increases in demand. Hence safety stock is the extra inventory held as a buffer of protection against the possibility of stock due to higher demand.

However, a larger inventory of safety stock will involve a higher inventory carrying costs, and on the other hand, the higher safety stock will decrease stock-out costs. Therefore one has to make a balance between these two costs in order to find out an optimal safety costs.

Note:

The optimum safety-stock level exists where the costs of carrying an extra unit are exactly counter balanced by the expected stock-out costs. This would be the level that minimizes the annual total stock-out and carrying costs.

Stock-out costs

These are the opportunity costs of running out of stock. They include:

i. The costs of lost customer sales, and therefore lost contribution to fixed costs.
ii. Potential loss of goodwill with customers whose demand cannot be net.
iii. Acquiring emergency supplies at higher prices to meet demand.
iv. Cost production of finished goods, where raw material stock-outs occur.

The computation of safety stocks lingers on demand forecasts. The manager will have some notion (usually based on past experience) of the range of daily demand. That is the probability that exists for usage of various quantities.

Hence total inventory costs will be as follows:

Total inventory costs = Purchase price cost + carrying costs + stock-out cost + order costs.

= Purchase price costs + "normal~ carrying costs (Q÷2 H) + Buffer Stock holding costs (B x H) + Stock-out costs + order costs.

Total inventory costs = $D \cdot C + Q \div 2 \cdot H + (B \times H)$ + stock-out costs + $D \div Q \cdot Co$

Where: D = Total annual demand
H = Holding costs per unit
B = Buffer stock
Q = EOQ

Note:

1. The normal EOQ formula is used to compute order quantity Q. Hence purchase costs, carrying costs, and ordering costs remain unchanged. Only buffer stock holding costs and stock-out costs change. Accordingly, the minimization of these two costs will also mean that total/overall costs will be minimized.

2. Stock-out costs = Number of units short x Probability of being short.

= {(Number of units short x Stock-out costs per unit Probability of being short)—Stock-out costs for every usage duration} x Number of orders per year.

3. Buffer Stock-holding costs = Bx H

>>> Illustration

A company has an annual demand for material X of 250 tonnes per annum. Order lead time is 4 days and usage during lead time as shown by past record is

Usage	Probability
0	0
1	0.01
2	0.05
3	0.15
4	0.25
5	0.30
6	0.10
7	0.09
8	0.05

The cost per tonne is £20 and stock holding cost is 25% per annum of the stock value. Delivery cost per batch is £4. The costs of stock out also estimated to be £4.

You are required to:

a. Calculate the economic batch quantity and the expected number of orders per annum
b. Ascertain the re-order level taking the information given above into consideration.

Solution:

a. EBQ or EOQ where stock-outs are permitted

$$EBQ \text{ or } EOQ = \sqrt{\frac{2DK}{h}} \sqrt{\frac{h + C_s}{C_s}}$$

Where D is annual demand
K is order cost

h is holding cost

and C_s is stock out cost

$$EBQ = \sqrt{\frac{2 \times 250 \times 4}{5}} \sqrt{\frac{5 + 4}{4}}$$

$$= \sqrt{400} \sqrt{\frac{9}{4}}$$

= 30

No. of orders = $\frac{250}{30}$

(*Note:* Stock holding cost b = 25% of £20 = £5)

We are required to find out expected demand during lead time.

Usage *x*	Prob p(*x*)	*x* p(*x*)
0	0	0.00
1	0.01	0.01
2	0.05	0.10
3	0.15	0.45
4	0.25	1.00
5	0.30	1.50
6	0.10	0.60
7	0.09	0.63
8	0.05	0.40
	∑*x*p(*x*)	4.69

Hence normal usage during lead time is 4.69 tonnes but maximum usage during lead time can be as large as 8 tonnes with a probability of 0.05.

Average usage in four days = 4.69 tonnes and at this level there is no buffer stock. The problem is how much buffer stock we should have, so that the cost of holding stock together with the cost of expected stock-out cost is minimum.

Let $\propto_1$ = 4.69 tonnes.

B = Buffer stock

S = Re-order level (for lead time) = $\propto_1$+B

Hence B = S-$\propto_1$

Here B = S - 4.69

1	2	3	4	5	6	7	
Re-order Levels S	**Buffer Stock B**	**Expected Stock-out per order**	**Expected Annual Shortage**	**Expected stock-out cost (£)**	**Holding Cost (£)**	**Total cost (£)**	
4.69	0	0.5974	4.978	19.912	0	19.912	
5	0.31	0.43	3.58	14.32	1.55	15.87	
6	1.31	0.19	1.583	6.332	6.55	12.882	← minimum cost
7	2.31	0.05	0.4166	1.664	11.55	13.214	
8	3.31	0	0	0	16.55	16.55	
			Working column 3 x 250 30	Column 4 x 4	Column 2 x 5 i.e. B x h		

Hence for minimum cost S = 6

Buffer stock S=6-4.69

= 1.31 tones

and minimum cost = £12.88

Workings and explanations

1. When Re-order Level S = 4.69

B = 0

Hence possible shortages will occur when demand is 5, 6, 7 or 8 units.

Demand	Shortage *x*	Prob p(*x*)	Expected Value *x*p(*x*)
5	5 - 4.69	0.30	0.31 x 0.30 = 0.93
6	6 - 4.69	0.10	1.31 x 0.10 = 0.131
7	7 - 4.69	0.09	2.31 x 0.09 = 0.2079
8	8 - 4.69	0.05	3.31 x 0.05 = 0.1655
		∑*x*p(*x*)	0.5974

This is expected stock out per order when demand is 5, 6, 7 or 8

2. Similarly if Re-order level is 5 Shortages will occur if demand is 6, 7, 8

Working in the way as above

Demand	Shortage *x*	Prob p(*x*)	Expected Stock-out cost
6	1	0.10	0.10
7	2	0.09	0.18
8	3	0.05	0.15
		∑*x*p(*x*)	0.43

3. If re-order level is 6, shortage will occur if demand is 7 or 8

Demand	Shortage *x*	Prob p(*x*)	Expected Stock-out cost
7	1	0.09	0.09
8	2	0.05	0.10
		∑*x*p(*x*)	0.19

4. If re-order level is 7, shortage if demand is 8

   Expected shortage cost = (8 - 7) x 0.05 = 0.05

5 If re-order level is 8, there is no probability of shortage

a. Expected Annual Shortage = (Expected Stock-out per order) x No. of orders

i.e (Expected stock-out per order) x $\frac{250}{3}$

b. Expected stock-out cost = (Expected annual shortage) x Shortage cost per item

c. Holding cost = Buffer stock x cost of holding per item

Important Note:

If shortage C_s is not taken into account

$$EOQ = \sqrt{\frac{2 \times 250 \times 4}{5}}$$

$$= \sqrt{400} = 20$$

and number of orders = $\frac{250}{20}$ = 12.5

Using this model, we can still develop a table similar to the table worked out in this problem.

Graph of total cost against re-order level can be drawn using the table. The minimum cost and the re-order level can then read from the graph. Once re-order level is known, safety stock can be worked out.

In the next example, the initial EOQ value has been taken using the formula

$$EOQ = \sqrt{\frac{2DK}{h}}$$

>>> **Illustration**

1. Assume a manufacturer has experienced trouble from stock shortages (stock-outs) of raw materials X which is required in a manufacturing process. Usage of X averages 6,000 units per year where a year consists of 50 weeks.
2. Assume the costs of ordering each batch of X is Sh 30 and the lead time is 2 weeks (known for certain). The annual holding costs amount to Sh 1 per unit of X held. The cost of a stock-out has been estimated to be Sh 5 per unit short.

3. Assume the demand (usage) is unknown. However, the total usage of raw material X over the 2 week lead time is expected to be as follows:

Usage in units	Probability
60	0.07
120	0.08
180	0.20
240	0.30
300	0.20
360	0.08
420	0.07

Required:

a. Calculate the EOQ and the expected number of orders per annum
b. Calculate the average usage per 2 weeks (Lead-time)

Solution

Annual demand = 6,000 units

Order cost = Sh 30

Holding cost = Sh 1

Shortage cost = Sh 5 per unit short

$$EOQ = \sqrt{\frac{2 \times 6{,}000 \times 30}{1}} = 600 \text{ units}$$

Number orders $\frac{6{,}000}{600} = 10$

Average usage for two weeks = 60 x 0.07 + 120 x 0.08 + 180 x 0.20 + 240 x 0.30 + 300 x 0.20 + 360 x 0.08 + 420 x 0.07

= 240 units

Re-order Levels	***Buffer Stock***	***Expected Stock-out per order***	***Expected Annual Shortage***	***Expected stock-out cost***	***Holding Cost at Sh 1***	***Total cost***
240	0	34.2	342	1,710	0	1,710
300	60	13.2	132	660	60	720
360	120	4.2	42	210	120	330
420	180	0	0	0	180	180

STUDY TEXT

i. Expected Stock out per order where re-order level is 240

(300 - 240) x 0.2 + (360 - 240) x 0.08 + (420 - 240) x 0.07 = 34.2

ii. Similarly for re-order level = 300

(360 - 300) x 0.08 + (420 - 300) x 0.07 = 13.2

iii. And for re-order level = 360

(420 = 360) x 0.07 = 4.2

iv. No shortage when re-order level is 420
Hence total cost is minimum when re-order level is 420 units.

Best policy is to have safety stock of 180 units.

6.5.2 SENSITIVITY ANALYSIS OF EOQ MODEL

FAST FORWARD: Sensitivity Analysis is concerned with the way in which those results of solutions change in response to change in model parameters.

$$EOQ = \sqrt{\frac{2DO}{H}}$$

Note:

It is important to appreciate that in formulating our inventory models, we have really been performing a planning exercise. Thus we have made certain assumptions and estimates (e.g. annual demand D, holding costs H, & ordering costs O) and out solutions have obviously been affected by these. When for example calculating a deterministic EOQ value with maximization of total inventory costs as the objective, expected annual demand (D) is taken into account. If we subsequently find that annual demand has differed from that expected then we will find that the EOQ we selected was not the optimum and, as a result, the total inventory cost was not actually minimum.

>>> **Illustration:**

1. Assume X Ltd expected annual demand for 1991 for 62,500 units of raw material X per annum.
2. Assume holding costs are Sh 15 per unit per annum and each order costs Sh 10.
3. Assume that the end of the year actual demand has been found to have been for 90,000 units, not the 62,500 expected.

Required:

Calculate the additional costs borne by X Ltd through basing the size and frequency of orders on expected figures.

Solution:

a. Calculating EOQ based on expected figures, and the associated inventory costs.

$$EOQ = \sqrt{\frac{2 \times 62{,}500 \times 10}{5}}$$

$$EOQ = \sqrt{\frac{1{,}250{,}000}{5}} = \sqrt{250{,}000}$$

= 500 units

Total inventory costs = $\frac{62{,}500}{500}(10) + \frac{500}{2}(5)$

= 1,250 + 1,250

= Sh 2,500

b. Calculating the total inventory costs based on actual demand.

TC= $\frac{90{,}000}{500}(10) + \frac{500}{2}(5)$

= 1,800 + 1,250

= Sh 3,050

c. Calculating the total inventory costs had the company forecasted the actual demand accurately.

$$EOQ = \sqrt{\frac{2 \times 90{,}000 \times 10}{5}}$$

$$EOQ = \sqrt{\frac{1{,}800{,}000}{5}} = \sqrt{360{,}000}$$

= 600 units

TC = $\frac{90{,}000}{500}(10) + \frac{600}{2}(5)$

= 1,500 + 1,500

= Sh 3,000

STUDY TEXT

Therefore, X Ltd total inventory costs are actually Sh 50 (3,050 - 3,000) higher than they would have been if the EOQ had been set in accordance with perfect information.

Observation:

Hence the change in demand by 44% $\frac{(99{,}000 - 62{,}500)}{62{,}000}$ has result in a 20% $\frac{(600 - 500)}{500}$

Increase in EOQ but only 91.64% $\frac{(3{,}050 - 3{,}000)}{3{,}000}$ increase in total costs.

Hence we can conclude that total cost is relatively insensitive to changes in demand.

6.5.3 Simulation of reorder models

Constructing the Model

Steps

- Identify the objectives of the simulation (A detailed listing of the results expected will help to clarify the output variables.
- Identify the input variables. Distinguish between controlled and non-controlled variables.
- Where necessary determine the probability distribution
- Identify any parameters and status variables
- Identify the output variables
- Determine the logic of the model

Note:

The key questions are how the input variables changed into output results, what formulae/ decision rules are required? How will the probabilistic elements be dealt with? How should the results be presented?

>>> Inventory Model Illustration

XYZ Ltd has set the re-ordering point at 15 units and order quantity (Q) of 20 units. The holding cost has been computed to be Sh 10 per unit per week, and the cost of placing an order is Sh 25. Also the stock-out cost is Sh 100 per unit short. Assume the inventory on hand at the beginning of first week is 20 units. The demand and lead time have been shown to be explained by the following prob. distribution.

Demand (units)	Probability	Cum. Prob.	Distribution of Random Nos.
0	0.02	0.02	00–01
1	0.08	0.10	02–09
2	0.22	0.32	10–31
3	0.34	0.66	32–65
4	0.18	0.84	66–83
5	0.09	0.93	84–92
6	0.07	1.00	93–99

Demand (weeks)	Probability	Cum Prob.	Distribution of Random Nos.
1	0.23	0.23	00–22
2	0.45	0.68	23–67
3	0.17	0.85	68–84
4	0.09	0.94	85–93
5	0.06	1.00	94–99

Required

Simulate the problem for 14 weeks, and determine the average weekly cost using the following random nos.

68 52 50 90 59 08 72 44 95 85 81 93 28 89 15 60 03

Steps:

- Set up a probability distribution for each relevant variable
- Build a cumulative probability distribution for each variable
- Establish interval of random numbers for each variable and therefore allocate the random numbers
- Generate the RNs using a table, or computer

  Perform the simulation

Demand			Delivery			Inventory				
Wks	Rand. No.	DD units	Rand. No.	Del. (wks)	Units recvd.	Bal. Hand	Inv hold	Ord. cost	Stock cost	Total cost
0						20				
1	68	4				16	160			160
2	52	3				13	130			
3	90	5	50	2		8	80	25		155
4	59	3			20	25	250			240
5	08	1				24	240			200
6	72	4				20	200			170
7	44	3				17	170			
8	95	6				11	110			
			85	4				25		135
9	81	4				7	70			70
10	93	6				1	10			10
11	28	2				0	0		100	100
12	89	5			20	15	150			
			15	1				25		175
13	60	3	15	1	20	32	320			320
14	3	1				31	310			310
							2200	Total		2375
								Average		Sh. 169.94

Selective Inventory Management

The inventory of an industrial firm generally comprises thousands of items with diverse prices, usage and lead time, as well as procurement and/or technical problems. It is neither desirable nor possible to exercise the same degree of control over all those items. The organisation should pay more attention and care to those items whose usage value is high and less attention to those whose usage and consumption value is low. The organisation has, therefore, to be selective in its approach to control its investment in various types of stocks and inventories. Such a system is known as *`selective inventory control'* system.

6.5.4 ABC Analysis (Pareto Analysis)

In ordinary parlance, *ABC analysis* can be best compared with our class society where the population is categorized into Top, Middle and Lower classes. In the case of inventories also, it has been noticed that out of a large number of items (in a million-tonne capacity steel plant there would be usually about 50,000 items of inventory of various types) that are generally held in stock, some of the items are quite significant whereas the others are not that important. Through *ABC* plan which is in fact an analytical approach based on common statistical techniques, the relative importance of the various items is established for the purpose of individual scrutiny and subsequent control. Through this technique `VIP' or the `privileged few' and the `trivial many' are distinguished and treated as such.

ABC analysis contemplates to classify all the inventory items in a number of categories, generally in three categories based on their values. Items of high value but small in number are classified as `A' items which would be under a strict control. `C' items represent relatively small value items and would be under simple control. Items of moderate value and size are classified as `B' items and would attract reasonable attention of the management. Since this plan concentrates attention on the basis of the relative importance of the various items of inventory, it is also known as `control by importance and exception'. As items are classified in order of their relative importance in terms of value, it is also known as the `proportional value analysis'.

It has been found that normal inventory items in most organisations show the following distribution pattern:

A — 5 to 10% of total number of items account for about 70% of the total consumption value. These items may be called "A" items.

B — 10 to 20% account for 20% of total consumption value.

C — The remaining large number of items account for the balance of 15% of the consumption value.

Remark: When a detailed scrutiny was conducted in respect of inventories held by the Ford Motor Company, the following results were obtained.

1. 9% of the total items (in number) were accounting for 57% of the total value of the inventory. These were classed as `A' items.

2. 10% of the items (in number) were found to be accounting for 18% of the total value. These were categorized as `B' items.

3. 81% of the items (in number) were found to be accounting for only 25% of the total value. These were classified as `C' items.

Similarly, when ABC ANALYSIS was done in the case of G.E.C., the results obtained were as under:

`A' Category*—Items accounting for 8% of the total number but 75% of total value. *`B' Category—Items accounting for 25% of the total number and 20% of total value. *`C' Category*—Items accounting for 67% of the total number and only 5% of the total value.

It would thus be observed that substantial and effective controls are made possible if greater attention is focused on `A' category items since these would be covering quite a substantial part of the inventory in terms of shilling value.

Some Remarks:

1. There is no hard and fast rule that all the inventory items should be classified only in these three categories. There can be a large number of classifications based on the requirements of the company and the nature of the items. For example `A' items may be further sub-classified as $A_1$, $A_2$, $A_3$, etc. The same principle may be extended to `B' items also or alternatively all the inventory items may be classified into A, B, C, D, E, F, etc.

2. All items that the company consumes must be considered together while classifying into ABC classes. Separate classification of raw materials, spares and consumable is not really meaningful.

While classifying as ABC items, what counts is the consumption shillings and not the unit price of an item or its consumptions in terms of units. Thus of the three items given below, the last one is most important since its annual consumption in terms of value is more than the other two.

Item	*Price/Unit S*h	*Annual Consumption in units*	*Annual Consumption in Sh*
X	20,000	2	40,000
Y	0.02	100,000,000	200,000
Z	1,000	500	500,000

4. Even though, so far we have referred to annual consumption, it is not at all necessary that the consumption figures should be taken only for one year. It can be for 6 months or even 3 months. But the period should be so selected that the consumption figures would be representative. However, annual figures are far more convenient and are universally followed.

5. If a firm follows ABC analysis, it will devote much time and effort on the control of `A' items. For example, extra care will be taken in the determination of minimum, maximum, reorder level, etc. of the `A' items, whereas so much control may not be exercised on `C' items. `A' items may be purchased only once in a year. For `A' items perpetual inventory system may be applied whereas in the case of `C' items, only a bin card may be maintained. In the same way an appropriate accounting method for `B' items may

be devised. However, in the classification of items into ABC categories if there are some critical items which are of small value whose non-availability may hamper the production, may in the normal situation, be classified as `C' items but, due to the critical nature of these items extra care may be taken so that these may not go out of stock.

6. The objective of classifying inventory items into `A', `B' and `C' categories is to develop policy guidelines for selective control. Such a policy can be designed in a variety of ways. In general `A' items merit a tightly controlled inventory system with periodic attention, and `C' items to subject to loose control with casual attention.

7. TABLE SHOWING FEATURES OF ABC ANALYSIS

Nature	A items (High value)	B items (Moderate value)	C items (Low value)
1. Extent of control	Rigid control (close day to day control)	Moderate control (Regular review)	Loose control (infrequent review)
2. Safety stock coverage	Low safety stocks	Medium safety stock	Large safety stocks
3. Frequency of order	Frequently	Less frequently	Bulk ordering
4. Degree of posting	Individual posting	Small group postings	Group postings
5. Period of review	Every fortnight	Quarterly	Yearly
6. Sources of supplies	Good number of sources	Few reliable sources	One or two sources
7. Follow up	Vigorous	Periodic	Occasional
8. Control statements	Weekly control statements	Monthly control reports	Quarterly control reports
9. Forecasting	Emphasis on accurate forecast	Focus on past trend	Rough estimate
10. Level of management	Senior management	Middle management	Stores supervisor
11. Lead time	Maximum efforts to reduce lead time	Moderate efforts	Minimum clerical efforts
12. Value % and item percentage (Approximation)	80% of the value in 20% of the items	15% of the value in 30% of the items	5% of the value in 50% of the items

ADVANTAGES OF "ABC ANALYSIS"

The benefits derived from this analysis and its subsequent follow up are summarized below:

- Facilities selective control and thereby save valuable time of busy executives.
- Eliminates lot of unnecessary paper work involved in various other control procedures. Tangible savings can be effected in this behalf by following Two-Bin System which is very closely related with this technique.
- Facilitates Inventory Control and control over usage of stores materials which ultimately results in cost control.

LIMITATIONS OF ABC ANALYSIS

Although ABC analysis is a fundamental tool for exercising selective control over numerous inventory items, it does not, in its present form, permit precise consideration of all relevant problems of inventory management. For instance, a never-ending problem in inventory management is that of adequately handling thousands of low-value `C' items. Low-value purchases frequently require more items and thereby reduce the time allowance available to purchasing personnel for value analysis, vendor investigation, and other `B' items.

Besides, if ABC analysis is not periodically reviewed and updated, the very approach of control may be defeated. For example, `C' items like diesel oil in a firm, will become most high-value items during power crisis should, therefore, deserve more attention, but this point may be overlooked if classification of items is not reviewed and updated.

The following steps are involved in implementing the ABC analysis:

1. Classify the items of inventories, determining the expected use in units and price per unit for each item.
2. Determine the total value of each item by multiplying the expected units by its unit price.
3. Rank the items in accordance with the total value, giving first rank to the item with highest total value and so on.
4. Compute the ratios (percentage) of number of units of each item to total units of all items and the ratio of total value of each item total value of all items.

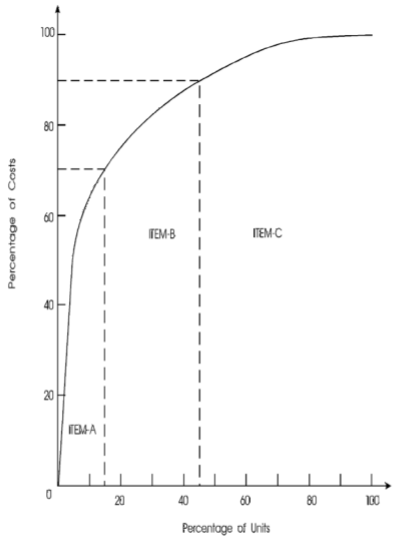
Combine items on the basis of their relative value to form three categories—A, B and C.

The data in the table below illustrates the ABC analysis.

TABLE: ABC ANALYSIS

Item	Units	% of total		Cumulative	Unit price	Total cost	% of total		Cumulative
1	10,000	10			30.4	304,000	38.00		
			15	15				70	70
2	5,000	5			51.20	256,000	32.00		
3	16,000	16			5.50	88,000	11.00		
			30	45				20	90
4	14,000	14			5.14	72,000	9.00		
5	30,000	30			1.70	51,000	6.38		
			55	100				10	100
6	15,000	15			1.50	22,500	2.81		
7	10,000	10			0.65	6,500	0.81		
TOTAL	100,000					800,000			

The tabular and graphic representation indicates that “Item A” forms a minimum proportion, 15 per cent of total units of all items, but represents the higher value, 70 per cent. On the other hand, “Item C” represents 55 per cent of the total units and only 10 per cent of the total value. “Item B” occupies the middle place. Items A and B jointly represent 45 per cent of the total units and 90 per cent of the investment. More than half of the total units are item C, representing merely 10 per cent of the investment. Thus, a tighter control should be exercised on “Item A” in order to maximize profitability on its investment. In case of “Item C” simple controls will be sufficient.



6.5.5 Just-in Time (JIT) Inventory management

JIT is a system whose objective is to produce or to purchase products or components as they are required by customers or for use rather than for stock.

A JIT system is a pull system which responds to demand as opposed to a push system in which stocks acts as ***confi rm this* between the different element of the system such as purchasing, production and sales

JIT production

Is a production system, which is driven by demand for the fi nished products whereby each component on the production line is produced only when needed for the next stage.

JIT purchasing

On the other hand is a purchasing system in which material purchased are contracted so as that the receipt and usage of materials to the maximum extent possible, coincide.

JIT concept can be traced back to the Japanese company whose success in the international market generates interest among many western companies as t6o how this success was achieved.

The implementation of JIT production methods was considered to be pursuit of excellence in all phase of manufacturing systems design and operations.

The JIT are to produce the required items at the required quality and in the required quantities, at the precise time that they are required.

JIT seeks to achieve the following goals

(1) Elimination of non-value adding activities.
(2) Zero inventory.
(3) Zero defects.
(4) Batch size of one.
(5) Zero break-downs.
(6) 100% on time delivery services.

The above goals represent perfection and are most unlikely to be archived in practice. They do however offer targets and create a climate for continuous improvement and excellence.

Major features of JIT

(1) Elimination of non-value added activity

JIT manufacturing can be described as a philosophy of management, dedicate to the elimination of waste. Waste is defi ned as anything that does not add value to a product.

The cycle time involved in manufacturing and selling a product consist of

- Process time-add values
- Inspection time
- More time
- Queue time
- Storage time

Of these 5 steps only process time actually adds value to the products. All the other activities add cost and No value to the production and therefore are deemed as non-value within the JIT philosophy.

Usually in many companies, process time is less than 10% of total manufacturing, lead and cycle time. Therefore 90% of the manufacturing lead time disassociated with the product, adds cost but no-value to the product by adapting a JIT philosophy and forecasting, on reducing lead time, it is claimed that total cost can be signifi cantly reduced.

The ultimate products with lead-time = processing time, and eliminating all non-value adding activities.

(2) Factory Layout

The fi rst stage of implementing the JIT manufacturing techniques is to rearrange the factory fl oor away from the batch production functional layout towards a production layout using low lines with a functional plant layout production through a No. of special departments that normally contain a group of similar machines.

Products are processed in stage batches so as to minimize the set times when machine settings are changed between processing batches of different products. Batches move via different and complex routes through the various departments, traveling over much of the factory fl oor before they are complete.

Each process normally involves a considerable amount of waiting time and which much time is taken transporting items from one process to another.

A further problem is that it is not easy at any point in time to determine what progress has been made on individual batches and therefore detailed cost accumulation records are necessary to track work in progress. This results in long manufacturing cycles and high work in progress levels.

The JIT solution is to reorganize the production process by dividing the many different products that an organization makes into families of similar products or component. All the products is a in a particular group will have similar production requirement and routing. Production is necessary so that each production family is manufactured in a well-defi ned production cell based on fl ow line principles. In a production how lines specialist department containing similar markets no longer exist. Instead groups of dissimilar markets are organized into products or component family fl ow lines that function like an assembly line.

For each production lines the market are placed close together in the order in which they are required by the group of products to be processed. Items in each product family can now move one at time from process to process more easily, thereby reducing wastage, and lead time.

The aim is to produce products or component from start to fi nish without returning to the stock room or stores.

(3) Batch size of one

Set up time is the amount of time required to adjust equipment and to retool for a different product. Long set ups a change over time make the production of batches with a small no. of units uneconomical.

However, the creation of large batches leads to substantial lead time delays and the creation of high inventory levels. The JIT philosophy is to reduce and eventually eliminate set-up times.

E.g., by investing in advanced manufacturing technology some machines setting can be adjusted automatically instead of manually.

Alternatively some set up times can be eliminated entirely by reducing products, so that markets do not have to be reset each time a different product has to be made.

If the set up times are approaching zero, then there's no advantage production in batches and therefore the optimal batch size can be one. With a batch size of one, the work can fl ow smoothly to the next stage without the need for and to schedule the next machine to accept this item.

JIT purchasing arrangements

JIT philosophy also extends to adapting JIT purchasing techniques whereby delivery of material immediately precedes their use. By arranging with suppliers for more frequent deliveries stocks can be out to a **minimum.**

Considerable savings in material handling expenses can be obtained by requiring suppliers to inspect materials before their delivery and guarantee their quality.

These improved services is obtained by giving more business to fewer suppliers and **placing long tern purchasing orders,** therefore the suppliers has an assurance of long term sales and can plan to meet this demand.

Companies that have implemented JIT purchasing techniques have claimed to substantially reduce **their investment in raw materials and work in progress stocks.**

Other advantages include

1. Substantial savings in factory space.

2. Large quantity discount.

3. Savings in time from negotiating with fewer suppliers

4. Reduction in paper work arising from issuing (long term orders) to a few suppliers rather than individual purchase order to many suppliers.

JIT and Management Accounting

Management accountants in many organisations have been criticized because of their failure to change their managing accounting system to reflect the mode from a traditional manufacturing to a JIT manufacturing system.

Conventional management accounting systems can encourage behaviour that is inconsistent with JIT philosophy, management, accounting must support JIT manufacturing by monitoring, identifying, and communicating to decision makers any delays errors and waste in the system.

Modern management accounting systems are now placing greater emphasis on providing information on suppliers reliabilibility set up times cycle times, percentage of deliveries that are on time and defect rates

All these measures are critical in supporting JIT manufacturing philosophy.

6.6 FINANCIAL MANAGER'S ROLE IN INVENTORY MANAGEMENT

The techniques of inventory management, discussed above are very useful in determining the optimum level of inventory and finding answers to the problems of the economic order quantity, the re-order point and the safety stock. The techniques are very essential to economize the use of resources by minimizing the total inventory cost. Although out treatment of inventory management has been simple, it indicates the broad framework of managing inventories. Many sophisticated techniques have been evolved to handle inventory management problems more efficiently and effectively and the improvements are still continuing. For the majority of the companies, inventory represents a substantial investment. Thus, the goal of the wealth maximization is related to the efficiency with which inventory is managed. Consequently, the financial manager has an important role to play in the management of inventory, although it is not his operating responsibility to control inventory. The financial manager should see that only an optimum amount is invested in inventory. He should be familiar with the inventory control techniques and ensure that inventory is managed well. He should introduce the policies which reduce the lead time, regulate usage and thus, minimise safety stock. The net effect would be to reduce inventory investment and increase the firm's prospects of making more profits.

CHAPTER SUMMARY

According to International Accounting Standards (IAS 2), **inventory** is described as assets:

- Held for sale in the ordinary course of business
- In the process of production for such a sale
- In the form of materials or supplies to be consumed in the production process or in the rendering of services.

Raw material: materials, components, fuels etc used in the manufacture of the product.

Work in progress (WIP)*:* partly finished (semi-processed) goods that are waiting further processing.

Finished goods: these are the completed products ready for sale or distribution.

The **relevant costs** to be considered when determining the optimal stock levels consist of **holding costs** and **ordering costs**.

Stock-out costs: These are the opportunity costs of running out of stock.

Minimum level is a warning level to draw management attention to the fact that stocks are approaching a dangerously low level and that a stock out is possible.

Maximum level is a warning signal for management to show them that stocks are reaching a potentially wasteful level.

Deterministic Models: whereby all parameters are known with certainty, e.g. lead-time, annual demand, etc.

Stochastic Models: in which parameters (particularly demand and lead time) are not known with certainty, but follow known probability distributions (i.e. risks)

Economic Order Quantity (EOQ) is the order size for materials that will result in a minimization of the costs of ordering inventory and carrying inventory.

Lead time is the interval between the time that an order is placed and the time that the order is finally received from the supplier

Reorder point is the point in time when an order must be placed to replenish depleted stocks; it is determined by multiplying the lead time by the average daily or weekly usage

A **JIT system** is a pull system which responds to demand as opposed to a push system in which stocks acts as buyers* between the different element of the system such as purchasing, production and sales.

CHAPTER QUIZ

1. What motives do firms have in holding stock?
2. What are holding costs?
3. What are ordering costs?
4. What are stock-out costs?
5. State three characteristics of the re-order level system.
6. What are the assumptions of the economic order quantity model?

ANSWERS TO QUIZ QUESTIONS

1. Motives for holding stocks:

i. Transaction motives: this is where a firm would be holding stocks to ensure that sufficient goods are available to meet anticipated demand.
ii. A firm may hold additional stocks to cover the possibility that it may have underestimated its future production and sales requirements or supply of raw material may have been unreliable because of uncertain events affecting the supply of materials.
iii. It may provide a buffer between production processes. This is applicable to work in progress stocks which effectively decouple operations.
iv. Holding stocks especially in bulk would help the firm qualify for quantity discounts.
v. The form may have precautionary motives when they foresee a shortage in the future.
vi. Holding stocks will enable the production process to flow smoothly and efficiently.
vii. Holding stocks may be a necessary part of the production process e.g. maturing of whiskey.
viii. Holding of stocks may also be dependent, to an extent, on expected price movements e.g. if future prices are expected to go up, a firm may decide to buy more stocks to take advantage of the lower prices now.

2. Holding costs are also known as carrying costs and includes the following:

a) Storage and store operations-rent, lighting, heating, refrigeration etc
b) Store employee wages , maintenance and running costs
c) Handling costs
d) Incremental insurance costs
e) Deterioration costs- disposal costs of obsolete stock
f) Opportunity cost of investment in stocks. Holding stock involves tying up ofcapital on which interest must be paid.
g) Pilferage

3. Ordering costs: If stock levels are kept too low, small quantities of stock will have to be ordered more frequently, thereby increasing the following ordering and procurement costs;

a) Clerical and administrative costs associated with purchasing, accounting for and receiving goods e.g. making the purchasing requisitions, issuing purchase orders, follow up action, inspection for quality of goods, placing goods in the store etc.
b) Transport costs
Production runs costs. This is for inventory that is produced internally rather than purchased from external sources.

4. Stock out costs are costs associated with running out of stock. They are caused by:

i. Last contribution form lost sales
ii. Loss of future sales due to disgruntled customers who will take their businesses elsewhere
iii. Loss of customer goodwill
iv. Cost of production stoppages

v. Labor frustrations over stoppages
vi. Extra costs associated with urgent often small quantity replenishment orders.

5. The characteristics of the re-order level system are:

- Each item has a predetermined re-order level.
- A replenishment order is issued when stock levels fall to this re-order level.
- The replenishment quantity could also be called EOQ –*Economic Order Quantity*

6. Assumptions of economic order quantity model are:

- The stock holding costs are known with certainty.
- The ordering costs are known and constant
- The demand is known, is continuous and constant over time.
- There's a constant price per unit
- The suppliers lead time is zero i.e. stock are delivered immediately on the day the order is made.
- Stock outs are not allowed.

PAST PAPER ANALYSIS

The EOQ model was tested in the following examinations:

12/'07

06/'07

06/'05

12/'01

12/'00

07/'00

Just-in-time system was tested in 12/'02.

EXAM QUESTIONS

QUESTION ONE

Explain the advantages and disadvantages of the Just-in-time inventory system. (6mks)

A company has determined that the EOQ for its only raw material is 2000 units every 30 days. The company knows with certainty that a four day lead time is required for ordering. The following is the probability distribution of estimated usage of the raw material for the month of December 2002.

Usage (units)	Probability
1800	0.06
1900	0.14
2000	0.30
2100	0.16
2200	0.13
2300	0.10
2400	0.07
2500	0.04

The stock-outs will cost the company sh100 per unit and the average monthly holding cost will be sh10 per unit.

Required:

Determine the optimal safety stock (12 marks)

Compute the probability of being out of stock (2 marks)

(20 marks)

QUESTION TWO

Muthothi Ltd. operates a conventional stock control system based on re-order levels and Economic Order Quantities (EOQ). The various control levels were set originally based on estimates which did not allow for any uncertainty and this has caused difficulties because, in practice, lead times, demands and other factors to vary.

As part of a review of the system, typical stock item, part no. X 206, has been studied in detail as follows:

Data for Part No.X 206			
Lead times	**Probability**	**Demand**	**Probability**
(Days)		**(units)**	
15	0.2	5000	0.4
20	0.5	7000	0.6
25	0.3		

The company works for 360 days per year and it costs Sh.1,000 to place an order. The holding cost is estimated at Sh.0.025 for storage plus 10% opportunity cost of capital. Each unit is purchased at Sh.2. The re-order level for this part is currently 150,000 units and it can be assumed that the demands would apply for the whole of the appropriate lead-time.

Required:

a) Calculate the level of buffer stock implicit in a re-order level of 150,000 units.(5 marks)
b) Calculate the probability of stock-outs. (2 marks)
c) Calculate the expected annual stock-outs in units. (4 marks)

d) Compute the stock-out costs per unit at which it would be worthwhile raising the re-order level to 175,000 units. (3 marks)
e) Discuss the possible alternatives to a re-order level EOQ inventory system and their advantages and disadvantages. (6 marks)

(Total: 20 marks)
CPA JUNE 2000

QUESTION THREE

a) Explain the advantages and disadvantages of the Just-In-Tie (JIT) inventory system. (6 marks)
b) A company has determined that the EOQ for its only raw material is 2000 units every 30 days. The company knows with certainty that a four-day lead time is required for ordering. The following is the probability distribution of estimated usage of the raw material for the month of December 2002.

Usage (units)	**Probability**
1800	0.06
1900	0.14
2000	0.30
2100	0.16
2200	0.13
2300	0.10
2400	0.07
2500	0.04

Stock-outs will cost the company Sh.100 per unit and the average monthly holding cost will be Sh.10 per unit

Required

i. Determine the optimal safety stock (12 marks)
ii. Compute the probability of being out of stock. (2 marks)

(Total: 20 marks)
(CPA DEC 2002)

CASE STUDY

Management Case Analysis: Zhou Bicycle Company EOQ model, reorder point

Questions/Computations that need to be answered/solved from attached sheet (noted specifically in read):

Need to show computations that lead to the recommendations made for each question listed below, based on the case study. Also need to see a simple EOQ model with computations of reorder point, safety stock and total annual inventory cost from the case study.

Zhou Bicycle Case Study

Zhou Bicycle Company, located in Seattle, is a wholesale distributor of bicycles and bicycle parts. Formed in 1991 by University of Washington Professor Yong-Pia Zhou, the firm's primary retail outlets are located within a 400-mile radius of the distribution center. These retail outlets receive the order from ZBC with 2 days after notifying the distribution center, provided that the stock is available. However, if an order is not fulfilled by the company, no backorder is placed; the retailers arrange to get their shipment from other distributors, and ZBC loses that amount of business.

The company distributes a wide variety of bicycle. The most popular model, and the major source of revenue to the company, is the AirWing. ZBC receives all the models from a single manufacturer in China, and shipment takes as long as 4 weeks from the times an order is place. With the cost of communication, paperwork, and customs clearance included, ABC estimates that each time an order is placed it incurs a cost of $65. The purchase price paid by ZBC, per bicycle, is roughly 60% of the suggested retail price for all the styles available, and the inventory carrying cost is 1% per month (12% per year) of the purchase price paid by ZBC. The retail price (paid by the customers) for the AirWing is $170 per bicycle.

ZBC is in interested in making as inventory plan for 2006. The firm wants to maintain a 9.5% service level with is customers to minimize the losses on the lost orders. The data collected for the past 2 years are summarized in the following table. A forecast for AirWing model sales in 2006 has been developed and will be used to make an inventory plan for ZBC.

Source: www.google.co.ke- case studies on EOQ model

CHAPTER SEVEN

STUDY TEX

PERFORMANCE EVALUATION DECISIONS

CHAPTER SEVEN

PERFORMANCE EVALUATION DECISIONS

▶ CHAPTER OBJECTIVES

At the end of this chapter the student will be able to assess the divisional performance of a decentralized enterprise.

▶ INTRODUCTION

Performance measurement is the attempt in business to be able to quantify what management has been doing during a certain period. The principle behind it is that of giving management the authority to make certain decisions in their areas of responsibility and later on make then accountable for them. In the end what a superior wants is a performance report from a manager concerning his division. The report would contain what he has been doing and whether targets set have been attained or not. This chapter will look at what sort of measures there are in performance both financial and non-financial; in private business and in not for profit organizations.

▶ DEFINITION OF KEY TERMS

Performance measurement is the attempt in business to be able to quantify what management has been doing during a certain period.

Responsibility accounting is a system of accounting based upon the identification of individual parts of a business which are the responsibility of a single manager.

Responsibility center is an individual part of a business headed by a manager having responsibility for its performance.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on Residual income.

Students should therefore understand this topic.

▶ INDUSTRY CONTEXT

Decentralized companies use performance measures to measure their performance.

The main measures that are used are:

- Return on Investment
- Residual income
- Discounted cash flow methods such as the NPV method
- Bench marking
- Balanced score card

7.1 OBJECTIVES OF PERFORMANCE EVALUATION

The question is what a company stands to gain form having performance evaluations.

i.Goal congruence

The performance criteria should assist managers in divisions to be able to direct their performance towards the achievement of the overall objectives of the firm. Proper coordination should prevent sub optimality and goal congruence would be achieved to a degree

ii. Through performance evaluations, the top management would be able to get feedback on how the divisional management is doing and how the unit he is heading is working. This will assist in judging its economic worth.

iii. Motivation

The performance appraisal system should be flexible enough to prevent stifling of initiative. The criteria chosen should be agreeable to all parties involved. In addition to that, the flexibility should accord to the divisional manager some sense of autonomy in making some decisions on her/his own.

iv. The should provide long run views rather than myopic tendencies in measurement

The performance appraisal system should encourage decision making that has the spirit of achieving long run objectives. Over-reliance on short term objectives (as will be seen) will have adverse effects on the company in the long run.

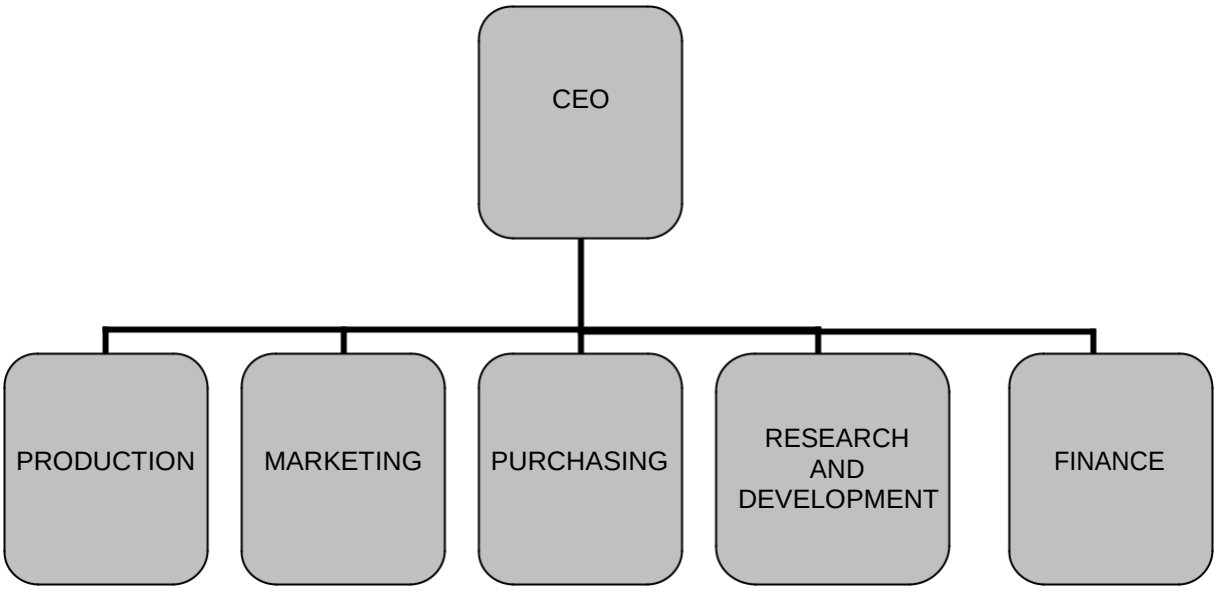
7.1.1 Decentralization and structure

As the organization grows in size, successful management of it by a small group of people becomes more difficult. In such circumstances, authority for certain types of decision making is *delegated* to subordinate managers.

There are two ways in which an organization could be structured:

- Functional
- Divisional

• Functional

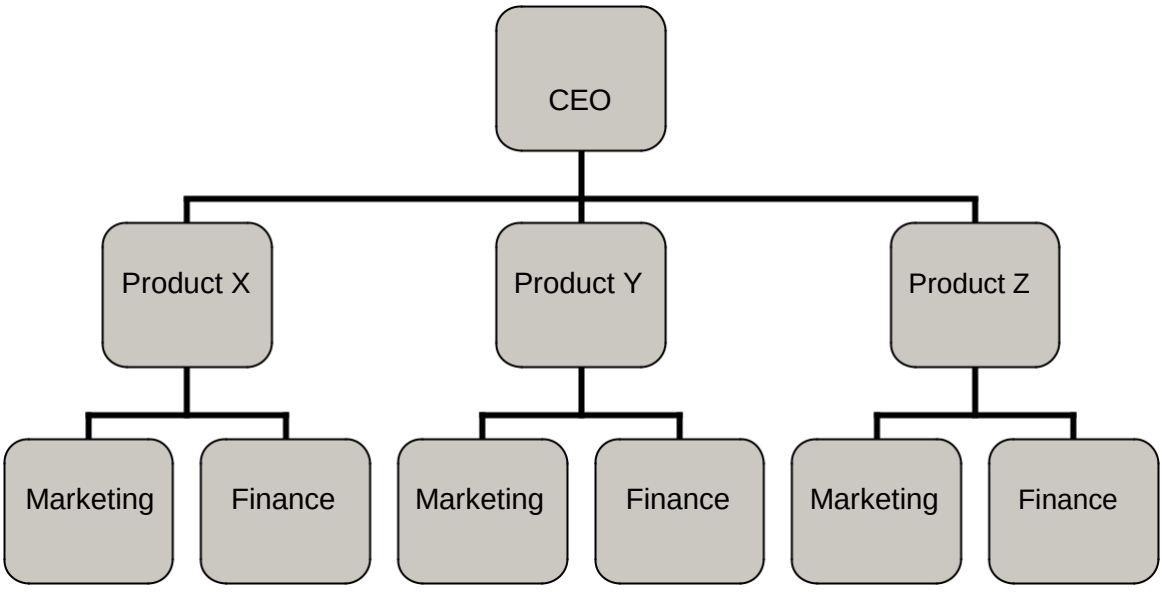


Here, the organization is split into departments based on their function. Each function is responsible for only one section of the process of coming up with the final product.

The departments such as production and purchasing will be termed only as *cost centers* while marketing will be called a *revenue center.* The only function that is responsible for the overall costs and revenues will be high up to the CEO.

• Divisional structure

In this structure, the division manager will be accorded with some level of autonomy to make **almost** all types of decision pertaining to the division. The departments have control of almost all their costs and revenues and would also be concerned with some investments on their own.



One major difference between divisional and functional is that the functional activities will now be in each of the divisions and not organization-wide.

Advantages of decentralization

i. It frees top management form day to day decision making enabling them to concentrate on strategic planning, policy formulation and providing overall direction for the company.
ii. The divisional manager will have experience of the local environment. Decentralization will improve decision making as local mangers will make decisions best suited to what is currently going on in the environment.
iii. Decision making will be made faster. To respond quickly and adequately to environment changes, a decentralized structure is preferred since referral to the central management will only take longer.
iv. It provides motivation to managers due to their increased status within the company and more control over the factors that determine good performance.

Disadvantages of decentralization

i. Managers in division might make suboptimal decisions that are only for the benefi t of their individual divisions and for not the overall good.
ii. With a number of departments there's the likelihood of duplicating services within the organization e.g. IT. Some of these services could be put in one department and act as organization-wide support function. Duplication means higher costs.
iii. To have a well functioning decentralized organization a lot of investment will have to go into sophisticated Information System.
iv. There may be friction between departments especially if the performance of one department depends on that of another.

Decentralizing the organization into autonomous divisions will place some sense of responsibility on the manager in charge. He will be held accountable for all decisions he has made concerning his unit. This leads us to what is called in management as *Responsibility accounting*

Responsibility accounting

It is a system of accounting based upon the identification of individual parts of a business which are the responsibility of a single manager. Its concept is that the accounting system should report results and performance in a manner that allows the achievement of individual divisions and their managers to be monitored. It is able to trace costs to the individual manager who was primarily responsible for making the decisions about the costs in question.

Responsibility center

It is an individual part of a business headed by a manager having responsibility for its performance. Examples of responsibility centers include:

i. Cost center

It is described as a responsibility center in a functional organizational structure where a manager is responsible for **costs** and not revenues nor profits. They include the purchasing department and production department.

ii. Revenue center

It is a responsibility center where the manager is held accountable for output of the center as measured in monetary terms i.e. revenues. He is not responsible for any costs. A sales department is a good example.

iii. Profit center **center"**

Revenue is a monetary measure of outputs whereas costs are measures of inputs. Profit therefore is the difference between revenue and costs. If performance is measured in terms of the difference between revenues and costs, the responsibility center is a profit center. Decisions made in a profit center will directly affect the numbers on the profit and loss which is therefore the basic management control document.

iv. Investment center center"

It is a form of profit center for which the manager is responsible for profit in relation to the capital invested in the division. Managers will be evaluated on their ability to generate a sufficiently high **return on investment – ROI.**

So far we have mentioned that performance measurement is a very important aspect in business. Therefore what areas of business require performance measurement?

The different areas that make up an organization are involved in some activity towards the achievement of the firms overall objectives. Therefore it is up to the central management to analyze the performance reports of the various areas to see if they are on track.

The different areas include:

a. Sales and marketing
This department will be involved in determining the demand trends through market research. There should be controls to ensure that they select an unbiased sample. They are also involved in setting up advertising campaigns.

b. Credit control
This will be involved in functions such as determining if the customers are taking long to pay back or determining if they are risky in terms of their credit worthiness.

c. Production department
This department strives to ensure that they fulfill their orders in time. They also have inspection to ensure that the quality of the product is maintained. They also determine how the maintenance of the machinery is to be conducted.

d. Personnel
This department will be involved in negotiating wages. Controls should be in place to ensure that the firm complies with legislation e.g. health and safety equality. They are also involved in the company's manpower plan such as in advertising vacancies.

e. Accounting department
This department is in charge of presenting financial information both for internal and external use. They should comply with the accounting policies in place.

7.1.2 Types of performance measures

Seeing how many different areas require measurement in an organization, the next question is how a division's performance should be judged; on absolute values such as profits or on relative values that are generally some form of **return on investment or capital employed.**

i. Absolute values (profits)

Let's have a diagram that will give us a summary

Divisional Revenue

Less Divisional variable costs

Divisional contribution

Less Controllable division fixed overheads

Less Depreciation on assets controlled by division

Controllable profit

(Profit center center")	(Investment center center")
Controllable profit	**Controllable profit**
Less Non-controllable divisional fixed overheads	*less* imputed interest on controllable investment
Less Depreciation assets not controlled by division	
Divisional profit	**Controllable residual profit**
	Less non-controllable divisional overheads
	Less depreciation on non-controlled divisional assets
	Less imputed interest on non-controlled investment
Less Apportioned central costs	*Less* Apportioned central costs
Net profit	**Net residual profit**
Less taxation	*Less* taxation
Net profit after tax	**Net residual value after tax**

N.B

- The divisional profit measure only includes revenues and costs that are the responsibility of that division's manager. They include sales, cost, material, labor and other expenses
- If overheads are controllable, they should be included in that analysis.
- Since depreciation is part of the overall investment of the company, it is slightly uncontrollable. But if the division can be an investment center and has control over purchasing the equipment, then depreciation can b included in the analysis.
- Centrally apportioned overheads are uncontrollable and are thus excluded.

>>> Let us have an illustration.

ABC ltd has produced that following data relating to division A.

Sales	475000
Marginal costs-Material	80000
Labor	47500
Overheads	21250
Fixed overheads	
- controllable by division	39000
- controllable be central mgt	20500
Divisional mgt cost	
Fixed asset purchases	
- divisional	225000
- central	125000
Total central administration and mgt costs	342105

(This is apportioned on the basis of sales revenue which was $2.6 million for the group as a whole)

The WACC was 15% whereas depreciation is charged at 25% on straight line basis.

Solution:

	$
Divisional revenue	**475000**
***Less* marginal cost**	**148750**
Divisional contribution	326250
***Less* controllable fixed overheads**	**39000**
***Less* controllable depreciation**	**56250**
Controllable profit	231000

a) Profit center center"

Controllable profit	**231000**
***Less* non-controllable fixed overheads**	**20500**
***less* non-controllable depreciation**	**31250**
Divisional profit	**179250**
***Less* apportioned central charges**	**62500**
Net profit before tax	**116750**

b) Investment center center"

Controllable profit	**231000**
***Less* imputed interest on controllable investment- 15%**	**33750**
Controllable residual profit	**197250**
***Less* non-controllable overheads**	**20500**
***Less* non-controllable depreciation**	**31250**
***Less* non-controllable imputed Interest- 15%**	**18750**
***Less* apportioned central charges**	**62500**
Net residual profit before tax	**64250**

Apportioned central charges

342105 * 475000 = 62500

2.6 million

Instead of focusing purely on the absolute size of the profits made by a division, a relative form called **return on investment or return on capital employed** could be applied. The two, ROI and ROCE could be used interchangeably although scholars would argue that the former is more suitable for specific projects and the latter can be used to evaluate the whole organization.

Other methods of appraisal include:

- Variance analysis- only controllable variances
- Ratio analysis – profitability, performance and liquidity ratios
- Other specific management ratios – contribution per limiting factor, sales per employee, transport costs per kilometer
- Other information such as staff turnover and market share

N.B Managers that are doing the evaluations are encouraged not to look at just one measure of performance but should try and look at a range of measures so that performance in its widest sense is assessed.

7.1.3 Performance reports

They should have the following characteristics.

i. Timeliness
They should be quickly produced to allow for quick corrective action to be taken.. However, the balance between speed and accuracy must be maintained.

ii. Goal congruence
Measures should be there to ensure goal congruence to prevent suboptimal decision making.

iii. Controllability
The most common measure of performance is profit. But which profits? As discussed earlier, several factors have to be considered.

- The definition of controllable costs
- Are we evaluating the division's performance or the managers?
- Short term Vs long term? - Some costs can only be controlled in the long term.
- Absorption Vs marginal profit?

Usually the marginal profit is preferred to absorption since most fixed costs are not controllable by a division's manager. However if fixed costs are controllable, absorption method can be used. On one hand it may be demotivating on the other it might force the central management to question the wisdom of using certain central services whose costs are apportioned out to customers.

- Interdependence
  As divisionalization tries to instill autonomy where an action of one division does not affect another's, it seems this doesn't happen in reality. Care must be taken to determine the true cause of any adverse performance by a division before jumping straight to conclusions

7.2 ROCE: RETURN ON CAPITAL EMPLOYED

It is the most commonly used appraisal measure. It is preferred partly because of its simplicity form a single percentage value that is calculated from readily available accounting information. It differs from other methods of evaluation in that **profits** rather than **cash flows** are used in the calculation.

It is more superior to methods that use absolute figures. Take for instance. Say we have division A that earns $1 million and B earns $2 million. Can we automatically say that B is more profitable than A? The answer is NO., since we must consider whether the divisions are making a high return on the assets invested in them. Say A has $2 million invested in assets and B has $8 million, does that perception change?

ROCE can be defined in various ways but commonly it is calculated as follows.

$$\text{ROCE} = \frac{\text{Profit}}{\text{Investment}} * 100$$

>>> Thus from our simple illustration:

	A	B
ROCE	$1 million	$2 million
	$2 million	$8 million
	50%	25%

Division A that has been thought to be less profitable in absolute terms is now considered to be more profitable since it gives a much higher ROCE.

ROCE can further be disaggregated as follows

$$\text{ROCE} = \frac{\text{Sales}}{\text{Investment}} * \frac{\text{Profit}}{\text{Sales}} * 100\%$$

I.e. ROCE = Asset turnover * Net profit percentage

During the assessment of a **manager,** the profits should be *controllable profits* and capital employed should be *controllable investment*. During the assessment of a **division,** non-controllable assets and costs could be included excluding interest costs.

What about the investment base? The term capital employed is really a wide term. Just what should it constitute?

i. Gross book value

With this base, it may be difficult to compare divisions' performances and may lead to suboptimal decisions. For example, when a new asset replaces an old one, the gross value will increase by the difference between their costs. The relevant capital cost for investment appraisal purposes is the new asset's cost less the scrap value of the old asset. As the scrap value is likely to be far less than the original cost of the old asset, the capital cost of the new asset will be **understated** when gross book values are used in ROCE calculations.

ii. Net book values

This is the original cost of the asset less accumulated depreciation. This is common although it has the disadvantage of it improving the ROCE as the net book value improves.

iii. Current replacement costs

In theory, the correct valuation of assets is their opportunity costs or their economic values. They are derived through the use of special indices that measure changing costs of various groups of assets. Multiplied by the historical costs, the indices give us the current replacement cost. However it is highly subjective and how are the indices gotten in the first place? If using current values for assets it also means that the profits should also be in current value.

Advantages of ROCE

a. Being a relative measure, it allows for the comparison of different divisions with different levels of profit and investment. In other words it provides a common denominator.
b. It is widely understood by users
c. Is ability to be split into further secondary ratios provides space for further analysis.
d. When funds for further investment are limited, ROI will force management to redirect their attention and focus on their current assets and work hard to try and get the best out of them.
e. By it analysis, the ROI can be improved as it highlights two major issues; **profits and investments.** it can be improved by either increasing profits or by forcing managers to identify assets e.g. obsolete ones, to be able reduce the excess capital employed.

Disadvantages

a. Making decisions based on ROI will not improve the *shareholder wealth* neither will it improve total profits.
b. Using net values as base will show that ROI will be improving as assets get older. There's no logic to explain this. A dysfunctional behavior by management of holding on to old assets and not investing in new one will ensue
c. Its disincentive to invest

Suboptimal decisions by the management will be taken. For example, if central management sees that getting new assets will improve the overall return, a divisional manager might opt not to if it reduces his division's ROI. Further, the division manager might decide to sell off assets to reduce the base even if these assets were generating reasonable profit.

Let us look at an illustration to explain this.

	Division A	Division B
Investment	$100 million	$100 million
Controllable profits	$40 million	$26 million
Return on project	40%	26%
ROI of division	45%	20%

The overall WACC of the company is 30%. Division A manager might be reluctant to invest the $100 million seeing that the return of the project of 40% is lower than the division's ROI of 45%. Division B would go ahead and invest the $100 million as the return of 26% is greater than his division's ROI of 20%.

Consequently, both managers will end up making suboptimal decisions. As a criterion, the company should only accept projects whose return is greater than the company's overall cost of capital of 30%. Division A rejects a project with a 40% return while division B accepts a project with a 26% return. The conclusion is that ROCE could lead to *goal incongruence.*

7.3 RESIDUAL INCOME- (R.I)

To overcome some disadvantages of ROI, Residual income can be applied.

>> In evaluating the performance of divisional managers:

Residual income = Controllable contribution – cost of capital charge on investment controllable by divisional manager

>> In evaluating the economic performance of the division:

Residual income = Divisional contribution – cost of capital charge in total investment in assets employed by the division

It is a measure of a center's profits after deducting a notional or imputed interest. The imputed cost of capital might be the organizations cost of borrowing or WACC. The use of RI highlights the finance charge associated with funding. The cost of capital however, can be adjusted to take into account other factors such as *risk levels.*

From our illustration on evaluation of division A and B

	Division A	Division B
Investment	$100 million	$100 million
Controllable profi ts	$40 million	$26 million
Less interest (30%)	$30 million	$30 million
Residual income	$10 million	-$4 million

Conclusion:

The results indicate that the residual income of division A would be $10 million and that of B would be -$4 million. Division A would therefore invest and B would reject the proposal. This would be in the interest of the organization as a **whole.**

Advantages of residual income

a. It is more fl exible since different costs of capital can be applied to investments with different risk characteristics.
b. It reduces the problem of under investing or failing to take up projects with ROI greater than the group's target but less than the division's. Any project that generates a positive RI contributes to measured performance.
c. As opposed to ROI, RI is more consistent with the objective of maximizing total profi tability of the group.
d. The cost if fi nancing a division is brought home to the divisional managers.

Weaknesses of residual income

a. Being an absolute fi gure, it does not facilitate comparisons between investment centers nor does it relate a center's income to the size of the investment.
b. It also suffers form the same problems associated with profi t and asset measurement i.e. it may be diffi cult to decide on an appropriate and accurate measure of capital employed upon which to base the imputed interest charge.

7.3.1 ROI Vs Residual income

Most scholars in performance management actually advocate for the use of the two techniques for evaluation. They both have limitations but can still be applied only if the user is aware of them. For justifi cation for their use, they should be applied supported by other appraisal information. But just which of the two is better?

- RI is superior in ranking projects for it encourages management to make cash outlays on assets that will give larger returns than the imputed interest.
- It also prevents suboptimal decision making of failing to invest in worthwhile assets or selling off the same just to improve their divisional ROI.

- Generally though, ROCE is still a widely used measure in practice.

ROI = Income

Invested Capital (method) of Liability analysis

ROI can provide more insight to performance when it is divided into the Dupont components. The Dupont method states that:

ROI = Capital turnover X profit margin

= Revenue X Income

Invested capital Revenue

Dupont method leads to the generalization that ROI can be increased by any action that:

- Decreases costs
- Increases revenue
- Decreases invested capital

Return on investment highlights the benefits that managers can obtain by decreasing investment in both current and fixed assets. Investment in cash, inventory, accounts receivable and fixed assets should be minimized for any level of effective performance. This requires that idle cash is invested, proper inventory levels are kept, credit is managed judiciously and fixed assets are invested in carefully.

However, return on investment may induce managers of a highly profitable division to reject projects, which from the view point of the organisation as a whole should be accepted. ROI encourages managers to make decisions which may increase short-term profit without considering their effect on the future of the company.

>>> ILLUSTRATION

Assume that a company has 3 subsidiaries A, B, and C and that the company does not allocate corporate headquarters' costs or interest on long-term debt to the subsidiaries. Summary of the results are as follows.

	£'000'	£'000'	£'000'	£'000'	£'000'
	A	B	C	H	Total
Operating y income	240	300	480		1020
Variable cost of H				80	
Fixed costs of H				120	
Interest on L.T debt				400	(600)
Income before taxation					420
Taxes					150
Income after taxation					270
Average book values					
Current assets	400	500	600	200	1700
Fixed assets	600	1500	2400	300	4800
					6500

Required:

> Compute the return on investment.

> Compute residual income assuming that the company requires a 10% interest on total assets of each subsidiary.

> Assume that there is an asset available to subsidiary A which costs £100,000 but which has an annual profit of £20,000. Advise the manager of A on whether to undertake the project and comment on whether this decision is in line with the overall objective of the organisation.

Solution

a)

	A	B	C	Total
ROI = Income	240	300	480	820
Capital	1000	2000	3000	6500
	0.24	0.15	0.16	0.126

The best performer is subsidiary A, followed by C, while B is the worst performer.

b) RI = Income – Imputed interest charge
$RI_A = 240 – (0.1 \times 1000) = 140$
$RI_B = 300 – (0.1 \times 2000) = 100$
$RI_C = 480 – (0.1 \times 3000) = 180$

Based on RI, the best performer is C, followed by A and B in that order.

c) With the new project ROI of A will be: ROI = $\frac{260}{1100}$
= 23.6%

The overall ROI will be

ROI = $\frac{860}{6600}$ = 12.7%

Based on ROI, the manager of A should not invest in project A since ROI decreases from 24% to 23.6%. However, from the overall point of view the project is viable as it increases ROI BY 0.1%

The Residual Income with the new project will be:

$RI_A = 260 – (0.1 \times 1100) = 150$

The manager of A should take project as it increases residual income from 140 to 150.

Note

The objective of maximizing residual income assumes that as long as the division earns a rate in excess of the imputed charge on the investment, then it should expand. Residual income is a short-term measure and therefore, contradicts the going concern concept of the firm.

7.4 NET PRESENT VALUE AND IRR

These have been looked at in the previous chapter in capital budgeting, but can they be used in divisional performance evaluation? **Cash flow Return on Investment (CROI)** is a business performance measure which expresses the return a business generates as the present values of its sustainable cash flow. It can either be in absolute or relative terms. Unlike ROI and RI, it is not vulnerable to manipulation and accounting policies.

Before we look at an elaborate illustration on how a division can be evaluated using ROI, RI and NPV, there's one thing we need to look at.

Notice that using RI in the long run will force management to make decisions that are consistent with those he would be making with NPV. However in the short run, the use of conventional methods of depreciation would lead to decisions inconsistent with NPV. When the cash flows are constant, the **annuity method of depreciation** will be used. The results, in the short term, would produce a *constant* RI.

Annuity method of depreciation

It is method of calculating depreciation that results in a constant RI. In addition, the total present value of RI will be equal to the NPV calculation i.e. decisions taken on the basis of short term measures will be consistent with decisions taken on the long term measures; NPV rule.

Annuity depreciation method has come to solve a major problem of ROI and RI improving; that of improving as equipment ages forcing suboptimal decision making by management. To calculate annuity depreciation, we need to determine an annual equivalent cash flow that represents that annual net cash inflow required so that, in present value terms, the investment would 'break even'.

$$\textbf{Annual equivalent cash flow} = \frac{\textbf{Investment}}{\textbf{Cumulative interest factor}}$$

Since it is the annual cash inflow that ensures that the investment breaks even, annual equivalent cash flow is the total of costs that the investment will cause i.e. interest and depreciation.

Annual equivalent cash flow = Depreciation + Interest

Annuity depreciation = annual equivalent cash flow – imputed interest on capital employed

7.5 BENCHMARKING

It is the principle behind the formal inter-firm comparison scheme. It is the establishment, through data gathering, of targets and comparators through whose use related levels of performance (and particularly areas of under performance) can be identified. By adopting the best practices it is hoped that performance will improve.

Traditional benchmarking had focused mostly on financial aspects and less on key operational matters such as productivity and quality. Comparing ourselves to **industry leaders** will assist in improving efficiency and cost reduction as we can focus on the areas that are critical to success and improve on them in an attempt to catch up.

Types of benchmarking include:

- Internal benchmarking

It compares one operating unit or function with another within the **same** industry.

- *Functional benchmarking*
  The internal functions are compared with those of the best external practitioners of those functions **regardless** of the industry they are in. it is also known as operational or generic benchmarking.
- *Competitive benchmarking*
  In which information is gathered about direct competitors through techniques such as reverse engineering
- *Strategic benchmarking*
  It's a type of competitive bench marking aimed at strategic action and organizational change.

7.5.1 Stages of benchmarking

- Step 1: Objectives are set and areas to benchmark are determined
- Step 2: Key performance measures are determined
- Step 3: Organizations to study are selected
- Step 4: Own and other's performance are measured
- Step 5: Performances are compared
- Step 6: Improvement programme is designed and implemented
- Step 7: Improvements are monitored

7.5.2 Advantages of benchmarking

Some advantages of benchmarking are:

(i) It identifies processes that need improvement.
(ii) It assists in cost reduction.
(iii) Benchmarking assesses a firm's existing position and therefore provides a basis for establishing performance standards.
(iv) Sharing of information can encourage innovation.
(v) It can be used in both private and public sectors
(vi) Encourages teamwork

7.5.3 Disadvantages of benchmarking

Some disadvantages of benchmarking are:

(i) Areas to benchmark may be difficult to select
(ii) It depends on accurate information about companies being compared. This information may not be accurate.
(iii) It implies that the best way to do business is only one. This may not be case.

7.6 TARGET COSTING

Target costing involves setting a target cost by subtracting a desired profit margin from a competitive market price.

Target cost is an estimate of a product cost which is determined by subtracting a desired profit margin from a competitive market price.

A market research is conducted to determine the perception of the customer concerning the value of the product. It involves the following stages:

i. Determine, through market research, that target price which customers will be prepared to pay for the product.
ii. Deduct a target profit margin form the target price to determine the target cost. The target profit is based in the company's ROI.
iii. Estimate the *actual* costs of the product.
iv. If estimated actual costs exceed the target cost, investigate ways of driving down that actual costs to the target cost

A major advantage of target costing is that just like lifecycle costing, it shifts management's attention to the design and developments stage. As noticed earlier, costs incurred at this stage are locked and committed and hence, except for the learning curve effect, it will be difficult to achieve cost savings after manufacture. If the target cost cannot be achieved, products should not be launched. A balance should be established between costs and quality. This is because designers might decide to remove the functional parts of a product in order to attain the target cost.

7.6.1 Target-costing principles

Target costing can best be described as a systematic process of cost management and profit planning. The six key principles of target costing are:

1. **Price-led costing.** Market prices are used to determine allowable—or target—costs. Target costs are calculated using a formula similar to the following:
   Market price – required profit margin = target cost.

2. **Focus on customers.** Customer requirements for quality, cost, and time are simultaneously incorporated in product and process decisions and guide cost analysis.
   The value (to the customer) of any features and functionality built into the product must be greater than the cost of providing those features and functionality.

3. **Focus on design.** Cost control is emphasized at the product and process design stage. Therefore, engineering changes must occur before production begins, resulting in lower costs and reduced "time-to-market" for new products.
4. **Cross-functional involvement.** Cross-functional product and process teams are

responsible for the entire product from initial concept through final production.

5. **Value-chain involvement.** All members of the value chain—e.g., suppliers, distributors, service providers, and customers—are included in the target costing process.
6. **A life-cycle orientation.** Total life-cycle costs are minimized for both the producer and the customer.

Life-cycle costs include purchase price, operating costs, maintenance, and distribution costs.

7.6.2 Implementing target costing

In 'Product Costing/pricing strategy' (ACCA Students Newsletter, August 1999), one of the examiners summarized the steps in the implementation of the target costing process as follows:

- Step 1: Determine a product specification of which an adequate sales volume is estimated.
- Step 2: Set a selling price at which the organization will be able to achieve a desired market share.
- Step 3: Estimate the required profit based on return on sales or return on investment.
- Step 4: Calculate the target cost=target selling price-target profit
- Step 5: Compile an estimated cost for the product based on the anticipated design specification and current cost levels.
- Step 6: Calculate target cost gap=estimated cost-target cost
- Step 7: Make efforts to close the gap. This is more likely to be successful if efforts are made to 'design out' costs prior to production, rather than to 'control out' costs during the production phase.
- Step 8: Negotiate with the customer before making the decision about whether to go ahead with the project.

7.6.3 Calculating target cost

Target cost is simply price less profit.

>>> Example

A car manufacturer wants to calculate a target cost for a new car. The price of this car will be set at Sh.4million. The company requires a 10% profit margin.

Required

What is the target cost?

Solution

Profit required=10% x shs.4million = Sh.400,000

Target cost=Sh(4,000,000-400,000) = Sh.3,600,000

The Target-costing process

Essentially, companies use target costing to establish concrete and highly visible cost targets for their new products. To maximize cost control and enhance profit improvement, most companies set relatively aggressive targets. The process begins when top management establishes a target cost for a new product, for example, a Chrysler Neon or a Caterpillar Excavator. A cost estimating group will then decompose the target cost for the product as a whole into cost targets for subassemblies and individual component parts—engine, transmission, seats, and so on.

Frequently a "gap" exists between the target cost and cost projections for the new product based on current designs and manufacturing capabilities. Closing the gap through cost reduction is central to the target costing process. This is accomplished through cross-functional target costing teams, which analyze the product's design, raw material requirements, and manufacturing processes to search for cost savings opportunities. The cross-functional teams employ a variety of management tools and initiatives to help them achieve their objectives.

The following section describes some of these tools and initiatives and other characteristics of successful target costing companies.

7.6.3 Target costing enablers

The best practice companies demonstrated certain commonalities in their operations and the way in which they supported the target costing process. They all had very effective organizational structures, responded to the "voice of the customer," streamlined their product development process, and actively engaged their supply chain to achieve target costing objectives. To better understand these practices, we visited the four companies that had achieved the most success in each area.

Our objective was to document "best practices" in deploying these key elements of target costing.

At each best practice company, target costing is supported by a matrix organizational structure where a vertical, functional organization combines with horizontal, cross-functional teams. For example, U.S. Operations for DaimlerChrysler has five platform teams that cover large cars, small cars, mini-vans, trucks, and jeeps. Each team is cross-functional and includes members from design engineering, manufacturing engineering, purchasing, production, and finance. The target costing system determines cost objectives and performance goals for each platform team, and meeting these goals is an important component of team members' annual performance reviews.

The target costing system at DaimlerChrysler makes use of a "toolbox" of management initiatives to improve productivity and reduce costs. The toolbox includes value engineering/value analysis, design for manufacturing assembly, paper kaizen, and lean manufacturing.

Each initiative is implemented through workshops composed of multifunctional teams. The teams vary from fi ve to 30 individuals and meet anywhere from one to fi ve days. The workshops are “working” sessions where participants brainstorm, troubleshoot, and generally try to solve problems and improve operations.

- **Value Engineering/Analysis** is used to increase the value of DaimlerChrysler’s products to consumers through improved designs. Changing a part’s design can be quite expensive because it generally requires new tooling. Therefore, the benefi ts of the new design to the consumer must more than offset the cost of the new tooling.
- **Design for Manufacturing Assembly (DFMA)** occurs throughout product design but before the fi rst pilot vehicle is built. Essentially, DFMA evaluates the effectiveness of the design with regard to assembly operations.
  One benchmark is to minimize the number of vehicle components and to simplify the assembly processes. The result is fewer assembly errors and improved reliability and serviceability of the vehicles.
- **Paper Kaizen** is the term used to promote the concept of continuous improvement. It is most effective immediately after a new part is designed but before the manufacturing process begins. During this stage in a product’s life cycle, workstation setups, assembly steps, and process fl ows are simulated and optimized on paper before expenses are incurred.
- **Lean Manufacturing** occurs after product launch and extends beyond DaimlerChrysler to include its supply chain. Benefi ts from this “hands-on” workshop include improved material fl ow and the elimination of unnecessary inventory movement, reduced setup times, and a general optimization of the workforce.

STUDY TEXT

7.7 KAIZEN

What is Kaizen?

http://www.1000advices.com/micro/ten3_micro_sets_biz_processes.html - Lean Kaizen means “improvement”. Kaizen strategy calls for never-ending efforts for improvement involving everyone in the organization – managers and workers alike.

Kaizen and Management

Management has two major components:

1. Maintenance, and
2. Improvement.

The objective of the maintenance function is to maintain current technological, managerial, and operating standards. The improvement function is aimed at improving current standards.

Under the **maintenance** function, the management must first establish policies, rules, directives and standard operating procedures (SOPs) and then work towards ensuring that everybody follows SOP. The latter is achieved through a combination of discipline and human resource development measures.

Under the **improvement** function, management works continuously towards revising the current standards, once they have been mastered, and establishing higher ones. Improvement can be broken down between innovation and Kaizen. Innovation involves a drastic improvement in the existing process and requires large investments. Kaizen signifies small improvements as a result of coordinated continuous efforts by all employees.

Kaizen philosophy and kaizen method

The Kaizen method of continuous incremental improvements is an originally Japanese management concept for incremental (gradual, continuous) change (improvement). K. is actually a way of life philosophy, assuming that every aspect of our life deserves to be constantly improved. The Kaizen philosophy lies behind many Japanese management concepts such as Total Quality Control, Quality Control circles, small group activities, labor relations. Key elements of Kaizen are quality, effort, and involvement of all employees, willingness to change, and communication.

Japanese companies distinguish between innovation (radical) and Kaizen (continuous). K. means literally: change (kai) to become good (Zen).

The foundation of the Kaizen method consists of 5 founding elements:

1. teamwork,
2. personal discipline,
3. improved morale,
4. quality circles, and
5. Suggestions for improvement.

Out of this foundation three key factors in K. arise:

- elimination of waste (muda) and inefficiency
- the Kaizen five-S framework for good housekeeping
    1. Seiri - tidiness
    2. Seiton - orderliness

3. Seiso - cleanliness

4. Seiketsu - standardized clean-up

5. Shitsuke - discipline

- Standardization.

When to apply the Kaizen philosophy? Although it is difficult to give generic advice it is clear that it fits well in incremental change situations that require long-term change and in collective cultures. More individual cultures that are more focused on short-term success are often more conducive to concepts such as Business Process Reengineering.

When Kaizen is compared to BPR is it clear the K. philosophy is more people-oriented, easier to implement, requires long-term discipline. BPR on the other hand is harder, technology-oriented, enables radical change but requires major change management skills.

Characteristics of Kaizen-Teian:

Kaizen: improvement

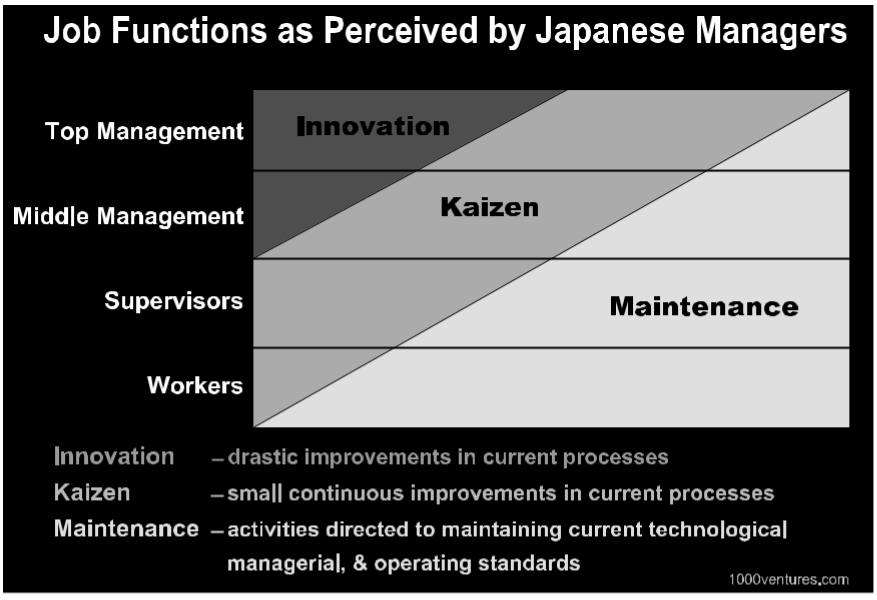
Teian: proposal

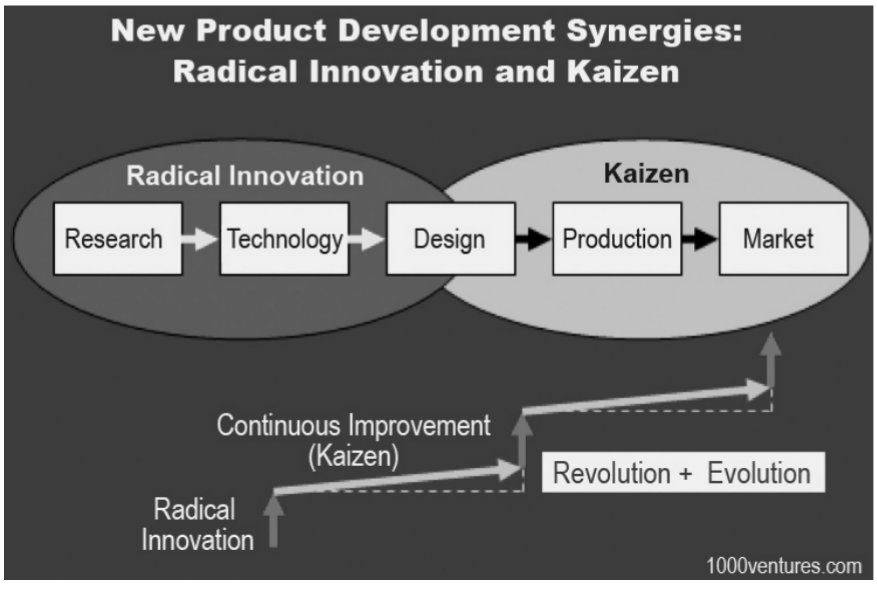
- Gradual and continuous accumulation of small improvements
- Focus on team of collaborators (vs. team of experts/consultants), engage the entire workforce
- Promote a maintained progress (vs. lack of continuity)
- Implement incremental improvements in small steps (vs. big leaps)
- Is a building block of a typical lean organization? (The other building block is identifying waste in operations.)
- Typical setting: a small team of 8-20 people from all levels and functions/departments of the organization identifying, analyzing, and implementing a project in a matter of 4-5 days.

Kaizen-Teian vs. Business Process Reengineering Kaizen-Teian	
("Improvement Proposal") Business Process Reengineering	
• Incremental, long-term improvement process driven by workforce • Empowers workers who are closer to the process and build unity in organization • Benefit from the insight of those closest to the process • Not as disruptive • Workforce may only achieve "local optimum" but not "global optimum" • Process being improved might be inherently "flawed" • Difficult to engage everyone in the organization	• Big change: enabling element to get on the next "S" curve • Lead by example: management is willing to change • See the entire system: avoid negative outcome of seemingly unrelated local improvements that are in fact related • Drastic changes are not easy • "Push" system: not necessarily customers-focused and may undermine organizational identity • May results in layoffs that might "chill" participation

Adapted from ESD.60 Systems Change Debate Results on 6/14/2004

Part I: Introduction Part II: Concepts Part III: Application Part IV: Disconnects Part V: Conclusion





Common Disconnects/Roadblocks in Kaizen Implementation

Technical Factors

- Little visible technical impediment on kaizen.
- Measurement metrics for kaizen efforts

Social Factors

- Overly formalizing the kaizen process will collapse the improvement program.
- Competition between departments on kaizen can be both positive and negative.
- Negative workers-management friction will impede the kaizen process.
- Lack of management commitment to kaizen can impede the improvement program.

STUDY TEXT

(Part I: Introduction Part II: Concepts Part III: Application Part IV: Disconnects Part V: Conclusion)

Concluding Comments

- Kaizen-Teian emphasizes “Just Do It!”
- Kaizen-Teian is a building block of a typical lean organization.
- Kaizen-Teian is a gradual and continuous accumulation of small improvements and focuses on a team of collaborators.
- Kaizen-Teian treats every variance from target as a problem to be solved and everyone in the organization as a responsible contributor.
- Standardization and measurements are the keys to successful Kaizen-Teian efforts.

7.8 BALANCED SCORECARD

Through their article “The balanced scorecard- measures that drive performance” in the Harvard Business review in 1992, Robert S. Kaplan and David P. Norton were able to prompt a minor industry of academic writing and business consulting. Their approach emphasizes on the need to provide management with a set of information that covers all relevant areas of performance in an objective way. The information could be both financial and non-financial in nature. The idea of the *balanced scorecard* is that performance could be measured form four different perspectives.

i. Customer perspective

How do customers view our business? This will be followed by measures of aspects that customers find important e.g. quality, after sales service, inspection etc

ii. Internal perspective

What skills and processes must we excel at? Improvement of internal processes and decision making procedures will have to ensue.

iii. Innovation and learning

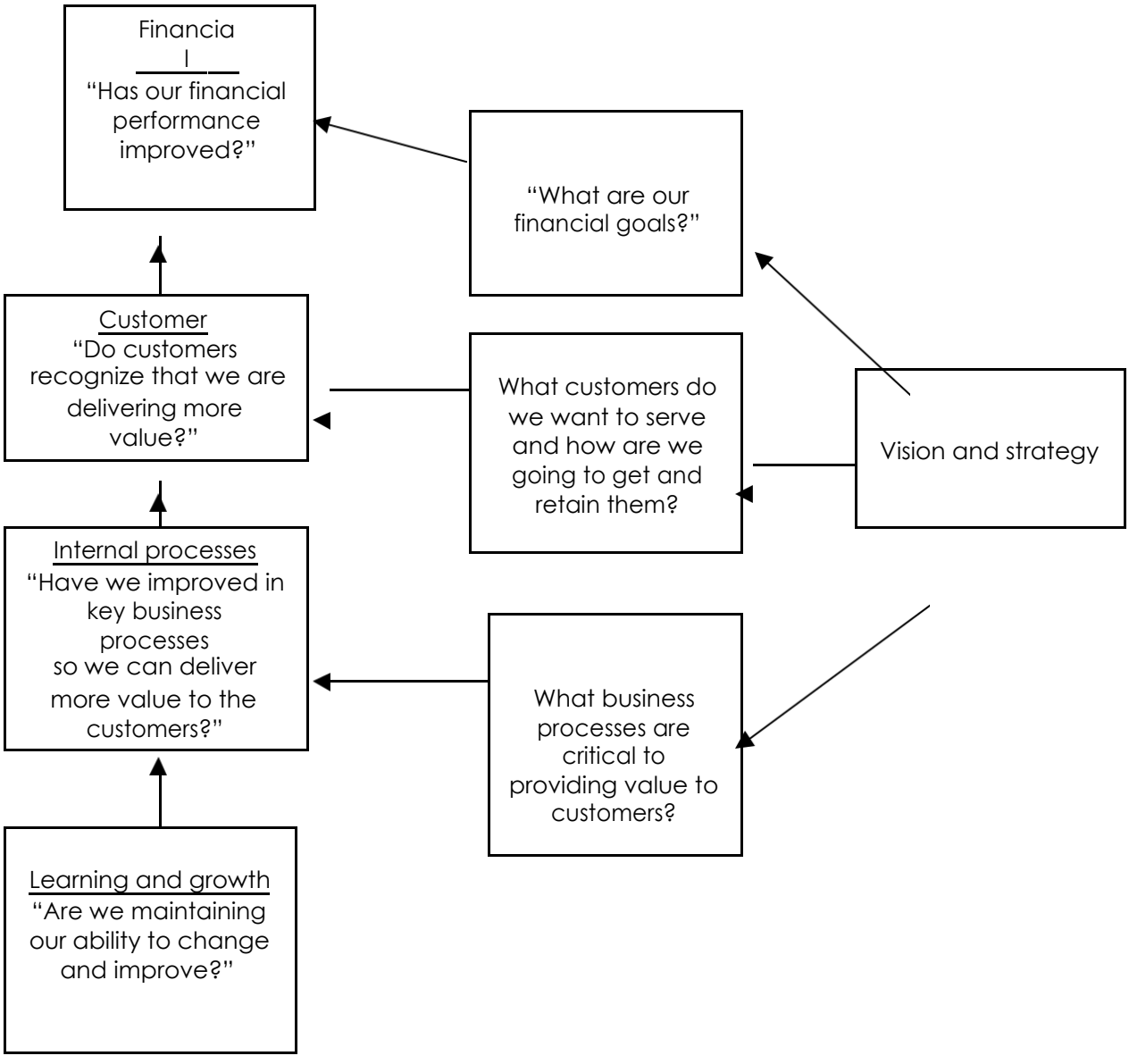
How can we improve ourselves and increase value/ this perspective looks at the ability of the firms to attain and retain its competitive position through the acquisition of new skills and development of new products.

iv. Financial perspectives

How do shareholders view our business? Traditional financial measures could be applied here include those of profitability ROI and EPS

A 'balance' has to be created to prevent managers for trying to make more improvements in one area at the expense of another.

Here's an illustration how this could be done.



Important features of this approach are as follows.

- It looks at both internal and external matters concerning the company.
  Customer and fi nancial- external
  Internal processes and learning and growth- internal
- It is related to key elements of the company's strategy.
- Financial and non-fi nancial measures are linked together

CHAPTER SUMMARY

Performance measurement is the attempt in business to be able to quantify what management has been doing during a certain period.

There are two ways in which an organization could be structured:

- Functional
- Divisional

Responsibility accounting is a system of accounting based upon the identifi cation of individual parts of a business which are the responsibility of a single manager.

Responsibility center is an individual part of a business headed by a manager having responsibility for its performance.

Cost center center" **:** It is described as a responsibility center in a functional organizational structure where a manager is responsible for **costs** and not revenues nor profi ts

Revenue center: It is a responsibility center where the manager is held accountable for output of the center as measured in monetary terms i.e. revenues. He is not responsible for any costs.

Annuity method of depreciation is a method of calculating depreciation that results in a constant RI. In addition, the total present value of RI will be equal to the NPV calculation i.e. decisions taken on the basis of short term measures will be consistent with decisions taken on the long term measures; NPV rule.

CHAPTER QUIZ

1. State four objectives of performance evaluation.
2. State three characteristics of performance reports.
3. State three advantages and three disadvantages of decentralization.

ANSWERS TO QUIZ QUESTIONS

1. Objectives of performance evaluation:

a) Goal congruence
The performance criteria should assist managers in divisions to be able to direct their performance towards the achievement of the overall objectives of the firm. Proper coordination should prevent sub optimality and goal congruence would be achieved to a degree

b) Through performance evaluations, the top management would be able to get feedback on how the divisional management is doing and how the unit he is heading is working. This will assist in judging its economic worth.

c) Motivation
The performance appraisal system should be flexible enough to prevent stifling of initiative. The criteria chosen should be agreeable to all parties involved. In addition to that, the flexibility should accord to the divisional manager some sense of autonomy in making some decisions on her/his own.

d) The should provide long run views rather than myopic tendencies in measurement
The performance appraisal system should encourage decision making that has the spirit of achieving long run objectives. Over reliance on short term objectives (as will be seen) will have adverse effects on the company in the long run.

2. Performance reports should have the following characteristics:

a) Timeliness
They should be quickly produced to allow for quick corrective action to be taken. However, the balance between speed and accuracy must be maintained.

b) Goal congruence
Measures should be there to ensure goal congruence to prevent suboptimal decision making.

c) Controllability
The most common measure of performance is profit. Several factors have to be considered:
- The definition of controllable costs
- Are we evaluating the division's performance or the managers?
- Short term Vs long term? - Some costs can only be controlled in the long term.
- Absorption Vs marginal profit?
  Usually the marginal profit is preferred to absorption since most fixed costs are not controllable by a division's manager. However if fixed costs are controllable, absorption method can be used. On one hand it may be demotivating on the other it might force the central management to question the wisdom of using certain central services whose costs are apportioned out to customers.
- Interdependence
  As divisionalization tries to instill autonomy where an action of one division does not affect another's, it seems this doesn't happen in reality. Care must be taken

to determine the true cause of any adverse performance by a division before jumping straight to conclusions

3. Advantages of decentralization

i. It frees top management form day to day decision making enabling them to concentrate on strategic planning, policy formulation and providing overall direction for the company.
ii. The divisional manager will have experience of the local environment. Decentralization will improve decision making as local mangers will make decisions best suited to what is currently going on in the environment.
iii. Decision making will be made faster. To respond quickly and adequately to environment changes, a decentralized structure is preferred since referral to the central management will only take longer.
iv. It provides motivation to managers due to their increased status within the company and more control over the factors that determine good performance.

Disadvantages of decentralization

i. Managers in division might make suboptimal decisions that are only for the benefit of their individual divisions and for not the overall good.
ii. With a number of departments there's the likelihood of duplicating services within the organization e.g. IT. Some of these services could be put in one department and act as organization-wide support function. Duplication means higher costs.
iii. To have a well functioning decentralized organization a lot of investment will have to go into sophisticated Information System.
iv. There may be friction between departments especially if the performance of one department depends on that of another.

PAST PAPER ANALYSIS

Residual income was tested in the following examinations:

05/'06

05/'02

EXAM QUESTIONS

QUESTION ONE

Division A of Miujiza ltd is the only source of supply for an intermediate product that is converted by Division B into a saleable final product. Most of A's costs are fixed. For any output up to 1000 units per day, its total costs are shs15000 per day. Total costs increase by Sh3000 per day for every additional thousand units made. Division A judges that its own results will be optimized if it sets its price at shs12 per unit and it acts accordingly.

Division B incurs additional costs in converting the intermediate product supplied by A into a finished product. These costs are Sh37500 for any output up to 1000 units and Sh7500 per thousand for outputs in excess of 1000. On the revenue side, B can increase its revenue only by spending more on sales promotion and by reducing the selling prices. Its sales forecasts are as follows:

Sales in units	**Net revenue/'000units**
	Sh
1000	52500
2000	39750
3000	33000
4000	27750
5000	24000
6000	20000

Required:

a. Prepare a schedule comparing B's costs including its purchases from A, revenue and net income at the following levels of output (1000, 2000, 3000, 4000, 5000, 6000) (5 marks)

b. What is B's maximum net income? At that level, what is A's net income? At that level, what is Miujiza's aggregate income? (5 marks)

c. Suppose the company abandons its divisionalized structure. Thus the two profit centers A and B are combined into a single profit center with responsibility for the complete production and marketing of the product. Prepare a schedule similar to that in (a). What volume level will provide the highest net income? (5 marks)

d. Evaluate the results in (c). What did the circumstances in requirement (a) lead to less income than in requirement (c)? How would you adjust the transfer pricing policy to ensure that overall company net income will be maximized where separate profit centers A and B are maintained? (5 marks)

(20 marks)

CPA JUN 1993

QUESTION TWO

CD plc is a nationwide warehousing and distribution company, organized into eight geographical regions in each of which there is a depot and a fleet of vehicles.

These regions differ widely in respect of their area size, their mix of different types and sizes of shops and the major and minor roads that they comprise.

The remuneration of the general managers of each region comprises:

- Basic salary: This is a starting figure of $12000 per annum which increases by $1000 per annum for every year of service as a manager up to a maximum of $22000 per

annum.

- Bonus of 0.75% of the excess of sales over target for the year. The target sales figure is calculated by a formula based on the value of vehicles operated by the region.

- Bonus based on the region's return on capital employed (ROCE)

$$\text{ROCE} = \frac{\text{Annual net profit before interest and tax}}{\text{End of year book value of net assets}}$$

The bonus is the ROCE multiplied by:

3% of the capital employed if the capital employed is $2 million or above

2% of the capital employed if the capital employed is below $2 million

This different percentage is to encourage expansion through the use of greater assets.

For regions 3 and 7 the following figures show the actual data for the year just ended (31 October 1990) and the budgeted data for the year to 31 October 1991:

	Region 3		**Region 7**	
	Actual	**Budgeted**	**Actual**	**Budgeted**
Year to:	**31 Oct 90**	**31 Oct 91**	**31 Oct 90**	**31 Oct 91**
	'000	**'000**	**'000**	**'000**
Sales	2400	2750	3700	3600
Cost of sales	1872	2172.5	3034	2844
Net profit*	123	147	166	241

End year capital employed

Working capital	180	210	230	230
Fixed assets:				
Building	640	680	820	820
Vehicles	1030	1370	1750	1850
Target sales	2250	2700	3400	3600
General mangers salary	18000		22000	

Required:

As chief management accountant:

a. Calculate what change there will be for each of the general managers of regions 3 and 7 between the remuneration based on the actual results for the year to 31 October 1990 and the remuneration based on the budgeted results for the year to 31 October 1991; show your workings. (6 marks)

b. Explain whether you consider the changes calculated in (a) above show an appropriate reward for the performance of each of the regional general managers; show the relevant workings. (9 marks)
c. Recommend what changes in the basis of the remuneration scheme for regional general managers you would propose for discussion with the managing director. Briefly explain why you have included each recommendation.

Assume that:

i. Your objective is to achieve rewards for the general managers that will more adequately recognize effective performance of benefit to the company as a whole.

ii. The company does not wish to make changes in the operating methods of the regional managers or in the ways in which the regions are financed (10 marks)

CASE STUDY

Essex Engineering

Topic: Performance measures,

Essex is an industrial company with three divisions. Both the Midland Division and the North Division are long established. Senior managers are concerned that these divisions have a high percentage of products that are near the end of their product life-cycle. Forecast sales increases over the next 5 years are expected to be in the region of 4-5% per annum.

The East Division was acquired in 1999 and senior managers are optimistic that this division has very good growth potential. Most of the senior managers at this division have experience of working at the other divisions.

Since 1999 the head office has ranked all divisions according to return on investment (ROI) and residual income (RI). All managers believe that the rankings are important for future promotions and career development.

A small number of other performance measures are also used by managers. These include:

1.	Non-productive time: Non-productive direct labour hours (percentage of total hours paid). Non-productive time includes time wasted as a result of production delays or material shortages.
2.	Customers: Customer complaints (percentage of total number of customers)
3.	Lead time: Time from order to delivery

These performance measures were agreed by all managers in 1999. At the time it was thought that managers should focus on only a small number of measures.

Source: www.google.co.ke-case studies on management accounting

CHAPTER EIGHT

STUDY TE

TRANSFER PRICING

CHAPTER EIGHT

TRANSFER PRICING

▶ CHAPTER OBJECTIVES

At the end of this the chapter the student will be able to appreciate the need for appropriate transfer prices between departments/divisions. They will also see the impact negative or positive that transfer prices have on individual managers.

▶ INTRODUCTION

In chapter 7, we looked at divisional performance and the different ways it can be measured. These measures will however be significantly affected once these divisions transfer goods and services to one another. Management is therefore tasked with coming up with the various prices at which the receiving department will pay and the supplying department will charge.

This chapter will study the various techniques that can be used in setting theses prices. The "transfer prices" will become necessary in order to determine separate performance of both the 'buying' and the 'selling' profit centers.

Transfer pricing is an internal accounting system that doesn't really affect the overall profitability of the organization. However it could in some circumstances when a divisional manager is forced to take business externally if they find that the other department's prices are not favorable.

▶ DEFINITION OF KEY TERMS

Transfer price: The price charged when one division or segment provides goods or services to another division or segment of an organization.

▶ EXAM CONTEXT

In past examinations, the examiner has tested the students' knowledge on Transfer pricing.

▶ INDUSTRY CONTEXT

Organisations use transfer pricing when there are inter-department sales so as to determine the appropriate price to charge.

For example, one department of a firm may be producing an item which is a raw material needed by another department in the same firm. This will result in an inter-department sale which will require transfer pricing to determine the transfer price.

8.1 TRANSFER PRICING

A transfer pricing system should do the following:

i. Goal congruence

It should provide information that will motivate the managers in their respective divisions to make 'good' decisions that while satisfying its own divisional objectives it will also do s for the overall objectives of the firm. They should discourage suboptimal decision making.

ii. Performance appraisal

The system should provide information that is useful for evaluating the managerial and economic performance of the division. The prices should assist in:

- Guide to good decision making
- Appraises managerial performance
- Evaluating contribution made by individual divisions to the overall profits of the organization.
- Assesses the economic worth of the division.

iii. Ensures that the divisional autonomy is not undermined

The profits of one division should not be dependent on the action of another. The transfer prices should as much as possible tries to maintain divisional autonomy to enable the benefits of decentralization to be felt.

To meet all the objectives will obviously be difficult in practice. For example, setting transfer prices

centrally will diminish benefi ts of decentralization and motivation will be eroded. On the other hand a *laizzes faire* attitude in setting of transfer prices in the divisions will lead to suboptimal decision making. A balance, although diffi cult, will have to be struck.

The choice of a transfer price could also be made more complex especially when each division may be supplying portions of its output to outside customers as well as sister divisions. Another thing is that, the price charged by the transferring division will be a cost to the receiving division. The higher the price charged would mean a lower rate of return for the receiving division and the opposite for the supplying.

8.2 TRANSFER PRICING METHODS

There are basically three approaches of setting transfer prices:

i. Cost basis using either marginal cost or full cost.
ii. Market basis where the prices are set based on the market prices for the same item.
iii. Negotiated market prices

Now let us look at the methods in detail.

i. Cost basis

In this approach, prices are set based on cost or a cost plus some markup.

The cost will in addition to the usual product cost include a portion of administrative and research costs. Some fi rms will make transfers based on costs ignoring any element of profi t to the selling division. Two methods will be looked at here.

a. Full cost transfer pricing

As noted above, the full cost will include the actual manufacturing costs plus portions of marketing and administrative costs. It is widely used in most organizations since inventories are valued at full cost for the purpose of external reporting.

Advantages:

- It is simpler to apply for the full cost is already available and can be obtained at low cost ad convenience.
- Transferring at full cost ensures that we leave no pending intra-company profi ts when it comes to the consolidation of statements. For example, when transfers are recorded at below cost, the inventories have to be adjusted to the ‘true cost’. If transferred above cost, all profi ts have to be eliminated before consolidation of statements.

Disadvantages:

- The division managers will have no incentives to control costs and hence ineffi ciencies may be transferred form one division to another since "we will transfer it anyway"
- Arbitrarily adding a markup to cost could mislead management to believe that a division is profi table yet it is not.
- With a full cost basis, management will not be provided with a divisional profi t fi gure for the selling division. So to say that it is not an appropriate basis for a decentralized organization seeking to seriously gauge the profi tability of a division.
- Full cost transfer prices could lead to a departure from goal congruence. For example, a purchasing department could opt to purchase from outside seeing that it gives a "better" price. But later on it could be discovered that a reduction of the transfer price to market price would have recovered all variable costs and a portion of the fi xed costs. This fi xed costs will not be covered due to the decision to purchase from outside
  Also as noted, the use of *actual costs* will not provide an incentive to management in the process of cost control. Therefore the use of standard costing/budgeted cost would prevent the direct "don't care" transference of ineffi ciencies.

b. ***Marginal cost plus transfer pricing***

Ideally, when costs bases are used, the basis should be on a standard variable cost plus a predetermined charge to account for fi xed costs. This way, the receiving department will not be subject to changes in effi ciency and volume of the selling department.

Advantages:

- Using a standard variable (marginal) cost is in line with good decision making regarding the short run utilization of resources.

Disadvantages:

- Transfer pricing based on marginal cost will not fulfi ll the purpose of divisional (profi t center) evaluation as it will not be fair to the selling division. The selling division will always report a net income that is reduced by the amount of its fi xed costs plus its unfavorable variable cost variance.

Computing a transfer price

A formula has been created to serve as a starting point for managers wishing to come up with a transfer price. It considers that a transfer price *should be equal to the unit variable cost of the item being transferred plus a contribution margin per unit that is lost to the selling division as a result of giving up sales from outside.*

Thus:

Transfer price = variable cost/unit + lost contribution/unit on outside sales

>>> Illustration:

Say a company has two divisions A and B. Division A manufactures a component X that it can either sell outside or transfer it to division B. The component has a variable cost of $24 to manufacture and sells for $40. A single component of X requires one direct labor to complete and the division has a capacity of 25000 components per year. Division B manufactures a product that requires a component slightly different form X. It has a choice either buying it from outside or get it from division B. Variable manufacturing costs would total $20 per unit component of X.

What would be the starting point for the transfer price?

=20+(40–24)=$36

Example

A division has a product costing £5 which is transferred within a group of companies. Calculate a transfer price for the division for each of the following mutually exclusive divisional targets:

1. A net profit margin of 10%
2. A mark-up on cost of 10%
3. A net assets turnover rate of 5 and an ROCE of 30%.
4. An output of 1,000,000 units, a capital employed of £2,000,000 and an ROCE of 20%

Solutions:

1. A net profit margin of 10% is the same as a mark-up on cost of 10/90. The selling price is 100/90. Using a cost of £5, the transfer price should be:

   £5 X 100/90 or £5/0.9, which is £5.56, a profit of £0.56

2. The transfer price would be £5.50

3. Using the relationship:
   Return on capital employed = $\frac{\text{Net profit}}{\text{Capital employed}}$

   $= \frac{\text{Net profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital employed}}$

The figures for the division would be:

30% = Net profit margin X 5

Net profit margin = 6% (30%/5)

Transfer price = £5.32 (£5/0.94)

This example illustrates a general procedure applicable in other situations.

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4. Each unit of output utilizes £2 of capital employed (£2,000,000/1,000,000). The required return is 20% profit per unit of £0.40. The required transfer price is therefore £5.40.

ii. Variable cost based transfer prices

FAST FORWARD: Variable cost based systems overcome the decision-making problem of full cost system.

Transfers from one division to another are made at variable cost. Standard variable cost overcomes the problem of passing on inefficiencies and diseconomies from division to division.

There are two ways by which profits can be created at a divisional level. The first approach is to apply the principles illustrated in *A* to marginal costing. Transfer pricing schemes would allow a suitable level of contribution, as measured in terms of contribution on sales ratio. An alternative approach is to create a two-part charging system. One part of the scheme would transfer a lump sum, representing an allowance for divisional fixed cost once a year to allow each division the chance of creating a final profit. The second part of the scheme would value transfers at variable cost.

iii. Market based transfer prices

FAST FORWARD: Using transfer prices based on market prices is a form of opportunity cost approach as the divisions are charged the same price as that of outside customers.

It is considered better because the market prices go hand in hand with the profit center concept and makes profit based performance evaluation of divisions more feasible.

The aim is to get an approximate of an arms-length, bargained, open market price. In most cases, where the supplying division's products are almost at par in terms of price and quality with those of outsiders, internal procurement will surely follow.

Using a market price basis will only be possible when the product is actively traded in the open market. An advantage is that the market prices are set objectively rather than by parties who have an interest in the results.

This basis has also a very interesting use. For example, if a division cannot improve on the products enough to recover the acquisition costs of the product on the open market plus a cost of production, then the division should be shut down. In other words, if a division cannot 'handle' paying the market prices, it should not be permitted to buy internally at less than the market price. On the other hand, if it can sell outside at market, it should not be compelled to sell internally for less.

In many instances however, the selling and buying at lower than the market can be justified especially when large purchases are made, selling costs are fewer and when an advantage is obtained through an exclusive supplier contract or through a cost-plus arrangement assuring profits in all cases.

A major disadvantage of this basis is that it requires an existence of a well developed outside competitive market; a perfectly competitive one and that the decentralized organization's divisions are independent of one another for supply and demand.

However there may be no market price for the products that are considered unique. This might cause a considerable cost in the preparation of bids. Uniqueness could also be brought about by the fact where the divisions produce units for internal consumptions only e.g. those with secret designs.

If the transfer does not happen often enough, they may not be a market large enough for the product to give a valid market price since market prices based on a very small number of market transactions are not usually.

iv. Negotiated transfer prices

As noted above, there could be justifying reasons for transfers made below market price: large purchases with quantity discounts, lower selling costs or when selling division has idle capacity. These prices are called **negotiated transfer prices.** Such prices will be negotiated between supplying and receiving divisions with top management (minimally) serving as an arbitrator to avoid time consuming and inflammatory negotiations. The widest use of negotiated market prices is in situations where there are no intermediate prices available.

>>> Illustration:

Division X has developed a new product that requires a custom made fitting. Division Y has the experience to produce it. Division X has approached Y for a quoted unit price based on the production of 5000 fittings per year. Division Y has determined that the fitting would require variable cost of $80 per unit. However, on order to have time to produce the fitting, division Y would have to reduce production of a different product A, by 350 units per year. Product A sells for $450 per unit and has variable costs of $250 per unit. What transfer price would be quoted by Y to X?

Transfer price = variable cost/unit + lost contribution per unit on outside sales

Lost contribution from A:

	$
Selling price	450
Variable cost	(250)
Contribution/unit	200
Sales units given up	350
	$70000

Lost contribution per unit = $70000/5000 = $14

Transfer price = $80 + $14 = $94

STUDY TEXT

The transfer prices quoted by Y should not be less than $94 per unit. They would quote a higher figure if it wants to increase overall profits but not less than $94 as the company as a whole would suffer.

However if division Y had some idle capacity, the transfer price could be relaxed. The lower limit for it could be the $80 variable cost discussed earlier. But since no division wants to only recover the costs, the actual transfer price would be higher then the $80. Despite the advantages, the negotiation process would be very time consuming and require frequent reexamination and revision of prices. For it to work, divisions such as X should be allowed to go to the outside market of the negotiations fail.

Further, the negotiated prices will be marred with a lot of subjectivity which is considered unsuitable if they are trying to maximize the profits of the company as a whole. As a result, the negotiated price may distort segment financial statements and mislead top management in its attempts to evaluate performance and make decisions.

With no established market price and disagreements, top management will be force to intervene to establish an arbitrary transfer price. This will be a good thing to prevent sub-optimization on one hand, but on the other, frequent arbitrary setting of prices would breach divisional authority and the whole point of decentralization and profit centers (autonomy) will be subverted.

v. Linear programming based transfers

Consider the following example:

>>> Example

Two products, Exe and Wye are produced by Hifi, an electronics company which operates two departments. Both departments are limited to working a maximum of 10 hours per day per machine and both departments utilize 10 machines. A five-day week is in operation. Product cost information for Exe and Wye is as follows:

	Exe	Wye
	£	£
Selling price	9.50	8.50
Materials cost	1.00	1.00
Variable overheads cost:		
Department 1		
2 hours @ £1.50	3.00	
1 hour @ £1.50	1.50	
Department 2		
1.25 hours @ £2	2.50	
2 hours @ £2	4.00	
Contribution	3.00	2.00

Processing this example through a linear programming computer package reveals a total contribution of 181.8 units of Exe and 136.4 units of Wye, with shadow prices for department 1 and 2 of £1.2727 and £0.3636 respectively. Were the centralized management accounting department to run this package, they would instruct both departments to produce 182 units of Exe and 136 units of Wye. The transfer price would be calculated as the total of variable cost and opportunity cost. The opportunity cost of each product is given by the shadow price; in the case of Exe, calculated as follows:

Department 1 2 hours @ £1.2727	£2.545
Department 1 1.25 hours @ £0.3636	£0.455
	£3.000

There is no coincidence that this is the product contribution in this case. Transfer prices of £7 for Exe and £4.50 for Wye would be established. This implies that department 2 would not be able to show a profit.

A situation can be illustrated where the constraints of the linear programming model lead to the supplying division's manager being motivated to achieve optimum levels of production through the transfer price. In this case, the transfer price can itself motivate the achievement of optimum levels of output for both the supplying division and the organisation as a whole, where all output from one division is processed by the next. The supplying division is not allowed a profit and must be given production instructions from the centre, with loss of divisional autonomy.

vi. Dual pricing

The seeming harshness of the foregoing authoritarian approach can be modified if organizations recognize that there's no necessity to have a **single** transfer price. It should be seen in practice that one transfer pricing method should not be adopted as the one and only authority as it is unlikely that one will fulfill all the needs of management. Different transfer prices should be used depending upon the purpose for which they are needed. For example, one for the purpose of making economic decisions and another for purpose of performance evaluation.

The dual pricing would allow each segment to use the transfer price which would provide the optimum decision for the segment and still remain within the goals of the overall company.

Clearly dual pricing does not follow the neat double entry balancing act required in accounting hence some of the segmental profits would have to be eliminated.

Illustration:

Suppose division A can sell its component in the market for $10 and that its variable cost is only $7. The component is also a requirement to be used in division B. division B manager doesn't feel that he should pay the same price as an outsider especially since top management is *forcing* him to buy form division A.

If management wishes to evaluate divisional performance of A, it should consider using the market as the transfer price as there's no reason for it to sell it for less. This will give division A credit for a basis that represents the opportunity it lost in the market by making the sale to another segment in the company.

If this market price was imposed on the buying division which did not have the complete authority

to choose whether to buy from division A or not, a conflict may arise. This is because the manager of B probably would resent the manager of A making a profit at his expense when he did not have the authority to buy from anywhere else.

The better procedure in these circumstances is to charge its buying division with variable or differential costs. The interdependence of the subunits is then recognized. The solution doesn't allow one segment manager to make a profit at the expense of another segment manager.

However dual pricing has the major weakness where all segment managers may win but the overall company may lose. This may result because the buying segment purchases at a low price while the supplying sells at a higher price as a result the incentive for cost control is lost and inefficiencies may develop.

It has been discovered to be dangerous to assume that the market price will always be used as the selling segment's transfer price and that the cost based transfer price will always be used for the buying division.

>>> Illustration

Suppose the full cost of a product from A is $100 and this product is further refined in B. However assume also that B would purchase this elsewhere for $90. The solution using dual pricing should here involve A selling the products to home office for $100 and in turn B buying the product from the home office at $90. In this case, the home office has created a fictitious loss which will be eliminated when the overall company profit is determined.

8.3 INTERNATIONAL TRANSFER PRICING

International transfer pricing refers to the determination of prices to be charged between related persons and in particular within a multinational enterprise for transactions between various group members (sales of goods, the provision of services, transfer and use of patents and know-how granting of loans etc.) As these prices are not negotiated in a free open market they may deviate from prices agreed upon by non-associated trading partners in comparable transactions under the same circumstances.

The above leads to a special interest on the part of tax authorities in intra-group transactions and especially in cross- border transactions. In many circumstances the tax authorities would seek to adjust the prices adopted in these transactions to arm's length prices. However, the intra-group trading partners themselves may find it difficult to settle on satisfactory transfer prices, even if they are in many cases no comparable transactions in the open market. In such circumstances the tax authorities may seek to arrive at the arm's length price by using cost-based methods or methods based on the price changed to the final customer – the 'resale minus' or resale price method or any other which can produce an acceptable result.

8.4 TRANSFER PRICING WITH THIRD PARTY CONSEQUENCES

Transfer prices are used not only for internal record keeping and performance evaluation purposes.

There are several settings where transfer prices have direct cash consequences for a company. The most widely cited case is in interstate and international transactions where transfer prices may affect tax liabilities, royalties or other payments due to different government jurisdiction. Since tax rates differ across states, or jurisdictions, companies have an incentive to establish a transfer price which will increase the income in the lower tax jurisdiction and decrease income in the higher tax jurisdiction.

>>> Example:

Assume that the Kerbrook Shirt Company owns a manufacturing plant in Kenya where its marginal tax rate is 60 per cent of net income. These shirts are imported by Zambia where the marginal tax rate is 75 per cent of net income. For simplicity assume that there are no currency controls and that tax regulations concerning the definition of taxable income are the same between the two countries.

During the current year, the company incurred production costs equivalent to sh.2 million in Kenya. Costs incurred in Zambia aside from the costs of the shirts amounted to an equivalent of sh.6 million. Sales revenues in Zambia were sh. 24 million. Similar goods imported by independent companies in Zambia would have cost an equivalent of sh. 3 million.

However, Kerbrook Shirt Company points out that because of its special control over its operations in Kenya and the special approach it uses to manufacture its goods, the appropriate transfer price is sh. 10 million.

Required:

What would Kerbrook Shirt Company's total tax liability in both countries be if it used the sh. 3 million transfer price?

What would the liability be if it used the Sh. 10 million transfer price?

Solution:

The solution is approached by determining the taxable income for each country under the alternative transfer price scenarios. The resulting taxable income is multiplied by the tax rate in each country to obtain the tax liabilities.

For the sh. 3 million transfer price, the tax liability is computed as follows;

	Kenya (sh)	Zambia (sh)
Sales revenues	3,000,000	24,000,000
Third party costs	2,000,000	6,000,000
Transferred goods costs	-	3,000,000
Total costs	2,000,000	9,000,000
Taxable income	1,000,000	15,000,000
Tax rate	60%	75%
Tax liability	600,000	11,250,000

Total tax liability = sh 11,850,000

- For the sh.10 million transfer price;

	Kenya (Sh).	Zambia (Sh).
Revenues	10,000,000	24,000,000
Third party costs	2,000,000	6,000,000
Transferred goods costs	-	10,000,000
Total Costs	2,000,000	16,000,000
Taxable income	8,000,000	8,000,000
Tax rate	60%	75%
Tax liability	4,800,000	6,000,000

Total tax liability = Sh. 10,800,000

The tax liability assuming a sh. 10 million transfer price is about 9% less than the liability that would be incurred if the transfer price was sh. 3 million.

International taxing authorities look closely at transfer prices when examining the tax returns of companies engaged in related party transactions which cross jurisdictional lines. Companies must therefore have adequate support for the use of the transfer price which they have chosen for such a situation.

Another situation where transfer pricing has direct economic consequences is where the owner of one entity holds a different ownership percentage than he or she holds in another entity. It is generally in the best interest of this person to transfer income to the entity in which he or she holds the higher ownership in percentage.

In situations where transfer prices have direct economic consequences it is important to develop transfer prices in a manner that will meet third party scrutiny since tax authorities may investigate transfer prices which affect cross-border tax liabilities. In addition, in situations where an individual acts on both sides of a related party transaction, the possibility of litigation arises if transfer prices are not reasonable.

In general, transfer prices for goods and services between segments or companies located in different countries should reflect that countries have different tax rates and regulations. Due to these variances, companies have an incentive to transfer most of their income to the subsidiary that has a tax advantage over others within the corporate group. In addition some countries restrict payment of income or dividends to parties outside their national borders. In such cases, the company often increases the transfer prices so they pay more funds out of these countries while appearing to follow regulations.

Transfers from foreign countries where the wage level and/or tax rate is low may also be made at a domestic market price rather than on a cost basis because foreign economic conditions are so different from domestic conditions.

8.5 INTERNATIONAL TRANSFER PRICING - COMPLIANCE AND DOCUMENTATION

Transfer pricing is a perennial issue, within the international tax community (Richard Casna, Accounting and Business, February 1988, pp.30-31).

As multinationals become more sophisticated in employing transfer pricing techniques in their tax planning, the revenue authorities have increased their scrutiny of arrangements, putting transfer pricing at the forefront of international tax concerns.

It naturally follows that if profits can be shifted from a high tax jurisdiction to one of low tax through transfer pricing, the tax authorities will respond with rules designed to curtail tax avoidance and ensure tax payer compliance.

Revenue authorities around the globe have become more adept at countering the “profit-shifting” aspects of transfer pricing practices and are strengthening their statutory powers with ever more extensive and complex legislation and regulations.

To strengthen the tax authorities’ position, regulations typically introduce specific rules to determine arms’ length prices and require that tax payers maintain very extensive records documenting the methods used to determine their transfer prices (which often necessitates the employment of teams of both in-house and outside counsel, accountants and economists). Provision is made as well for the imposition of very stringent penalties in cases of non-compliance.

To achieve these ends, the statutes generally focus on guidelines set out by the OECD’s Committee

on Fiscal Affairs (the tax policy body of the OECD), first in its 1979 document "Transfer pricing and multinational Enterprises" and the 1995-1996 "Transfer pricing Guidelines for Multinational Enterprises and Tax Administrations." These guidelines generally stipulate the parameters of the arm's length pricing standard and the methodology to be followed in achieving arm's length prices.

The practitioner as adviser to multinationals which faces the complexities of transfer pricing legislative and regulatory controls has therefore to simply consider the statutes in each country/ state carefully, comply with the rules and maintain extensive documentation.

8.6 CRITIQUE OF PERFORMANCE MEASUREMENT

This section brings together material from preceding data in this and the previous chapter in order to provide a critical appraisal of performance measurement. In a sense, all of the material in the study text can be related to the measurement of performance; good managers make good decisions form good plans, establish good control practices and this should be reflected in measures of performance. An alternative view is that performance measurement drives the decision making, planning and control functions of management; managers manipulate performance results so that they can appear to be performing well. This provides an explanation for ROI approaches to the capital investment decision; managers are more concerned to appear to be making the right decision than to be making the right decision in reality. Whatever the view, transfer pricing and performance measurement provides good material for assessing the problems facing the management accountant who is trying to devise systems which will benefit organisations. The critique which follows provides a summary of the problems of ensuring that performance measurement systems achieve the purposes for which they are designed. The list which is provided can be considered as coverage of some of the themes which influence management accounting as a whole.

A. Transfer pricing and performance measurement relies upon the judgment of the management accountant to make a suitable choice of approach and to calculate suitable values where appropriate.

>>> **Example**

Alton division (A) and Birmingham division (B) are two manufacturing divisions of Conglom plc. Both of these divisions make a single standardised product; A makes product I and B make product J. Every unit of J requires one unit of I. The required input of I is normally purchased from division A but sometimes it is purchased from an outside source.

The following table gives details of selling price and costs for each product.

	Product I	Product J
	£	£
Established selling price	30	50
Variable costs		
Direct material	8	5
Transfers from A	—	30
Direct labour	5	3
Variable overhead	2	2
	15	40
Divisional fixed cost (per annum)	£500,000	£225,000
Annual outside demand with current selling prices (units)	100,000	25,000
Capacity of plant (units)	130,000	30,000
Investment in division	£6,625,000	£1,250,000

Division B is currently achieving a rate of return well below the target set by the central office. Its manager blames this situation on the high transfer price of product I. Division A charges division B for the transfers of I at the outside supply price of £30. The manager of division A claims that this is the price `determined by market forces'. The manager of B has consistently argued that intra group transfers should be charged at a lower price based on the costs of the producing division plus a `reasonable' mark-up.

The board of Conglom plc is concerned about B's low rate of return and the division manager has been asked to submit proposals for improving the situation. The board has now received a report from B's manager in which he asks the board to intervene to reduce the transfer price charged for product I. The manager of B also informs the board that he is considering the possibility of opening a branch office in rented premises in a nearby town, which should enlarge the market for product J by 5,000 units per year at the existing price. He estimates that the branch office establishment costs would be £50,000 per annum.

You have been asked to write a report advising the board on the response that it should make to the plans and proposals put forward by the manager of division B. Incorporate in your report a calculation in the rates of return currently being earned on the capital employed by each division and the changes to these that should follow from an implementation of any proposals that you would recommend.

An answer to this question would be provided in report style for examination purposes. The discussion which follows shows the influence of management accounting judgment rather than providing an ideal examination answer. It is anticipated that students will have the necessary skill to convert the points of discussion into an answer suitable for examination conditions.

If I and J are traded in a perfect market and both divisions are given complete autonomy, the

present transfer price is optimal. Any increase in transfer price would lead to B purchasing from external sources, which would not be in the interests of the organisation. Any decrease in transfer price would lead to A selling to external customers, which would again not be in the best interests of the organisation.

It could be argued that A does not have to find the resources to market I and that some reduction from the external price is appropriate in setting the transfer price. The amount of the reduction could be a matter of negotiation between the managers of A and B or could be established through the judgment of the management accountant, bearing in mind any information available on competitor's selling costs.

If the market is imperfect then negotiated or cost based prices should be considered. It is a matter of judgment to determine whether negotiated prices would provide a suitable resolution to the problem, taking into account the personalities of the managers of A and B. Although the managers appear to be entrenched in their respective points of view, management training and/or an explanation of the purpose of transfer pricing may improve relations between the managers, lead to an acceptable transfer price and improve the future prospects for Conglom as a whole. Divisional autonomy would be maintained. Negotiated prices are thus to be recommended to the board of directors as a suitable alternative. The management accountant would have a role to play in educating managers in the purposes, benefits and limitations of management accounting systems. Cost based prices would require a degree of intervention from the centre, the part of the organisation where it could be expected that the necessary information is available.

Division A can meet B's demand for 25,000 units and the outside demand for 100,000 units, within its capacity of 130,000 units. Division B would meet the external demand. This would lead to the following financial statement under the present transfer price:

	Division	**Division**
	A	***B***
	£'000	**£'000**
Sales revenue (external customers)	3,000	1,250
Transfers	750	(750)
	3,570	500
Variable cost (excluding transfers)	1,875	250
Contribution	1,875	250
Fixed cost	500	225
Profit	1,375	25
Investment	6,625	1,250
Return on investment	20.8%	2 .0%

If autonomy is maintained, division A could make a decision on whether to sell to division B or not, and at what price on a short-term basis. The existence of surplus capacity should lead to any price in excess of variable cost being acceptable. Using variable cost as the transfer price would lead to the following results:

	Division A	Division B
	£'000	£'000
Sales revenue (external customers)	3,000	1,250
Transfers (at A's variable cost of £15 per unit)	375	(375)
	3,375	875
Variable cost (excluding transfers)	1,875	250
Contribution	1,500	625
Fixed cost	500	225
Profit	1,000	400
Investment	6,625	1,250
Return on investment	15.1%	32 .0%

Any cost based price between £15 and £30 would appear to be acceptable and the management accountant could apply judgment to decide on appropriate levels of profitability for each of the divisions.

If it is judged that an equal opportunity to achieve profit returns should be given, then the transfer price could be calculated as follows:

Total profit involved	£1,400,000
Total investment involved:	£7,875,000
Average return on investment:	17.8%
Total costs in department A are:	(1875 + 500) = £2,375,000

Applying the relationship:

ROI = Net profit/investment

$$= \frac{\text{Net profit}}{\text{Total costs}} \times \frac{\text{Total cost}}{\text{Investment}}$$

Provides: 17.8 = Net profit mark-up X 2,375/6,625

Net profit mark-up = 49.7%	
Cost per unit in A is (2375/125)	£19.00
Average selling price is (19 x 1.497)	£28.44
Total sales: 125,000 @ £28.44	£3,555,000.00
Less external sales:	£3,000,000.00
Transfer value:	£ 555,000.00
Transfer price (555/25)	£ 22.20

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The reported financial statements would also be as follows:

	Division A	Division B
	£'000	£'000
Sales revenue (external customers)	3,000	1,250
Transfers (at £22.20 per unit)	555	(555)
	3,555	695
Variable cost (excluding transfers)	1,875	250
Contribution	1,680	445
Fixed cost	500	225
Profit	1,180	220
Investment	6,625	1,250
Return on investment	17.8%	17 .6%

There are two aspects to the behavioral aspects of this situation which will be discussed. The first concerns the extent to which managers of A and B would find the transfer price `fair'. Any attempt by the management accountant to impose a transfer price would be perceived to be an infringement of autonomy and may lead to dysfunctional consequences. Wherever possible, if the autonomy of the division is to be guarded and an imperfect market operates, negotiated prices appear to offer most prospects of optimising the behavioral implications. The second behavioral implication concerns the motivation of managers to accept worthwhile projects. If it is accepted that managers are motivated to improve their reported performance, performance measures which lead to managers rejecting profitable projects are dysfunctional. This particular idea can be explored in relation to

Example 1

At the existing transfer price of £30, the manager of B would produce the following calculations of the value of opening the branch office:

Additional sales 5,000 @£50		£250,000
Additional variable costs:		
Transfer price	£150,000	
Other variable costs	£ 50,000	
Fixed costs	£ 50,000	£250,000
Net profit		£ nil

On behavioral grounds, the project would be rejected by the manager because performance does not improve as a result of the effort necessary to open the branch. However, from Conglom plc's point of view the calculation would appear as follows:

Additional sales 5,000 @£50		£250,000
Additional variable costs:		
Transfer price	£ nil	
Other variable costs	£125,000	
Fixed costs	£ 50,000	£175,000
Net profit		£ 75,000

It is advantageous to the company as a whole, for the branch office to be opened. Since A has spare capacity sufficient to meet the additional requirement, a transfer price equal to the variable costs incurred in division A would lead to the manager of department B making the correct decision. A transfer price between £15 and £30 would lead to the branch being opened but a transfer price of £15 alone would ensure that all future decisions were evaluated correctly at divisional level. This leads to the second point in the critique performance measurement.

B. FAST FORWARD: Values which are suitable for performance measurement purposes are not necessarily suitable for decision making, planning and control purposes.

Example 4 illustrated the problem of meeting both performance measurement and decision-making requirements. For planning purposes, reasonable future forecasts or targets which meet long-term planning requirements present two acceptable approaches and incremental budgeting offers a third means by which values can be established in practice. For control purposes, values should ideally be set just above aspiration levels. For performance measurement purposes, values should be set which avoid sub-optimization and dysfunctional behaviour and which further the objectives of the performance measurement scheme and of the company in general. It is unlikely that a single value can meet all requirements.

In some circumstances, multiple values can be established. In overcoming the problem of setting up reliable and valid values for planning, control, decision making and performance measurement needs, however, further problems may arise. Imagine that a company establishes one target for performance measurement purposes and another, lower value, for planning purposes. The planning value must be kept secret from the divisional manager if it is to motivate since some types of manager may lower aspiration levels to the planned target. Secrecy can have detrimental effects to the coordination and communication objectives of budgeting. Again, the behavioral consequences of establishing values are of paramount importance and the management accountant finds that effective accounting is partly based on setting up sound systems at the technical level and partly based on setting up systems which work for the people within the organisation.

C. Emphasis on cost, profit and investment centre performance in the short term can have detrimental effects on the organisation in the long term. *Example 2* is taken from a situation which has occurred in practice.

>>> **Example 2**

A company found it necessary for cash flow purposes to close one of its divisions. Two divisions were prime contenders for closure. Each would have brought in roughly equal amounts of cash and the amounts involved would have been sufficient to solve the cash flow crisis. Division A was set up ten years earlier and its assets were almost fully depreciated. Division B was set up two years earlier, incorporating the latest technology and had substantial balance sheet values because its assets were depreciated over a ten-year period. In the previous financial year, division A showed a 30% ROCE whilst division B showed a 20% ROCE. Which division should have been closed?

The company closed division B, because division A showed the best performance, as measured by ROCE. However, it found two years later that it needed to invest substantially in division A because of obsolete assets. A further cash flow crisis ensued.

This dysfunctional decision could have been avoided by applying a more appropriate valuation base for the assets than that provided by historic values derived from balance sheets designed primarily for financial accounting purposes.

Original cost, replacement value or an SSAP 16 philosophy have all been suggested as means by which ROCE can more reliably measure performance. The selection of asset valuation base is a matter of judgment.

Further examples of dysfunctional decisions arising from the need to meet short-term goals in terms of performance and/or budgetary control include postponing vital expenditure or investment. Postponement has the effect of ensuring that short-term goals are met but can disadvantage organisations in comparison with competitors who pursue long-term optimization at some slight loss of optimization in the short-term.

D. Accounting figures can provide distorted information. Where a company imposes a cost based transfer price, results may be biased in favour of certain divisions at the expense of others, as *Example 4* illustrated. Where a company uses ROCE as a performance measure, performance appears to improve as assets age because the effect of depreciation is to reduce the asset base in the ROCE calculation. The accountant's figures on performance do not necessarily measure the true improvement or deterioration in divisional performance.

E. Financial measures of performance can give insufficient emphasis to non-financial and qualitative aspects of organisational management.

F. It is difficult to determine whether the manager's performance or department's performance is being measured in some circumstances. This is important where an organisation wishes to promote its most able managers to ensure the long-term successful management of the enterprise.

G. Independence and interdependence factors can lead to pseudo-profit and investment centres, where the accounting system treats divisions as autonomous despite the reality that autonomy cannot be achieved without detriment to the organisation as a whole. A transfer price which requires a decision from head office is likely to infringe divisional autonomy. Any system which requires a central accounting function to calculate a transfer price is therefore likely to lead to a loss of independence at divisional level.

H. The accounting models available to management accountants appear to create a potentially spurious sense of accuracy, reliability and validity. A budgeted target appears to have validity because it is visible and appears to be certain. In an uncertain world, deterministic targets may be invalid and probabilistic approaches may be more valid, but are unfortunately beset by problems, particularly the difficulty of establishing subjective probabilities. The section on forecasting suggested a number of reasons why managers tend to rely on relatively simple forecasting models in order to predict the workings of a complex world.

The problem facing the practical management accountant is to select an accounting model which most closely matches the reality of the situation faced by an organisation and for which data capture is feasible.

CHAPTER SUMMARY

Transfer price: The price charged when one division or segment provides goods or services to another division or segment of an organization

Transfer pricing shares profits between divisions but does not, on its own, affect total profits.

Absorption cost based transfer prices transfer the full cost of the supplying department to the receiving department.

Variable cost based systems overcome the decision-making problem of full cost system. Transfers from one division to another are made at variable cost. Standard variable cost overcomes the problem of passing on inefficiencies and diseconomies from division to division.

International transfer pricing refers to the determination of prices to be charged between related persons and in particular within a multinational enterprise for transactions between various group members (sales of goods, the provision of services, transfer and use of patents and know-how granting of loans etc.) As these prices are not negotiated in a free open market they may deviate from prices agreed upon by non-associated trading partners in comparable transactions under the same circumstances.

Negotiated prices is used where market based prices are not applicable, it allows managers to bargain with each other in order to establish transfer prices thus develops the kind of management skills which are necessary to the future of the enterprise. Managers would need to have detailed knowledge of their own resources and costs and would need to apply their inter-personal skills of communication, persuasiveness and bargaining in order to show a profit.

CHAPTER QUIZ

1. What is a transfer price?
2. Distinguish between full cost transfer pricing and marginal cost plus transfer pricing.
3. What are the transfer pricing methods?

ANSWERS TO QUIZ QUESTIONS

1. A transfer price is a value attached to the output of a department in order to measure the value of its trade with other departments inside the organisation. The transfer price of the supplying division is charged to the receiving division.

2. **Full cost transfer pricing** will include the actual manufacturing costs plus portions of marketing and administrative costs. It is widely used in most organizations since inventories are valued at full cost for the purpose of external reporting.

   Marginal cost plus transfer pricing will include a standard variable cost plus a predetermined charge to account for fixed costs. This way, the receiving department will not be subject to changes in efficiency and volume of the selling department.

3. Transfer pricing methods:
   a) Absorption cost based transfer prices
   b) Variable cost based transfer prices
   c) Market value based transfer prices
   d) Negotiated prices
   e) Linear programming based transfers

PAST PAPER ANALYSIS

Transfer pricing was tested in the following examinations:

12/ '06

05/ '06

12/ '05

06/ '05

12/ '02

12/ '01

06/ '01

06/ '00

EXAM QUESTIONS

QUESTION ONE

a) The Z division of XYZ Ltd. produces a component which it sells externally, and can also be transferred to other divisions within the organization. The division has set a performance target for the coming financial year of residual income of Sh.5, 000,000. The following budgeted information relating to Z division has been prepared for the coming financial year.

1. Maximum production/sales capacity 800,000 units.
2. Sales to external customers: 500,000 units at Sh.37.
3. Variable cost per component Sh.25.
4. Fixed costs directly attributable to the division Sh.1, 400,000.
5. Capital employed: Sh.20,000,000 with cost of capital of 13%

The X division of XYZ Ltd has asked Z division to quote a transfer price for units of the component.

Required:

i Calculate the transfer price per component which Z division should quote to X division so that its residual income target is achieved. (6 marks)

ii Explain why the transfer price calculated in (i) above may lead to sub-optimal decision making from the point of view of XYZ Ltd taken as a whole. (4 marks)

b) A manufacturer produces and sells two products, A and B. The unit variable cost is sh.12 and sh.8 for A and B respectively. A review of selling prices is in progress and it has been estimated that, for each product and increase in the selling price would result in a fall in demand of Sh.500 units per every Sh.1 increase in price and similarly a decrease of Sh.1 in price would result in an increase in demand of 500 units.

The current sales prices and sales demand are:-

	Price (Sh.)	Demand (Units)
A	30	15,000
B	58	21,000

Required:

Calculate the profit-maximizing price for reach product. (10 marks)

CPA JULY 2000

STUDY TEXT

QUESTION TWO

Kanorer Enterprises Ltd has two divisions Mugaa and Gwashati.

Mugaa division manufactures an intermediate product for which there is no external market. Gwashati division incorporates the intermediate product into a final product, which it sells. One unit of the intermediate product is used in the production of the final product. The expected units of the final product which Gwashati division estimates it can sell at various selling prices are as follows:

Net selling Price	**Quantity sold**
Sh.	**Units**
100	1000
90	2000
80	3000
70	4000
60	5000
50	6000

The variable and fixed costs of each division are as follows:

	Mugaa	**Gwashati**
	Sh.	**Sh.**
Variable cost pr unit	11	7
Fixed cost per annum	60,000	90,000

The transfer price is Sh.35 for the intermediate product, and is determined on a full cost-plus basis.

Required:

a) Profit statements for each division and the company as a whole for the various selling prices. (12 marks)

b) Which selling prices maximize the profits of Gwashati division and the company as a whole? Comment on why the selling price (which is selected by the company) is not selected by Gwashati division. (3 marks)

c) It has been argued that full cost is an inappropriate basis for selling transfer prices. Outline the objections which can be raised against this basis. (5 marks)

(Total: 20 marks)
CPA JUNE 2001

CASE STUDY

Almost 90% of the responding firms use transfer pricing; firms that do not, say their intra-company transfers were insignificant. The most frequent method for pricing domestic transfers was market price; for international transfers it was cost plus. When looking at all possible methods, a different picture emerges, however. The breakdown of transfer pricing methods for domestic transfers was cost-based (53%), market-based (26%) and negotiated (17%), compared to a breakdown for international transfers of cost-based (43%), market-based (36%) and negotiated (14%). Thus, domestic transfers, overall, are more likely to use cost-based prices than are international transfers. In both cases, however, the probability that subsidiaries are left alone to negotiate transfer prices between themselves is small (14-17%) and does not seem to have changed much from the earlier surveys.

Source: **www.google.co.ke-** ***JIBS Book Review***

CHAPTER NINE

STUDY TEX

FINANCIAL AND NON FINANCIAL PERFORMANCE

CHAPTER NINE

FINANCIAL AND NON FINANCIAL PERFORMANCE

▶ CHAPTER OBJECTIVES

After this chapter, the student will know:

- The need for financial statement information
- What ratio analysis is and the ratios used in analysis of financial statements

▶ INTRODUCTION

Financial statement analysis is used to identify the trends and relationships between financial statement items. Both internal management and external users (such as analysts, creditors, and investors) of the financial statements need to evaluate a company's profitability, liquidity, and solvency. The most common methods used for financial statement analysis are trend analysis, common-size statements, and ratio analysis. These methods include calculations and comparisons of the results to historical company data, competitors, or industry averages to determine the relative strength and performance of the company being analyzed.

▶ DEFINITION OF KEY TERMS

Ration analysis is the systematic production of ratios both from internal and external financial statements to try and establish relationships and results in order to appraise financial performance.

Trend Analysis is a comparison of the firm's performance over time.

Cross sectional analysis is a comparison of the firm's performance with other firms in the same industry.

Debt-holders are providers of long term funds.

Creditors are providers of short-term funds.

Financial analysts are experts who study the financial position of the company.

▶ EXAM CONTEXT

This chapter has not been tested but the student should understand it.

▶ INDUSTRY CONTEXT

Firms require this topic to know how to calculate ratios which are important for financial statement analysis. Financial statement analysis is important for evaluation of the firm's performance, going concern and so on.

9.1 NEED FOR FINANCIAL STATEMENT INFORMATION

a) Shareholders need financial statement information to know the evaluation ratios of the firm

b) Prospective investors need financial statement information to know the theoretical value and evaluation ratio of the firm.

c) Debt-holders need financial statement information to check the going concern of the company, its profitability and gearing ratios.

d) Creditors need financial statement information to check the gearing position of the company as well as its liquidity.

e) Government needs financial statement information to check the taxable income of a firm and whether it is operating at the rules and regulations set forth and the GDP of the economy.

f) Customers need financial statement information to check the going concern of the company so that they can know whether they have a future supplier. It tells the customers if he/she is being exploited.

g) Employees need financial statement information to check the going concern of the company so that they can know whether they have job security.

h) Financial analysts need financial statement information because they are concerned with all aspects of the firm.

g) Society in general needs financial statement information because they are concerned with the social responsibility of the company to the society.

9.2 RATIO ANALYSIS

FAST FORWARD: *Ratio analysis* is the systematic production of ratios both from internal and external financial statements to try and establish relationships and results in order to appraise financial performance.

One important way by which stakeholders of an organization can evaluate the performance of an organization is through the use of accounting ratios. These ratios range form those just evaluating performance, others liquidity or investments.

A primary advantage of rations is that they can be used to compare the risk and return relationship of firms of different sizes. They can also provide a profile of the firm, its economic characteristics and competitive strategies and unique operating, financial and investment characteristics.

There are four broad categories of ratios:

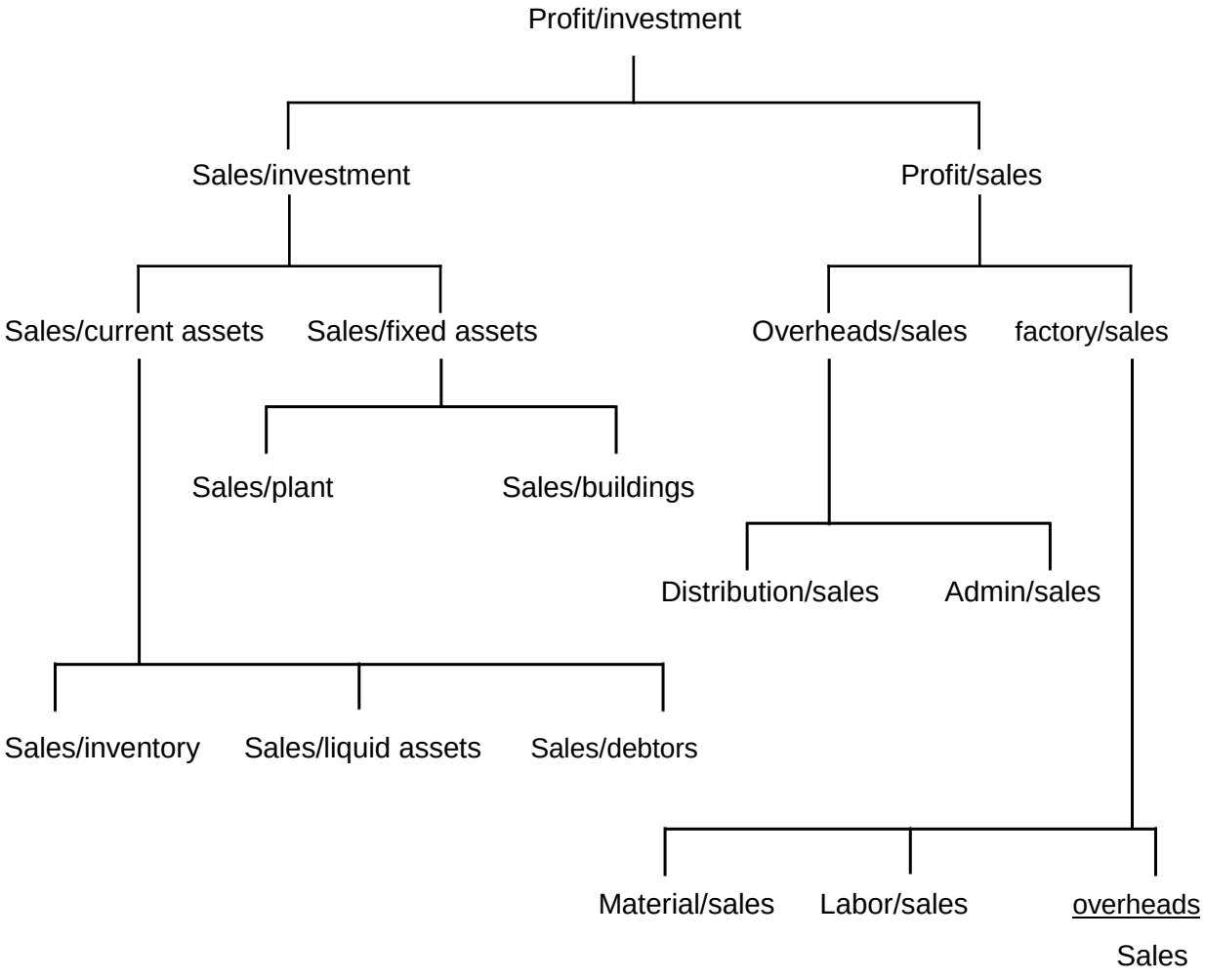
i. *Activity ratios:* they evaluate revenue and output generated by the firms assets
ii. *Liquidity analysis:* they measure a firms ability to meet its near term cash obligations
iii. *Long term/solvency analysis:* it examines the firm's capital structure, including the mix of financial resources and ability of firm to satisfy its longer term debt and investment obligations.
iv. *Profitability analysis:* measures the return of the firm relative to its revenues and invested capital.

There uses will be looked at in our comprehensive example.

However, the utility of ratios will only be enhanced if:

i. They are produced regularly with consistent bases so that a trend can be highlighted.
ii. Ratios prepared for the firm can be compared with other firms in the same industry
iii. They are not prepared in isolation but other factors or ratios affecting should be highlighted.

The interdependence mentioned in point (iii) would be represented in a ratios pyramid as follows:



ABC ltd has provided the following financial information for 2006 this year, 2005 for the previous year together with forecasts for 2007

Income statements

	2005	2006	2007
	'000	'000	'000
Sales	215	236	276
Less: material	79	82	96
Labor direct	34	33	37
Indirect	35	39	44
Others	26	29	36
	174	183	213
Administrative costs.	21	26	33
Selling costs	6	7	7
Distribution	3	3	4
	204	219	257
Net profit before tax	11	17	19

STUDY TEXT

Balance sheets

	2005	2006	2007
	'000	'000	'000
Fixed assets – cost	120	155	175
Less depreciation	65	65	80
NBV	55	90	95
Inventory	55	62	68
Debtors	35	32	34
Bank	4	4	3
	94	98	105
Less current liabilities	17	13	15
	77	85	90
	132	175	185

Number of people employed

Average during the year	2005	2006	2007
Direct employees	43	41	47
Indirect "	31	35	40
Administration	30	37	36
Sales	6	7	7
	110	120	130
Floor space occupied (m_2)	30000	30000	32000

Solution

Profitability

	2005	2006	2007
Profit/capital employed	8.3%	9.7%	10.3%
Profit/sales	5.1%	7.2%	6.9%
Sales/capital employed	1.63 times	1.35 times	1.49 times

STUDY TEXT

Production costs			
Percentage of costs	%	%	%
Materials	45.4	44.9	45.0
Direct labor	19.5	18.0	17.4
Indirect labor	20.1	21.3	20.7
Others	15.0	15.8	16.9
	100	100	100
Labor			
Indirect: direct			
Monetary values	1.03	1.18	1.19
Numbers	0.72	0.85	0.85
$ per employee/annum			
Direct labor	$791	$804	$787
Indirect	$1129	$1114	$1100
Profit			
Per direct worker	$256	$415	$404
Per indirect worker	$354	$485	$475
Sales			
Selling costs/sales	2.8%	30.%	2.5%
Sales/sales employee	$35833	$33714	$39429
Profit/sales employee	$1833	$2428	$2714
Financial control			
Stock period:			
Inventory/production	115 days	124 days	117 days
Debtors' period			
Debtors/sales	59 days	49 days	45 days

Creditors' period			
Current liabilities/materials	79 days	58 days	57 days
Current ratio			
Current assets/current liabilities	5.5	7.5	7.0
Quick ratio			
Debtors+bank/current liabilities	2.3	2.8	2.5

Interpretation:

Profitability

- The profit increase form 11000 to 17000 shows an increase of more than 50% from a sales volume increase of only 10%**.** ROCE improved while sales as a percentage of capital employed decline. This shows an increased efficiency but lower utilization
- Although budgeted sales are much higher for 2007, the target profit to sales figures is reduced suggesting efforts to increase volume at expense of price.

Production

- Material content as a proportion of total costs remains constant whilst direct labor is declining
- Other costs show an increase in proportion suggesting a change in production methods. This is supported by increased ration and cost of indirect compared with direct employees.
- Profit per worker in both categories has increased as a result of methods and plant rather than labor.
- Selling costs to sales id not change significantly, the addition to staff being represented by higher volume turnover.
- Since no increased o planned in staff members to achieve the substantially higher sales budget for 2007, there's still some capacity available in existing sales force.

Balance sheet

- Plant has increased this year. Further increase is expected next year.
- Higher stocks relate to increased turnover budgeted but maintenance of the debtors figure suggests a quicker turnover confirmed by debtors' turnover rate.
- All working capital ratios are better than standard supporting interpretation of effective financial controls. Current year indicates investments in new equipment reflected in higher productivity form labor. Budget forecasts the intention to continue this trend through to the next period.

9.3 IMPORTANCE OF FINANCIAL RATIOS

Ratios can be used to determine:

(i) The firm's ability to meet its short-term maturing obligations. This is done by the use of liquidity ratios.
(ii) The extent to which the firm is financed by non-user supplied funds. This is done by gearing ratios.
(iii) Financial risk done by liquidity and gearing ratios
(iv) The efficiency with which the firm uses its resources to generate sales revenue and a return to the owners. This is done by activity and profitability in relation to investment ratios.
(v) The firm's ability to control production, operating and financial decisions. This is done by profitability in return to sales ratio.
(vi) The ratios can be used to determine the theoretical value of the company's securities. This is done by the use of revaluation method.
(vii) Ratios can be used to carry out cross-sectional analysis is to compare the firm's performance with other firms in the industry. This is also referred.
(viii) Ratios can be used to compare the firm's performance over time, i.e. trend analysis or time series analysis.

9.4 TREND ANALYSIS AND CROSS-SECTIONAL ANALYSIS

Trend Analysis

This is a comparison of the firm's performance over time. It is mainly determined whether the company is progressing as expected. It could also be used to determine the accuracy of past forecasts.

Methods: -

(a) Describe the trend
(b) Possible causes:

Cross sectional analysis

This is a comparison of the firm's performance with other firms in the same industry. It is important as it helps the firm in carrying out a SWOT analysis. (Strength, Weaknesses, Opportunities, Threats).

>>> Illustration

The comparative ratios of XYZ are given below:

	Incl. Aug 1999	1997	1998	1999
Current ratio ratio"	2.00	2.42	2.21	1.76
Price ratio	1.00	1.23	1.00	0.73
Stock turnover	5.6	3.10	3.08	2.64
Debtors turnover	8.5	7.88	7.58	16.00
Gross profit margin %	36.7	39.6	39.8	40.9
Net profit margin %	3.2	5.1	3.6	3.7
Operating expense ratio	33.5	34.5	36.2	37.2

Carry out a trend and cross-sectional analysis.

Trend analysis

The liquidity position has been decreasing as shown by both the current ratio, which decreased from 2.42 in 1997 to 1.76 in 1999, and the quick ratio, which also decreased from 1.23 to 1.00 in 1999. This may have been caused by a decrease in current assets over time or increase in current liabilities over time.

Alternatively, the current liabilities may be increasing faster than the increase in current assets; this implies that the firm's ability to meets its short-term maturing obligations have been decreasing while its financial risk has been increasing.

The activity position of the company has decreased as shown by the stock turnover, which decreased from 3.1 to 2.64 in 1997 to 1999; however, the debtors' turnover shows a slight decrease in 1998 before a significant increase in 999. This must have been caused by the company applying a stringent credit policy, which discouraged credit sales and therefore resulted in the increase in the stocks held. The company is not utilising its resources efficiently to generate the sales revenue.

The profitability position: It shows a slight increase as shown by the gross profit margin which increased from 39.6% in 1997 to 40.9 in 1999. However, the net profit margin shows a significant decrease from 3.6% before recovering slightly to 3.7% in 1999. This may have been caused by a decrease over time but an increase in operating expenses. This can be confirmed by the operating expense ration which has been decreasing and therefore although the company is able to control production decision. It has been unable to control operating and financing decision.

Cross sectional analysis

We compare the industrial performance with that of the company. In carrying out the analysis a report if we are above or below average is to be stated.

The company's liquidity position is below industry coverage shown by both the current and quick ratio which are below the industrial coverage. This applies that the companies is bound to meet its short-term liabilities is less than that in the industry. The activity position is below the industrial average as shown by the stocks turnover which is less than ½ the industrial coverage. However, the debtors' turnover is significantly higher than the industrial coverage, which may imply than the company is applying a very stringent credit policy compared to other companies in the industry. This can be confirmed by computing the average collection period of the firm which is 22.5 and for the industry is 2.35 days profitability position.

The company is higher than the industrial coverage as shown by the Gross and Net profit margin. However, the company is incurring higher operating expenses than average firms in the industry. Therefore, although the company is able to make the production and financing decision better than industrial average, it has been unable to do so in the operations.

On the overall, the company is a high risk, high return company.

9.5 LIMITATIONS OF FINANCIAL RATIOS

(i) It is hard to categorise firms in industrial classification, mainly due to diversification. This makes cross-sectional analysis very hard.
(ii) It is impossible to carry out cross-sectional analysis on industries with only one **monopolistic** firm.
(iii) Different firms use **different accounting policies** and methods and this makes industrial analysis difficult.
(iv) Ratios are compiled at a point in time and suffer from short-term changes. They are therefore used for short-term planning and not long-term planning.
(v) Ratios are included from historical data and therefore are not accurate indicators of the future.

9.6 NON-FINANCIAL PERFORMANCE INDICATORS- NFPI

FAST FORWARD: These are measures of performance based on non-financial information which may originate in and be used by operating departments to monitor and control their activities without accounting input.

Why have they become important?

They have because of the limitations of financial performance indicators. Some of which are:

i. ***Concentrate on too few variables***
They focus entirely on those items that can be expressed in monetary terms and ignore others that can't for example strict cost cutting measures could be in place. These are monetarily measurable but the about the staff morale or quality of the product?

ii. ***Lack of information on quality***
Traditional accounting systems fail to provide information on quality or importance of operations.

iii. ***Measuring success does not ensure success***
Financial measures simply measure success. What organizations need, however, are indicators that ensure it. They should be linked to the company's critical success factors and are non-financial in nature.

iv. ***Changes in cost structure***
Modern technology requires investment and product life cycles are now shorter. Greater proportion of costs are sunk and greater are planned or engineered into a product before production

v. ***Changes in competition***
In modern competition, firms have moved away form competing on the basis of measurable financial indicators. Quality, after sales service, reliability etc are what they are now competing on.

vi. ***Changes in the manufacturing environment***
Modern manufacturing techniques focus on minimizing throughput times, stock levels and set up times. Managers can reduce the costs for which they are responsible by increasing stock levels through maximizing output. With strict conformance to financial aspects, managers may concentrate on cost reduction and ignore other important strategic manufacturing goals.

A major advantage of NFPI is that they are less likely to be manipulated by managers than financial indicators. This helps solve the problem of short termism and focus more attention on the long run. Why? Concentrating on short term profit at any expense is detrimental to the organization in the long run if NFPI are not taken into consideration. On the other hand, NFPI will be numerous and if they are all presented **information overload** will be the result. This is because some of the information may not be necessary or may send mixed signals making decision making difficult. Furthermore, management focus too much on operational goals, they may end up making sub-optimal decisions disregarding the overall strategy.

In the end a combination of both financial and non-financial indicators will be more successful.

Based on CIMA official terminology, non financial performance indicators will be as follows.

Personnel	- Number of complaints received - staff turnover - days lost through absenteeism - days lost through accidents/sickness - training time per employee
Marketing effectiveness	-Trend in market share - sales volume growth - customer visit per sales person - client contact hours per sales person - sales volume forecast Vs actual - number of customers - customer survey response information
Production performance	- set up times - number of suppliers - day's inventory in hand - output per employee - material yield percentage - schedule adherence - proportion of output requiring rework - manufacturing lead times
Service quality	- number of complaints - proportion of repeat booking - customer waiting time - on-time deliveries

9.7 NON-FINANCIAL PERFORMANCE IN SERVICE INDUSTRY

B.A.A, British Airports Authority uses regular customer survey for measuring customers' feelings towards the quality of services. Fitzgerald *et al* identified 12 factors pertaining to service quality. From the survey of customer views concerning services by B.A.A had the following results.

Factor	Measures	Mechanism
Access	- walking distances - ease of finding way around	- surveys/operational data
Aesthetics	- staff appearance - airport's appearance - quality/quantity/appearance of food	- customer survey - mgt inspections
Availability	- equipment availability	- internal fault monitor system - customer survey - internal operational data
Cleanliness	- cleanliness of environment & Equipment	- customer survey - mgt inspections
Comfort	- crowdedness of airports	- customer survey - mgt inspections
Communication	- information clarity - clarity of labeling and pricing	- customer survey - mgt inspections

Courtesy	- courtesy of staff	- customer survey - mgt inspections
Friendliness	Staff attitude	- customer survey - mgt inspections
Reliability	Number of equipment faults	- surveys and inspections
Responsible	- staff responsiveness	- customer survey - mgt inspections
Security	- efficiency of security checks - number of urgent security reports	- surveys - internal data

How satisfied are customers?

Again there are no hard and fast financial indicators to measure customer satisfaction. NFPI in customer satisfaction include:

- Repeat purchases form that customer
- Mew customer s attained
- Time it takes for personnel to handle customer queries
- How often do you deliver on time
- Percentage of products which fail early or excessively
- Percentage of complaints on total sales volume
- Percentage of defective units delivered to customers
- Market research concerning the product

9.8 PERFORMANCE MANAGEMENT IN NON-PROFIT MAKING ORGANIZATIONS (NPO)

According to Bois, “an NPO is an organization whose attainment of its prime goal is not assessed by economic measures. However, in pursuit of that goal, it may undertake profit making activities.”

They are organizations for social, educational and philanthropic purposes. Examples include schools, charities, churches, hospitals, local and central government. Unlike other businesses, NPO have the difficulty of defining their objectives. Further, some NPO could be having multiple objectives. Nevertheless, performance management is important for them especially for those in the public sector where accountability to local and national tax payers is of concern.

Some of the problems with performance management in NPO in the public sector are:

- Some have multiple objectives
- Some of the outputs form these organizations can not be measured e.g. what is the output of the fire services
- There's the lack of profit measures. There are no "sales" hence no profit and so measures such as ROI and RI are meaningless
- The nature of the service provided is unique. Like one cannot define a cost unit for the army
- Financial constraints. They have limited borrowing power if any. Their ability to raise funds is subject to strict control by the central government.
- There are political, social and legal considerations to make e.g. the decision to close a "loss making" hospital could have social impact. Some International Accounting Standards could be difficult in some areas to apply.

But even with these problems, why would these organizations insist on having performance measures:

i. Without information on outputs and inputs, efficient resource allocation will not be possible. Without the indicators, allocation will be done subjectively, on personal whims or even in response to political pressure.
ii. Without indicators, managers won't know the extent to which operations are contributing to effectiveness and efficiency, determine any trends over time or compare with other similar units
iii. The government would need information to know how much and where to spend in the public sector. That is "what are your results at this level of funding?" Donors also need to know how their money is being used.

FINANCIAL DISTRESS

Financial distress is defined as a condition where obligations are not met or are met with difficulty. A major disadvantage for a firm taking on higher levels of debt is that it increases the risk of financial distress, and ultimately liquidation. This may have detrimental effect on both the equity and debt holders.

Effects of Financial Distress

- The risk of incurring the costs of financial distress has a negative effect on a firm's value

which offsets the value of tax relief of increasing debt levels.

- These costs become considerable with very high gearing. Even if a firm manages to avoid liquidation its relationships with suppliers, customers, employees and creditors may be seriously damaged.
- Suppliers providing goods and services on credit are likely to reduce the generosity of their terms, or even stop supplying altogether, if they believe that there is an increased chance of the firm not being in existence in a few months' time.
- Customers may develop close relationships with their suppliers, and plan their own production on the assumption of a continuance of that relationship. If there is any doubt about the longevity of a firm it will not be able to secure high-quality contracts. In the consumer markets customers often need assurance that firms are sufficiently stable to deliver on promises.

In a financial distress situation, employees may become demotivated as they sense increased job insecurity and few prospects for advancement. The best staff will start to move to posts in safer companies.

Bankers and other lenders will tend to look upon a request for further finance from a financially distressed company with a prejudiced eye – taking a safety-first approach – and this can continue for many years after the crisis has passed.

Management find that much of their time is spent “fire fighting” – dealing with day-to-day liquidity problems – and focusing on short-term cash flow rather than long-term shareholder wealth.

The indirect costs associated with financial distress can be much more significant than the more obvious direct costs such as paying for lawyers, accountants and for refinancing programs. Some of these indirect and direct costs are shown in the table below:

Some Indicators of Financial Distress

As the risk of financial distress rises with the gearing ratio shareholders (and lenders) demand an increasing return in compensation.

The important issue is at what point does the probability of financial distress so increase the cost of equity and debt that it outweighs the benefit of the tax relief on debt?

Financial Analysis may be used to view some of the indicators of the financial distress. Important ratios to be considered include:

- Liquidity ratios
- Debt management ratios
- Asset utilization ratios

The ratios provide indicators on whether the firm is facing financial problems in meeting both its current and long term debt obligations. Other indicators are as discussed below.

Some Factors Influencing the Risk of Financial Distress Costs

The susceptibility to financial distress varies from company to company. Here are some influences:

1. The sensitivity of the company's revenues to the general level of economic activity.
   If a company is highly responsive to the ups and downs in the economy, shareholders and lenders may perceive a greater risk of liquidation and/or distress and demand a higher return in compensation for gearing compared with that demanded for a firm which is less sensitive to economic events.
2. The proportion of fixed to variable costs.
   A firm which is highly operationally geared, and which also takes on high borrowing, may find that equity and debt holders demand a high return for the increased risk
3. The liquidity and marketability of the firm's assets.
   Some firms invest in a type of asset which can be easily sold at a reasonably high and certain value should they go into liquidation. This is of benefit to the financial security holders and so they may not demand such a high-risk premium.

The cash-generation ability of the business

Some firms produce a high regular flow of cash and so can reasonably accept a higher gearing level than a firm with lumpy and delayed cash inflows.

9.9 VALUE FOR MONEY AUDITS (VFM)

FAST FORWARD: VFM audits 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

Performance in NPO is usually judged in terms of inputs and outputs and thus the VFM criteria is assessing performance based on the 3Es: **economy, efficiency and effectiveness**.

Economy: this is concerned with ensuring that the minimum quantity and quality of resources are used to achieve that desired output. Focus is on reducing costs and inputs. However the best quality should be ensured.

Effectiveness: it is the relationship between an organization's outputs and its objectives. Are their efforts attaining them?

Efficiency: it is the relationship between inputs and outputs. Where, for a certain level **output**, target will be attained with as little input as possible or for a certain level of **input** a high level of output should be attained.

VFM audits are intended to help management do a better job by identifying waste and inefficiencies and recommending corrective action. Although it is applicable in both the private and public sector, the latter is under more pressure to prove that they are operating under the 3Es to be able to "qualify" for future funding and support. However VFM is seen by some as an approach to spreading costs in the public expenditure fairly across services. Others view it as a necessity to ensure the desired impact is achieved with the minimum use or resources.

Steps in the VFM audit

i. What is the objective of the NPO? This needs to be established at the star of the audit.
ii. Examine the systems of control used to achieve the objectives. How are the objectives achieved? How are the achievements monitored and measured?
iii. Document the organization being audited. Identifying and evaluating the key controls.
iv. Verify and test the system in operation. Are the controls strong or too weak? Do they have a scope for cost saving?
v. Examine the *efficiency* of the system. Are too may resources being used? Are the performance indicators suitable?
vi. Evaluate the *effectiveness* of the organization. Does the system meet its objectives?

Specifically, value for money audits may involve the examination and analysis of:

- Human resource management (HRM)
- Proper management of all assets
- The management systems; planning, budgeting and control
- Managerial decision making including good allocation of existing resources and strategic matters.

Benefits and problems of performance measurement

Berry, Broadbent and Otley have described the various problems and benefits of performance measurement.

Benefits

i. Indicators clarify the objectives of the organization
ii. It means that they are the agreed measure of activity
iii. There will be a greater understanding of processes.
iv. They facilitate the comparison of performance in different organizations
v. They facilitate the setting of targets for the organization and its managers
vi. They promote accountability of the organizations to their stakeholders.

Problems

i. ***Tunnel visioning***
It is placing undue focus on performance to the detriment of other areas.

ii. ***Sub optimization***
It is the focus on objectives so that others cannot be achieved

iii. ***Myopia***
It is the short-sightedness leading to neglect of longer term objectives.

iv. ***Measure fixation***
They are the measures and behaviors in order to achieve specific performance indicators which may not be effective

v. ***Misrepresentation***
"Creative" accounting to suggest the results are acceptable

vi. ***Misinterpretation***
It is the failure to recognize the complexity of the environment in which the organization operates

vii. ***Gaming***
It is the deliberates distortion of a measure to secure some strategic advantages

viii. ***Ossification***
It is the unwillingness to change the performance measure scheme once it has been set-up

The main issue highlighted in the above problem is the conflict between **individual** and **organizational goals**.

What could be solutions to them?

- Involve staff at all stages of development and implementation
- Performance measures should be used flexibly. Prevents fixation and misrepresentation
- They should be constantly reviewed. Prevents ossification an gaming
- Careful consideration should be given to the dimensions of performance
  - Quantity objectives- overcome sub-optimization
  - Focus on customer satisfaction – prevents tunnel visioning and sub-optimization
- Consideration should be given to the audit of the system

Expert interpretation of performance measurement schemes help to provide an idea of the incidence of problems. Careful audit of data also helps to reduce incidence and impact of measure fixation, misinterpretation and gaming.

- Recognition of the key feature necessary in any scheme should help to overcome the range of problems listed. Key features include, a longer term view amongst staff, a sensible number of measures, benchmarks which are independent of past activity)

9.10 ECONOMIC VALUE ADDED (EVA) MEASUREMENT (Source-Shane Johnson's article)

'Economic Value Added' (EVA) is a trademark of the Stern Stewart consulting organisation. Stern Stewart maintains that the implementation of a complete EVA-based financial management and incentive compensation system gives managers both better information and superior motivation to make decisions that will create the greatest shareholder wealth in any publicly-owned or private organisation.

It is argued that linking performance to profit breeds a short-termist boom–bust culture. For instance, a firm might adopt a cost minimization programme to increase profits and, to this end, make immediate redundancies. This short-term decision would most likely trigger problems in the medium to long–term for the business. This is one of the concerns that EVA directly addresses, and the principal success of EVA as a performance metric is the link with long–term wealth maximization and discount factor techniques. Studies have shown that companies that adopt EVA as a performance measure outperformed their peers by 8.5% annually, and for those companies operating in a declining market this jumps to over 12% per annum.

The real benefits are realised when EVA is further linked to management compensation packages. In this scenario it was found that companies outperformed their peers by 57% over a five–year period (Stern Stewart, 2005).

Stern Stewart argues that EVA is the financial performance measure that comes closer than any other to capturing the true *economic* profit of an organisation, and is the performance measure most directly linked to the creation of shareholder wealth over time. EVA™ is an estimate of the amount by which earnings exceed or fall short of the required minimum rate of return that shareholders and debt holders could get by investing in other securities of comparable risk. The formula is as follows:

EVA = net operating profit after tax - WACC x book value of capital employed

Stern et al (ed 2001) suggest that 'when fully implemented' EVA will be 'the centerpiece of an integrated financial management system that incorporates the full range of corporate financial decision making'. It is argued that the following advantages can be gained from the adoption of an EVA–based approach to performance measurement:

- Profits are shown in the way shareholders count them
- Company decisions are aligned with shareholder wealth
- A financial measure is used that line managers understand
- The confusion of multiple goals is ended.

Aligning decisions with shareholder wealth

Stern et al (2001) argue that the development of EVA coincides with the increased 'empowerment' of managers as decision makers, and is a tool to meet the potential agency issues that are created when ownership and management are separated.

It is argued that EVA helps managers incorporate two basic principles of finance into their decision making. The first is that the primary financial objective of any company should be to maximize the wealth of its shareholders. The second is that the value of a company depends on the extent to which investors expect future profits to exceed or fall short of the cost of capital. Stern et al argue that a sustained increase in EVA will precipitate an increase in the market value of an organisation.

They further suggest that the adoption of an EVA approach has proved effective in virtually all types of organisation, from emerging growth companies to those organisations involved in 'turnaround' situations. They believe that the current level of EVA isn't what really matters since the current performance of an organisation is already reflected in its share price. It is the continuous improvement in EVA that brings continuous increases in shareholder wealth.

A financial measure that line managers understand

EVA has the advantage of being conceptually simple and easy to explain to non-financial managers, since it starts with familiar operating profits and simply deducts a charge for the capital invested either in the company as a whole, or in a business unit, or even in a single plant, office, or assembly line. In addition, EVA is closely analogous to the concept of residual income (RI) which is both widely practiced and well established in literature as a measure of divisional performance.

By assessing a charge for using capital, EVA raises managerial awareness of the need for care in the management of the balance sheet as well as the income statement, and helps them to properly assess the trade-offs between the two. This broader, more complete view of the economics of a business can have a profound influence on business performance. Unlike net present value (NPV) calculations, EVA can be used as an effective performance measure because of its ability to measure results periodically. Proponents of EVA assert that its use provides a superior measure of the year–to–year value that the business creates. Moreover, because EVA™ measures performance in terms of 'value', it should be the cornerstone of any financial management system used to set corporate strategy, or to evaluate potential capital investment decisions, corporate acquisitions, or performance.

Ending the confusion of multiple goals

Most companies use a confusing array of measures to express financial goals and objectives. Strategic plans are often based on growth in revenues or market share. Companies may evaluate individual products or lines of business on the basis of gross margins or cash flow. Business units may be evaluated in terms of return on assets or against a budgeted profit level. Finance departments usually analyse capital investments in terms of

NPV, but weigh prospective acquisitions against the likely contribution to earnings growth. And bonuses for line managers and business unit heads are typically negotiated annually and are invariably based on a profit plan.

The result of such varied standards, goals, and terminology is usually in-cohesive planning, operating strategy, and decision making.

EVA eliminates this confusion by using a single financial measure that links all decision making with a common focus, ie 'How do we improve EVA'. EVA is the only financial management system that provides a common language for employees across all operating and staff functions. It allows all management decisions to be modelled, monitored, communicated, and compensated in a single and consistent way –always in terms of the value added to shareholder investment.

EVA ADJUSTMENTS

Typical adjustments that are required in EVA calculations include:

Adjustment to net profit	Adjustment to capital employed
Add net capitalized intangibles	Add net book value of intangibles
Add goodwill written off and accounting depreciation (deduct economic depreciation)	Add cumulative goodwill and cumulative depreciation previously written off
Add increases in provisions such as those in respect of bad debts and deferred tax	Add provisions such those in respect of bad debts and deferred tax
Add back interest on debt capital forms part of capital employed	Add debt to net assets such that it

In assessing EVA, one should recognise that it is an annual measure of performance with a historic perspective. The use of EVA represents an attempt to measure whether the management of an entity has used available funds in order to 'create' or 'destroy' value.

Under accounting conventions, retained profits are arrived at only after a significant number of expenses and non-cash adjustments have been made. It is arguable, however, that these might be perceived as being similar to investments.

Investments in intangibles, such as promotional activities, research and development, and employee training and development, are written off in the income statement under conventional accounting rules. Each of these items could be regarded as constituting discretionary expenditure by management. Thus, in the calculation of EVA they would be added back to capital employed on the premise that such expenditures would have otherwise been available to be paid as dividend, or to reduce the level of debt finance employed. Likewise, the amount of expenditure on such items would be added to or deducted from the net profit or loss for the year.

In calculating EVA, depreciation and amortization during the period are added back to the capital employed. This is because, when the assets were acquired, the funds expended would otherwise have been available to the organisation and could have been returned to shareholders. Under EVA principles, it is the historic cost of non-current assets (less a charge for economic depreciation) which is deemed to be the relevant figure, due to the fact that it represents the total funds expended by the management.

The addition to net profit, of increases in provisions such as bad debts and deferred taxation, emanates from recognition of the need to apply prudence under conventional accounting practices. There is the tendency to be over-prudent in the making of provisions which could seriously undermine the use of reported profit as a measure of performance. From a balance sheet perspective, such over-prudence leads to an understatement of the true capital employed within a business.

The existence of operating leases and other forms of off-balance sheet financing can create distortions in measuring performance based on an understated capital base. The addition of such debt instruments to capital employed avoids any distortion to calculated EVA values resulting from management decisions which have affected the capital gearing of the organisation. Otherwise, an organisation could improve its EVA simply by replacing its equity with such debt capital. One must be mindful of the need to add back any interest charged during a period to net profit; this is not only consistent with the adjustment to capital employed, but also avoids the ‘double-counting’ of interest paid on assets financed by debt capital. In the absence of such an adjustment, interest paid would have been deducted from profit and again deducted in the calculation of EVA.

EXAMPLE OF AN EVA CALCULATION

Value Co (VC):

Summary income statements for the year:

	2007	2006
	$m	$m
Revenue	608	520
Pre-tax accounting profit (Note 1)	134	108
Taxation	(46)	(37)
Profit after tax	88	71
Dividends	(29)	(24)
Retained earnings	59	47

Summary balance sheet for the year ending:

	2007	2006
	$m	$m
Non-current assets	250	192
Net current assets	256	208
	506	400
Financed by:		
Shareholders' funds	380	312
Medium and long-term bank loans	126	88
	506	400

Note 1: After deduction of the economic depreciation of the company's non-current assets. This is also the depreciation used for tax purposes.

Other information is as follows:

1 Capital employed at the end of 2005 amounted to $350m.
2 VC had non-capitalized leases valued at $16m in each of the years 2005 to 2007. The leases are not subject to amortization.
3 VC's pre-tax cost of debt was estimated to be 9% in 2006 and 10% in 2007.
4 VC's cost of equity was estimated to be 15% in 2006 and 17% in 2007.
5 The target capital structure is 70% equity, 30% debt.
6 The rate of taxation is 30% in both 2006 and 2007.
7 Economic depreciation amounted to $64m in 2006 and $72m in 2007. These amounts were equal to the depreciation used for tax purposes and depreciation charged in the

income statements.

8 Interest payable amounted to $6m in 2006 and $8m in 2007.

9 Other non-cash expenses amounted to $20m per year in both 2006 and 2007.

Solution

As discussed above, in order to compute EVA, adjustments must be made to the conventional, after-tax profit measures of $71m and $88m shown in the example. Usually, an adjustment is made to convert depreciation (calculated under conventional financial accounting) to an estimate of economic depreciation, but in this example we know that profits have already been calculated using economic depreciation.

Non-cash expenses are added back since the adjusted profit attempts to approximate cash flow after taking account of economic depreciation. Net interest is also added back because the returns required by the providers of funds will be reflected in the cost of capital deduction. It is vital to note that net interest is added back because interest will have been allowed as an expense when determining the payment of taxation.

The capital employed used to calculate EVA should be based on adjustments that seek to approximate book economic values at the start of each period. In practice, this might necessitate several adjustments.

However, because there is insufficient information in this example, the book value of shareholders' funds, together with medium and long-term loans at the end of 2005, is used as a starting point in determining the economic capital employed at the beginning of 2006.

	2007	**2006**
	$m	**$m**
Adjusted profit	113.6 (88 + 20 + (0.7 x 8))	95.2 (71 + 20 + (0.7 x 6))
Capital employed	416 (400 + 16)	366 (350 + 16)

The weighted average cost of capital should be based on the target capital structure. The calculation is as follows:

2006: (15% x 0.7) + (9% x 0.7 x 0.3) = 12.39%

2007: (17% x 0.7) + (10% x 0.7 x 0.3) = 14.00%

EVA 2006 = 95.2 - (366 x 0.1239) = $49.85m

EVA 2007 = 113.6 - (416 x 0.14) = $55.36m

Potential problems of EVA

The calculation of EVA™ can be complicated when many adjustments are required.

EVA is difficult to use for inter-firm and inter-divisional comparisons because it is an absolute rather than a relative measure. Allowance should be made for size when inter-company comparisons are made.

Due to the calculation being a year-to-year performance metric, the result could be manipulated by, for example, choosing short-term, early yield projects over longer-term, delayed income stream, higher yield projects. Management could also select projects with low initial set up costs, and therefore with a lower overall NPV, over those with high initial investment costs, and therefore with a higher NPV. Management might also limit its investment cash flows, such as research and development or advertising costs, to the long-term detriment of the business.

EVA is a short-run concept that deals only with the current reporting period, whereas managerial performance measures should focus on the future results anticipated as a consequence of present managerial actions. In an ideal world, divisional performance should be evaluated on the basis of economic income by estimating future cash flows and discounting them to their present value. This calculation could be made for a division at the beginning and end of a measurement period. The difference between the beginning and ending values would represent the estimate of economic income. However, the main problem associated with the use of estimates of economic income to evaluate performance is that it lacks precision and objectivity. Very often, the person who is best placed to provide the cash flow estimates is the individual whose performance is being 'measured'. In such circumstances, managers may be tempted to provide biased estimates.

The use of estimates of economic income to evaluate performance is also inconsistent with the external financial information used by financial analysts to evaluate an organisation as a whole.

Other value drivers are ignored which might be important despite not being disclosed in the accounts.

The use of conventional depreciation methods means that there is no guarantee that the measurement of EVA in the short-term will be consistent with the measurement of EVA in the longer-term.

Economic depreciation is difficult to estimate and conflicts with generally accepted accounting principles, which may hinder its acceptance by financial managers.

STUDY TEXT

CHAPTER SUMMARY

Ration analysis is the systematic production of ratios both from internal and external financial statements to try and establish relationships and results in order to appraise financial performance.

There are four broad categories of ratios:

i. **Activity ratios:** they evaluate revenue and output generated by the firms assets
ii. **Liquidity analysis:** they measure a firms ability to meet its near term cash obligations
iii. **Long term/solvency analysis:** it examines the firm's capital structure, including the mix

of financial resources and ability of firm to satisfy its longer term debt and investment obligations.

iv. **Profitability analysis:** measures the return of the firm relative to its revenues and invested capital.

Non-Financial Performance Indicators- NFPI are measures of performance based on non-financial information which may originate in and be used by operating departments to monitor and control their activities without accounting input.

A major advantage of NFPI is that they are less likely to be manipulated by managers than financial indicators.

An **NPO** is an organization whose attainment of its prime goal is not assessed by economic measures.

Value for Money audits (VFM) 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

Performance in NPO is usually judged in terms of inputs and outputs and thus the VFM criteria is assessing performance based on the 3Es: **economy, efficiency and effectiveness**.

VFM audits are intended to help management do a better job by identifying waste and inefficiencies and recommending corrective action.

Value added statements VAS shows how much value has been created by the firms own effort.

CHAPTER QUIZ

1. Who are the users of financial statements?

2. What are the categories of ratios?

3. Explain the importance of financial ratios.

ANSWERS TO QUIZ QUESTIONS

1. a) Shareholders
   b) Prospective investors
   c) Debt-holders
   d) Creditors
   e) Government
   f) Customers
   g) Employees
   h) Financial analysts
   f) Society

2. There are four broad categories of ratios:

i. *Activity ratios:* they evaluate revenue and output generated by the firms assets
ii. *Liquidity analysis:* they measure a firms ability to meet its near term cash obligations
iii. *Long term/solvency analysis:* it examines the firm's capital structure, including the mix of financial resources and ability of firm to satisfy its longer term debt and investment obligations.
iv. *Profitability analysis:* measures the return of the firm relative to its revenues and invested capital.

3. Ratios can be used to determine:

i. The firm's ability to meet its short-term maturing obligations. This is done by the use of liquidity ratios.
ii. The extent to which the firm is financed by non-user supplied funds. This is done by gearing ratios.
iii. Financial risk done by liquidity and gearing ratios
iv. The efficiency with which the firm uses its resources to generate sales revenue and a return to the owners. This is done by activity and profitability in relation to investment ratios.
v. The firm's ability to control production, operating and financial decisions. This is done by profitability in return to sales ratio.
vi. The ratios can be used to determine the theoretical value of the company's securities. This is done by the use of revaluation method.
vii. Ratios can be used to carry out cross-sectional analysis is to compare the firm's performance with other firms in the industry. This is also referred.
viii. Ratios can be used to compare the firm's performance over time, i.e. trend analysis or time series analysis.

EXAM QUESTIONS

The following is a summarised Profit and Loss account of XYZ Ltd. For the year ended 31 December 1992 and the balance sheet as that date.

PROFIT AND LOSS A/C

	Sh	**Sh**
Sales		850,000
Less Cost of Sales		
Opening stock	99,500	
Purchases	545,250	14,250
	659,000	
Less closing stock	149,000	510,000
Gross Profits	340,000	
Less operating expenses		
Selling and distribution		30,000
Depreciation		10,000
Administration Expenses	135,000	175,000
EBIT	165,000	
Less interest (financing) expenses	15,000	
Earnings before taxes	150,000	
Taxes at 50%	(75,000)	
Net income after taxes	75,000	
Less ordinary dividend		
Sh.075 per share	15,000	
Retained profits	60,000	

STUDY TEXT

BALANCE SHEET

	Sh		Sh
Land and Buildings	250,000	Issued Capital	
Plant and Machinery (net)	80,000	(20,000 shares of sh.10 each)	200,000
		Reserves	90,000
Inventories	149,000	Retained profits	60,000
Debtors 75,000		Long-term debt	100,000
	71,000		
Less provision for bad debts 4,000	30,000	Current Liabilities	130,000
Cash			
	580,000		580,000

Calculate;

i) Current ratio

ii) Leverage ratios (given in %)

CASE STUDY

A London Borough

Value-added activities

The chief executive has indicated that all managers will have to contribute to a cost reduction exercise in the next 6 months. No details are yet available but Clara believes managers will be asked to identify value-added and non-value added activities for the exercise.

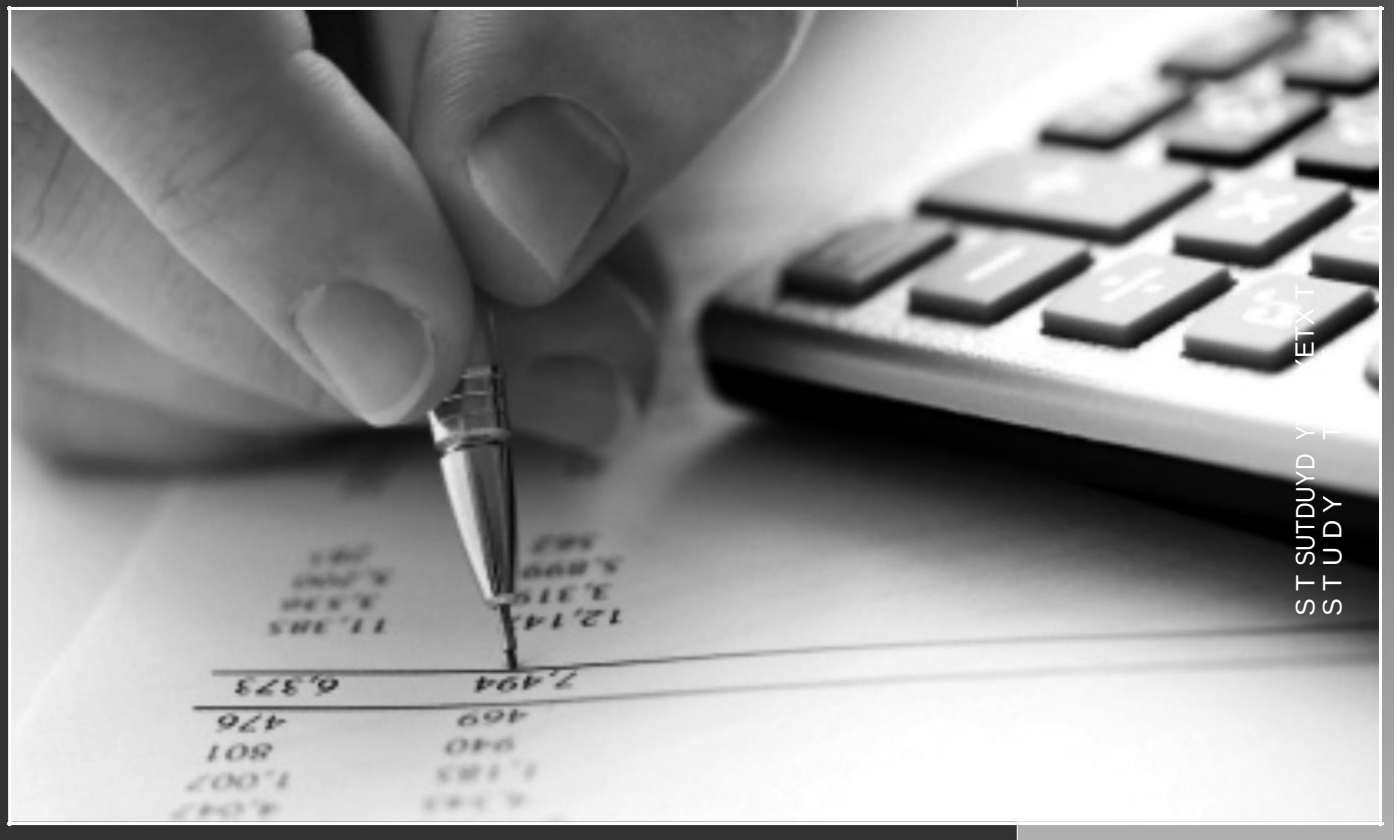
Appendix 1

Brief details of the key activities identified Clara and her staff are given below:

Activity	Brief description
Requests for information from businesses	Information packs have been prepared for telephone enquiries or letters to standardize the response to requests for information. Additional research may be necessary but this is not a significant activity.
Request for information from developers	Information packs are provided giving details of labour market, training, financial information and further contacts.
Project management and development.	The department develops and manages a wide range of projects including environmental improvements, seminars, training projects and joint venture developments. There is a lot of time taken up by preparing reports for committees.
Policy development	A policy contribution includes work for different bodies such as the Government departments.
Work for other council departments.	It is difficult to define a typical request for information but generally each request involves a similar amount of activity.
Other	This is time spent on various activities in the department, which Clara will consider in more detail in the future.

Source: www.google.co.ke- *case studies on management accounting*

CHAPTER TEN



INFORMATION SYSTEMS AND REPORTING TO MANAGEMENT

CHAPTER TEN

INFORMATION SYSTEMS AND REPORTING TO MANAGEMENT

▶ CHAPTER OBJECTIVE

After this chapter, the student will know:

- What a management information system is and its importance
- What a reporting system is and its importance

▶ INTRODUCTION

An information system is a set of interrelated components that collect, manipulate, process and transform data into information and provide feedback to meet a specified objective. A computer based information system is an information system that uses computer technology to perform input, processing and output activities. Due to the massive computerization of manual information systems, computer based information systems are simply referred to as information systems. They are the subject of discussion in this chapter.

Common examples of information systems include: Automated Teller Machines (ATMs), Point of Sale (POS) terminals used by supermarket checkout clerks, airline reservation systems or flight schedule systems used by airlines, student registration systems used by colleges etc.

▶ DEFINITION OF KEY TERMS

Information is data that has been processed.

Reports are designed to convey and record information that will be of practical use to the reader. They are organized into discrete units of specific and highly visible information

Information system is a set of interrelated components that collect, manipulate, process and transform data into information and provide feedback to meet a specified objective

▶ EXAM CONTEXT

This topic has not been tested but students need to understand it.

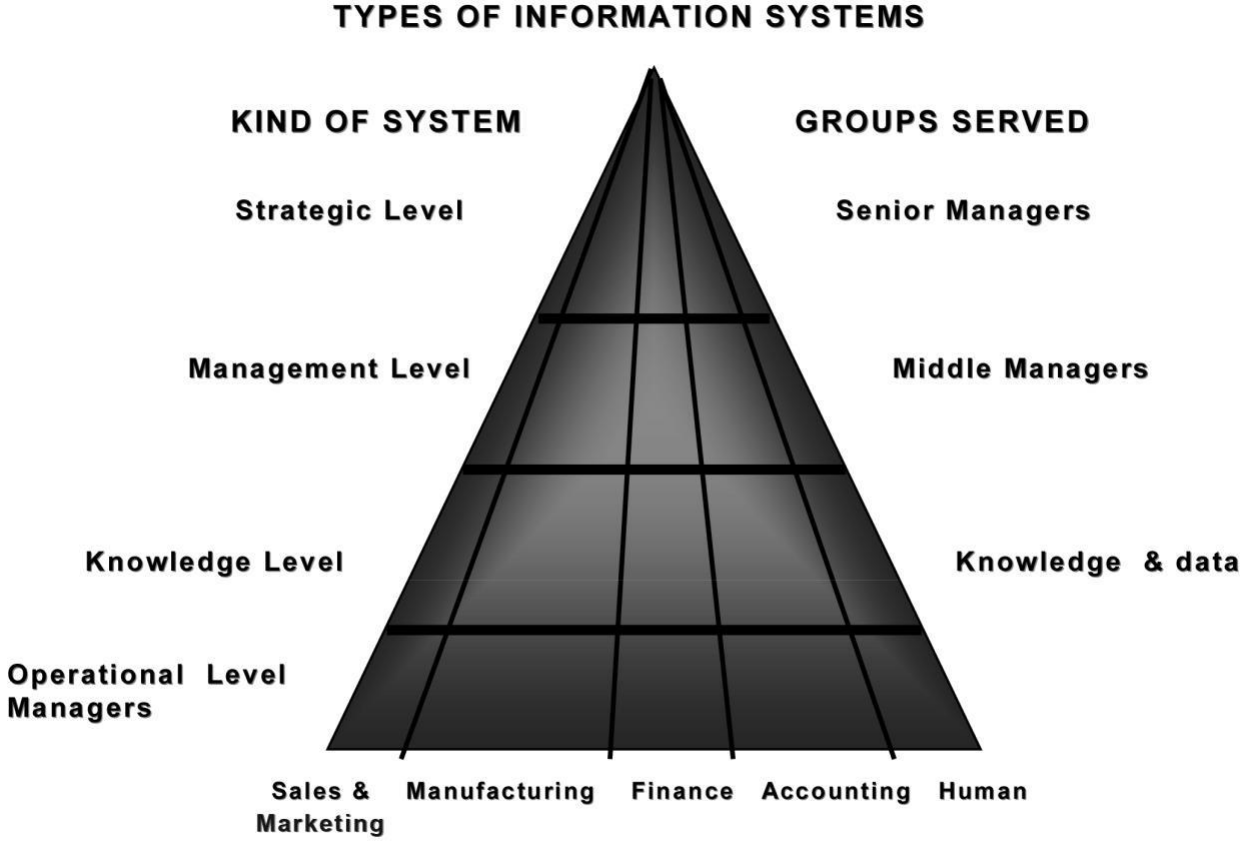
INDUSTRY CONTEXT

Firms require this topic so as to know how to achieve an effective and efficient information system and also an efficient and effective reporting system.

MANAGEMENT STRUCTURE AND USE OF INFORMATION

Information systems support different types of decisions at different levels of the organizational hierarchy. While operational managers mostly make structured decisions, senior managers deal with unstructured decisions and middle managers are often faced with semi-structured decisions.

For each functional area in the organization, four levels of organizational hierarchy can be identified: the operational level, knowledge level, management level and strategic level. Different types of information systems serve each of these levels.



COMPONENTS OF AN INFORMATION SYSTEM

Components of an information system include:

- People – These use the system to fulfill their informational needs. They include end users and operations personnel such as computer operators, systems analysts, programmers, information systems management and data administrators.

- Computer Hardware – Refers to physical computer equipment and devices, which provide for five major functions.
  - Input or data entry
  - Output
  - Secondary storage for data and programs
  - Central processor (computation, control)
  - Communication

- Computer Software – Refers to the instructions that direct the operation of the computer hardware. It is classified into system and application software.

- Telecommunication System/Communication network

- Databases – Contains all data utilized by application software. An individual set of stored data is referred to as a file. Physical storage media evidences the physical existence of stored data, that is: tapes, disk packs, cartridges, and diskettes.

- Procedures – Formal operating procedures are components because they exist in physical forms as manuals or instruction booklets. Three major types of procedures are required.

  - User instructions – for application users to record data, to use a terminal for data entry or retrieval, or use the result.
  - Instructions for preparation of input by data preparation personnel.
  - Operating instructions for computer operations personnel.

FUNCTIONS OF AN INFORMATION SYSTEM

The functions of an information system can be generally classified into those functions involved in:

- Transaction processing
- Management reporting
- Decision support

TRANSACTION PROCESSING

Major processing functions include:

i. Process transactions – Activities such as making a purchase or a sale or manufacturing a product. It may be internal to the organization or involve an external entity. Performance of a transaction requires records to:

- Direct a transaction to take place
- Report, confirm or explain its performance
- Convey it to those needing a record for background information or reference.

ii. Maintain master files – Many processing activities require operation and maintenance of a master file, which stores relatively permanent or historical data about organizational entities. E.g. processing an employee paycheck needs data items such as rate of pay, deductions etc. transactions when processed update data items in the master file to reflect the most current information.

iii. Produce reports – reports are significant products of an information system. Scheduled reports are produced on a regular basis. An information system should also be able to produce special reports quickly based on 'ad hoc' or random requests.

iv. Process inquiries – Other outputs of the information system are responses to inquiries using the databases. These may be regular or ad hoc inquiries. Essentially inquiry processing should make any record or item in the database easily accessible to authorized personnel.

v. Process interactive support applications – The information system contains applications to support systems for planning, analysis and decision making. The mode of operation is interactive, with the user responding to questions, requesting for data and receiving results immediately in order to alter inputs until a solution or satisfactory result is achieved.

MANAGEMENT REPORTING

This is the function involved in producing outputs for users. These outputs are mainly as reports to management for planning, control and monitoring purposes. Major outputs of an information system include:

i. Transaction documents or screens
ii. Preplanned reports
iii. Preplanned inquiry responses
iv. Ad hoc reports and ad hoc inquiry responses
v. User-machine dialog results

DECISION SUPPORT

Types of decisions

a) Structured/programmable decisions

These decisions tend to be repetitive and well defined e.g. inventory replenishment decisions. A standardized pre-planned or pre-specified approach is used to make the decision and a specific methodology is applied routinely. Also the type of information needed to make the decision is known precisely. They are programmable in the sense that unambiguous rules or procedures can be specified in advance. These may be a set of steps, flowchart, decision table or formula on how to make the decision. The decision procedure specifies information to be obtained before the decision rules are applied. They can be handled by low-level personnel and may be completely automated.

It is easy to provide information systems support for these types of decisions. Many structured decisions can be made by the system itself e.g. rejecting a customer order if the customer's credit with the company is less than the total payment for the order. Yet managers must be able to override these systems' decisions because managers have information that the system doesn't have e.g. the customer order is not rejected because alternative payment arrangements have been made with the customer.

In other cases the system may make only part of the decision required for a particular activity e.g. it may determine the quantities of each inventory item to be reordered, but the manager may select the most appropriate vendor for the item on the basis of delivery lead time, quality and price.

Examples of such decisions include: inventory reorder formulas and rules for granting credit.
Information systems requirements include:

- Clear and unambiguous procedures for data input
- Validation procedures to ensure correct and complete input
- Processing input using decision logic
- Presentation of output so as to facilitate action

b) Semi-structured/semi-programmable decisions

The information requirements and the methodology to be applied are often known, but some aspects of the decision still rely on the manager: e.g. selecting the location to build a new warehouse. Here the information requirements for the decision such as land cost, shipping costs are known, but aspects such as local labour attitudes or natural hazards still have to be judged and evaluated by the manager.

c) Unstructured/non-programmable decisions

These decisions tend to be unique e.g. policy formulation for the allocation of resources. The information needed for decision-making is unpredictable and no fi xed methodology exists. Multiple alternatives are involved and the decision variables as well as their relationships are too many and/or too complex to fully specify. Therefore, the manager's experience and intuition play a large part in making the decision.

In addition there are no pre-established decision procedures either because:

- The decision is too infrequent to justify organizational preparation cost of procedure or
- The decision process is not understood well enough, or
- The decision process is too dynamic to allow a stable pre-established decision procedure.

Information systems requirements for support of such decisions are:

- Access to data and various analysis and decision procedures.
- Data retrieval must allow for ad hoc retrieval requests
- Interactive decision support systems with generalized inquiry and analysis capabilities.

>>> **Example: Selecting a CEO of a company.**

STUDY TEXT

TYPES OF INFORMATION SYSTEMS: CHARACTERISTICS AND DIFFERENCES

Major types of systems include:

1. Transaction Processing Systems (TPS)
2. Management Reporting Systems (MRS)
3. Decision Support Systems (DSS)
4. Executive Support Systems (ESS)
5. Expert Systems

TRANSACTION PROCESSING SYSTEM (TPS)

FAST FORWARD: Transaction processing systems were created to maintain records and do simple calculations faster, more accurately and more cheaply than people could do the tasks.

A transaction is any business related exchange, such as a sale to a client or a payment to a vendor. Transaction processing systems process and record transactions as well as update records. They automate the handling of data about business activities and transactions. They record daily routine transactions such as sales orders from customers, or bank deposits and withdrawals. Although they are the oldest type of business information system around and handle routine tasks, they are critical to business organization. For example, what would happen if a bank's system that records deposits and withdrawals and maintain accounts balances disappears?

TPS are vital for the organization, as they gather all the input necessary for other types of systems. Think of how one could generate a monthly sales report for middle management or critical marketing information to senior managers without TPS. TPS provide the basic input to the company's database. A failure in TPS often means disaster for the organization. Imagine what happens when an airline reservation system fails: all operations stops and no transaction can be carried out until the system is up and running again. Long queues form in front of ATMs and tellers when a bank's TPS crashes.

Characteristics of TPS:

- TPS are large and complex in terms of the number of system interfaces with the various users and databases and usually developed by MIS experts.
- TPS's control collection of specifi c data in specifi c formats and in accordance with rules, policies, and goals of organisation- standard format
- They accumulate information from internal operations o the business.
- They are general in nature—applied across organisations.
- They are continuously evolving.

The goals of TPS is to improve transaction handling by:

- Speeding it up
- Using fewer people
- Improving effi ciency and accuracy
- Integrating with other organizational information systems
- Providing information that was not available previously.

>>> **Examples —** Airline reservation systems, Automated Teller Machines (ATMs,) order processing systems, registration systems, Payroll systems and point of sale systems.

MANAGEMENT REPORTING SYSTEM (MRS)

Management Reporting Systems (MRS) formerly called Management information systems (MIS) provide routine information to decision makers to make structured, recurring and routine decisions, such as restocking decisions or bonus awards. They focus on operational efficiency and provide summaries of data. A MRS takes the relatively raw data available through a TPS and converts it into meaningful aggregated form that managers need to conduct their responsibilities. They generate information for monitoring performance (e.g. productivity information) and maintaining coordination (e.g. between purchasing and accounts payable).

The main input to an MRS is data collected and stored by transaction processing systems. A MRS further processes transaction data to produce information useful for specific purposes. Generally, all MIS output have been pre-programmed by information systems personnel. Outputs include:

a) Scheduled Reports – These were originally the only reports provided by early management information systems. Scheduled reports are produced periodically, such as hourly, daily, weekly or monthly. An example might be a weekly sales report that a store manager gets each Monday showing total weekly sales for each department compared to sales this week last year or planned sales.
b) Demand Reports – These provide specific information upon request. For instance, if the store manager wanted to know how weekly sales were going on Friday, and not wait until the scheduled report on Monday, she could request the same report using figures for the part of the week already elapsed.
c) Exception Reports – These are produced to describe unusual circumstances. For example, the store manager might receive a report for the week if any department's sales were more than 10% below planned sales.

Characteristics of MRS

- MIS professionals usually design MRS rather than end users- using life cycle oriented development methodologies.
- They are large and complex in terms of the number of system interfaces with the various users and databases.
- MRS are built for situations in which information requirements are reasonably well known and are expected to remain relatively stable. This limits the informational flexibility of MRS but ensures that a stable informational environment exists.
- They do not directly support the decision making process in a search for alternative solutions to problems. Information gained through MRS is used in the decision making process.
- They are oriented towards reporting on the past and the present, rather than projecting the future. Can be manipulated to do predictive reporting.
- MRS have limited analytical capabilities. They are not built around elaborate models, but rather rely on summarization and extraction from the databases according to the given criteria.

DECISION SUPPORT SYSTEM (DSS)

Decision support systems provide problem-specific support for non-routine, dynamic and often complex decisions or problems. DSS users interact directly with the information systems, helping to model the problem interactively. DSS basically provide support for non-routine decisions or problems and an interactive environment in which decision makers can quickly manipulate data and models of business operations. A DSS might be used for example, to help a management team decide where to locate a new distribution facility. This is a non-routine, dynamic problem. Each time a new facility must be built, the competitive, environmental, or internal contexts are most likely different. New competitors or government regulations may need to be considered, or the facility may be needed due to a new product line or business venture.

When the structure of a problem or decision changes, or the information required to address it is different each time the decision is made, then the needed information cannot be supplied by an MIS, but must be interactively modelled using a DSS. DSS provide support for analytical work in semi-structured or unstructured situations. They enable mangers to answer 'What if' questions by providing powerful modelling tools (with simulation and optimization capabilities) and to evaluate alternatives e.g. evaluating alternative marketing plans.

DSS have less structure and predictable use. They are user-friendly and highly interactive. Although they use data from the TPS and MIS, they also allow the inclusion of new data, often from external sources such as current share prices or prices of competitors.

DSS components include:

a) Database (usually extracted from MIS or TPS)
b) Model Base
c) User Dialogue/Dialogue Module

EXECUTIVE INFORMATION SYSTEM (EIS) / EXECUTIVE SUPPORT SYSTEMS (ESS)

EIS provide a generalized computing and communication environment to senior managers to support strategic decisions. They draw data from the MIS and allow communication with external sources of information. But unlike DSS, they are not designed to use analytical models for specific problem solving. EIS are designed to facilitate senior managers' access to information quickly and effectively.

ESS has menu-driven user-friendly interfaces, interactive graphics to help visualization of the situation and communication capabilities that link the senior executives to the external databases he requires.

Top executives need ESS because they are busy and want information quickly and in an easy to read form. They want to have direct access to information and want their computer set-up to directly communicate with others. They want structured forms for viewing and want summaries rather than details.

EXPERT SYSTEM (ES)

- It is an advanced DSS that provides expert advice by asking users a sequence of questions dependent on prior answers that lead to a conclusion or recommendation. It is made of a knowledge base (database of decision rules and outcomes), inference engine (search algorithm), and a user interface.
- ES use artificial intelligence technology.
- It attempts to codify and manipulate knowledge rather than information
- ES may expand the capabilities of a DSS in support of the initial phase of the decision making process. It can assist the second (design) phase of the decision making process by suggesting alternative scenarios for "what if" evaluation.
- It assists a human in the selection of an appropriate model for the decision problem. This is an avenue for an automatic model management; the user of such a system would need less knowledge about models.
- ES can simplify model-building in particular simulation models lends itself to this approach.
- ES can provide an explanation of the result obtained with a DSS. This would be a new and important DSS capability.
- ES can act as tutors. In addition ES capabilities may be employed during DSS development; their general potential in software engineering has been recognized.

OTHER INFORMATION SYSTEMS

These are special purpose information systems. They are more recent types of information systems that cannot be characterized as one of the types discussed above.

(i) Office Automation Systems (OAS)

Office automation systems support general office work for handling and managing documents and facilitating communication. Text and image processing systems evolved as from word processors to desktop publishing, enabling the creation of professional documents with graphics and special layout features. Spreadsheets, presentation packages like PowerPoint, personal database systems and note-taking systems (appointment book, notepad, card file) are part of OAS.

In addition OAS includes communication systems for transmitting messages and documents (e-mail) and teleconferencing capabilities.

(ii) Artificial Intelligence Systems

Artificial intelligence is a broad field of research that focuses on developing computer systems that simulate human behaviour, that is, systems with human characteristics. These characteristics include, vision, reasoning, learning and natural language processing.

Examples: Expert systems, Neural Networks, Robotics.

(iii) Knowledge Based Systems/ Knowledge Work Systems (KWS)

Knowledge Work Systems support highly skilled knowledge workers in the creation and integration of new knowledge in the company. Computer Aided Design (CAD) systems used by product designers not only allow them to easily make modifications without having to redraw the entire object (just like word processors for documents), but also enable them to test the product without having to build physical prototypes.

Architects use CAD software to create, modify, evaluate and test their designs; such systems can generate photo-realistic pictures, simulating the lighting in rooms at different times of the day, perform calculations, for instance on the amount of paint required. Surgeons use sophisticated CAD systems to design operations. Financial institutions use knowledge work systems to support trading and portfolio management with powerful high-end PCs. These allow managers to get instantaneous analysed results on huge amounts of financial data and provide access to external databases.
Workflow systems are rule-based programs - (IF 'this happens' THEN 'take this action')
- that coordinate and monitor the performance of a set of interrelated tasks in a business process.

(iv) Geographic Information Systems (GIS)

Geographic information systems include digital mapping technology used to store and manipulate data relative to locations on the earth. An example is a marketing GIS database. A GIS is different from a Global Positioning System (GPS). The latter is a satellite-based system that allows accurate location determination.

(v) Virtual Reality Systems

Virtual reality systems include 3-dimensional simulation software, where often the user is immersed in a simulated environment using special hardware (such as gloves, data suits or head mounted displays). Sample applications include flight simulators, interior design or surgical training using a virtual patient.

(vi) E-Commerce/E-Business Systems

E-Commerce involves business transactions executed electronically between parties. Parties can be companies, consumers, public sector organizations or governments.

(vii) Enterprise Resource Planning (ERP) systems

ERP systems are a set of integrated programs that handle most or all organization's key business processes at all its locations in a unified manner. Different ERP packages have different scopes. They often coordinate planning, inventory control, production and ordering. Most include finance and manufacturing functions, but many are now including customer relationship management, distribution, human resource as well as supply chain management. ERP systems are integrated around a common database. Some well known ERP vendors are ORACLE, SAP and PeopleSoft.

For instance a manufacturing company may prepare a demand forecast for an item for the next month. The ERP system would then check existing items inventory to see if there is enough on hand to meet the demand. If not, the ERP system schedules production of the shortfall, ordering additional raw material and shipping materials if necessary.

(viii) Electronic Funds Transfer (EFT)

EFT is the exchange of money via telecommunications without currency actually changing hands. EFT refers to any financial transaction that transfers a sum of money from one account to another electronically. Usually, transactions originate at a computer at one institution (location) and are transmitted to a computer at another institution (location) with the monetary amount recorded in the respective organization's accounts. Because of the potential high volume of money being exchanged, these systems may be in an extremely high-risk category. Therefore, access security and authorization of processing are important controls.

Security in an EFT environment is extremely important. Security includes methods used by the customer to gain access to the system, the communications network and the host or application-processing site. Individual customer access to the EFT system is generally controlled by a plastic card and a personal identification number (PIN). Both items are required to initiate a transaction.

(ix) Automated Teller Machine (ATM)

An ATM is a specialized form of point of sale terminal designed for the unattended use by a customer of a financial institution. These customarily allow a range of banking and debit operations, especially financial deposits and cash withdrawals. ATMs are usually located in uncontrolled areas and utilize unprotected telecommunications lines for data transmissions. Therefore the system must provide high levels of logical and physical security for both the customer and the machinery.

Recommended internal control guidelines for ATMs include the following:

- Review measures to establish proper customer identification and maintenance of their confidentiality
- Review file maintenance and retention system to trace transactions
- Review and maintain exception reports to provide an audit trail

Review daily reconciliation of ATM machine transactions.

STUDY TEXT

MANAGEMENT ACCOUNTING AND COMPUTERS

Advanced Manufacturing Technology (A.M.T)

FAST FORWARD: In the fast moving sophisticated environment, organizations need to have manufacturing techniques that are innovative and flexible enough to handle issues such as the short life cycle of products.

AMT encompasses automatic production technologies, computer aided design (CAD) and computer aided manufacturing (CAM), flexible manufacturing systems, robotics, Total Quality Control (TQC). Further advancement in production management has also been seen in the application of Material Requirement Planning (MRP) and Just-In-Time (JIT).

With AMT, companies will be able to produce high quality goods at low prices to be able to compete. They are all in a bid to rid the production processes of non-value activities such as setups or holding of inventories. Some of the components of AMT include:

a. Computer aided Design (CAD)

It's a computer based technology allowing interactive design and testing of a manufacturing component on a VDT (visual display terminal). Interaction between designer, computer and database enables may more options around the design of the drawings manipulating them to see how the shapes would change wit any adjustments. Although they have high initial costs, the benefits will be quickly realized.

b. Computer Aided Engineering (CAE)

This enables designers to test whether their design can be manufactured in the available machines and ascertain the costs. Once approved, the feasible design will now be transmitted t a CAD system.

c. Computer Aided Manufacturing system

It is an expression to cover the use of computers for the programming and control of production machines. The ability to reprogram as required, CAM offers many advantages:

- flexibility
- greater control
- reduced set up times
- fewer reworked items and less scrap
- less reliance on direct labor

d. Flexible manufacturing systems (FMS)

It is an integrated production system which is computer controlled to produce a family of parts in a flexible manner. They are machines that can be reprogrammed to switch from one production process to another. It is a mixture of CNC (computer numerically controlled) machines, robots and automated material handling equipment that are able to move for tool to tool. With FMS, Dilts and Russell, *Accounting for the factory of the future (1985)* suggested the following benefits

- Greater variety of products
- Accuracy and repeatability of the manufacturing process ensures better product quality.

- Shifting quickly form one product to another reduces setup times, lead times for customer demand. This in turn reduces WIP, inventories and plant space.
- It places less emphasis on direct labor thus saving costs on them.

However there are some risks in its implementation:

- There could be resistance from the labor force due to fears of their job security.
- In the initial stages there could be lack of qualified engineers and other management systems to support Flexible Manufacturing System

Besides the improvements in manufacturing technology, major strides have been mage in improving the production management systems more so aspects of planning and control.

a. Materials Requirement Planning (MRP)

It is a system which maximizes the efficiency in the timing of raw materials orders through to the manufacture and assembly of the final product. It is obviously a computerized information planning and control system. It first determines the quantity and timing of the finished goods demanded in the *master production schedule*. From this the requirements for raw material and sub assemblies at each of the prior stages of production can be determined. Consider the chart.

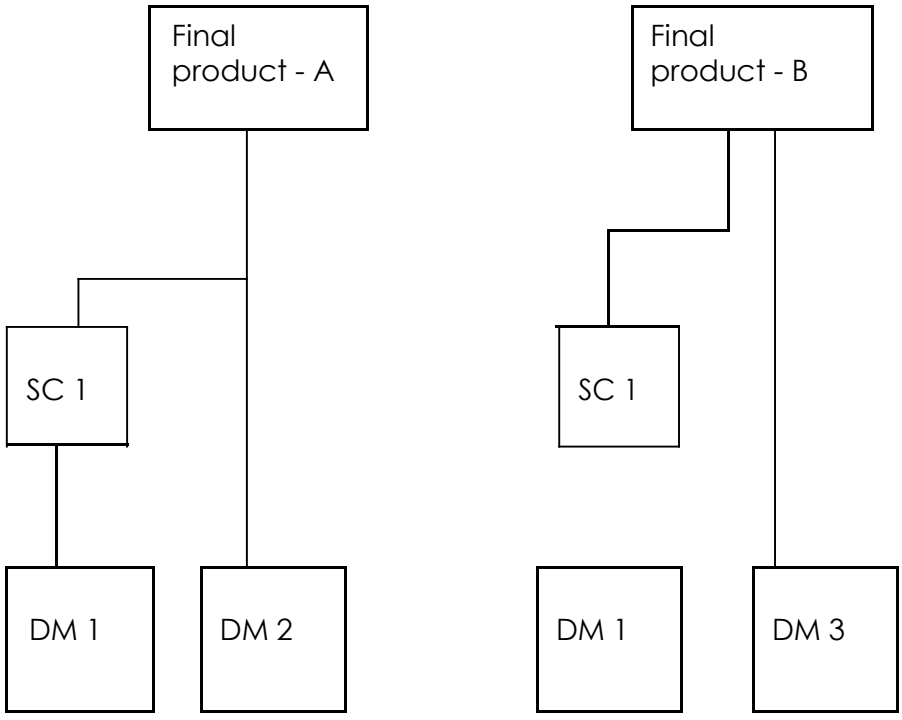
For the MRP system to operate, some prerequisites include:

- A master production schedule with specifics on quantities demanded and timing required for the finished goods to be completed.

- A bill of material (BOM)
  It shows the sub-assembly, components and materials required.

- Inventory file
  It should contain details on number of items (sub assembly, component, parts) on hand, scheduled receipts and number of items allocated to released orders but not yet drawn from the stores

- Master parts file
  It contains the lead times of all items to be purchase and sub assemblies and components produces internally.



MRP has later evolved into MRPII which is now an integrated approach to the management of all resources. It now draws its attention towards machine capacity planning and labor scheduling.

b. Just-In-Time (JIT)

CIMA official terminology defines it as

"It is a system whose objective is to produce or procure products or components as they are required by the customer or for use rather than for stock. A JIT system is a "pull' system which responds to demand in contrast to a "push" system in which stocks act as buffers between the different elements of the system such as purchasing production and sales."

Just in time **production** is a system which is driven by demand for finished products whereby each component on a production line is produced only when needed for the next stage.

Just in time **purchasing** is a system in which material purchases are contracted so that the receipt and usage of material to the maximum extent possible coincide.

JIT systems were developed and have been successfully in Japanese firms. It strives to ensure a continuous commitment to the pursuit of excellence in all phases of the manufacturing system design and operation. A JIT system produces the required product at the required quality and quantity at the precise time required.

A JIT environment is composed of the following:

- Tries to maintain zero inventory
- It eliminates non-value adding activities
- Perfect quality is required i.e. zero defect
- Short set ups
- Batch sizes of one
- Zero breakdowns
- 100% on-time deliveries

Some elements of JIT explained:

i. Elimination of non-value adding activities

JIT is committed to the elimination of waste i.e. any thing that does not add value to the product. Consider the following lead times associated with the production of a typical product. (Not in any order)

Inspection time>Transport time>queuing time>storage time>processing time

Of all the steps shown, it is only processing time that adds value to the product. Studies by Berliner and Brimson (1988) show that processing only accounts for 10% of the total lead time. The other 90% is taken up by other non-value adding activities. With the application of JIT some of these activities will be eliminated and the results will be massive savings. The ideal time in JIT should be *equal* to the processing time.

ii. Factory layout

In implementing a JIT system, the first step would be to rearrange the factory. There's need to move away form batch production functional layout toward one that uses flow lines. In traditional layouts, products usually go through a number of specialized departments that would usually contain a group of similar products. The products have to move over much factory floor before being completed. It is very difficult to determine the progress of production in a batch hence the need to keep detailed accumulation records for WIP in individual batches. The result is high working progress and longer manufacturing costs.

What does JIT do? The production process is rearranged by dividing the many different products into families of similar production requirements and routing so that each cell will be like a small assembly line where groups of dissimilar machines are organized into product or component flow line. The machines will be kept close together so that now the products can move easily one by one form one process to another reducing WIP and manufacturing time.

iii. Batch size of one

Set up is the time required to adjust equipment and retool for a different product. It has been shown to be uneconomical to produce products in small batches with long setups and changeover times. On the other hand, in an attempt to increase the batch size, the result will be more throughput delays and high inventory levels due to long production runs.

JIT will put into use AMT such as flexible machining so that machines can be adjusted automatically and not manually. Redesigning the product so that machines do not have to be reset could also go a long way. Therefore with set up times approaching zero, the need for production in batches is reducing. The optimal batch is therefore 1(one). With a batch size of one, work can flow smoothly to the next stage without the need for storage and to schedule next machine to receive them.

iv. JIT purchasing arrangements

Arrangements with suppliers to make frequent deliveries could keep stock levels at a minimum. Cost savings on activities such as material handling can be obtained by requiring suppliers to inspect their materials and guarantee quality.

Having few suppliers and giving them almost all your business will give them an assurance of long term sales and will make great effort to meet your demand needs. Companies with JIT purchasing techniques say they have substantially reduced their investment in raw material and WIP.

As a final note, JIT has rendered the traditional EOQ model virtually useless.

Recall: $$EOQ = \frac{2 * C_o * D}{C_h}$$

Where: C_o = order cost per unit

C_h = holding cost per unit

D = annual demand

JIT causes the ordering costs to decline towards zero and since the model is optimal when holding costs is equal to ordering costs, the optimal becomes a virtually zero inventory level.

Benefits of JIT include:

i. Lower investment required in all forms of inventory.
ii. Space saving from reduction in inventory and improved layouts.
iii. Greater customer satisfaction resulting from higher quality, better deliveries and greater product variety.
iv. The buffers in traditional methods masked other areas of waste and inefficiency e.g. co-ordination and cash flow problems, bottlenecks, supplier unreliability etc. elimination of these problems improve performance dramatically.
v. The flexibility of JIT and ability to supply small batches enables companies to respond quickly to market changes and to be able to satisfy market niches.

ESSENTIALS OF A GOOD REPORTING SYSTEM

Timeliness

To simplify prompt decision making, an institution's reporting system should be capable of providing and distributing *current* information to appropriate users.

The system should be able to quickly collect and edit data, summarize results, and be able to adjust and correct errors promptly.

Accuracy

A sound system of automated and manual internal controls must exist throughout all reporting systems processing activities. Information should receive appropriate editing, balancing, and internal control checks. A comprehensive internal and external audit program should be employed to ensure the adequacy of internal controls.

Consistency

To be reliable, data should be processed and compiled consistently and uniformly. Variations in how data is collected and reported can distort information and trend analysis. In addition, because data collection and reporting processes will change over time, management must establish sound procedures to allow for systems changes. These procedures should be well defined and documented, clearly communicated to appropriate employees, and should include an effective monitoring system.

Completeness

Decision makers need complete and pertinent information in a summarized form. Reports should be designed to eliminate clutter and voluminous detail, thereby avoiding "information overload."

Relevance

Information provided to management must be relevant. Information that is inappropriate, unnecessary, or too detailed for effective decision making has no value.

Reporting systems must be appropriate to support the management level using it.

The relevance and level of detail provided through reporting systems directly correlate to what is needed by the board of directors, executive management, departmental or area mid-level managers, etc. in the performance of their jobs.

STEPS FOR EFFECTIVE REPORTING

The following stages are involved in writing a report:

- clarifying your terms of reference
- planning your work
- collecting your information
- organizing and structuring your information
- writing the first draft
- checking and re-drafting.

METHODS OF PRESENTATION

The following suggestions will help you to produce an easily read report:

- Leave wide margins for binding and feedback comments from your tutor.
- Paragraphs should be short and concise.
- Headings should be clear - highlighted in bold or underlined.
- All diagrams and illustrations should be labelled and numbered.
- All standard units, measurements and technical terminology should be listed in a glossary of terms at the back of your report.

REQUISITES OF AN IDEAL REPORT

It should have the following characteristics;

- Is expressed in language that differentiates the trainee's level of competency;
- Includes signatures from all the interested parties involved with the trainee;
- Identifies areas of development in all areas;
- Identifies progression;
- Is evidence based;
- Is contextualized to explain the status of the report and the date of the report;
- Provides contextual information on the school and information on the nature of school based training;
- Uses unambiguous language;
- Avoids educational jargon;
- Is professionally written in common language;
- Is informative;
- Includes action points for the trainee's continuing professional development and suggestions about how they can improve;
- Makes clear what the trainee's strengths and weaknesses are;
- Conveys clear, visual message;

- Involves the trainee and provides space for them to add their comments and signature;
- Indicates who the report is for.

Other requirements

- Coordinating mentor needs oversight of all reports. Has a 'quality assurance' function in ensuring there is consistency/ parity in report writing.
- The structure of all reports across a consortium is based on a set of agreed criteria to ensure consistency.

TYPES OF REPORTS

Informational

- Inform or instruct – present information
- Reader sees the details of events, activities or conditions.
- No analysis of the situation, no conclusion, no recommendations.

Analytical

- Written to solve problems
- Information is analyzed.
- Conclusions are drawn and recommendations are made

Persuasive

- An extension of analytical reports: main focus is to sell an idea, a service, or product.
- Proposals are the most common type.

>> *Difference between Reports and Correspondence*

- Reports usually have a more diverse audience, more than one purpose and more detailed information.

Typical Business Reports

Report	Purpose
Periodic Operating Reports	To monitor and control production, sales, shipping, service, etc.
Situational Report	To describe one-time events, such as trips, conferences, and seminars.
Investigative/Informational	To examine problems and supply facts – with little analysis.
Compliance	To respond to government agencies and laws.
Justification/Recommendation	To make recommendations to management and become tools to solve problems and make decisions.
Yardstick	To establish criteria and evaluate alternatives by measuring against the “yardstick” criteria.
Feasibility	To analyze problems and predict whether alternatives will be practical or advisable.
Research Studies	To study problems scientifically by analyzing a problem, developing hypotheses, collecting data, analyzing data, and drawing conclusions.
Proposals	To offer to solve problems, investigate ideas, or sell products and services.

CHAPTER SUMMARY

Information is data that has been processed.

Reports are designed to convey and record information that will be of practical use to the reader. They are organized into discrete units of specific and highly visible information

Information system is a set of interrelated components that collect, manipulate, process and transform data into information and provide feedback to meet a specified objective

Structured/programmable decisions-These decisions tend to be repetitive and well defined.

Semi-structured/semi-programmable decisions-The information requirements and the methodology to be applied are often known, but some aspects of the decision still rely on the manager.

Unstructured/non-programmable decisions-These decisions tend to be unique.

Risk reflects the potential, the likelihood, or the expectation of events that could adversely affect earnings or capital. Management uses MIS to help in the assessment of risk within an institution.

A **JIT system** is a "pull' system which responds to demand in contrast to a "push" system in which stocks act as buffers between the different elements of the system such as purchasing production and sales."

A **JIT environment** is composed of the following:

- Tries to maintain zero inventory
- It eliminates non-value adding activities
- Perfect quality is required i.e. zero defect
- Short set ups
- Batch sizes of one

- Zero breakdowns
- 100% on-time deliveries

CHAPTER QUIZ

1. What is an information system?

2. What are the components of an information system?

ANSWERS TO QUIZ QUESTIONS

1. An information system is a set of interrelated components that collect, manipulate, process and transform data into information and provide feedback to meet a specified objective.

2. Components of an information system include:

   - People – These use the system to fulfill their informational needs. They include end users and operations personnel such as computer operators, systems analysts, programmers, information systems management and data administrators.

   - Computer Hardware – Refers to physical computer equipment and devices, which provide for five major functions.
     - Input or data entry
     - Output
     - Secondary storage for data and programs
     - Central processor (computation, control) ○ Communication

   - Computer Software – Refers to the instructions that direct the operation of the computer hardware. It is classified into system and application software.

   - Telecommunication System/Communication network

   - Databases – Contains all data utilized by application software. An individual set of stored data is referred to as a file. Physical storage media evidences the physical existence of stored data, that is: tapes, disk packs, cartridges, and diskettes.

   - Procedures – Formal operating procedures are components because they exist in physical forms as manuals or instruction booklets. Three major types of procedures are required.

     - User instructions – for application users to record data, to use a terminal for data entry or retrieval, or use the result.
     - Instructions for preparation of input by data preparation personnel.
     - Operating instructions for computer operations personnel.

EXAM QUESTIONS

(a) Organizational information systems are categorized under:

(i) Transaction Processing System (TPS)
(ii) Management Information System (MIS)
(iii) Decision Support System (DSS)
(iv) Executive Information System (EIS)
(v) Expert System (ES)

Required:

Suggest one application of each of the systems types listed above for each of the following areas of business.

- Sales and Marketing (5 Marks)
- Finance (5 Marks)

(b) The general manager of a large organization has asked you to draw up a document identifying eight important characteristics against which managers can evaluate the success of an information system together with a brief explanation of each. What would your document contain?

(c) What is artificial intelligence? (2 Marks)

(Total: 20 marks)

SUGGESTED SOLUTIONS

TO EXAM QUESTIONS

SUGGESTED SOLUTIONS TO EXAM QUESTIONS

CHAPTER ONE: INTRODUCTION

QUESTION ONE

Petrol regular

premium

regular extra (at least 50% premium)

Value properly adjusted	50% premium	
	50% regular	minimum cost
Value out of adjustment	60% premium	
	40% regular	quantity required
	100,000 litres once value is adjusted	

Per litre

	Sh
Cost premium	3.20
Cost regular	3.00
Cost checking value	800.00
Cost adjusting the value	400.00

	Probability
Event Value in adjustment	0.7
Value out of adjustment	0.3

(a) Expected cost of checking the value of adjusting if necessary

	Cost	Prob.		
Value OK	800	0.7		560
Value needs adjustment	1200	0.3		360
			Sh	920

STUDY TEXT

OR

Cost of checking		=	800
+ Cost of adjustment	0.3 x 400	=	120
	800+ 120	=	Sh 920

(b) Value out of adjustment Prob. = 0.3

Cost/litre if value OK = $\frac{3.20+ 3.00}{2}$ = Sh 3.10/litre

Cost/litre if value not OK = 0.6 x 3.20 + 0.4 x 3.0

= 1.92 + 1.20

= Sh 3.12/litre

Cost of 10,000 litres if value OK	3.10 x	100,000	=	Sh 310,000
Cost of 10,000 litres if value not OK	3.12 x	100,000	=	Sh 312,000
		Difference	=	Sh 2,000

The probability is 0.3

Expected cost = 2,000 x 0.3 = Sh 600

(c) The extra cost is Sh 2,000

Let the Probability be p

2000 x p = 800 + (400 x p)

p = 0.5

(d) Comment on the result (a) and (b) above

It is not worth checking the value

QUESTION TWO

(a) Draw a diagram showing the logic of Boyesian statistics (5 marks)

Suppose P(A) is the probability that an event A occurs. Then P (A) is the probability that it doesn't

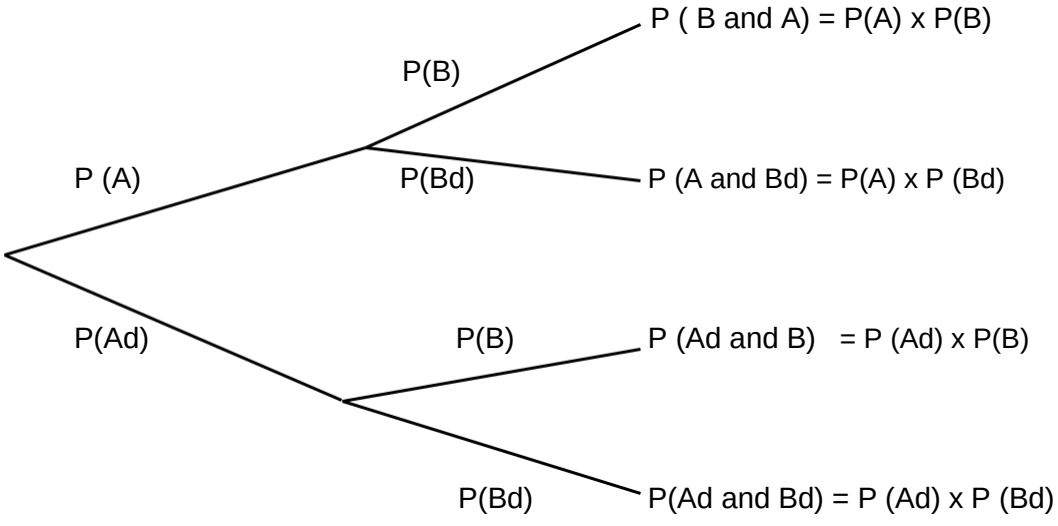
occur. Also, suppose event B follows the occurrence of even A so that even B can occur or not occur after (Diagram) event A has occurred or not occurred. Then P(B) = probability that event B occurs and P(B) is the probability that it doesn't occur.

To determine the probability that event B occurs given that event A has already occurred, the

$$P(B/A) = \frac{P(B) \times P(A/B)}{P(A)}$$

$$\text{Equally, } P(A/B) = \frac{P(A) \times P(B/A)}{P(B)}$$

This is represented in the diagram shown below:



(b) Discuss the importance of Bayesian statistics in making business decisions.

(3 marks)

Whenever a decision is made where the outcome of the decision is uncertain, there will always be some doubt that the correct decision has been taken. If a decision is based on selecting the option with the highest expected value of profit (or the lowest expected value of cost), it can be assumed that in the long run, the decision option so selected will give the highest average profit. Bayesian theory, which is based on expected values, is considered the possibility of improving the quality of decisions by providing more information about the likely outcome. It is especially helpful in enabling us determine the value of perfect information.

(c) Determine for Agricultural Ltd. the output for each of the two industries or sectors.

Let X_1 represent the output of the dairy industry and x_2 represent the output of the vegetable industry.

		User		
Industry	**X1**	**X2**	**Final Demand (D)**	**Total Output**
X1	1/6 = 0.17	0.33	4950	?
X2	0.5	0.25	8250	?

From these details we can derive total output using the input-output model as follows:

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} d_1 \\ d_2 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$\begin{bmatrix} 0.17 & 0.33 \\ 0.5 & 0.25 \end{bmatrix} \begin{bmatrix} x1 \\ x_2 \end{bmatrix} \quad \begin{bmatrix} 4950 \\ 8250 \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

We get the following equations:

$$0.17x_1 + 0.33x_2 + 4950 = x_1$$

$$0.5x_1 + 0.25x_2 + 8250 = x_2$$

For an open system i.e. a system with external demand

$$X=(I–A)^{-1}D$$

Where A the …… coefficient matrix is:

$$\begin{bmatrix} 17.17 & 0.33 \\ 5.5 & 0.25 \end{bmatrix}$$

I is the identity matrix i.e.

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

D is the final demand matrix i.e.

$$\begin{bmatrix} 4950 \\ 8250 \end{bmatrix}$$

and x is the total output matrix i.e.

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$$

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 0.17 & 0.33 \\ 0.5 & 0.25 \end{bmatrix} \times \begin{matrix} 4950 \\ 8250 \end{matrix}$$

$$= \begin{bmatrix} 0.83 & -0.33 \\ -0.5 & 0.75 \end{bmatrix}^{-1} \times \begin{bmatrix} 4950 \\ 8250 \end{bmatrix}$$

$\begin{bmatrix} 0.83 & -0.33 \\ -0.5 & 0.75 \end{bmatrix}^{-1}$ is determined as follows:

The inverse of a matrix is given by: $\frac{\text{Adjoint of the matrix}}{\text{Determinant of the matrix}}$

The determinant of (1 – A) = (.83 x .75) – (-0.5 x –0.33) = 0.4575

The cofactors of the matrix (1 – A) are:

$A_{11} = 0.75$, $A_{12} = 0.5$, $A_{21} = 0.33$ and $A_{22} = 0.83$

$$(I–A)^{-1} = \frac{1}{0.4575} \times \begin{bmatrix} 0.75 & 0.33 \\ 0.5 & 0.83 \end{bmatrix}$$

$$\begin{bmatrix} X_1 \\ x_2 \end{bmatrix} = \frac{1}{0.4575} \times \begin{bmatrix} 0.75 & 0.33 \\ 0.5 & 0.83 \end{bmatrix} \times \begin{bmatrix} 4950 \\ 8250 \end{bmatrix}$$

$$\begin{bmatrix} x1 \\ x2 \end{bmatrix} = \begin{bmatrix} 14{,}066 \\ 20{,}377 \end{bmatrix}$$

Therefore, the output of the dairy industry is **Sh. 14,066**

The output of the vegetable industry is **Sh. 20,377**

STUDY TEXT

(ii) Interpret the final allocation

Dairy (x_1) output is allocated as follows:

Sh. 2,391.20 to x_1 (dairy) i.e. 0.17 x 14,066

Sh. 6,724.40 to x_2 (veg) i.e. 0.33 x 20,377

Sh. 4,950 to final demand

14,065.6 - approximately 14,066

Vegetable (x_2) output is allocated as follows:

Sh. 7,033 to x_1 (dairy) i.e. 0.5 x 14,066

Sh. 5,094.25 to x_2 (veg) i.e. 0.25 x 20,377

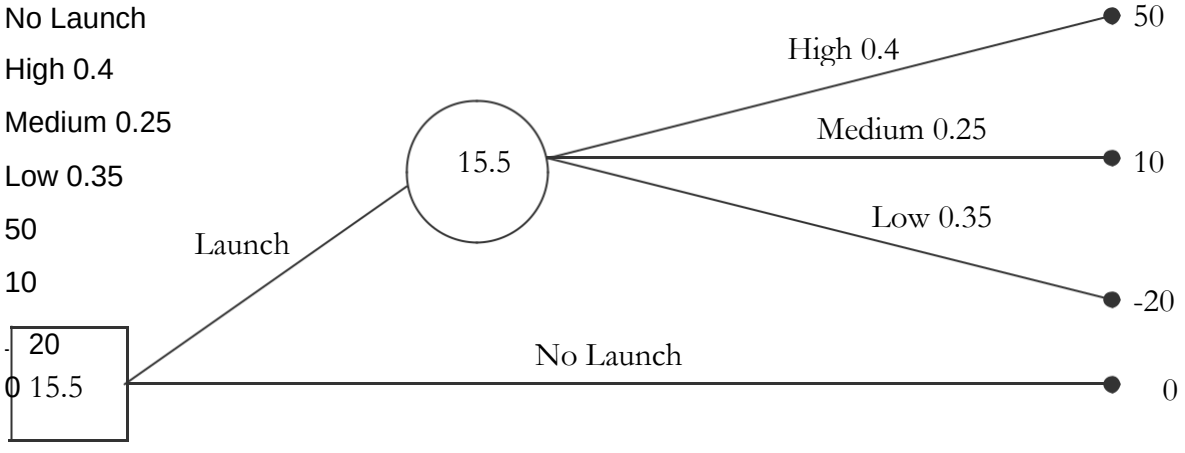
Sh. 8,250 to final demand

Sh. 20,377.25 – Sh. 20,377

QUESTION THREE

The question concerns the use of decision trees (or decision tables) to structure and resolve a decision problem.

a) The initial problem is to determine whether or not to launch the new product. The information can be summarized in a decision tree.



The values in the nodes of the decision tree are the expected values of the remainder of the tree from that point. If the launch takes place the expected profit is shs15.5 million, compared with zero if no launch takes place. Clearly, it is advisable to launch the product, given the information available.

b) The expected value of perfect information gives the increase in profi t that would be achieved if the decision maker knew what the outcome to the decision would be. The value of perfect information is calculated by fi nding the expected profi t that would be achieved with perfect information and subtracting from it the expected profi t from the strategy which is best in the absence of perfect information. Although perfect information is rarely available, it can be used as a benchmark against which the cost of information can be compared.
In this example, if the decision maker knew beforehand that sales would be either medium or high he would still launch the product, but if he knew it would be low he would recommend no such launch.

Hence the expected payoff from perfect information is:
EPPI = (50*0.4) + (10*0.25) + (0*0.35) = sh22.5million

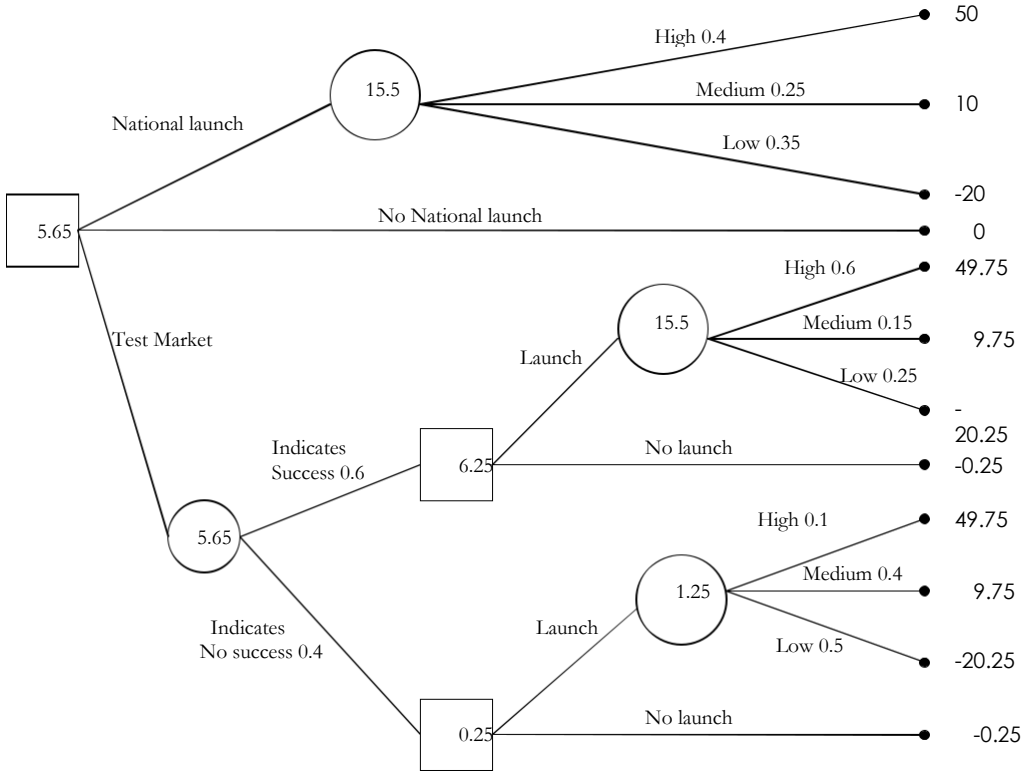
The expected value of perfect information:
22.5 – 15.5 = sh7 million

c) i.The table can be converted to probabilities in the following way:

S = Indication of successful national launch
U = Indication of an unsuccessful national launch H = High sales in national launch
M = Medium sales in national launch
L = Low sales in national launch

Hence we have:

P(S) = 0.6	P (U) = 0.4	
P (HIS) = 0.6	P (MIS) = 0.15	P (LIS) = 0.25
P (HIS) = 0.1	P (MIU) = 0.4	P (LIU) = 0.5



STUDY TEXT

A further branch is now added to the decision tree described in part (a)

Using roll back analysis for decision trees, the expected profit if the market is to be tested in the Midlands sales region is sh15.65 million. Hence the value of this imperfect information is:

Sh15.65 million – shs15.5 million = shs150000

ii. From the financial point of view, it is clear that the market should e tested prior to the national launch.

However the whole analysis is fraught with difficulties and approximations. For example, the potential sales of the product would cover a large number of possible values, and there is considerable approximation in classifying into only three categories. In addition, it is likely that the assigned probabilities are only approximations. Also the sales take place in the future when different market conditions may occur. We should also be aware that the financial amounts might not be the most appropriate unit on which to base the decision.
This type of analysis can give an indication of a likely outcome and is useful in ensuring that a manager does not make inconsistent decisions.

CHAPTER TWO: COST ESTIMATION AND FORECASTING QUESTION ONE

(a) Large – scale service organizations have a number of features that have been identified as being necessary to drive significant benefits from the introduction of ABC:
   i. They operate in a highly competitive environment
   ii. They incur a large proportion of indirect costs that cannot be directly assigned to specific cost objects.
   iii. Products and consumers differ significantly in terms of consuming overhead resources.
   iv. They market many different products and services.

   Furthermore, many of the constraints imposed on manufacturing organizations, such as also having to meet financial accounting stock valuation requirements, or a reluctance to change or scrap existing systems, do not apply. Many services organizations have only recently implemented cost systems for the first time. This has occurred at the same time as when the weaknesses of existing systems and the benefits of ABC systems were being widely publicized. These conditions have provided a strong measure for introducing ABC systems.

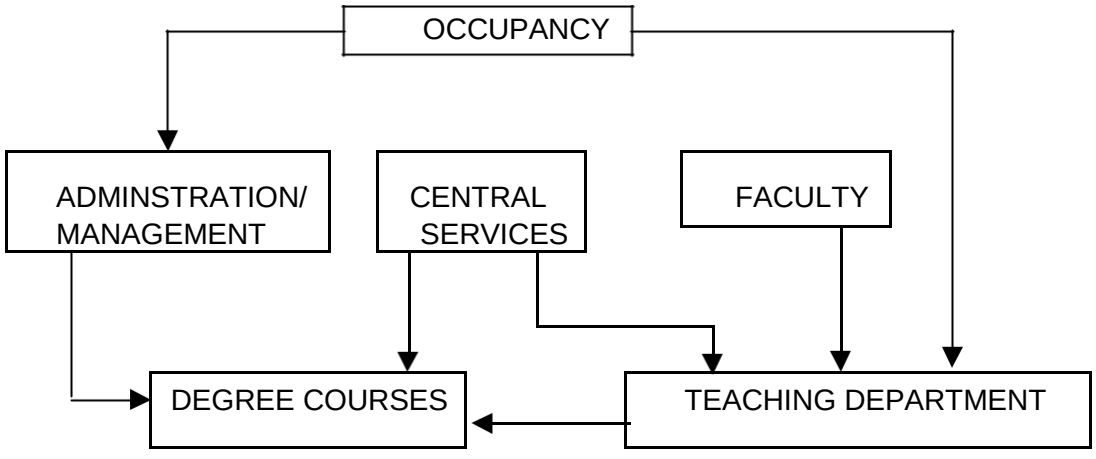
(b) The following may create problems for the application of ABC.
   i. Facility sustaining costs (such as property rents etc) represent a significant proportion of total costs and may only be avoidable if the organization ceases business. It may be impossible to establish appropriate cost drivers
   ii. It's often difficult to define products where they are of an intangible nature. Cost objects can therefore be difficult to specify;
   iii. Many service organizations have not previously had a costing system and much of the information required to set up an ABC system will be non-existent. Therefore introducing ABC is likely to be expensive.

(b) The uses for ABC information for service industries are similar to those for manufacturing organizations:

i. It leads to more accurate product costs us a basis for pricing decisions when cost-plus pricing methods are used;
ii. It results in more accurate product and customer profitability analysis statements that provide a more appropriate basis for decision-making.
iii. ABC attaches costs to activities and identifies the cost drivers that cause the costs. Thus ABC provides a better understanding of what causes costs and highlights ways of performing activities more effectively by reducing cost driver transactions. Costs can therefore be managed more effectively in the long term. Activities can be analyzed into value added and non-value added activities alteration is drawn to areas where there is a potential for cost reduction without reducing the products' service potentials to customers.

QUESTION TWO

Flow diagram



(b) **Step 1**

Apportion occupancy costs = Sh. 15,000,000 / ft 37,500 ft = Sh.400 per sq.

	Sh'000'
Administration/management	2,800
Central Services	1,200
Faculty	3,000
Teaching Departments	8,000
	15,000

STUDY TEXT

Step 2

Apportion Central Services costs:

10,000,000 + 1,200,000 = Sh. 0.7 per external costs

16,000,000

	Sh'000'
Faculty	1,680
Teaching departments	5,600
Degree courses	3,920
	11,200

Step 3

Apportion teaching department costs (includes 100% of faculty costs) and administration/ management costs to degree courses.

Teaching department =

8,000,000 + 5,600,000 + (3,000,000 + (1,680,000 + 7,000,000) + 55,250,000 = Sh. 80,530,000

Administration/management = Sh. 2,800,000 + 17,750,000 = Sh.20,550,000

Total degree courses costs =

Sh 80,530,000 + 20,550,000 + 3,920,000 = Sh. 105,000,000

Average university cost per student = 105,000,000 =

Sh.42,000 2,500

Step 4

Analyze Sh. 105,000,000 by degree courses (in round Sh '000')

	Business studies **Sh '000'**	**Mechanical Engineering** **Sh '000'**	**Catering Studies** **Sh '000'**
Teaching department	2,416	2,013	5,637
Administration/management	514	1,028	822
Central services (base on external cost)	224	336	224
Average cost per graduate	3,154	3,377	6,683

STUDY TEXT

(c) The average cost per graduate will differ from one-degree course to another for several reasons, the most obvious of which is the very different nature of the courses.

The engineering and catering courses will require much greater use of expensive machinery and equipment, which in turn will need more room. In addition these courses will probably require much greater lecturer input than on the business studies courses. The much lower staff/student ratio will push up the teaching costs per student.

Another factor to be considered is the variability in the student numbers. This variable is unlikely to have an impact on many of the university costs, which are mainly fixed in nature. For example, if in the following year intake is up to sixty on the mechanical engineering degree, with a similar level of costs, the average cost per student would fall to nearly that being reported for a catering studies student.

These average costs figures must be interpreted with great care by the management. They give a 'rough' guide to the relative cost of degree courses but the arbitrary apportionments render them very nearly useless for decision-making. For decision making incremental costs are required.

QUESTION THREE

(a) Expressing in Year 5 terms

Year 1	Sales	$200{,}000(1.10)^4$	292,820
	Costs	$100{,}000(1.07)^4$	131,080
		= Contribution	£ 161,740
Year 2	Sales	$260{,}000(1.10)^3$	346,060
	Costs	$132{,}000(1.07)^3$	161,706
		= Contribution	£ 184,354
Year 3	Sales	$300{,}000(1.10)^2$	363,000
	Costs	$156{,}000(1.07)^2$	161,706
		= Contribution	£ 184,354
Year 4	Sales	408,000(1.10)	448,800
	Costs	188,000(1.07)	201,160
		= Contribution	£ 184,354

Summary ('000s)

Output	Contribution (to nearest whole number)
150	162
180	184
200	184
230	248

x	*y*	x^2	*xy*
150	162	22,500	24,300
180	184	32,400	33,120
200	184	40,000	36,800
230	248	52,900	57,040
760	778	147,800	151,260

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

$$= \frac{4 \times 151{,}260 - 760 \times 778}{4 \times 147{,}800 - 760^2}$$

$$= \frac{13{,}760}{13{,}600} = 1.012$$

$$a = \frac{\Sigma y - b\Sigma x}{n}$$

$$= \frac{778 - 1.012 \times 760}{4} = 2.22$$

$$\therefore y = 2.22 + 1.012x$$

As the planned output is 260,000 the contribution = 2.22 + 1.012(260)

= 265.34 or £265.340

95% confidence interval for the point estimate for 260,000 units is:

265.34 ± 4.303 x 14.5

= 265.34 ± 62.39

Upper limit £327,730

Lower limit £202,950

STUDY TEXT

These are the limits within which we can be 95% certain that the actual value of contribution will be.

The limits are extremely broad because single point estimates (as opposed to the whole regression line) are relatively inaccurate especially in this case where there are only 4 readings from which to calculate the regression coefficients.

c. The regression line calculated by least squares is the line of best fit calculated mathematically. It utilises all the values and is statistically valid and can be used to show an average value of forecast provided that:

   i. there is a genuine linear relationship between the dependent and independent variables;
   ii. Conditions in the past continue into the future;
   Extrapolation is not carried out too far into the future or too far beyond the base value.

QUESTION FOUR

The first stage is to convert all costs to Year 5 basis. The calculations are as follows:

	Year 1 (Sh.000)	Year 2 (Sh.000)	Year 3 (Sh.000)	Year 4 (Sh.000)
Raw materialss"				
Skilled labor}	$242(1.2)_4$	$344(1.2)_3$	$461(1.2)_2$	477(1.2)
Unskilled labor				
Factory overheads	$168(1.15)_3(1.2)$	$206(1.15)_2(1.2)$	246(1.15) (1.2)	265(1.2)
Power	$25(1.1)\ (1.25)_3$	$33(1.25)_3$	$47(1.25)_2$	44(1.25)
Raw materialss"				
Skilled labor }	500.94	595.12	663.84	572.4
Unskilled labor				
Factory overheads	306.432	326.304	339.48	318
Power	53.625	64.35	73.32	55
Total (2002 prices)	861000	986000	1077000	945000
Output (units)	160000	190000	220000	180000

The equation $Y = a + bx$ is calculated from the above schedule of total production costs (2002 prices) and output. The calculations are as follows:

STUDY TEXT

Output In units (000) X	Total cost (Sh.000) Y	X_2	XY
160	861	25600	137760
190	986	36100	187340
220	1077	48400	236940
180	945	32400	170100
∑x =750	∑y = 3869	$\sum x^2$ = 142500	∑xy = 732140

We now solve the following simultaneous equations:

$$\sum y = Na + b\sum x$$

$$\sum xy = \sum xa + b\sum x_2$$

Therefore

$$= 4a + 750b \quad (1)$$

$$732140 = 750a + 142500b \quad (2)$$

Multiply equation (1) by 190(142500/750) and equation (2) by 1.Then equation (1) becomes

$$735110 = 760a + 142500b \quad (3)$$

Subtract equation (2) from equation (3):

$$2970 = 10a$$

$$a = 297$$

Substitute for a in equation (1)

$$3869 = 4 \times 297 + 750b$$

$$2681 = 750b$$

$$b = 3.57$$

The relationship between total production costs and volume for 2002 is:

$$Y = \$297000 + 3.57x$$

Where y = total production costs (at 2002 price) and x = output level.

(b) General company overheads will still continue whether or not product LT is produced. Therefore the output of LT will not affect general production overheads. Consequently, the regression equation should be calculated from cost data that includes general

company overheads. General company overheads will not increase with increment in output of product LT. hence a short time decisions and cost control should focus on those costs that are relevant to production of LTs. Common and unavoidable general fixed costs are not relevant tot the production of LT, and should not be included in the regression equation.

QUESTION FIVE

(a) Number of labor hours

Units X	Average (y)	Total*	Marginal cost	Computations
1	1250	1250	1250	$Y= 1250 \times 1^{-0.322} = 1250$
2	1000	2000	750	$Y= 1250 \times 2^{-0.322} = 1000$
3	878	2634	634	$Y= 1250 \times 3^{-0.322} = 878$
4	800	3200	566	$Y= 1250 \times 4^{-0.322} = 800$
8	640	5120		$Y= 1250 \times 8^{-0.322} = 640$

*Total hours = Average labour hours x no. of units

(b) Unit no.	Direct materials	Direct labor	Variable manufacturing overhead	Total overheads
1	40,000	20x1250=25000	1000+(0.6x25000)	81,000
2	40,000	20x 750=15000	1000+(0.6x15000)	65,000
3	40,000	20x 634=12680	1000+(0.6x12680)	61,288
4	40,000	20x 566=11320	1000+(0.6x11320)	59,112

CHAPTER FOUR: PLANNING AND DECICION MAKING QUESTION ONE

a. Expected profit

	Football	Cricket
Volume (units)	40,000	300,000
	£	***£***
Contribution/unit	50	100
Total contribution	2,000,000	3,000,000
Less Fixed Costs	1,050,000	1,950,000
= Profit	£ 950,000	£ 1,050,000

b. Sensitivity analysis for volume, price, variable cost per unit and fixed costs.
(Critical value £200,000 profit).

Football	**Cricket**
Value % Change	**Value % Change**
Volume	
1,050,000 + 200,000 / 50	25,000
40,000 - 25,000 / 40,000	37.5
1,950,000 + 200,000 / 100	21,500
30,000 - 21,500 / 30,000	28.3
Price	
1,250,000 + 3,200,000 / 40,000	£111.25
(130 - 111.25) / 130	14.4
2,150,000 + 3,000,000 / 30,000	£171.67
(200 - 171.67) / 200	14.2

Variable cost/unit

5,200,000 - 1,250,000 £98.75
40,000

(80 - 98.75) 23.4
80

6,000,000 + 2,150,000 £128.33
30,000

(100) - 128.33) 28.3
100

Fixed Costs £1.8M

71.4 £2.8M

43.6

c. Although the cricket game has the higher expected profit it has the higher risk in that smaller changes in price and volume cause its profit to drop to the critical value.

The most sensitive factors for the 2 products are:

Football	**Cricket**
Most sensitive Price	Price
Variable cost	Volume & variable cost
Volume	Volume
Fixed cost	Fixed cost
Least sensitive	

Other factors which need to be considered are:
1. The quality of the estimates;
2. Reaction of competitors;
3. Do these products fit in with the existing business?;
4. Will demand increase/decrease?.

QUESTION TWO

i) The first step is to calculate the average contributions margin at assumed mix:

	Units	**Revenue (Sh)**	**Contribution margin (Sh)**
Product A	30000	150000	60000
Product B	40000	100000	30000
		250000	90000

Average contribution margin = 90000/250000 * 100 = 36%

The break even sales volume is obtained by dividing this average into the fixed costs i.e.

Sh72000/0.36 = Sh200000

Units of A: (150/250 * 200000) / sh5 = 24000 units

Units of B: (100/250 * 200000) / sh2.50 = 32000 units

ii) Margin of safety

Actual sales:	Sh
Product A: 30000 * sh5	150000
Product B: 40000 * sh2.5	100000
Total sales	250000
Break even revenue	200000
Margin of safety	50000

Anticipated profit = Sh90000 – 72000 = sh18000

= 50000 * 0.36 = sh18000

Net volume and contribution margin:

	Units	Revenues	Contribution margin
Product A	40000	200000	80000
Product B	32000	80000	24000
		280000	104000
Fixed costs			81700
Profit			22300

Decision: the proposal should be accepted as it results in a higher profit by an amount of:

(22300 – 18000) sh4300

Average contribution margin at the new mix is:

Sh104000/shs280000 * 100 = 37.14%

Therefore the breakeven sales volume = Sh(72000 + 9700)/ 37.14%

= sh220000

The two main assumptions are that as volume drops, sales of the two products will drop proportionally and fixed costs will remain at sh81700. Either of these assumptions can be challenged.

QUESTION THREE

a) Expected demand is computed as follows:

Demand (units)	Probability	Expected demand (units)
4000	0.4	1600
7000	0.5	3500
11,000	0.1	1100
Expected demand		6200

b) The expected profit from purchasing and selling would be equal to the unit contribution times the expected quantity or
Sh (80 – 70) x 6200 = Sh62,000

c) Even though the production cost is stated as a variable cost, since a minimum of 9,000 units must be produced, the cost is really fixed up to that point because of the minimum production constraints. Units produced in excess of 9,000 could carry the variable cost of Sh40 each. The expected profit from manufacturing is:

Demand (units)	Probability	Manufacturing cost	Profit (Sh)	Expected profit (Sh)
4000	0.4	360,000	(40,000)	(16,000)
7000	0.5	360,000	200,000	100,000
11,000	0.1	440,000	440,000	44,000
				128,000

d) The standard deviation from purchasing and selling is:

I – Î	(I – Î)² P (million)
(4,000 – 6200) Sh10	193.6
(7,000 – 6200) Sh10	32.0
(11,000 – 6200)Sh10	230.4
	456.0

∴ Standard deviation = $\sqrt{456m}$ = Sh21,354

e) The standard deviation from manufacturing and selling is

I – Î	(I – Î)²P (million)
-40,000 – 128,000	11,289.6
200,000 – 128,000	2,592.0
440,000 –128,000	9,734.4
Total	23,616.0

∴ Standard deviation = $\sqrt{23,616}$ million = Sh153,675

f) Coefficient of variation for purchasing and selling is (S/I)

I.e. $\frac{\text{Sh } 21,354}{\text{Sh } 62,000} = 0.344$

For manufacturing and selling is:

$\frac{\text{Sh } 153,675}{\text{Sh } 128,000} = 1.201$

STUDY TEXT

Note:

The coefficient of variation is a measure of risk associated with each alternative.

CHAPTER FIVE: BUDGETARY CONTROL QUESTION ONE

(a) Feed forward control describes a control system in which deviations in the system are anticipated in a forecast of future results, so that 'corrective action' can be taken in advance of any deviations actually happening while on the other hand, Feedback control system is information about actual achievements. In business organization, it is information about actual results, produced from within the organization (for example management accounting control reports) with the purpose of helping the control decisions.

(b) In his statement Chris Argyris, he identified situations why mangers could be reluctant in setting budgets: as follows:

(i) The budget is seen as a pressure device, based by management to force 'lazy' employees to work harder. The intention of such pressure is to improve performance, hut the unfavorable reactions of subordinates against is seems to be at the core of the budget problem.

(ii) The accounting department is usually responsible for recording actual achievement and comparing this against budget. Accountants therefore are 'budget man' in the failure of another manager and this failure causes loss of interest and declining performance. The accountant, on the other hand, fearful of having his budget derailed by factory management, obscures his budget and variance reporting, and deliberately makes it difficult to understand.

(iii) The budget usually sets targets for each department, achieving the departmental target becomes of paramount importance regardless of the effect this may have on the other departments and the overall company performance.

(iv) Budgets are used by mangers to express their character and patterns of leadership on subordinate; subordinates, resentful of their leadership style, blame the budget rather than the leader thus it looses meaning.

(c) The decision calls for the analysis of benefits and problems of budgeting.

Benefits

(i) It's the major formal way in which the organizational objectives are translated into specific plans, basics, and objectives related to individual managers and supervisors. It should provide clear guidelines for current operations.

(ii) It's an important medium of communication for organizational plans and objectives and the progress towards meeting those objectives.

(iii) The development of budgets (done properly) helps to achieve co-ordination between the various departments and functions of the organization.

(iv) The involvement of all levels of management with setting budgets, the acceptance of derived targets, the two way flow of information and other facets of a properly organized budgeting system all help to promote a coalition of interest and to increase motivation.

(v) Management's time can be saved and alterations directed to areas of most concern by the 'exception principle' which is at the heart of budgetary control.

(vi) Performance of all levels is systematically reported and monitored thus aiding the control of current activities.
(vii) The investigation of operations and procedures, which is part of budgetary planning and the subsequent monitoring of expenditure, may lead to reduced costs and greater efficiency.

Problems

(ii) There may be too much reliance on the technique as a substitute for good management.
(iii) The budgetary system perhaps of undue pressure or poor human relations, may cause antagonism and decrease motivation.
(iv) Variances are just as frequently due to changing circumstances, poor forecasting or general uncertainties due to managerial performance.
(v) Budgets are developed round existing organizational structures and departments, which may be inappropriate for current conditions and may not reflect the underlying economic realities.
(vi) The very existence of well documented plans and budgets may cause rigidity and lack of flexibility in adapting to change.

In conclusion, budgets should not be abolished as a company or an organization might not adjust to its set objectives without a budget system.

QUESTION TWO

a) Overhead absorption is the technique of attributing departmental overhead costs to a cost unit..
Traditionally, the basis of overhead absorption was the number of labour hours expected within the budget period and this was then used to calculate an absorption rate per labour hour. This was then used to attribute costs to the cost units on the basis of the number of labour hours used to produce the cost unit.

Alternative bases of apportioning exist such as the number of machine hours or the percentage of particular elements of prime costs incurred in respect of cost units. If the method of manufacture is machine intensive for example, it is more realistic to absorb the overhead cost on the basis of the number of machine hours instead of the number of labour hours.

A further development is to divide the overheads into those costs, which are labour related, and those, which are machine hour, related and apply a separate absorption rate to each part of the overhead cost. This is the use of multiple rates similar to the principle of activity bases costing (ABC).

ABC is based on the principle that activities cause costs and therefore the use of activities should be the basis of attributing costs to cost units. Costs are identified with particular activities and the performance of those activities is linked with products.

b) (i) Incremental budgeting uses the previous year's budget as the starting point for

the preparation of next year's budget. It assumes that the basic structure of the budget will remain unchanged and that adjustments will be made to allow for changes in volume, efficiency and price levels. The budget is therefore concerned with increments to operations that will occur during the period and the focus is on existing uses of resources rather than considering alternative strategies for the future budget period. Incremental budgeting suffers from the following weaknesses:

i It perpetuates past inefficiencies
ii There is insufficient focus on improving efficiency and effectiveness.
iii The resource allocation tends to be based on existing strategies rather than considering future strategies.
iv It tends to focus excessively on the short term and often leads to arbitrary cuts being made in order to achieve short-term financial targets

(ii) The answer should stress that:
i. The focus is on managing activities
ii. The focus is on the resources that are required for undertaking activities and identifying those activities resources that are un-utilized or which are insufficient to meet the requirements specified in the budget.
iii. Attention is given to eliminating non-value-added activities.
iv. The focus is on the control of the causes of costs (i.e. the cost drivers).

CHAPTER FIVE: STANDARD COSTING AND VARIANCE ANALYSIS

QUESTION ONE

Standard costing variances should not be viewed in isolation because they may be interrelated; a variance in one cost might have cost a variance in another cost. Some examples of possible inter-relationships are:

Material price, material usage and efficiency variances

Cheaper materials may produce a favorable material price variance but may be more difficult to process. The difficulties may lead to adverse material usage and efficiency variances

Labor rate and efficiency

If a more highly skilled employee is used at a higher rate of pay, this could result in adverse labor rate variance. However, a favorable efficiency may also arise and therefore the two are interrelated. The case of a less skilled employee at a lower rate of pay is similarly true.

Sales price and sales volume

A reduction in sales price might stimulate sales volume so that the resulting adverse sales price variance and favorable sales volume variances are interrelated. A number of factors need to be considered when deciding whether to investigate a variance or not.

Its significance

Management might set control limits for variances. If a recorded variance falls outside these control limits, then it is deemed worthy of investigations.

Cost and benefits of the investigations

Management must use their experience to judge the likely cost of an investigation and the benefit which may arise if the investigation is successful in correcting the variance. An investigation can only be justified by its benefits exceeding its costs

Controllability

The cause of some variances might be uncontrollable and therefore an investigation is not worthwhile. An example is where a price variance was due to fluctuations in market prices, which are out of the management's control.

The type of standard set

Some types of standards will often give rise to a variance, which need not necessarily be investigated. E.g. an ideal efficiency standard will almost always lead to adverse variances.

Your initial reaction might be that no variance should occur in a TQM environment because the organization should be getting it right the first time. However, do not forget the following:

- The organization might get it right the first time from its own point of view and yet find that variances arise due to factors beyond its control. For example a worldwide payrise, a change in government policy etc.
- TQM is also about continuous improvement. Favorable variances should therefore be the norm

Traditional variance analysis can be unhelpful and potentially misleading in the modern organization and can make managers focus their attention on the wrong issues. For example:

Adverse efficiency variances are regarded as a bad thing, which means that manager try to prevent idle time and to keep up production. Action to eliminate idle time could result in the manufacture of unwanted products that must be held in store and might eventually be scrapped. Efficiency variances could focus at management attention on the wrong problems or give rise to new problems.

In a JIT environment, the key issues with materials purchasing are supplier reliability, materials quality and delivery in small order quantities. Purchasing managers should not be shopping around every month looking for the cheapest price. Many JIT systems depend on long term contractual links with suppliers, meaning that material price variances are not relevant for managerial control purposes.

QUESTION TWO

Material		$
X	60Kg * $2.00	120
Y	40Kg * $1.00	40
Z	100Kg * $1.40	140
		300

Therefore the average standard cost per Kg of material input:

$300/200 = $1.50/Kg

Direct material total variance

Material	Standard material cost. (1980 Kg output)	Actual material cost	Variance
X	$120 * 11 = 1320	700 * $1.80 =1260	60 (F)
Y	$40 * 11 = 440	440 * $1.10 = 484	44 (A)
Z	$140 * 11 = 1540	1120 * $1.30 =1456	84 (F)
	3300	**3200**	**100 (F)**

Direct material price variance

Material	STD price per Kg	Actual price Per KG	Difference	Actual Quantity	Variance
X	2.0	1.8	0.2(F)	700	140 (F)
Y	1.0	1.1	0.1 (A)	440	44 (A)
Z	1..4	1.3	0.1 (F)	1120	112 (F)
					208 (F)

Direct material usage variance

Material	Standard usage (1980Kg output)	Actual Usage (Kg)	Difference (Kg)	Standard Price	Variance
X	60*11=660	700	40(A)	2.0	80 (A)
Y	40*11=440	440	0	1.0	0
Z	100 * 11 = 1100	1120	20 (A)	1.4	28 (A)
					108 (A)

Direct material mix variance

Material	Actual QTY in STD mix (Kg)	Actual mix (Kg)	Difference (Kg)	STD price	Variance
X	(6) 678	700	22 (A)	2.00	44 (A)
Y	(4) 452	440	12 (F)	1.00	12 (F)
Z	(10) 1130	1120	10 (F)	1.10	14 (F)
					18 (A)

Direct material yield variance:

1980 Kg of output required	2260
But should have required (* 200/180)	2200
Yield variance in Kg	60 (A)
At average STD cost per Kg	$1.5
Yield variance	$90

Direct labor efficiency variance

Output per hour for 10 employees	= 40 Kg of product
Therefore STD hours per Kg	= 0.25 hours
Therefore STD hours for 1980Kg	= 0.25 * 1980Kg
	= 495hours
Actual hours (45* 10 employees)	= 450
Variance in hours	45 hours (F)
@ STD per hour	$4
Variance	$180 (F)

STUDY TEXT

QUESTION THREE

Price variance variance" – Material A

	Sh.
7,800kgs should have cost	156,000
But did cost	159,000
Price variance variance"	3,900 (A)

Usage variance- Material A

800 units should have used (x 10kgs)	8,000kgs
But did use	7,800kgs
Usage variance in kgs	200kgs (F)
X standard cost per kilogram	x Sh.20
Usage variance in Sh.	Sh.4,000 (F)

Price variance variance" - Material B

	Sh.
4,300 units should have cost (x Sh.6)	25,800
But did cost	23,650
Price variance variance"	2,150 (F)

Usage variance-Material B

800 units should have used (x 5litres)	4,000
But did use	4,300
Usage variance in litres	300
X standard cost per litre	x Sh.6
Usage variance in Sh.	Sh.1,800 (A)

Labour rate variance	Sh.
4,200 hrs should have cost (x Sh.6)	25,200
But did cost	24,150
Rate variance	1,050 (F)

Labour efficiency variance	
800 units should have taken (x5hrs)	4,000 hrs
But did take	4,200 hrs
Efficiency variance in hours	200 hrs (A)
x standard rate per hour	xSh.6
Efficiency variance in Sh.	Sh.1,200 (A)

Fixed overhead expenditure variance	
	Sh.
Budgeted expenditure (Sh.50 x 900)	45,000
Actual expenditure	47,000
Expenditure variance	2,000 (A)

Fixed overhead volume variance	
	Sh.
Budgeted production at standard rate (900 x Sh.50)	45,000
Actual production at standard rate (800 x Sh.50)	40,000
Volume variance	5,000 (A)

CHAPTER SIX: INVENTORY CONTROL DECISIONS

QUESTION ONE

a) Advantages of JIT:

- Leads to substantial savings in stockholding costs
- Elimination of waste
- Savings in factory and warehouse space, which can be used for other profitable activities
- Reduction in obsolete stocks
- Considerable reduction in paper work arising from a reduction in purchasing stock and accounting transaction or procedures

Disadvantages

- Additional investment costs in new machinery, changes in plant layout and goods and services, thus affecting the cash-flows of the organization
- Difficulty in predicting weekly or daily demand, which is a key feature of the JIT philosophy.
- Increased risk due to greater probability of stock-out costs arising from strikes or other unforeseen circumstances that restrict production or supplies.

b)

Safety stock	Stock-out	Stock-out costs	Probability	Expected costs	Total
		@ shs100		Sh	(Sh)
500	0	0	0	0	0
400	100	10000	0.04	400	400
300	200	20000	0.04	800	
	100	10000	0.07	700	1500
200	300	30000	0.04	1200	
	200	20000	0.07	1400	
	100	10000	0.10	1000	3600
100	400	40000	0.04	1600	
	300	30000	0.07	2100	
	200	20000	0.10	2000	
	100	10000	0.13	1300	7000
0	500	50000	0.04	2000	
	400	40000	0.07	2800	
	300	30000	0.10	3000	
	200	20000	0.13	2600	
	100	10000	0.16	1600	12000

SUMMARY

Safety stock	Stock-out costs	Holding costs @ sh10	Total costs
0	**12000**	**0**	**12000**
100	**7000**	**1000**	**8000**
200	**3600**	**2000**	**5600**
300	**1500**	**3000**	**4500**
400	**400**	**4000**	**4400**
500	**0**	**5000**	**5000**

The optimal safety stock is therefore **400 units.** The P (probability of being out of stock) at this level is **0.04**

QUESTION TWO

(a) Expected Value of Usage

Lead-Times (Days)		Probability	Joint Demand (units)	Probability	Expected Value (Usage)
15 working days	0.2	0.4	5,000	0.08	(15 x 5000) 0.08 = 6,000
		0.6	7,000	0.12	(15 x 7,000) 0.12 = 12,600
20 working days	0.5	0.4	5,000	0.20	(20 x 5,000) 0.20 = 20,000
		0.6	7,000	0.30	(20 x 7,000) 0.30 = 42,000
25 working days	0.3	0.4	5,000	0.12	(25 x 5,000) 0.12 = 15,000
		0.6	7,000	0.18	(25 x 7,000) 0.18 = 31,500
				1.00	127,100

Buffer stock at 150,000 units re- order level = (150,000 – 127,100)

= 22,900 units

(b) The P (stock out cost i.e. Demand in excess of 150,000 units)
= (25 x 7,000) = 175,000 units
! P (stock out cost) = 0.18

STUDY TEXT

(c) **EOQ** = $\sqrt{\frac{2 \times (6,200 \times 360) \times 1,000}{0.0025 + (0.1 \times 2)}}$ = 140,855 units

Daily Demand = 5,000 (0.4) + 7,000 (0.6) = 6,200

No of average orders per annum = $\frac{6,200 \times 360}{140,855}$ = 15.85

! The expected annual stock outs in units per annum
= {(0.225) (175,000 – 150,000)} x 15.85 = 89,156 units

(d) The additional annual holding cost if the re-order level is increased to 175,000 units:

15 (175,000 – 150,000) (0.025 x 1.1 x 2) = 1,375

Therefore, are-order level of 150,000 units the expected value of stock outs per annum is 10,766 units.
Then the increase in stock is justified where stock out cost per unit is greater then Shs.0.3 (1,375/10,766)

 JIT (Just in time) it involves a continuous commitment to re-pursuit of excellence in all phases off manufacturing systems design and operation.

Advantages of JIT

i. Leads to substantial savings in stockholding costs.
ii. Elimination of waste
iii. Savings in factory and warehouse space, which can be used for other profitable activities.
iv. Reduction in obsolete stocks
v. Considerable reduction in paper work arising from a reduction in purchasing, stock and accounting transactions

Disadvantages of JIT

i. Additional investment costs in new machinery, changes in plant layout and goods inwards facilities.
ii. Difficulty in predicting duty or weekly demand, which is a key feature of the JIT philosophy.
iii. Increased risk due to the greater probability of stock out costs arising from strikes, or other unforeseen circumstances, then restrict production or supplies.

QUESTION THREE

a) Advantages of Just-In-Time (JIT)
   i. Leads to substantial savings in stockholding costs
   ii. Elimination of waste
   iii. Savings in factory and warehouse space, which can be used for other profitable activities
   iv. Reduction in obsolete stocks
   v. Considerable reduction in paper work arising from a reduction in purchasing stock and accounting transaction or procedures.

Disadvantages

i. Additional investment costs in new machinery, changes in plant layout and goods services, thus affecting cash flow of the organization
ii. Difficulty in predicting daily or weekly demand, which is a key feature of the JIT philosophy.
iii. Increased risk due to the greater probability of stock out costs arising from strikes, or other unforeseen circumstances, that restrict production or supplies.

(b) i.

Safety stock	Stock out	Stock out cost @ Sh.100	Probability	Expected Cost (Sh)	Total (Sh)
	0	0	0	0	
	100	10,000	0.04	400	
500	200	20,000	0.04	800	
400	100	10,000	0.07	700	
300	300	30,000	0.04	1,200	1,500
	200	20,000	0.07	1,400	
200	100	10,000	0.10	1,000	
	400	40,000	0.04	1,600	
	300	30,000	0.07	2,100	
100	200	20,000	0.10	2,000	
	100	10,000	0.13	1,300	3,600
	500	50,000	0.04	2,000	
	400	40,000	0.07	2,800	
0	300	30,000	0.10	3,000	
	200	20,000	0.13	2,600	
	100	10,000	0.16	1,600	7,000
					12,000

SUMMARY

Safety Stock	Stock out cost	Holding Cost @ sh.10	Total Cost
0	12,000	0	12,000
100	7,000	1,000	8,000
200	3,600	2,000	5,600
300	1,500	3,000	4,500
400	400	4,000	4,400
500	0	5,000	5,000

The optional safety stock is 400 units

STUDY TEXT

ii. P (being out of stock) i.e. at optimal safety stock of 400 units = 0.04

CHAPTER SEVEN: PERFORMANCE EVALUATION DECISIONS QUESTION ONE

REQUIREMENT A

Division B's output (units)	B's Own Processing Costs	A's Charge to B for intermediates	B's Total costs	B's Revenue (Net of selling Costs) per 1,000 units	B's Total revenue	B's Net income
(1)	(2)	(3)	(4) (2) + (3)	(5)	(6) (1) x (5)	(7) (6) - (4)
	Sh	Sh	Sh	Sh	Sh	Sh
1,000	37,500	12,000	49,500	52,500	52,500	3,000
2,000	45,000	24,000	69,000	39,750	79,500	10,500
3,000	52,500	36,000	88,500	33,000	99,000	10,500
4,000	60,000	48,000	108,000	27,750	111,000	3,000
5,000	67,500	60,000	127,500	24,000	120,000	(7,500)
6,000	75,000	72,000	147,500	19,980	119,880	(27,120)

B. The most profitable policy for Division B, in the circumstances, is to set its output at either 2,000 or 3,000 units a day and to accept a profit of Sh 10,500 a day. If its output is more than 3,000 or less than 2,000 it will make even less profit.

With Division B taking 3,000 units a day from it, Division A's revenue, at Sh 12 per unit = Sh 36,000 and its total costs = Sh 21,000. Therefore, A's separate profit is Sh 15,000.

C.

Output (units)	Cost of Producing intermediates	Cost of processing to completion	Total Costs	Total revenue	Net income
(1)	(2)	(3)	(4)	(5)	(6)
Sh	Sh	Sh	Sh	Sh	
1,000	15,000	37,500	52,500	52,500	—
2,000	18,000	45,000	63,000	79,500	16,500
3,000	21,000	52,500	72,500	99,000	25,500
4,000	24,000	60,000	84,000	111,000	27,000
5,000	27,000	67,500	94,500	120,000	25,500
6,000	30,000	75,500	105,000	120,000	15,000

A single profit centre will operate more profitably than the two divisions formally did. By making and selling 4,000 units a day it can earn a profit of Sh 27,000 or Sh 1,500 a day in excess of the best result achieved by the combined activities of Divisions A and B.

D. "The Company is seen to have been paying a price for the luxury of divisionalization. By sub-optimizing (i.e. by seeking maximum profits for themselves as separate entities), the divisions have caused the corporation to less than optimize its profits as a whole.
The reason was of course, that Division B reacted to the transfer price of Sh 12 a unit by restricting both its demand for the intermediate and its own output of the finished product. By making for itself the best of a bad job, it created an unsatisfactory situation for the company. But who can blame it? Assuming that the instructions to B were to maximize the division's separate profit, it did just that, given the conditions confronting it.
Yet it is not fair to blame that division either, for it too was only carrying out instructions in seeking to maximize its own profit; and a transfer price of Sh 12, while it leads to a less than optimal result for the corporation, does maximize A's own profit.
"One further feature of this illustration is worth nothing. So far as its own profit was concerned, it was a matter of indifference to Divison B whether it sold 2,000 or 3,000 units. We assumed that it decided to sell 3,000. If it had chosen to sell only 2,000, its own profit would have been unaffected, while A's profit would have been cut from 15,000 to 6,000, so that the corporate profit would have been diminished by Sh 9,000.
In a situation like this, negotiations about the price between A and B would probably have prevented this further damage to the corporation resulting from sub-optimization. But it is unlikely that the divisions, left to themselves, would arrive at an optimal solution from the corporate point of view.
"The management of the single profit centre arrived at the conclusion that 4,000 units was its optimal output through comparison of incremental costs with incremental revenue for each prospective addition to output. Pushing output beyond 4,000 did not pay because an extra 1,000 units would have added Sh 10,500 to costs while adding only Sh 9,000 to revenues. The fact that incremental costs are made up of two parts (the cost of producing the intermediate product and the cost of processing it to completion) does not affect the result. Nor, from the point of view of the firm as a whole, should the result be affected if responsibility for the two operations happens to be split between two responsibility centres.
"The second responsibility centre (second, that is, in the chain of processes) can only do what is best for the company when deciding how much of the first division's production to take **if it has knowledge of the other division's incremental costs.** Leaving these decisions to divisions to work out for themselves implies that transferor divisions should offer their products to other responsibility centers at a figure not in excess of the incremental cost of producing them.
"This result appears to be a very far cry from the most common basis for fixing transfer prices, namely, the price of the transferred product on the outside market, provided the product, in fact, has an outside market. Actually, however, a close examination will show that **if the transferred product can be bought and sold in a competitive market**, the `incremental cost' rule and the `market price' rule for the transfer pricing are not in conflict.
"If there really is a competitive market for the transferred products, a transferee division can satisfy its needs for intermediate products by buying them outside at the going price. It will be in the company's interest that should do so to prevent another division from incurring **incremental** costs of a greater amount in supplying the intermediate. To do otherwise would cause the company to incur a greater cost in production of the

intermediate than in buying it. If the transfer price of the intermediate is set at its market price, the transferor division can supply as much as it wishes (which will be as much as it can produce without incurring incremental costs in excess of the price it will get), leaving the transferee division to acquire any additional supplies it may need by outside purchase. Alternatively, the transferor division may be able and willing to supply more of the intermediate at the market price than the consuming division can use. In that case, the correct course is for the supplying division to go on producing so long as its incremental cost is below the market price. It can sell on the market any output not taken by the other division."

A. General Manager's Remuneration

Region 3	**1990**	**1991**
	£000	**£000**
Basic salary	18,000	19,000
Sales Bonus:		
£2,400 - 2,250 x 0.75%		1,125
£2,750 - 2,700 x 0.75%		375
ROCE bonus:		
	123 = 6.65%	147 = 6.50%
	1,850	2,260
2% of £1,850,000 x 6.65%	2,460	
3% of £2,260,000 x 6.50%		4,407
	21,585	23,782

Region 7	**1990**	**1991**
	£000	**£000**
Basic salary	22,000	22,000
Sales Bonus:		
£3,700 - 3,400 x 0.75%	2,250	
£3,600 - 3,600 x 0.75%		—
ROCE bonus:		
	166 = 5.93%	241 = 8.31%
	2,800	2,900
3% of £2,800,000 x 5.93%	4,981	
3% of £2,900,000 x 8.31%		7,230
	29,231	29,230

STUDY TEXT

Region 3 General Manager's remuneration increases by £2,197.

Region 7 General Manager remuneration reduces by £1.

Consideration of the appropriateness of the reward to the general managers.

The significant figures are:

	Region 3	**Region 7**
	1991 v 1990	**1991 v 1990**
Sales	+14.6%	-2.7%
Expenses	+6.3%	+3.0%
Profit	+19.5%	+45.2%
Gross profit/sales	-1.0% +3.0%	
Investment	+22.2%	+3.6%
(now over £2 million)		
ROCE -2.3% +40.1%		
Sales/Target sales	1990 + 6.7%	1990 + 8.8%
	1991 + 1.9%	1991 —
Remuneration	+10.2%	Slightly negative

B. Relative performance 1991 v 1990

Region 3

The general manager is expected to exceed his sales target, but by a smaller margin than in 1990. His return on capital employed is lower than in 1990. However, capital employed will grow in the year so that by year-end the book value will exceed £2 million. At this level bonus increases from 2% to 3%.

Region 7

The general manager is only expected to just reach his sales target in 1991 whereas he exceeded it in 1990. However his return on investment is expected to improve by over 40% mainly due to a lower cost of sales/sales ratio and a lower proportionate increase in his expenses.

Overall, I do not consider the changes in the remuneration are appropriate rewards for the results expected in 1991.

Region 3

General manager will receive a 10% increase. Half of this is due to the service increment of £1,000 and the remainder to the responsibility of handling a higher investment. Performance related to beating the sales target and ROCE are expected to be poorer than in 1990.

Region 7 general manager is expected to be slightly worse remunerated than in 1990. he has reached his maximum salary and probably based on his age is not expected to exceed his sales target. However, his experience appears to enable him to reduce expenses to give a greatly improved ROCE. The bonus for this does not completely offset his static sales performance. As ROCE should be a main criterion of performance this good work deserves a better remuneration.

Ignoring inflation an increase of 5% for Region 3 to reward experience and responsibility and 10% for Region 7 for probability would seem more appropriate.

C. Recommended changes in remuneration

Basic salary — company service and responsibility.

The basic salary with ten annual increments of £1,000 each based entirely on length of service is likely to lead to dissatisfaction between managers. For example, when a manager of ten year's service is replaced by a newcomer, the incoming manager's salary will only be 55% of his predecessors.

Smaller increment for service could be offset by a salary increment based on responsibility. This could be the size of the operation measured by investment in each depot. Thus, if the service element was limited to a 25% salary differential (£3,000), then £7,000 could be available for `responsibility'. A proposed allocation could be £1,000 for each £0.5 million investment, so that the £7,000 would be received at an investment level of £3.5 million.

Bonus — sales

A bonus based on exceeding a pre-set sales target is a good method of rewarding performance. However, it does not seem satisfactory to have this based on the value of the vehicles operated by the region. First the `value' is the written-down book value which in itself leads to anomalies according to the age of the vehicles. a first major improvement would be to relate these to replacement cost. The replacement cost for the vehicle should be readily available.

A much more understandable sales target should be set for each region based on the potential business available in that area.

Bonus — return on capital employed

This is the ultimate test of effectiveness and should again be judged on performance against a pre-set target. This will encourage the managers to operate their vehicles as cost effectively as possible in the handling of the available traffic. Where a nationwide service is offered, many company policies are established which affect each region differently. For example:

> `Providing an overnight service'—this might be well-used in some regions, but sparsely used in others.
>
> `Accepting business from large manufacturers at national rates'—these rates tend to be averaged for the whole country and again may be more profitable in one region than another.

As a good basis, therefore, the budget preparation needs to be done carefully with a full analysis of the likely business, available vehicles and staff requirements. The resulting expected profit can be set against the required investment. Returns on capital employed will vary between regions, but should average to an acceptable overall figure for the company. It is against these target returns for the regions that each manager's performance should be measured. The bonus should be a straight percentage based on the improved return. The present differential relating to investment above or below the £2 million level should be eliminated. The single step at £2 million is too blunt an incentive and may encourage unnecessary investment just to get above the figures.

Thus the general manager would be more fairly rewarded by:

- Basic salary to reflect company loyalty and also responsibility based on the total assets entrusted to the manager.

- Bonus based:
  i. on achieving above target sales, and
  ii. at undertaking these sales cost effectively to achieve above target return on capital employed.

CHAPTER EIGHT: TRANSFER PRICING

QUESTION ONE

a)

(i)

		Sh. '000'
Desired Residual Income	5,000	
Current Income from external sales		
Contribution = 500 (37 – 25)	6,000	
Fixed costs	(1,400)	
Capital cost 13% x 20 m	(2,600)	2,000
Contribution to be generated by internal transfers		3,000

Contribution per unit = $\frac{3,000}{300}$ = Sh.10 per unit

Transfer price = Sh.25 + Sh.10 = Sh.35 per unit

(ii) The transfer price above may motivate the Z division manager to want to sell the components externally at Sh.37 rather than to transfer them to other divisions at Sh.35. This may result in the other divisions being forced to buy components externally and thus incur buying costs while Z will incur selling cots. The net effect is that the company as a whole losses.

b) The demand function can be determined as follows:

$$P = A - bV$$

Where P is the price per unit

STUDY TEXT

V is the volume of sales at that price
A is the price at which V = O (Maximum price)
b is the rate at which the price falls for volume increases a proportion of sales volume.

Product A
Demand is currently 15,000 units at a price of Sh.30. The demand changes by 500 units for each Sh.1 change in price.

$$A = 30 + \frac{15,000}{500} \times 1 = Sh.60$$

The maximum price = Sh.60

$$b = \frac{1}{500}$$

The demand function will be

$$P = 60 - \frac{1}{500}Q$$

$$\text{Total revenue} = PQ = 60Q - \frac{1}{500}Q^2$$

Profit is maximized where MR = MC

$$MR = \frac{dTR}{dQ} = 60 - \frac{2Q}{500} = 60 - \frac{Q}{250}$$

MC is the unit variable cost = Sh.12

At Maximum profit MR = MC

$$60 - \frac{Q}{250} = 12$$

Q = 12,000 units
Substituting to find P

$$P = 60 - \frac{12,000}{500} = Sh.36$$

The profit maximizing price is Sh.36 and profit maximizing Quantity is 12,000 units.

Product B
This is solved in the same way as A

$$A = 58 + \frac{21,000}{500} \times 1 = Sh.100$$

$$P = 100 - \frac{1}{500}Q$$

$$TR = 100Q - \frac{Q_2}{500}$$

$$MR = \frac{dTR}{dQ} = 100 - \frac{Q}{250}$$

MC = Sh.8
At maximum profit MR = MC

$$100 - \frac{Q}{250} = 8$$

Q = 23,000 units
Substituting

$$P = 100 - \frac{23,000}{500} = \textbf{Sh.54}$$

The profit maximizing price is Ksh.54 while the profit maximizing quantity is Sh.23,000 units

QUESTION TWO

(a) Contributions for each division and the company as a whole for the various selling prices are as follows:

Mugaa Division

Output Units	Total Revenue Sh.	Variables Costs Sh.	Total Contribution Sh.
1,000	35,000	7,000	24,000
2,000	70,000	22,000	48,000
3,000	105,000	33,000	72,000
4,000	140,000	44,000	96,000
5,000	175,000	55,000	120,000
6,000	210,000	66,000	144,000

Gwashati Division

Output Units	Total Revenue Sh.	Variables Costs Sh.	Total Cost Transfers Sh.	Total Contribution Sh.
1,000	100,000	7,000	35,000	58,000
2,000	180,000	14,000	70,000	96,000
3,000	240,000	21,000	105,000	114,000

STUDY TEXT

4,000	280,000	28,000	140,000	112,000
5,000	300,000	35,000	175,000	90,000
6,000	300,000	42,000	210,000	48,000

Whole Company

Output Units	**Total Revenue Sh.**	**Company Variables Costs Sh.**	**Total Contribution Sh.**
1,000	100,000	18,000	82,000
2,000	180,000	36,000	144,000
3,000	240,000	54,000	186,000
4,000	280,000	72,000	208,000
5,000	300,000	90,000	210,000
6,000	300,000	108,000	192,000

(b) Based on the statements in (a) Gwashati division should select a selling price of Sh.80 per unit. This selling price produces a maximum divisional contribution of Sh.114,000. it is in the best interest of the company as a whole if the selling price of Sh60 per unit is selected. If Gwashati division selects a selling price of Sh.60 per unit instead of Sh.80 per unit, it's overall marginal revenue would increase bySh.60,000 but it's marginal cost would increase by shs.84,000. Consequently, Gwashati Division will not wish to lower the price.

(c) Where there is no market for the intermediate product and the supplying division has no capacity constraints, the correct transfer price is the marginal cost of the supply division for that output at which marginal revenue received from the intermediate product. When unit variable cost is constant and fixed cost remains unchanged, this rule will result in a transfer price that is equal to the supplying division's unit variable cost. Therefore the transfer price will be set at Sh11 per unit when the variable cost transfer pricing rule is applied. Gwashati division will be faced with the following revenue schedules:

Output units	**Marginal cost (NOTE) Sh.**	**Marginal Revenue Sh.**
1,000	18,000	100,000
2,000	18,000	80,000
3,000	18,000	60,000
4,000	18,000	40,000
5,000	18,000	20,000
6,000	18,000	NIL

Note:

- Marginal cost = transfer price of Sh11 per unit plus conversion variable cost of Sh7 per unit.
- Gwashati will select the optimum output level for the group as a whole (i.e. 5,000 units)
- And the optimal selling price of Sh60 will be selected. A transfer price equal to the variable cost per unit of the supplying division will result in the profits of the group being allocated to Gwashati, and Mugaa will incur a loss equal to the forced costs. Consequently, a divisional profit incentive cannot be applied to the supplying division.

CHAPTER NINE: FINANCIAL AND NON FINANCIAL PERFORMANCE

i) Current ratio ratio" = Current assets / Current Liabilities

250 / 130 = 1.92:1

Quick (acid test) ratio = current assets – stock / Current liabilities

= (250 – 149) / 130

= 0.78:1

This is a more refined measure of liquidity as it excludes stocks which are not easily convertible to cash.

Cash ratio = Cash + marketable securities (short-term securities) / Current Liabilities

= 30,000 / 130,000

= 0.23: 1

Net working capital ratio = Net working capital (NWC) / Net assets

NWC=CA–CL

= 250 – 130 / 580 – 130

= 0.27: 1

STUDY TEXT

ii) Leverage ratios (given in %)

a) Debt ratio = $\frac{\text{Total liabilities}}{\text{Total assets}}$

Measures the proportion of total assets supplied by non-owner funds

= $\frac{100 + 130}{580}$

= 0.4 or 40%

b) Debt equity ratio = $\frac{\text{Total liability}}{\text{Net worth (NW = TA – TL)}}$

This ratio measures the amount of non-owner supplied funds for every shilling from the owner.

= $\frac{230}{580 - 230}$

= 0.66 = 66%

c) Long-term debt ratio = $\frac{\text{Long-term liabilities}}{\text{Net Assets}}$

= $\frac{100}{450}$

= 22%

This measures the proportion of permanent assets financed by non-owner supplied funds.

Note: The higher the ratio, the higher the gearing ratio.

d)Time interest earned = $\frac{\text{Earning before interest (operating profits)}}{\text{(Interest + coverage ratio)}} + \frac{\text{taxes + depreciation}}{\text{Interest expenses}}$

The ratio measures the number of times interest expense is covered by operating profit. The higher the ratio, the lower the leverage position.

= $\frac{(165 + 10)\ 000}{15{,}000}$

= 11.7 times

Gearing ratio and liquidity ratios can be used to measure the financial risk of the company. The higher the liquidity ratios, the lower the financial risk.

(a) The higher the gearing ratio, the higher the financial risk, (the ability to pay the short-term liabilities).

$$\text{Stocks turnover} = \frac{\text{cost of sales}}{\text{Average stocks}}$$

$$\text{Average stock} = \frac{\text{Opening stock + closing stock}}{2}$$

$$= \frac{510}{\frac{99-5+149}{2}}$$

$$= 4.1 \text{ times}$$

Told 360. If not told, assume 360 days.

$$\text{Inventory conversion period} = \frac{\text{No of days in the year}}{\text{Stock turnover}}$$

$$= \frac{360}{41}$$

$$= 8.78 \text{ days}$$

Number it takes to convert raw materials to finished goods + makes sales

(b) $$\text{Debtors turnover} = \frac{\text{Credit sales}}{\text{Average debtors}}$$

$$= \frac{80\% \times 850}{\frac{(89 + 71)}{2}}$$

$$= 8.5 \text{ times}$$

$$\text{Average collection period} = \frac{\text{360 days in a year}}{\text{Debtors turnover}}$$

$$= \frac{360}{8.5}$$

$$= 42.4 \text{ days}$$

STUDY TEXT

It shows the number of days the company takes to cover what is due from customers.

(c) (i) creditors' turnover = credit purchases / Average creditors

= 545,250 / 130,000

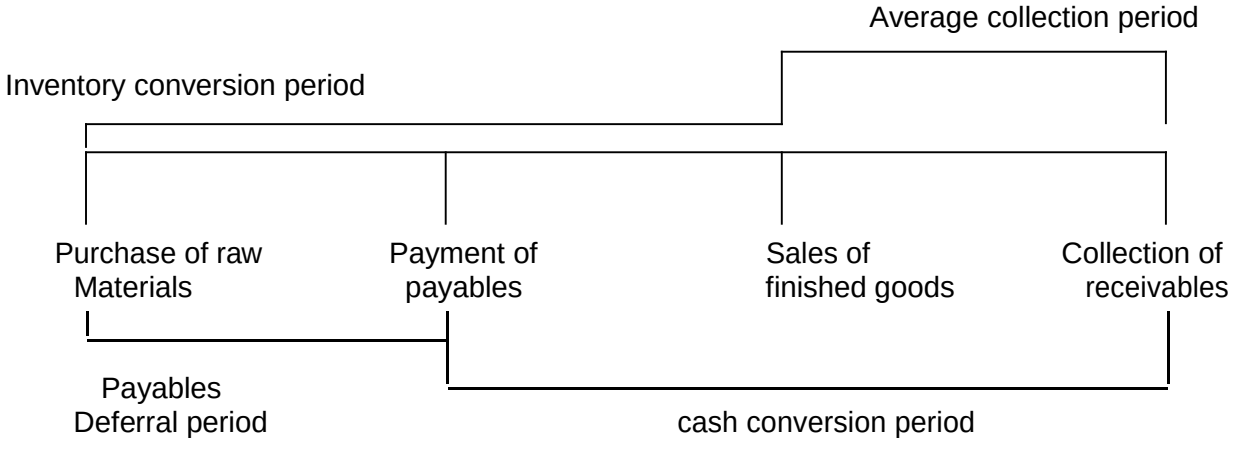
= 4.2 times

(ii) Payables deferral period = No of days in the year / Creditors turnover

= 360 / 4.2

= 85.7

Working capital (cash conversion) cycle



Cash conversion cycles = Inventory conversion Period + Average collection period - Payables deferral period

= 87.8 + 42.4 - 85.7

= 44.5 days

Turnover = 360 / Cash conversion cycle

360 / 44.5 = 8.1 times

Fixed asset turnover = Sales

Average fixed assets

= 850

(340 + 330) ½

= 2.54 times

Total asset turnover = Sales

Total assets

= 850

580

= 1.47 times

The rate at which the company is using fixed assets, (total) to make sales revenue.

Availability in relation to sales

Gross profit margin = Gross profit

Sales

= 340

850

= 40%

Gross profit margin measures the firm's ability to control production decisions.

b) (i) Operating margin = operating profit (EBIT)

Sales

= 165

850

= 19%

Operating ratio = Total expenses (production + operating)

Sales

= 510 + 175

850

= 81%

Operating ratio + Operating ratio should be equal to 100%

(Profit) expenses = sales

The two ratios measure the firm's ability to control growth, production and operating decisions.

Net profit margin = Net profit after taxes / Sales

= 75,000- / 850,000

= 9%

This measures a firm's ability to control production, operating and financing decisions.
Profitability in relation to investments:

return of investment = Net profit after taxes / Total assets

= 75,000 / 580,000

= 13%

The ratio measures the efficiency in which the company uses it's funds to generate a return to the owner of the company.

Return on capital employed = Net profit after taxes / Net Assets

= 750,000 / 450,000

= 17%

This ratio shows the efficiency with which the company uses permanent funds to generate a return to their owners.

Return on equity (Return on net work) = Earnings attributable to shareholders / Net worth

= 75,000 / 350,000

= 21%

This is the efficiency with which the company uses owner supplied funds to generate a return to the owners.

EVALUATION (equity) RATIO

Earnings/Share ratio (EPS) = Earnings attributable to equity holders / Number of common shares outstanding

This shows the returns that the shareholders expect to receive from the company in form of earnings for every share held.

Outstanding shares are the ones that have been sold to the public. If some have been repurchased by the issuing company are known as the treasury stock. This is not allowed in Kenya due to the efficiency of the markets in Kenya. It is a safeguard against arbitral profits.

= 75,000 / 20,000

= Sh 3.75

(b) Earning yield = Earning per shares / Market price/share

This ratio shows the amount of money the shareholders expect to receive for every share invested in the company. This is used to compare different company securities. The higher the earning yield, the better the firm.

E.g.	A	B
EPS		5
MPS		

(c) Dividends/Share (DPS) = Total common dividend / Number of common shares outstanding

This measure the amount the shareholders expect to receive in form of dividend for every share held in the company.

= 15,000 / 20,000

= 0.75

(d) Dividend yield (DY) = DPS / MPS

= 0.75 / 15

= 0.05

This ratio expresses the amount the shareholder expects to receive in form of dividends for everys hare invested in the company.

(e) Dividend pay-out ratio = $\frac{\text{DPS (Dividend/Share)}}{\text{EPS (Earning/Share)}}$

This ratio shows the proportion of earning paid out by dividends by the company.

$$= \frac{0.75}{3.75}$$

$$= 20\%$$

(f) Retention ratio = 1 - Dividend pay-out ratio (DPR)

OR

$$= \frac{\text{Retained earnings}}{\text{Earnings attributable to equity holders}}$$

(i) 1 – 0.2 = 0.8 or 80%

(ii) $\frac{60{,}000}{70{,}000}$

= 80%

This shows the proportion of profit retained by the company.

(g) Price-earning ratio = $\frac{\text{MPS}}{\text{EPS}}$

$$= \frac{15}{3.75}$$

$$= 4$$

This ratio is the risk of buying the shares. The lower the ratio, the lower the risk. This also shows the number of years it takes to recover the investment, i.e. the payback period.

This ratio can be used to classify companies into equivalent risk classes. The assumption that the companies in the same industry have the same price-earning ratio holds. The ratio is assumed to remain constant throughout.

20% 20%

↑ MPS = f [E(EPS) ↑, E(δ)] MPS = EPS x price-earning ratio

f[E®, E(δ)]

(h) Book value per share = $\frac{\text{Net worth}}{\text{Number of common shares outstanding}}$

$= \frac{350{,}000}{20{,}000}$

= 17.50 Sh

This ratio measures the amount the shareholders would get for every share held if the company was liquidated and the assets sold at the book value.

Market book value/share = $\frac{\text{Market price/share}}{\text{Book value/share}}$

$= \frac{15}{17.50}$

= 0.86

This ratio measures the value the market attaches to the firm as a going concern. It measures the company's goodwill. If the ratio is less than one, then the company has negative good will. Such a company should not be held as a going concern.

CHAPTER TEN: INFORMATION SYSTEMS AND REPORTING TO MANAGEMENT

(a)

	Sales & Marketing	Finance
TPS	- Order Processing - Customer ledgers	- Billing systems - Point of sale systems - Payroll processing
MIS	- Periodic analysis of sales by region, product, volume - Identification of loyal customers	- Pending bills analysis - Listing payment defaulters - Analysing Over/underpayments - Periodic accounting reports
DSS	- Redistribution of resources to increase sales volume - Analysing effects on sales of increasing the workforce	- Increasing petty cash allocations - Financial analysis and risk analysis - Pay increases
EIS	- Competitor analysis - Sales forecasting	- Impact of government policies on organizational cash flows
ES	- Market trend projections - Introduction of a new product line	- Capital Budgeting - Investment decisions

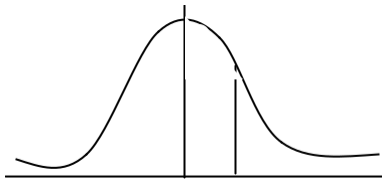
(b)

- Systems uptime/downtime – the length of time the system is operational
- Systems effectiveness (measures how well a system achieves its goals. It can be calculated by comparing actual performance to expected performance.) E.g. Budget allocations vs. actual usage – is the system performing within its cost budget?
- Level of integration – how well it performs a variety of applications
- Compatibility with existing business systems
- Degree of complexity in terms of development, installation, maintenance and learning how to use it
- Cost savings achieved as a result of using the system
- Level of efficiency (ratio of what is produced to what is consumed) attained by the entire organization as a result of adopting the system
- System's security level – is organization's information and resources exposed to unauthorized access.
- User acceptance

(c) A field that focuses on developing techniques to enable computer systems to perform activities that are considered intelligent (in humans and other animals).

Table I

Areas under the Standard Normal Curve from 0 to Z



Z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141

0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1623	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3073	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319

1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1 2.0	0.4821 0.4772	0.4826 0.4778	0.4830 0.4783	0.4834 0.4788	0.4838 0.4793	0.4842 0.4798	0.4846 0.4803	0.4850 0.4808	0.4854 0.4812	0.4857 0.4817
2.2 2.1	0.4861 0.4821	0.4864 0.4826	0.4868 0.4830	0.4871 0.4834	0.4875 0.4838	0.4878 0.4842	0.4881 0.4846	0.4884 0.4850	0.4887 0.4854	0.4890 0.4857
2.3 2.2	0.4893 0.4861	0.4896 0.4864	0.4898 0.4868	0.4901 0.4871	0.4904 0.4875	0.4906 0.4878	0.4909 0.4881	0.4911 0.4884	0.4913 0.4887	0.4916 0.4890
2.4 2.3	0.4918 0.4893	0.4920 0.4896	0.4922 0.4898	0.4925 0.4901	0.4927 0.4904	0.4929 0.4906	0.4931 0.4909	0.4932 0.4911	0.4934 0.4913	0.4936 0.4916
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4761	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4669	0.4970	0.4971	0.4972	0.4973	0.4974

2.8	0.4974	0.4975	0.4976	0.4977	0.4877	0.4978	0.4979	0.4979	0.4780	0.4781
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

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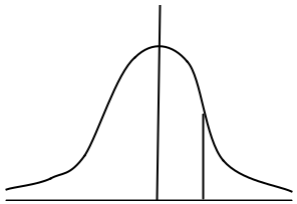
Table II



Normal distribution

Shaded area = p

0 Z

Z	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
P	0.500	0.460	0.421	0.382	0.345	0.308	0.274	0.242	0.212	0.184

Z	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9

P	0.159	0.136	0.115	0.097	0.081	0.067	0.055	0.045	0.036	0.029
Z	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9
P	0.023	0.018	0.014	0.011	0.008	0.006	0.005	0.003	0.003	0.002
Z	3.0	3.1	3.2	3.3	3.4					
P	0.0013	0.0010	1.0007	0.0005	0.0003					

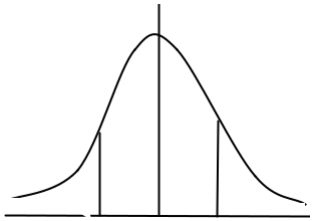


Table III

Percentage points of the t distribution.

The table shows the total of the shaded area

The table gives the values for the area in both tails.

0

t

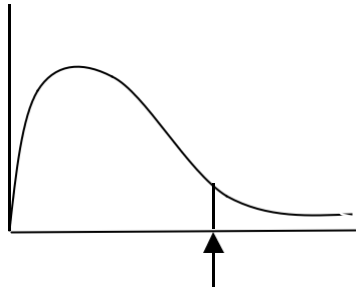
Degree of freedom	Area in both tables combined			
	.10	.05	.02	.01

Degrees of freedom	Area in both tables combined			
	.10	.05	.02	.01

v = 1	6.314	12.706	31.821	63.657	v = 21	1.721	2.080	2.518	2.831
2	2.920	4.303	6.965	9.925	22	1.717	2.074	2.508	2.819
3	2.353	3.182	4.541	5.841	23	1.714	2.069	2.500	2.807
4	2.132	2.776	3.747	4.604	24	1.711	2.064	2.492	2.797
5	2.015	2.571	3.365	4.032	25	1.708	2.060	2.485	2.787
6	1.493	2.447	3.143	3.707	26	1.706	2.056	2.479	2.779
7	1.895	2.365	2.998	3.499	27	1.703	2.052	2.473	2.771
8	1.860	2.306	2.896	3.355	28	1.701	2.048	2.467	2.763
9	1.833	2.262	2.821	3.250	29	1.699	2.045	2.462	2.756
10	1.812	2.228	2.764	3.169	30	1.697	2.042	2.457	2.750
11	1.796	2.201	2.718	3.106	40	1.684	2.021	2.423	2.704
12	1.782	2.179	2.681	3.055	60	1.671	2.000	2.390	2.660
13	1.771	2.160	2.650	3.012	12	1.658	1.980	2.358	2.6170

14	1.761	2.145	2.624	2.977	∞	1.645	1.960	2.326	2.576
15	1.753	2.131	2.602	2.947					
16	1.746	2.120	2.583	2.921					
17	1.740	2.110	2.567	2.898					
18	1.734	2.101	2.552	2.878					
19	1.729	2.093	2.539	2.861					
20	1.725	2.086	2.528	2.845					

TableIV



Thedistribution

0

X^2value off

Degrees of freedom	Level of significance	
	5%	1%
v = 1	8413.	6356.
2	9915.	2109.

3	7.815	11.345
4	9.488	13.277
5	11.070	15.086
6	12.592	16.812
7	14.067	18.475
8	15.507	20.090
9	16.919	21.666
10	18.307	23.209

Table V

Percentage points of the f distribution

Percentage points of the f distribution V_1 = Degrees of freedom for numerator

V_1 = Degrees of freedom for numerator

V_2 = Degrees of freedom for denominator	1	2	3	4	5	6	7	8	9	10	11	12
	1	2	3	V_1 = Degrees of freedom for numerator 4	5	6	7	8	9	10	11	12
	1	2	3	4	5	6	7	8	9	10	11	12
1	161	200	216	225	230	234	237	239	241	242	243	244
1	161 (4,052)	200 (4,999)	216 (5,403)	225 (5,625)	230 (5,764)	234 (5,859)	237 (5,928)	239 (5,981)	241 (6,022)	242 (6,056)	243 (6,082)	244 (6,106)
2	(4,052)	(4,999)	(5,403)	(5,625)	(5,764)	(5,859)	(5,928)	(5,981)	(6,022)	(6,056)	(6,082)	(6,106)
1	161	200	216	225	230	234	237	239	241	242	243	244
2	18.51 (98.49) (4,052)	19.00 (99.01) (4,999)	19.16 (99.17) (5,403)	19.25 (99.25) (5,625)	19.30 (99.30) (5,764)	19.33 (99.33) (5,859)	19.36 (99.34) (5,928)	19.37 (99.36) (5,981)	19.38 (99.38) (6,022)	19.39 (99.40) (6,056)	19.40 (99.41) (6,082)	19.41 (99.42) (6,106)
3	(98.49)	.01)	.17)	.25)	.30)	(9994.33)	(99.34)	(99.36)	(99.38)	(99.40)	(99.41)	(99.42)
2	10.13 18.51	(99.55 19.00	(99.28 19.16	(99.12 19.25	(99.01 19.30	8. 19.33	8.88 19.36	8.84 19.37	8.81 19.38	8.78 19.39	8.76 19.40	8.74 19.41
3	10.13 (94.12) (98.49)	9.55 (30.81) (99.01)	.28 (29.46) (99.17)	9.12 (28.71) (99.25)	9.01 (28.24) (99.30)	8.94 (27.91) (99.33)	8.88 (27.67) (99.34)	8.84 (27.49) (99.36)	8.81 (27.34) (99.38)	8.8(27 (27.23) (99.40)	8.6(27 (27.13) (99.41)	8.4(27 (27.05) (99.42)
4	(34.12)	(30.81)	(29.46)	(28.71)	(28.24)	(27.91)	(27.67)	(27.49)	(27.34)	(27.23)	(27.13)	(27.05)
3	7.71 10.13	6.94 9.55	6.59 9.28	6.39 9.12	6.26 9.01	6.16 8.94	6.09 8.88	6.04 8.84	6.00 8.81	5.96 8.78	5.93 8.76	5.91 8.74

	(21.20)	(18.00)	(16.69)	(15.98)	(15.52)	(15.21)	(14.98)	(14.80)	(15.68)	(14.64)	(14.45)	(14.37)
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.78	4.74	4.7	4.68
	(16.26)	(13.27)	(12.06)	(11.39)	(10.97)	(10.67)	(10.45)	(10.27)	(10.15)	(10.05)	(9.98)	(9.89)
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.03	4.00
	(13.75)	(10.92)	(9.78)	(9.15)	(8.75)	(8.47)	(8.26)	(8.10)	(7.98)	(7.87)	(7.79)	(7.72)
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.63	3.60	3.57
	(12.25)	(9.55)	(8.45)	(7.35)	(7.46)	(7.19)	(7.00)	(6.84)	(6.71)	(6.62)	(6.54)	(6.47)
8	5.32	4.46	4.07	3.34	3.69	3.58	3.50	3.44	3.39	3.34	3.31	3.28
	(11.26)	(8.65)	(7.59)	(7.01)	(6.93)	(6.37)	(6.19)	(6.08)	(5.91)	(5.82)	(5.74)	(5.67)
9	5.12	4.26	3.83	3.63	3.48	3.37	3.29	3.23	3.18	3.13	3.10	3.07
	(10.56)	(8.02)	(6.99)	(6.42)	(6.06)	(5.80)	(5.62)	(5.47)	(5.35)	(5.38)	(5.18)	(5.11)
10	4.96	4.1	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.97	2.94	2.91
	(10.04)	(7.58)	(6.55)	(5.99)	(5.64)	(5.39)	(5.21)	(5.06)	(4.93)	(4.85)	(4.76)	(4.71)

11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.86	2.82	2.79
	(9.65)	(7.20)	(6.22)	(5.67)	(5.32)	(5.07)	(4.88)	(4.74)	(4.63)	(4.54)	(4.46)	(4.40)
12	4.75	3.88	3.49	3.26	3.11	3.00	2.92	2.85	2.80	2.70	2.73	2.69
	(9.33)	(6.93)	(5.95)	(5.41)	(5.06)	(4.82)	(4.65)	(4.50)	(4.39)	(4.30)	(4.23)	(4.18)

Values of f:

Right tail of the distribution for P = .05

Right tail of the distribution for P = .01 (in brackets).

Table VI

(a) Table of individual Poisson probabilities

Mean (m)	Number of occurrences (x) 0	1	2	3	4	5	6
0.1	0.9048	0.0905	0.0045	0.0002	0.000	0.000	0.000

(a) Table of individual Poisson probabilities

Mean (m)	Number of occurrences (x) 0	1	2	3	4	5	6
0.2	0.8187	0.1637	0.0164	0.0011	0.0001	0.000	0.000

Mean (m) 0 1 2 3 4 5 6
0.1 0.9048 0.0905 0.0045 0.0002 0.000 0.000 0.000

0.3	0.7408	0.2222	0.0333	0.0033	0.0003	0.000	0.000
0.2	0.8187	0.1637	0.0164	0.0011	0.0001	0.000	0.000
0.1	0.9048	0.0905	0.0045	0.0002	0.000	0.000	0.000
0.4	0.6703	0.2681	0.0536	0.0072	0.0007	0.0001	0.000
0.3	0.7408	0.2222	0.0333	0.0033	0.0003	0.000	0.000
0.2	0.8187	0.1637	0.0164	0.0011	0.0001	0.000	0.000
0.5	0.6065	0.3033	0.0758	0.0126	0.0016	0.0002	0.000
0.4	0.6703	0.2681	0.0536	0.0072	0.0007	0.0001	0.000
0.3	0.7408	0.2222	0.0333	0.0033	0.0003	0.000	0.000
0.6	0.5488	0.3293	0.0988	0.0198	0.0030	0.0004	0.000
0.5	0.6065	0.3033	0.0758	0.0126	0.0016	0.0002	0.000
0.4	0.6703	0.2681	0.0536	0.0072	0.0007	0.0001	0.000
0.7	0.4966	0.3476	0.1217	0.0284	0.0050	0.0007	0.0001
0.6	0.5488	0.3293	0.0988	0.0198	0.0030	0.0004	0.000
0.5	0.6065	0.3033	0.0758	0.0126	0.0016	0.0002	0.000
0.8	0.4493	0.3595	0.1438	0.0383	0.0077	0.0012	0.0002
0.7	0.4966	0.3476	0.1217	0.0284	0.0050	0.0007	0.0001
0.6	0.5488	0.3293	0.0988	0.0198	0.0030	0.0004	0.000
0.9	0.4066	0.3659	0.1647	0.0494	0.0111	0.0020	0.0003
1.0	0.3679	0.3679	0.1839	0.0613	0.0153	0.0031	0.0005

Table shows probability of a given number of occurrences for a given mean (m).

(b) Table of cumulative Poisson

Table shows probability of a given number of occurrences for a given mean probabilities (m).

(b) Table of cumulative probabilities

Poisson

Number of occurrences (x)

Mean(b)Table of cumulative (m)probabilities0 1

Number of occurrences (x) Poisson

2 3 4 5 6

Mean (m)	0	1
0.1	0.9048	0.9953
Mean 0.1 0.2 (m)	0.9048 0.8187 0	0.9953 0.9824 1
0.2 Mean.30 0.1 (m)	0.8187 0.7408 0.9048 0	0.9824 0.9630 0.9953 1
0.3 0.4 0.2 0.1	0.7408 0.6703 0.8187 0.9048	0.9630 0.9384 0.9824 0.9953
0.4 0.5 0.3 0.2	0.6703 0.6065 0.7408 0.8187	0.9384 0.9098 0.9630 0.9824
0.5 0.6 0.4 0.3	0.6065 0.5488 0.6703 0.7408	0.9098 0.8781 0.9384 0.9630
0.6 0.7 0.5 0.4	0.5488 0.4966 0.6065 0.6703	0.8781 0.8442 0.9098 0.9384

Number of occurrences (x)				
2	3	4	5	6
0.9998	1.00	1.00	1.00	1.00
0.9998 Number 0.9988 of 0	1.00 occurrences. 0.9999	1.00 (x)	1.00 5	1.00 6
0.9988 0.9963 0.9998	0.9999 0.9996 1.00	1.00 0.9999 1.00	1.00 1.00 5	1.00 1.00 6
0.9963 0.9920 0.9988	0.9996 0.9992 0.9999	0.9999 0.9999 1.00	1.00 1.00 1.00	1.00 1.00 1.00
0.9920 0.9856 0.9963	0.9992 0.9982 0.9996	0.9999 0.9998 0.9999	1.00 1.00 1.00	1.00 1.00 1.00
0.9856 0.9769 0.9920	0.9982 0.9967 0.9992	0.9998 0.9997 0.9999	1.00 1.00 1.00	1.00 1.00 1.00
0.9769 0.9659 0.9856	0.9967 0.9943 0.9982	0.9997 0.993 0.9998	1.00 1.00 1.00	1.00 1.00 1.00

0.8	0.4493	0.8088	0.9526	0.9909	0.9986	0.9998	1.00
0.9	0.4066	0.7725	0.9372	0.9866	0.9977	0.9997	1.00
1.0	0.3679	0.7358	0.9197	0.9810	0.9963	0.9994	0.9999

Table shows probability of finding x or fewer occurrences for a given mean (m).

Table VII

Compound interest

Table shows value of £1 at compound interest (1 + r)^n

	Interest rates (r) %										
Years (n)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.110
Years (n)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210	1.232
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.110
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331	1.368
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210	1.232
4	1.041	1.082	1.126	1.167	1.216	1.262	1.311	1.360	1.412	1.464	1.518
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331	1.368
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.610	1.685
4	1.041	1.082	1.126	1.167	1.216	1.262	1.311	1.360	1.412	1.464	1.518
6	1.061	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772	1.870
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.610	1.685
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949	2.076
6	1.061	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772	1.870
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144	2.304
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358	2.558

10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594	2.839
11	1.116	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853	3.152
12	1.127	1.268	1.426	1.601	1.796	2.012	2.252	2.519	2.813	3.138	3.498
13	1.138	1.294	1.468	1.665	1.886	2.133	2.410	2.720	3.066	3.452	3.883
14	1.149	1.319	1.513	1.732	1.980	2.261	2.578	2.937	3.342	3.797	4.310
15	1.161	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177	4.785
20	1.220	1.486	1.806	2.191	2.653	3.207	3.870	4.661	5.604	6.727	8.062
25	1.282	1.641	2.094	2.666	3.386	4.292	5.427	6.848	8.623	10.835	13.585

Interest rates (r) %

Years (n)	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**25**	**30**
1	1.120	1.130	1.140	1.150	1.160	1.170	1.180	1.190	1.200	1.250	1.300

2	1.254	1.277	1.297	1.322	1.346	1.367	1.392	1.416	1.440	1.562	1.690
3	1.405	1.443	1.481	1.521	1.561	1.602	1.643	1.685	1.728	1.953	2.197
4	1.573	1.630	1.689	1.749	1.811	1.874	1.939	2.005	2.074	2.441	2.856
5	1.762	1.842	1.925	2.011	2.100	2.192	2.288	2.386	2.488	3.052	3.713
6	1.974	2.082	2.195	2.313	2.436	2.565	2.700	2.840	2.986	3.815	4.827
7	2.211	2.353	2.502	2.660	2.826	3.001	3.186	3.379	3.583	4.768	6.275
8	2.476	2.658	2.853	3.059	3.278	3.511	3.759	4.021	4.300	5.960	8.157
9	2.773	3.004	3.252	3.518	3.803	4.108	4.435	4.785	5.159	7.451	10.604
10	3.106	3.395	3.707	4.046	4.411	4.807	5.234	5.695	6.192	9.313	13.786
11	3.478	3.836	4.226	4.662	5.117	5.624	6.176	6.777	7.430	11.641	17.922
12	3.896	4.334	4.818	5.350	5.936	6.580	7.288	8.064	8.916	14.552	23.298
13	4.363	4.898	5.492	6.153	6.886	7.699	8.599	9.596	10.699	18.190	30.287
14	4.887	5.535	6.261	7.076	7.988	9.007	10.147	11.420	12.839	22.737	39.374

15	5.474	6.254	7.138	8.137	9.265	10.539	11.974	13.589	15.407	28.422	51.186
20	9.646	11.523	13.743	15.366	19.461	23.106	27.393	32.429	38.338	86.736	190.050
25	17.000	21.230	26.462	32.920	40.874	50.658	62.669	77.388	95.396	264.698	705.641

Table VIII

Present value factors. Present value of £1 (1 + r)$^{-n}$

Interest rates (r)

Present**eriods** value factors. Present value of **%**£1 (1 + r)$^{-n}$

(n) Periods	**1%**	**2%**	**4%**	**Interest 6% rates 8% (r) %**		**10%**	**12%**	**14%**	**15%**
1	0.990	0.980	0.962	0.943	0.926	0.909	0.893	0.877	0.870
(n) Periods	**1%**	**2%**	**4%**	**Interest rates (r) 6% % 8%**		**10%**	**12%**	**14%**	**15%**
2	0.980	0.961	0.925	0.890	0.857	0.826	0.797	0.769	0.756
1	0.990	0.980	0.962	0.943	0.926	0.909	0.893	0.877	0.870
(n)	**1%**	**2%**	**4%**	**6%**	**8%**	**10%**	**12%**	**14%**	**15%**
3	0.971	0.942	0.889	0.840	0.794	0.751	0.712	0.675	0.658
2	0.980	0.961	0.925	0.890	0.857	0.826	0.797	0.769	0.756
1	0.990	0.980	0.962	0.943	0.926	0.909	0.893	0.877	0.870
4	0.961	0.924	0.855	0.792	0.735	0.683	0.636	0.592	0.572
3	0.971	0.942	0.889	0.840	0.794	0.751	0.712	0.675	0.658
2	0.980	0.961	0.925	0.890	0.857	0.826	0.797	0.769	0.756
5	0.951	0.906	0.822	0.747	0.681	0.621	0.567	0.519	0.497
4	0.961	0.924	0.855	0.792	0.735	0.683	0.636	0.592	0.572
3	0.971	0.942	0.889	0.840	0.794	0.751	0.712	0.675	0.658
6	0.942	0.888	0.790	0.705	0.630	0.564	0.507	0.456	0.432
5	0.951	0.906	0.822	0.747	0.681	0.621	0.567	0.519	0.497
7	0.933	0.871	0.760	0.665	0.583	0.513	0.452	0.400	0.376
6	0.942	0.888	0.790	0.705	0.630	0.564	0.507	0.456	0.432
8	0.923	0.853	0.731	0.627	0.540	0.467	0.404	0.351	0.327
7	0.933	0.871	0.760	0.665	0.583	0.513	0.452	0.400	0.376
9	0.914	0.837	0.703	0.592	0.500	0.424	0.361	0.308	0.284
8	0.923	0.853	0.731	0.627	0.540	0.467	0.404	0.351	0.327

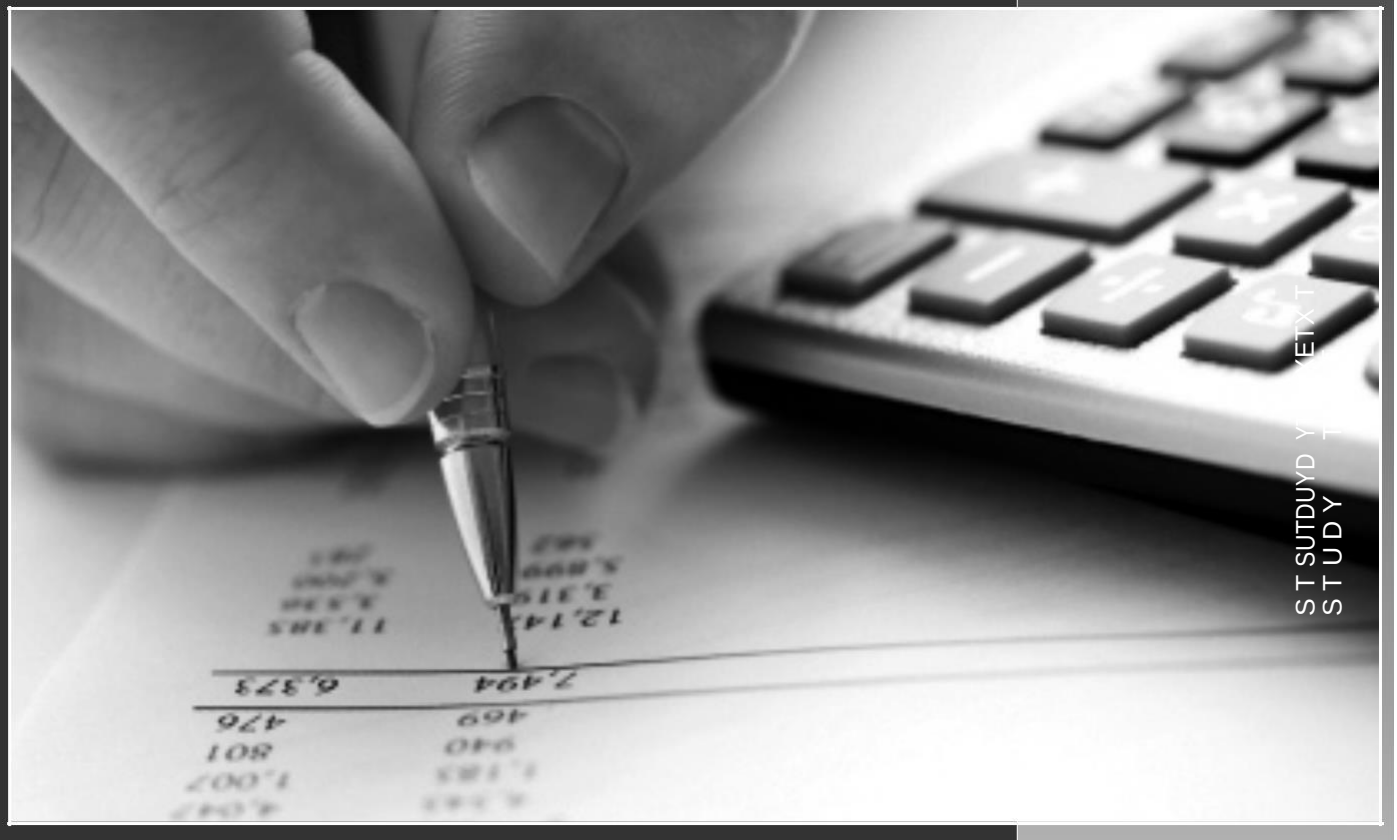
10	0.905	0.820	0.676	0.558	0.463	0.386	0.322	0.270	0.247
11	0.0896	0.804	0.650	0.527	0.429	0.350	0.287	0.237	0.215
2 1	7 **0.**0896	788 **0.**804	25 **0.**50**6**	49 **0.**52**7**	397 **0.**429	19 **0.3**50	5 **0.**8**2 7**	08 **0.2**37	187 **0.**215
3 12	79 **0.**87	73 **0.**88**7**	01 **0.**25**6**	69 **0.**97**4**	68 **0.3**97	290 **0.**319	29 **0.**57**2**	182 **0.**208	63 **0.1**87
4 13	0 **0.87**9	58 **0.**73	577 **0.**601	42 **0.**69**4**	40 **0.**68**3**	63 **0.2**90	05 **0.**29	60 **0.1**82	41 **0.1**63
5 14	61 **0.**70**8**	43 **0.**58**7**	55 **0.**77**5**	17 **0.**42	15 **0.**40**3**	39 **0.2**63	183 **0.**205	4 **0.16**0	23 **0.1**41
16 15	0.853 0.861	0.728 0.743	0.534 0.555	0.394 0.417	0.292 0.315	0.218 0.239	0.163 0.183	0.123 0.140	0.107 0.123
17 16	0.855 0.853	0.714 0.728	0.513 0.534	0.371 0.394	0.270 0.292	0.198 0.218	0.146 0.163	0.108 0.123	0.093 0.107
18 7 16	0.836 5 **0.85**3	0.700 14 **0.**28**7**	0.494 13 **0.**34**5**	0.350 71 **0.**94**3**	0.250 70 **0.**92**2**	0.180 19 **0.**21**8**	0.130 46 **0.1**63	0.095 08 **0.1**23	0.081 093 **0.**107
19 8 17	0.828 36 **0.**55**8**	0.686 00 **0.**14**7**	0.475 494 **0.**513	0.331 50 **0.**71**3**	0.232 5 **0.7**2 0	0.164 80 **0.1**98	0.116 30 **0.**46**1**	0.083 095 **0.**108	0.070 81 **0.0**93
20 19	0.820 0.828	0.675 0.686	0.456 0.475	0.312 0.331	0.215 0.232	0.149 0.164	0.104 0.116	0.073 0.083	0.061 0.070
21	0.811	0.660	0.439	0.294	0.199	0.135	0.093	0.064	0.053

22	0.803	0.647	0.422	0.278	0.184	0.123	0.083	0.056	0.046
23	0.795	0.634	0.406	0.262	0.170	0.112	0.074	0.049	0.040
24	0.788	0.622	0.390	0.247	0.158	0.102	0.066	0.043	0.035
25	0.780	0.610	0.375	0.233	0.146	0.092	0.059	0.038	0.030

Periods	Interest rates (r) %								
(n)	16%	18%	20%	22%	24%	25%	26%	28%	30%
1	0.862	0.847	0.833	0.820	0.806	0.800	0.794	0.781	0.769
2	0.743	0.718	0.694	0.672	0.650	0.640	0.630	0.610	0.592
3	0.641	0.609	0.579	0.551	0.524	0.512	0.500	0.477	0.455
4	0.552	0.516	0.482	0.451	0.423	0.410	0.397	0.373	0.350
5	0.476	0.437	0.402	0.370	0.341	0.328	0.315	0.291	0.269
6	0.410	0.370	0.335	0.303	0.275	0.262	0.250	0.227	0.207
67	0.410354	0.37014	0.335279	0.303249	0.27522	0.62102	0.250198	0.227178	0.207159
78	0.35405	0.314266	0.79332	0.24904	0.222179	0.210168	0.19857	0.17839	0.59231
89	0.305263	0.26625	0.233194	0.204167	0.17944	0.68341	0.15725	0.13908	0.123094
910	0.26327	0.225191	0.94621	0.1637	0.14416	0.34071	0.125099	0.108085	0.94750
11	0.195	0.162	0.135	0.112	0.094	0.086	0.079	0.066	0.056

12	0.168	0.137	0.112	0.192	0.076	0.069	0.062	0.052	0.043
13	0.145	0.116	0.093	0.075	0.061	0.055	0.050	0.040	0.033
14	0.125	0.099	0.178	0.062	0.049	0.044	0.039	0.032	0.025
15	0.108	0.084	0.065	0.051	0.040	0.035	0.031	0.025	0.020
16	0.093	0.071	0.054	0.042	0.032	0.028	0.025	0.019	0.015
17	0.080	0.060	0.045	0.034	0.026	0.023	0.020	0.015	0.012
16	0.093	0.071	0.054	0.042	0.032	0.028	0.025	0.019	0.015
18	0.069	0.051	0.038	0.028	0.021	0.018	0.016	0.012	0.009
17	0.080	0.060	0.045	0.034	0.026	0.023	0.020	0.015	0.012
19	0.060	0.043	0.031	0.023	0.017	0.014	0.012	0.009	0.007
18	0.069	0.051	0.038	0.028	0.021	0.018	0.016	0.012	0.009
20	0.051	0.037	0.026	0.019	0.014	0.012	0.010	0.007	0.005
19	0.060	0.043	0.031	0.023	0.017	0.014	0.012	0.009	0.007
21	0.044	0.031	0.022	0.015	0.011	0.009	0.008	0.006	0.004
20	0.051	0.037	0.026	0.019	0.014	0.012	0.010	0.007	0.005
22	0.038	0.026	0.018	0.013	0.009	0.007	0.006	0.004	0.003
21	0.044	0.031	0.022	0.015	0.011	0.009	0.008	0.006	0.004
23	0.033	0.022	0.015	0.010	0.007	0.006	0.005	0.003	0.002
22	0.038	0.026	0.018	0.013	0.009	0.007	0.006	0.004	0.003
24	0.028	0.019	0.011	0.008	0.006	0.005	0.004	0.003	0.002
25	0.024	0.016	0.010	0.007	0.005	0.004	0.003	0.002	0.001

GLOSSARY




GLOSSARY

Accelerated Cost Recovery System (ACRS): A method of depreciation required for income tax purposes that places a depreciable asset into one eight property classes according to the asset's useful life

Activity Based Costing: A costing method that creates a cost pool for each event or transaction in an organization that acts as a cost driver. Overhead costs are then assigned to products and services on the basis of the number of these events or transactions that the product or service has generated.

Administrative costs: All executive, organizational costs and clerical costs associated with the general management of an organization

After tax benefit: The amount of net cash inflow realized by an organization from a taxable cash receipt after income tax effects has been considered. The amount is determined by multiplying the cash receipt by (1-Tax rate)

After tax cost: The amount of net cash outflow resulting from tax deductible cash expense after income tax effect has been considered. The amount is determined by multiplying the cash expense by (1-Tax rate)

Avoidable cost: Any cost that can be eliminated (in whole or in part) as a result of choosing one alternative over another in a decision making situation. This term is synonymous with *relevant costs* and *differential costs*

Break even chart: The relationship between revenues, costs and level of activity in an organization presented in graphic form

Breakeven point: The level of activity at which an organization neither earns a profit nor incurs a loss. The break-even point can also be defined as the point where total revenue equals total costs as the point where the total contribution margin equals total fixed costs.

Bills of materials: A listing of the type and the quantity of each time of material required in the manufacture of a unit of product

Budget: A detailed plan outlining the acquisition and use of financial and other resources over some given time period.

Budget committee: A group of key management persons who are responsible for overall policy matters relating to the budget program and for coordinating the preparation of the budget itself.

Budget variance: A measure of the difference between the actual fixed overhead costs incurred during the period and budgeted fixed overhead costs as contained in the flexible budget.

Capital budget: A budget covering the acquisition of land, buildings and items of equipment; such a budget may have a time horizon extending 30 years or more into the future.

Capital budgeting budgeting" : Actions relating to the planning and financing of capital outlays for such purposes as the purchase of new equipment, the introduction of new product lines and the modernization of plant facilities

Capital decay decay" : A loss in marketing share resulting from technologically obsolete products and operations

Cash budget: A detailed plan showing how cash resources will be acquired and used over some specific time period.

Ceiling: A term used in relation to the range of flexibility that denotes the price that is obtained by adding a normal markup to the cost base in the cost plus pricing

Cell: A grouping of two or more automated machines in a flexible manufacturing system

Committed fixed costs: Those fixed costs that relate to the investment in plant, equipment and the basic organizational structure of the firm

Continuous or perpetual budget: A budget that covers a 12-month period but is constantly adding a new month on the end as the current month is completed

Contribution approach approach" : An income statement format that is geared to cost behavior in that costs are separated into variable and fixed categories rather than being separated according to the functions of production, sales and administration

Contribution margin margin" : The amount remaining from sales revenues after variable expenses have been deducted.

Contribution margin margin" **ratio**: The contribution margin per unit expressed as a percentage of the selling price per unit.

Control: The process of instituting procedures and then obtaining feedback as needed to ensure that all parts of the organization are functioning effectively and moving towards overall company goals

Controller: This is the manager in charge of the accounting department in an organization

Controllable costs: A cost is controllable at particular level of management if the level of management has power to authorize the cost

Conversion cost: The term used to describe labor costs combined with manufacturing overhead costs

Cost behavior behavior" : The way in which a cost will react or respond to changes in level of business activity

Cost center center" : A responsibility center that has control over the incurrence of cost but has no control over the generation of revenue or use of the investment funds

Cost driver driver" : Machine hours, direct labor hours, or similar base that is causal factor in the incurrence of overhead costs or is closely correlated with its incurrence

Cost of carrying sufficient inventory: Those costs that result from not having enough inventory in stock to meet customers' needs; such costs would include customer ill will, quantity discount foregone, erratic production, added transportation charges, and lost sales.

Cost of capital of capital" : The overall cost of an organization of obtaining investment funds, including the cost of both debt sources and equity sources

Cost of goods manufactured of goods manufactured" : The materials, labor and overhead costs that may have gone into the products that have been produced during the period

Cost of quality of quality" : A summation of all quality measures. It represents a total of all the specific costs that can be traced to producing a non-quality product

Cost plus pricing plus pricing" : A pricing method in which some predetermined markup is added to a cost base in determining a target selling price

Cost structure structure" : The relative proportion of fixed, variable and mixed costs found within an organization

Cost-volume-profit (CVP) graph: The relationship between revenues, costs and level of activity in an organization, presented in graphic terms

Curvilinear costs: The economists' expression of the relationship between costs and activity in an organization.

Cutoff rate: *required rate of return*

Decentralization: The delegation of decision making authority throughout an organization by allowing managers at various operating levels to make key decisions relating to their area of responsibility.

Decentralized organization: An organization in which decision making is not confined to a few top executives but rather is spread throughout the organization

Decision making making" : The process of making rational choices among alternatives

Delivery cycle time cycle time" : The amount of time required from receipt of an order from the customer to shipment of the completed goods.

Denominator activity: The estimated activity figure used to compute the predetermined overhead rate.

Dependent variable: A variable that reacts or responds to some controlling factor in a situation; total costs is the dependent variable, as represented by the letter *Y* in the equation $Y = a + bX$

Depreciation tax shield tax shield" : A reduction in the amount of income subject to tax that results from the presence of depreciation deductions on the income statements. The reduction in tax is computed by multiplying the depreciation deduction by the tax rate.

Differential costs: Any cost that is present under one alternative but is absent in whole or part in another alternative in a decision making situation.

Direct costss" : A cost that can be obviously and physically traced to the creation of product or other organizational segment

Directing: The overseeing of day to day activities in order to keep an organization functioning smoothly

Direct labor budget budget" : A detailed plan showing requirements over some specific time period

Direct material: Those materials that become an integral part of finished products that can be conveniently traced to it.

Direct material budget budget" : A detailed plan showing the amount of raw materials that must be purchased during a period to meet both production and inventory needs.

Economic Order Quantity (EOQ): The order size for materials that will result in a minimization of the costs of ordering inventory and carrying inventory

Economic production-run size: The number of units produced in a production run that will result in a minimization setup costs and the cost of carrying inventory.

Feedback: Accounting and other reports that help managers monitor performance and focus on problems and/or opportunities that might otherwise go unnoticed

Financial accounting: The face of accounting that is concerned with providing information to stockholders and others for use in evaluating operations and current financial conditions

Finished goods: Goods that are completed as to manufacturing but not yet sold to the

customers

Finished goods budget: A budget showing the dollar amount of cost expected to appear on the balance sheet for unsold units at the end of the period.

Fixed costs: A cost that remains constant, in total, regardless of changes in the level of activity.

Flexible budget: A budget that has been designed to cover a range of activity that can be used to develop budgeted costs at any point within that range to compare against actual costs incurred

Floor: A term used in relation to the range of flexibility that denoted the variable costs associated with a product

High-low method: A method of separating a mixed cost into its fixed and variable elements by analyzing the change in activity and cost between the high and low points of a group of observed data.

Hurdle rate: *required rate of return*

Ideal standards standards" : Standards that allow for no machine breakdowns or other work interruptions and that require peak efficiency at all times

Incremental costs: An increase in costs between two alternatives

Independent variable: A variable that acts as the controlling factor in a situation; activity is the independent variable, as represented by the letter X, in the equation Y = a + bX

Indirect cost cost" **s:** A cost that must be allocated in order to be assigned to a unit of product or some other organizational segment. Also known as a common cost

Indirect labor labor" : The factory labor costs of janitors, supervisors, engineers and others that cannot be traced directly to the creation of products in a "hands on" sense.

Indirect materials: Small items of materials such as glue and nails that may become an integral part of a finished product but that are traceable into the product only at great costs or inconvenience

Intermediate market: A market in which an item can be sold immediately and in its present form to outside customers rather than just being transferred to another division for use in its manufacturing process

Internal rate of return (IRR): The discount rate that will cause the net present value of an investment project to be equal to zero; thus, the IRR represents the true interest return promised by a project over its useful life. This term is synonymous with *time adjusted rate of return*

Interpolation: The process of finding odd rates of return that do not appear in published interest tables

Inventory carrying costs carrying costs" : Those costs that result from having inventory in stock, such as rental of storage space, handling costs, property taxes, insurance and on funds.

Inventory ordering costs ordering costs" **:** Those costs associated with the acquisition of inventory, such as clerical costs and transportation costs.

Inventory turnover turnover" **:** The number of times the average inventory balance has been used (and thereby replaced) during the period

Investment center center" : A responsibility center that has control over the incurrence of cost and over the generating of revenue and that also has control over the use of the investment funds

Joint product costs: Those manufacturing costs that are incurred up to the split-off point in producing joint products

Joint products: Two or more items that are produced from the common input

Labor efficiency variance efficiency variance" : A measure of the difference between the actual hours required to complete a task and the standard hours allowed, multiplied by the number of hours during the period.

Lead time: The interval between the time that an order is placed and the time that the order is finally received from the supplier

Least squares method: A method of separating a mixed cost into its fixed and variable elements; under this method, a regression line is fitted to an array of plotted points by statistical analysis.

Make or buy decisions: A decision as to whether an item should be produced internally or purchased from an outside supplier.

Management accounting: The phase of accounting that is concerned with with providing information to managers for use in planning and controlling operations and for use in decision making.

Management by exception: A system of management in which standards are set for the various operating activities, with actual results then compared against these standards and any differences that are deemed significant brought to the attention of the management as "exceptions"

Manufacturing: The conversion of raw materials into finished product through the efforts of workers and the use of production equipment.

Manufacturing overheads: All costs associated with the manufacturing process except direct materials and direct labor

Manufacturing overhead budget: A detailed plan showing the production costs, other than direct materials and direct labor that will be incurred in attaining the output budgeted for a period.

Margin: A measure of management's ability to control operating expenses in relation to sales. It is computed by dividing net operating income by the sales figure

Margin of safety: The excess of budgeted (or actual) sales over the breakeven volume of sales

Marginal cost: A term used in economics that means the addition to total costs resulting from the production and sale of one additional unit of product

Marginal revenue: A term used in economics that means the addition to total revenue resulting from the sale of one additional unit of product

Market price: The price being charged for an item on the open (intermediate) market

Markup: The amount added to a cost base in determining the target selling price in cost-plus pricing

Master budget: A summary of all the phases of a company's plans and goals for the future in which specific targets are set for sales, production and financing activities and that generally culminates in a projected statement of net income and a projected statement of cash position.

Materials price variance: A measure of the difference between the actual unit price paid for an item and the standard price that should have been paid, multiplied by quantity purchased.

Materials quantity variance: A measure of the difference between the actual quantity of materials used in production and the standard quantity allowed, multiplied by the standard price per unit

of materials

Material Requirement Planning (MRP): An operations research toll that employs the computer to assist the manager in overall materials and inventory planning.

Monopolist competition: A term used in economics that denotes a situation in which there are many sellers of similar products, with no one seller having a large enough share of the market for other sellers to be able to discern the effect of its pricing decisions on their sales

Monopoly: A term used in economics that denotes the absence of a directly competing product in the market

Multiple regression analysis: An analytical method required in those situations where more than one causative factor is involved in the behavior of the variable element of a mixed cost

Negotiated market price: A transfer price agreed on between buying and selling divisions that reflects unusual or mitigating circumstances

Net operating income: The income of an organization before interest and income taxes have been deducted

Net present value (NPV): The difference between the present values of the cash inflows and the cash outflows associated with an investment project

Non-value adding: Any activities that add to the cost of a product or service but do not add to its market value

Oligopoly: A term used in economics that denotes a situation in which a few large sellers of a product are competing directly with one another

Operating assets: Cash, accounts receivable, inventory, plant and equipment and all other assets held for productive use in an organization

Opportunity cost: The potential benefit that is lost or sacrificed when the selection of one course of action makes it necessary to give up a competing course of action

Organization: A group of people united for some common purpose

Organization chart: A visual diagram of a firm's organizational structure that depicts formal lines of reporting, communication, and responsibility between managers

Pay-back period: The length of time that it takes for an investment to recoup its own initial cost out of the cash receipts that it generates

Penetration pricing: The setting of a low initial price for a product in order to gain quick acceptance in a broad portion of the market

Period costs: All costs that are matched against revenues on a time period basis. Such costs consist of selling and administrative costs

Planning: The development of objectives of an organization and the preparation of various budgets to achieve these objectives

Practical standards: Standards that allow for normal machine downtime and other work interruptions and that can be attained through reasonable, though highly efficient, efforts of the worker at a task.

Preference decision: A decision as to which of the several competing acceptable investment proposals is best

Price elasticity elasticity" : A term used in economics that means the degree to which volume of

sales is affected by a change in price per unit

Production budget budget" : A detailed plan showing the number of units that must be produce during the period in order to meet both sales and inventory needs

Profit center center" : A responsibility center that has control over the incurrence of costs and the generating of revenues but has no control over the use of the investment funds.

Profitability index: The ratio of the present value of a project's cash inflows to the investment required

Profit volume ratio volume ratio" : See *contribution margin ratio*

Range of flexibility: The range between the 'floor' of the variable costs and the 'ceiling' of a normal target selling price in which a manager has to operate in special pricing decisions

Regression line: A line fitted to an array of points. The slope of the line denoted by the letter *b* in the linear equation represents the average variable cost per unit of activity; the point where the line intersects the cost axis, denoted by the letter *a* in the equation above, represents the average total fixed costs

Relevant costs: A cost that is applicable to a particular decision in the sense that it will have bearing on which alternative the manager selects

Relevant range: The range of activity within which assumption relative to variable and fixed cost behavior are valid.

Reorder point: The point in time when an order must be placed to replenish depleted stocks, it is determined by multiplying the leaf time by the average daily or weekly usage

Required rate of return: The minimum rate of return that an investment project must yield in order to be acceptable

Residual income: The net operating income that an investment center is able to earn above some minimum rate of return on it s operating assets

Responsibility Accounting: A system of accounting in which costs are assigned to different managerial levels according to where control of the costs is deemed to rest, with the managers then held responsible for differences between budgeted and actual results.

Return on Investment (ROI): A measure of profitability in an organization that is computed by multiplying the margin by the turnover.

Safety stocks: The difference between average usages of materials and maximum usage of materials that can reasonably be expected during lead times

Sales budget budget" : A detailed schedule showing the expected sales for the coming periods. These sales are typically expressed in both dollars and units

Sales mix mix" : The relative combination in which a company's products are sold. Sales mix is computed by expressing the sales of each product as a percentage of total sales.

Scatter-graph method: A method of separating a mixed cost into its fixed and variable elements; under this method, a regression line is fitted to an array of plotted points by simple visual inspection.

Screening decision: A decision as to whether a proposed investment meets some preset standard of acceptance

Selling and administrative expense budget: A detailed schedule of planned expenditure that will be incurred in areas other than manufacturing during a budget period.

Semi-variable cost: A cost that contains both variable and fixed cost elements

Setup costs: Labor and other costs involved in getting facilities ready for a run of a different production item.

Simple rate of return: The rate of return promised by an investment project when the time value of money is not considered; it is computed by dividing a project's annual net income by the initial investment required

Skimming pricing: The setting of a high initial price for a product, with a progressive lowering of the price as time passes and as the market broadens and matures

Standard cost card: A detailed listing of all the standard amounts of materials, labor and overheads that should go into a unit of product, multiplied by the standard price or rate that has been set.

Standard cost per unit: The expected cost of a unit of product as shown on the standard cost card; it is computed by multiplying the standard quantity or hours by the standard price or rate.

Standard hours allowed: The time that should have been taken to complete the period's output as computed by multiplying the number of units produced by the standard hours per unit.

Standard hours per unit: The amount of labor time that should be required to complete a single unit of product, including allowances for breaks, machine down times, cleanup, rejects and other normal inefficiencies.

Standard price per unit: The price that should be paid for a single unit of materials, including allowances for quality, quantity purchased, freight-in, receiving and other such costs, net of any discounts allowed.

Standard quantity allowed: The amount of materials that should have been used to complete the period's output as computed by multiplying the number of units by the standard quantity per unit.

Standard quantity per unit: The amount of materials that should be required to complete a single unit of product, including allowances for normal waste, spoilage, rejects and similar inefficiencies.

Standard rate per hour: The labor rate that should be incurred per hour of labor time, including allowances for employment taxes, fringe benefits and other labor costs

Static budget: A budget designed to cover only one level of activity and in which actual costs are always compared against budgeted costs at this one activity level.

Sell or process further decision: A decision as to whether a joint product should be sold at the split off point or processed further and sold at a later time in a different form

Split off point: That point in the manufacturing process where some or all of the joint products can be recognized as individual units of output

Step variable costs: A cost (such as the cost of a maintenance worker) that is obtainable only in large pieces and that increases or decreases only in response to fairly wide changes in the activity level.

Sub-optmization: An overall level of profitability that is less than an organization is capable of earning

Sunk costs: Any cost that has already been incurred and that cannot be changed by any decision made now or in the future

Target cost: A maximum amount of production costs, which is used as a guide in developing a product that can be sold within a desired price range

Test marketing: The introduction of a product in selected areas in order to gain data on customer acceptance, volume of activity at various prices, and so forth

Time adjusted rate of return: The discount rate that will cause the net present value of an investment project to be equal to zero; thus, the time adjusted rate of return represents the true interest return promised by a project over its useful life. It's also known as IRR

Time and material pricing: A pricing method, often used in service type organizations, in which two pricing rates are established- one based on labor time and the other based on materials used

Transfer price: The price charged when one division or segment provides goods or services to another division or segment of an organization

Turnover: A measure of the amount of sales that can be generated in an investment center for each dollar invested in operating assets. It is computed by dividing sales by the average operating assets

Unit contribution method: A method of calculating the break-even point in which the fixed costs are divided by the contribution margin per unit.

Variable costs: A cost that varies, in total, in direct proportion to changes in the level of activity.

Variable overhead efficiency variance: A measure of the difference between the actual activity (direct labor hours, machine hours or some other base) of a period and the standard activity allowed, multiplied by the variable part of the predetermined overhead rate

Variable overhead spending variance: A measure of the difference between the actual variable overhead cost incurred during a period and the standard cost that should have been incurred, based on the actual activity of the period.

Variance: The difference between standard prices and quantities and actual prices and quantities

Velocity: A measure of the speed that goods move through the production process i.e. throughput

Vertical integration: The involvement by a company in more than one of the steps from extracting or otherwise securing basic raw materials to the manufacture and distribution of a finished product

Volume variance: A measure of utilization of plant facilities. The variance arises whenever the standard hours allowed for the output of the period are different from the denominator activity level that was planned when the period began

Working capital: The excess of current assets over current liabilities

Yield: A term synonymous with *internal rate of return* and *time adjusted rate of return*

Zero based budget (ZBB): A method of budgeting in which mangers are required to start at zero based levels every year and to justify all costs as if the programs involved were being initiated for the first time.

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