ADVANCED MANAGEMENT ACCOUNTING
(MCM1C05)

STUDY MATERIAL

I SEMESTER
CORE COURSE

M.COM

(2019 Admission onwards)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION
CALICUT UNIVERSITY- P.O
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STUDY MATERIAL
FIRST SEMESTER

M.COM (2019 ADMISSION ONWARDS)

CORE COURSE:

MCM1C05-ADVANCED MANAGEMENT ACCOUNTING

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SYLLABUS

MCM1C05: ADVANCED MANAGEMENT ACCOUNTING

80 Hours **Credit: 4**

Module 1: Introduction to Management Accounting: Meaning and importance of Management Accounting- Tools of Management Accounting (Descriptive, Analytical, Diagnostic, and Predictive) – Skills required for Management Accountants- Strategic Role of Management Accountants- Functions of Management accountants.

10 Hours

Module 2: Performance Measurement: Financial and non-financial measurement of performance- ROI – Residual Income – KPI-Economic Value Added (EVA) – concept and measurement – Balanced Score Card- concepts and objectives- Multiple Score Card measures- New horizons in management control- Responsibility Accounting- Performance Budgeting- ZBB and ABB – Social Cost-benefit Analysis- Modern production Management techniques originating from Japan – Flexible Manufacturing Systems (FMS)- TQM.

15 Hours

Module 3: Decision making under Risk and Uncertainty: Nature and Types of risk- Techniques for decision making under risk and uncertainty- Optimistic and Pessimistic estimates- Risk adjusted Discount Rate- Certainty Equivalent Co-Efficient Method- Sensitivity technique- Probability Technique- Standard Deviation method- Co-efficient of Variation method- Simulation Technique- Decision Tree Analysis.

15 Hours

Module 4: Standard Costing and Variance Analysis: Types of Standards – setting standards- Variance Analysis- Importance- Material, Labour, Overhead, Sales and Profit Variance – Interpretation of variance - Control and Efficiency Ratios- Investigation of Variance – Techniques of interpretation of variance.

20 Hours

Module 5: Marginal Costing and its Application: CVP analysis and decision making – Managerial applications of CVP analysis make or buy decision- Alternative methods of production- Buy or Lease Decision- Shut down or continue- Repair or replace – Accepting bulk orders for Idle capacity utilization- pricing under different situations- suitable product mix and Key Factor.

20 Hours

(Theory 30% and Problems 70%)

MODULE 1

Introduction to Management Accounting: Introduction to Management Accounting- Meaning, Definition, Nature and Scope – Importance and Limitations of Management Accounting – Management Accounting Vs. Financial Accounting – Management Accounting Vs. Cost Accounting - Tools of Management Accounting (Descriptive, Analytical, Diagnostic, and Predictive) – Skills required for Management Accountants- Strategic Role of Management Accountants- Functions of Management accountants.

INTRODUCTION TO MANAGEMENT ACCOUNTING

Today management can no longer afford to wait up to the end of a year to know the results of the day-to-day transactions. The effect of each business transaction should be made available on a routine basis. The approach has changed the role of accounting from a mere device of recording to a powerful tool of forecasting, budgeting, budgetary control etc. This changing dimension of accounting has led to the development of the technique of "Management Accounting".

The increase in size and complexity of business and the application of sophisticated modem technology have resulted in the separation of ownership and management. The modem managers need meaningful and timely data for their primary function-decision making. Though the financial accounting conveys meaningful information to the outsiders, (e.g. Shareholders, creditors etc.), it fails to communicate valuable and varied information to the management. Financial accounting furnishes a good deal of factual information, but not of much use in the current management perspective. Thus, accounting information should be recorded and presented in the form of reports at such frequent intervals, as the management may want.

Meaning

Management accounting also is known as managerial accounting. Management Accounting can be referred to as "a system of accounting for management", which provides necessary information to the management for discharge of its functions. These functions include planning, organizing, directing, controlling and decision making. Management accounting assists the management to carry out these functions more efficiently in a systematic manner.

DEFINITION

Management Accounts comprised of two words 'Management' and 'Accounting'. It means the study of the managerial aspect of accounting. The emphasis of management accounting is to redesign accounting in such a way that it is helpful to the management in the formation of policy, control of execution and appreciation of effectiveness. Management Accounts of recent origin. This was first used in 1950 by a team of accountants visiting U.S.A under the auspices of Anglo-American Council on Productivity. Some of the important definitions of management accounting are:

The Institute of Chartered Accountants of England and Wales: "Any form of accounting which enables a business to be conducted more efficiently can be regarded as management accounting."

Robert N. Anthony: "Management accounting is concerned with accounting information that is useful to management."

The Institute of Chartered Accountants of India: "Such of its techniques and procedures by which accounting mainly seeks to aid the management collectively."

The Report of the Anglo-American Council of Productivity (1950) has also given a definition of management accounting, which has been widely accepted. According to it, "Management accounting is the presentation of accounting information in such a way as to assist the management in creation of policy and the day to day operation of an undertaking".

In short, management accounting can be defined in simple words as "accounting for effective management."

NATURE OR CHARACTERISTICS

Provides accounting information: Management accounting involves presentation of accounting information in such a way that it is suitable to the management

Forecasting: It helps in planning for the future course of action.

Decision making: It provides necessary information to top management for taking various decisions.

Internal accounting: It is concerned with the provision of information to the management to make better decisions.

Quantitative and qualitative information: It deals with both quantitative as well as qualitative information.

Techniques and concepts: It uses special techniques and concepts to make the accounting data more useful (e.g.: Marginal Costing, Cost-Volume-Profit Analysis etc.)

Multi-disciplinary: It is a combination of several disciplines such as financial accounting, cost accounting, operations research, statistics, economics etc.

Cause and Effect Analysis: It attempts to test the "cause" and "effect" relationship of different variables. For e.g.: if there is a loss, the reasons for the loss are looked in to.

No fixed norms: it has any fixed set of rules and formats, like that of financial accounting. The analysis of data depends upon the purpose and person using it.

Management-oriented: It is an accounting for the use of management.

Increase efficiency: It enables the management to select that alternative which is more profitable. In this way, it increases the efficiency of the business.

Arts and science: It may be regarded partly as a science and partly as an Art. It is the science of 'Quantifying and summarizing' and Art of 'Interpreting' accounting data.

IMPORTANCE or USES or NEED or ADVANTAGES

Management accounting is very beneficial and hence is being used widely now. The benefits are as follows:

Planning and policy formulation: planning is one of the primary functions of management. It involves forecasting on the basis of available information.

Help in the interpretation process: The main object is to present financial information. The financial information must be presented in easily understandable manner.

Helps in decision making: Management accounting makes decision making process more modern and scientific by providing significant information relating to various alternatives.

Controlling: The actual results are compared with pre determined objectives. The management is able to control performance of each and every individual with the help of management accounting devices.

Reporting: This facilitates management to take proper and timely decisions. It presents the different alternative plans before the management in a comparative manner.

Motivating: Delegation increases the job satisfaction of employees and encourages them to look forward. So it serves as a motivational devise.

Helps in organizing: "return on capital employed" is one of the tools if management accounting. All these aspects are helpful in setting up effective and efficient organization.

Coordinating operations: It provides tools which are helpful in coordinating the activities of different sections.

Helping Forecast the Future: Forecasting aids decision-making and answering questions, such as: Should the company invest in more equipment? Should it diversify into different markets? Should it buy another company? Management accounting helps in answering these critical questions and forecasting the future trends in business.

Helping in Make-or-buy Decisions: Is it cheaper to procure materials or a product from a third party or manufacture them in-house? Cost and production availability are the deciding factors in this choice. Through management accounting, insights will be developed which will enable decision-making at both operational and strategic levels.

Forecasting Cash Flows: Predicting cash flows and the impact of cash flow on the business is essential. How much cost will the company incur in the future? Where will its revenues come from and will the revenues increase or decrease in the future? Management accounting

involves designing of budgets and trend charts, and managers use this information to decide how to allocate money and resources to generate the projected revenue growth.

Helping Understand Performance Variances: Business performance discrepancies are variances between what was predicted and what is actually achieved. Management accounting uses analytical techniques to help the management build on positive variances and manage the negative ones.

Analyzing the Rate of Return: Before embarking on a project that requires heavy investments, the company would need to analyze the expected rate of return (ROR) If given two or more investment opportunities, how should the company choose the most profitable one? In how many years would the company break even on a project? What are the cash flows likely to be? These are all vital questions that can be answered through management accounting.

SCOPE

Management accounting is concerned with presentation of accounting information in the most useful way for the management. Its scope is, therefore, quite vast and includes within its fold almost all aspects of business operations. However, the following areas can rightly be identified as falling within the ambit of management accounting:

Financial Accounting: Management accounting is mainly concerned with the rearrangement of the information provided by financial accounting. Hence, management cannot obtain full control and coordination of operations without a properly designed financial accounting system.

Cost Accounting: Standard costing, marginal costing, opportunity cost analysis, differential costing and other cost techniques play a useful role in operation and control of the business undertaking.

Revaluation Accounting: This is concerned with ensuring that capital is maintained intact in real terms and profit is calculated with this fact in mind.

Budgetary Control: This includes framing of budgets, comparison of actual performance with the budgeted performance, computation of variances, finding of their causes, etc.

Inventory Control: It includes control over inventory from the time it is acquired till its final disposal.

Statistical Methods: Graphs, charts, pictorial presentation, index numbers and other statistical methods make the information more impressive and intelligible.

Interim Reporting: This includes preparation of monthly, quarterly, half-yearly income statements and the related reports, cash flow and funds flow statements, scrap reports, etc

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Taxation: This includes computation of income in accordance with the tax laws, filing of returns and making tax payments.

Office Services: This includes maintenance of proper data processing and other office management services, reporting on best use of mechanical and electronic devices.

Internal Audit: Development of a suitable internal audit system for internal control.

DISTINCTION BETWEEN FINANCIAL ACCOUNTING AND MANAGEMENTACCOUNTING

Financial accounting and management accounting are closely interrelated since management accounting is to a large extent rearrangement of the data provided by financial accounting. Moreover, all accounting is financial in the sense that all accounting systems are in monetary terms and management is responsible for the contents of the financial accounting statements. In spite of such a close relationship between the two, there are certain fundamental differences. These differences can be laid down as follows:

TERMS	FINANCIAL ACCOUNTING	MANAGEMENTACCOUNTING
Objectives	Financial accounting is designed to supply information to external parties like shareholders, creditors, banks, investors and Government. Thus, financial accounting is primarily an external reporting process.	Management Accounting is designed principally for providing accounting information for internal use of the management. So it is primarily an internal reporting process.
Analyzing performance	Financial accounting portrays the position of business as a whole. Financial accounting deals with the aggregates and, therefore, cannot reveal what part of the management action is going wrong and why.	Management accounting directs its attention to the various divisions, departments of the business and reports about the profitability, performance, etc., of each of them. It provides detailed analytical data for these purposes.
Data used	Financial accounting is concerned with the monetary record of past events. It is a post-mortem analysis of past activity and, therefore, out the date for management action.	Management accounting is accounting for future and, therefore, it supplies data both for present and future duly analyzed in detail in the 'management language' so that it becomes a base for management action.
Monetary measurement	In financial accounting only such economic events find place, which can be measured in terms of money.	The management is equally interested in non-monetary economic events, viz., technical innovations, personnel in the organization, changes in the value of money, etc. These events affect management's decision and, therefore, management accounting cannot afford to ignore them.
Periodicity of reporting	The period of reporting is much longer in financial accounting as compared to management accounting. The Income Statement and the Balance Sheet are usually	In management accounting there is more emphasis on furnishing information quickly and at comparatively short intervals as per the requirements of the management.

	prepared yearly or in some cases half-yearly.	
Nature	Financial accounting is more objective.	Management accounting is more subjective. This is because management accounting is fundamentally based on judgment rather than on measurement.
Legal compulsion	Financial accounting has more or less become compulsory for every business on account of the legal provisions of one or the other Act.	A business is free to install or not to install system of management accounting.
Accounting principles	It has principles and conventions	No such principles.

DISTINCTION BETWEEN COST ACCOUNTING AND MANAGEMENTACCOUNTING

Cost accounting is the process of accounting for costs. It embraces the accounting procedures relating to recording of all income and expenditure and the preparation of periodical statements and reports with the object of ascertaining and controlling costs. It is, thus, the formal mechanism by means of which the costs of products or services are ascertained and controlled. On the other hand, management accounting involves collecting, analyzing, interpreting and presenting all accounting information, which is useful to the management. Its closely associated with management control, which comprises planning, executing, measuring and evaluating the performance of an organization. Thus, management accounting draws heavily on cost data and other information derived from cost accounting.

TERMS	**COST ACCOUNTING**	**MANAGEMENTACCOUNTING**
Scope	Cost accounting has a limited scope.	Management accounting has a wider scope.
Purpose	Cost accounting is the process of accounting for costs. It embraces the accounting procedures relating to recording of all income and expenditure and the preparation of	Management accounting involves collecting, analyzing, interpreting and presenting all accounting information, which is useful to the management. It is closely associated with management

	periodical statements and reports with the object of ascertaining and controlling costs. It is, thus, the formal mechanism by means of which the costs of products or services are ascertained and controlled.	control, which comprises planning, executing, measuring and evaluating the performance of an organization.
information used	Uses only quantitative information.	Uses both quantitative and qualitative information.
Nature	Deals with cost.	Deals with both cost and revenue.
Data used	Based on both historical and current data.	Concerned with transactions relating to the future.

LIMITATIONS OF MANAGEMENT ACCOUNTING

Management accounting, being comparatively a new discipline, suffers from certain limitations, which limit its effectiveness. These limitations are as follows:

Limitations of basic records: Management accounting derives its information from financial accounting, cost accounting and other records. The strength and weakness of the management accounting, therefore, depends upon the strength and weakness of these basic records. In other words, their limitations are also the limitations of management accounting.

Persistent efforts: The conclusions draws by the management accountant are not executed automatically. He has to convince people at all levels. In other words, he must be an efficient salesman in selling his ideas.

Management accounting is only a tool: Management accounting cannot replace the management. Management accountant is only an adviser to the management. The decision regarding implementing his advice is to be taken by the management. There is always a temptation to take an easy course of arriving at decision by intuition rather than going by the advice of the management accountant.

Wide scope: Management accounting has a very wide scope incorporating many disciplines. It considers both monetary as well as non-monetary factors. This all brings inexactness and subjectivity in the conclusions obtained through it.

Top-heavy structure: The installation of management accounting system requires heavy costs on account of an elaborate organization and numerous rules and regulations. It can, therefore, be adopted only by big concerns.

Opposition to change: Management accounting demands a break away from traditional accounting practices. It calls for a rearrangement of the personnel and their activities, which is generally not like by the people involved.

Evolutionary stage: Management accounting is still in its initial stage. It has, therefore, the same impediments as a new discipline will have, e.g., fluidity of concepts, raw techniques and imperfect analytical tools. This all creates doubt about the very utility of management accounting.

TOOLS AND TECHNIQUES OF MANAGEMENT ACCOUNTING

Management accounting uses various tools and techniques to help managers to take better decisions. All the tools or techniques may be classified into Descriptive tools, Analytical tools, Diagnostic tools, Predictive tools and Prescriptive tools.

1. Descriptive tools: The descriptive analysis offers an answer to "What happened". This analysis provides a solution in a pre-determined manner. For example, reporting client revenue for the previous year or conducting financial ratio to compare role on historic performance using visualization and text mining tools. Following are the important descriptive tools: -

1.1. Historical cost accounting: It means that costs are recorded after being incurred. This is used for comparing with predetermined costs to evaluate performance. Cost accounting presents cost data in product wise, process wise, department wise, branch wise and the like. These cost data are compared with predetermined one. This comparison of two costs enables the management to decide the reasons responsible for the difference between

these costs. Historical cost accounting means that the date of their emergence is divided. Probably the importance of cost data is not so much. But the importance of historical instruments for the success of the management accounting is very high. Management accounting has historically been very successful. Because its history is very big and in the coming years it will be much more historically whatever it has been valued.

1.2. Auditing: The main task of auditing is to find out the errors and deception as well as to check and verify the property and liability. Therefore Auditing involves financial audit, cost audit, management audit, tax audit and internal audit. The purpose of the audit is to check the purity of the cost articles, while the purpose of the management audit is to increase the manager's work efficiency.

1.3. Management Reporting: The management accountant is preparing the report on the basis of the contents of profit and loss account and balance sheet and submits the same before the top management. Thus prepared reports disclose the strength and weakness indifferent areas of operating activities and financial activities. This identification is highly useful to management for exercising control and decision-making.

2. Analytical tools: Analytical tools are used to analyse the business activities and measure the performance of business. These tools help to analyse liquidity, solvency, profitability, efficiency etc. of the business. Following are the important analytical tools:-

2.1. Ratio Analysis: It is used to management in the discharge of its basic functions of forecasting, planning, coordination, communication and control. It paves the way for effective control of business operations by undertaking an appraisal of both the physical and monetary targets.

2.2. Standard Costing: Standard costing is predetermined cost. It provides a yard stick for measuring actual performance. It is used to find the reasons for the deviations if any. This is an important technique for control costs. Based on the average efficiency of any sub-processor process, the modification is determined beforehand. And when the work is almost finished, the cost is measured by standard cost and actual cost, by detecting and analyzing the reasons for these details then Corrective action will be taken. Just before starting the work, we put an estimate of it or set the amplitude so that we can know how much quantity is to

use. Therefore, there is also a technique within the technique of management accounting; the cost of the cost is determined by many heads of business.

2.3. Budgetary Control: Under Budgetary control techniques, future financial needs are estimated and arranged according to an orderly basis. It is used to control the financial performances of business concern. Business operations are directed in a desired direction. Budgetary control is a technique for managing and accounting control. By the creating a budget, different responsibilities are divided into different workers. In addition when real results are known, if they are compared to the target set in the budget, and efforts are made to keep departmental workers in line with the budget.

3. Diagnostic tools: Diagnostic tools are used to discover or determine why something has happened. In other words, diagnostic tools give answer to "how did it happen". Important diagnostic tools are Fund flow analysis and Cash flow analysis.

3.1. Fund Flow Analysis: This analysis find out the movement of fund from one period to another. Moreover, this analysis is very useful to know whether the fund is properly used or not in a year when compared to the previous year. The working capital changes and funds from operation are also finding out through this analysis.

3.2. Cash Flow Analysis: The movement of cash from one period to another can be finding out through this analysis. Besides, the reasons for cash balance and changes between two periods are also find out. It studies the cash from operation and the movement of cash in a period.

4. Predictive tools: Predictive tools are used to predict the future. These tools give the answer "what is likely to happen?" Important predictive tools include MIS, KPIs, simulation, and balance scorecards, demand forecasting, statistical and graphical techniques, regression analysis etc.

4.1. Management Information System: The free flow communication within the organization is essential for effective functioning of business. Hence, the management can design the system through which every employee of an organization can assess the information and used for discharging their duties and taking quality decisions. The management information system is meant to inform the management about the functioning of

the business or other important facts which must be taken into consideration by the management**.** In this work, yet the report description diagram or graphical performance, charts, etc. are used. Thus, within the business, there are different types of different managers and most differently we get information. All of these are put together in a format so that they can get data from the correct analysis.

4.2. simulation: simulation methods are widely used as powerful tools within management accounting and management control: for example, the use of simulation for evaluating operational and financial risks has a long tradition, simulation helps to estimate errors incorporated in accounting numbers; and in a nutshell, what-if analyses and sensitivity analyses are simulative approaches for figuring out the effects of changes in parameters on relevant performance measures. Keeping this in mind, simulation could be supposed to become even more relevant within management accounting and control since the need for tools reasonably increases which are capable to deal with uncertainty, complexity and dynamics.

4.3. A key performance indicator (KPI): A key performance indicator (KPI) is a core metric used by a business to monitor its progress toward achieving key goals and financial outcomes. KPIs will vary by industry, due to differences in their operational and financial structures. Among the more common KPIs related to finances are a firm's gross margin, net profit, current ratio, and debt to equity ratio. KPIs related to operations are more varied. For example, a warehouse could measure fulfillment days, while a retail store could measure period-to-period changes in sales, a website could measure page views, a human resources department could track gender diversity, a call center could measure employee turnover, and a hospital could track emergency room wait times. Different functions of a business may have different KPIs. For example, the sales manager may be most concerned with changes in the sales backlog, while the production manager focuses on the customer order fulfillment rate, and the customer service manager deals with the number of customer complaints settled on the first contact, as well as the number of customers who hang up while on hold. Further, the marketing manager may monitor the acquisition cost of each incremental customer gained.

4.4. Balance scorecards: A balanced scorecard is a strategic management performance metric used to identify and improve various internal business functions and their resulting external outcomes. Balanced scorecards are used to measure and provide feedback to

organizations. Data collection is crucial to providing quantitative results as managers and executives gather and interpret the information and use it to make better decisions for the organization. A balanced scorecard is a performance metric used to identify, improve, and control a business's various functions and resulting outcomes. It was first introduced in 1992 by David Norton and Robert Kaplan, who took previous metric performance measures and adapted them to include nonfinancial information. The balanced scorecard involves measuring four main aspects of a business: learning and growth, business processes, customers, and finance. Companies can easily identify factors hindering business performance and outline strategic changes tracked by future scorecards.

4.5. Demand forecasting: It refers to making estimations about future customer demand using historical data and other information. Proper demand forecasting gives businesses valuable information about their potential in their current market and other markets, so that managers can make informed decisions about pricing, business growth strategies, and market potential. Without demand forecasting, businesses risk making poor decisions about their products and target markets – and ill-informed decisions can have far-reaching negative effects on inventory holding costs, customer satisfaction, supply chain management, and profitability.

4.6. Statistical and graphical techniques: The management accountant uses various statistical and graphical techniques in order to make the information more meaningful and presentation of the same in such form so that it may help the management in decision-making. The techniques used are Master Chart, Chart of Sales: and Earnings, Investment Chart, Linear Programming, Statistical Quality Control, etc.

4.7. Regression analysis: Regression analysis is a method of determining the relationship between two sets of variables when one set is dependent on the other. In business, regression analysis can be used to calculate how effective advertising has been on sales or how production is affected by the number of employees working in a plant. Regression analysis can also show you if there is no relationship between variables.

5. Prescriptive tools: Prescriptive tools prescribe a number of different possible actions to and guide them towards a solution. Prescriptive analysis answers “How can I make it happen?” Diagnosis and prediction are useless without recommendations or suggestions as to how to bring about improvement. Sure, it might require some experimentation, but this will

help us to further understand the most appropriate course of action. Tools such as Machine Learning can help to come up with the optimal solution to the problems based on time, quality, and revenue versus cost. Important prescriptive tools are Financial Planning, Revaluation Accounting, Marginal Costing, Decision Accounting, Responsibility Accounting etc.

5.1. Financial Planning: Financial planning means the process of deciding the total amount of capital required for an institution and decision making in respect of its nature. The main objective of any business organization is maximization of profits. This objective is achieved by making proper or sound financial planning. Hence, financial planning is considered as best tool for achieving business objectives. It is that tool of management accounting which is needed to make good structure of capital mix we decide the proportion of share capital and loans in capital structure. Financial and operating leverages are also its sub-tools. The following actions are included in it.

- Estimate the required amount of capital?
- Determine various sources for capital receipts.
- Determine the mutual ratio of these securities.
- Proper policies of capital administration and management.

5.2. Revaluation Accounting: The fixed assets are revalued as per the revaluation accounting method so that the capital is properly represented with the assets value. It helps to find out the fair return on capital employed. Re-evaluation Accounting is also called Replacement Value Accounting. Its purpose is to get the confidence of this. The institution's capital has been kept safe, meaning the changes in price changes have been made in the accounts. Over time, everyone is re-evaluated; therefore management accounting to is a huge role of re-evaluation. Any property or property that holds their property within the company is fully evaluated from time to time. Inside there is a huge role of management.

5.3. Marginal Costing: Marginal costing technique is used to fix the selling price, selection of best sales mix, best use of scarce raw materials or resources, to take make or buy decision, acceptance or rejection of bulk order and foreign order and the like. This is based on the fixed cost, variable cost and contribution. The marginal cost method is the technique of dividing Production into Fix costs and variable costs. The marginal cost is based on the principle; the inclusion of permanent entrepreneurs in the production is unnecessarily confusing. Due to

this, their mistakes will happen in Business Decisions. Marginal cost is used in management accounting along with financial accounting and statistics and economics.

5.4. Decision Accounting: Decision accounting is used in making important decisions in business or company so that no decision proves to be false. It is essential to choose the best option among the different options to be adopted for achieving any goal. In order to choose the best option for these, various quantities of production, quantity, cost, profit, etc. have to be comprehended. A business problem can be solved by choosing any one of the best and most profitable alternative. To select such alternative, the relevant costs are compared. Thus, accounting information is used to solve the business problems which are arising out of increasing complexity of nature of business.

5.5. Responsibility Accounting: Responsibility accounting is "a system of management accounting under which accountability is established according to the responsibility delegated to various levels of management and a management information and reporting system instituted to give adequate feedback in terms of the delegated responsibility. Responsibility is a method of accounting control under which Accounts statements and other similar statements are arranged in such a manner that the financial information related to their work can be made available to the responsible persons related to various tasks. Everyone has somebody's responsibility at all. In addition, there is a lot of responsibility to the management account too. The entire business of the entire company is here because the way management manages any business in the same way that the business moves forward.

SKILLS REQUIRED FOR MANAGEMENT ACCOUNTANTS

Management accounting skills have changed as per business requirements and agility. Today there is a requirement of a Management Accountant who can derive actionable insights from data on a real-time basis. Some of the top Management Accounting skills expected today are:

1. Predictive Skills: Artificial Intelligence and Machine Learning are some of the catalyst that has transformed the nature of Management Accounting. In the previous years, Management Accountants were more involved with data, presentation and analysis. However, today the role has evolved. They are now expected to understand the business deeply and predict the impact of various factors on the operations. Today, it makes more

sense for a Management Accountant to be futuristic in his dealings rather than just analyzing the numbers in hindsight.

2. Communication skills: Today Management Accountants are not just expected to work on the data but also communicate the insights that they derive out of it to other business leaders. They must be able to do the storytelling and build a premise for the data. Communication is hence one of the must-have management accounting skills these days. The findings can be communicated in the form of visualization, case studies, stories, presentations and other mediums which are thoroughly supported by data to make it more effective.

3. Numerical skill: Numerical skill is one of the very basic skills needed for a career in accounting. Such number crunching skills are built around basic mathematical skills wherein you can demonstrate your ability to understand and analyze numerical information and draw meaningful conclusions in order to arrive at the right decision. As an accountant, you will be engaged in preparing various financial reports. You should be well versed with numbers so that you are able to connect the figures in the income statement to that of the cash flow or to the balance sheet.

4. Sound Technical Skills: This is an age of disruptive technologies. For a Management Accountant to remain relevant in the organization, he must have the ability to adapt well to changing technologies. The technical skills of a Management Accountant play a pivotal role in deciding the quality of information presented by him. Being able to handle automated processes, knowledge of Business Analytics, programming languages etc. are some of the basic requirements from a tech savvy Management Accountant. These are some of the common languages spoken in the organization and a Management Accountant should be adept at this to related well to everyone and communicate well.

5. People Management skills: Management Accountants do not work in isolation. They interact with teams across organizations and spearhead their own teams. Concrete information base forms the foundation of a Management Accountant's core job. These are information that comes outside the purview of data collected officially. A Management Accountant often receives such soft information from reliable team members and he must motivate these team members to continuously look for such information beyond the usual sources. The more such information, a Management Accountant can lay his hands on, the better placed he is to analyse the past, predict the future course and provide more ideas.

6. **Time Management skill:** The skill for time management goes hand-in-hand with the organizational requirements. A seasoned professional will manage the workload effectively by re-prioritizing competing tasks and juggling between myriad responsibilities to ensure timely completion of everything. So, to be a successful accountant you have to emulate the above-mentioned qualities immaculately, which will not only impress your manager, colleagues, and clients but also put you on a fast track to an exciting career prospect.

7. Organizational Skill: Accountants are required to manage various responsibilities, which results in a lot of activities to be accommodated in a tight schedule. As such, in order to become a good accountant, you should be able to track all these responsibilities efficiently. Such responsibilities can include portfolio management, transaction handling and meeting important deadlines. By discharging all these duties to the best of your ability you will be able to demonstrate competence to your colleagues and show them how well organized and reliable you are.

8. Management accounting skills: Unlike a Financial Accountant who is just restricted to work on financial reports and audit them, a Management Accountant has a much more strategic role to play. He is equally involved in the decision making process as much as with the core accounting process.

9. Analytical skill: "Analytical skill is the ability to visualize, articulate, and solve both complex and uncomplicated problems and concepts and make decisions that are sensible and based on available information." As an accountant, you must be comfortable analyzing a wide range of financial data. Know how to review common accounting reports to identify trends or point out anomalies. Focus on your ability to perform budgeting work or make future projections.

10. Other skills: apart from the above skills, management accountants require some other skills such as Conceptual skills, Human skills, Diagnostic skill etc. Conceptual skills allow a manager to visualize the entire organization and work with ideas and the relationships between abstract concepts. Conceptual skill is the ability to coordinate and integrates all of an organization's interests and activities. Human skills, also called human relation skills, require communication and attention to relationships with others. Diagnostic skill refers to the ability to visualize the best response to a situation.

In a nutshell, A Management Accountant skills should not only restrict oneself to analysis, but also be proactive in contributing to the bottom line of the business. Earlier, the Management Accountant used to be confined only to their respective departments. However, today they are found to be more involved with other business units and departments. They offer guidance to other non-finance professionals and help them to see things in the perspective of financial gains and optimal costing. This way they can also change the thought process of the other professionals and mould it to become more business oriented. Management Accountants are expected to be flexible enough to fit into multiple roles. This can be the role of a Financial Analyst, Data Analyst, as well as a Business Manager who understands the commercial viability of the projects. Today, it is the need of the hour that a management accountant is able to churn multiple ideas, build hypothesis and test the business case, forms strategies and advices the management to take corrective actions on a real-time basis.

STRATEGIC ROLE OF MANAGEMENT ACCOUNTANT

The role of the management accountant is to perform a series of tasks to ensure their company's financial security, handling essentially all financial matters and thus helping to drive the business's overall management and strategy. Management accountants are key figures in determining the status and success of a company. For management accounting must help accomplish the three strategic objectives of quality, cost, and time to have strategic significance by providing information that, first, links the strategic objectives of an organization. Strategic Management Accounting especially is used to check up on competition and one requires being vigilant and up-to-date when it comes to leadership in brand market. Traditional management accounting fell short in the subject of the fact that it fails to assess the relative cost positions of competitors; concentrates on the manufacturing and neglects the high cost post-conversion activities, it ignores the impact of other activities; over-reliance on existing accounting systems. Adding the strategic viewpoint to traditional management accounting required the role of accounting to extend in two directions. First, using strategic cost analysis, cost be incorporated and aligned into strategy. Secondly, to make certain the cost structure of competitors and keep an eye on changes that occurs over a period of time. Thus one could arrive at the cost of value-added functions given to customers as well as the cost of a certain product feature provided by a company’s product.

The strategic role of management accountant may be understood from the following points:

1. Strategic planning: Strategic planning is the logical process used to arrive at a vision for the future. This vision is then broken down into a series of manageable steps that can be followed in order to achieve the desired corporate direction. These action items are widely disseminated through the organization, so that employees are consistently engaged in activities that will force the organization in the direction of achieving the plan. The basic steps followed in strategic planning are as follows:

1. Assess the current environment and the company's capabilities.
2. Formulate strategy.
3. Translate the overall strategy into an operational plan.
4. Continually refine the plan through an ongoing feedback process.

Strategic planning is typically directed at where an organization should be a number of years from now. This longer duration differs from the tactical orientation followed by most organizations, which are more concerned with simply following the direction indicated by the annual budget. The ideal strategic plan is intended to bring a business into a competitive stance that cannot be easily attacked by competitors, and which allows it to generate above-average profitability for an extended period of time. The plan should also anticipate how long this enhanced competitive position will last, so that it can be adjusted to shift the business into an ongoing series of competitively robust positions.

Strategic planning is the primary responsibility of the senior management team. More junior staff may contribute ideas to the process, but senior managers are expected to formulate the plan and ensure that it is implemented. These managers must also maintain a high level of awareness regarding changes in the competitive landscape, so that they can adjust the strategic plan on an ongoing basis to ensure that the organization's expected future position aligns with the current and expected competitive landscape.

2. Setting profitability goals: Management accountants help management to set goals for the company, department or project in question. Goal setting often involves making changes to ensure profitability and motivate employees towards these goals. A business profitability goal determines the amount of revenue you need to generate from your business to meet your expenses and turn a profit. If you plan to run your business successfully, you need clear, specific goals in place. It's not enough to say that you want to make a lot of money. That isn't really a goal, since it's not specific and it doesn't include a series of steps to make it a reality.

Instead, you need to decide how much profit you want your business to generate over the year. This could be a set dollar amount or a percentage increase over the previous year's sales. If this figure isn't a specific amount, you won't know whether you have reached your goal or not. Set a specific goal for income and profit for your business. If you determine that you want to increase your profit by 10 percent over the previous year's figures, then you also need to determine how much more you need to collect in revenue to reach that goal. Part of reaching your business profitability goal is keeping track of your expenses. When you put forth additional effort to increase revenue, your business expenses might go up. This could include things like adding new products to your line or hiring more sales people to increase sales. The markup you charge customers for your products may need to be adjusted to generate more profit.

3. Creating acquisition strategy: The management accountant plays a vital role in the acquisition process from the strategic planning phase where objectives are defined to the integration of the infrastructure of the two organizations after the merger is complete. As companies continue to compete and attempt to gain an economic advantage, mergers and acquisitions will provide a vehicle for the management accountant to display his or her skills and values. A strategically sound investment is the result of a venture in which input is provided by numerous individuals within the company, including the management accountant. More important, however, is the recognition that the implementation of ethical principles and an appreciation of the effects on the various constituents in a merger will aid in restoring the corporate merger as a viable and ethical option in the future growth of the economy. The approach of many businesses in considering Mergers and Acquisitions will be a more strategic and reasoned procedure with special consideration of the ethical consequences on the many parties affected. The management accountant is in a position to contribute his expertise in the analysis of acquisition strategy. The need to determine whether acquisition or internal growth is more efficient in reaching long term goals requires accounting expertise and studied analysis of each company's situation. In certain instances, synergies may be obtained or developed which may result in creating an even more advantageous position for the acquiring company. The management accountant should be poised to provide insight into the determination of an appropriate strategy during the various stages of analysis from the defining of objectives to the integration of the companies, if a merger is consummated.

4. Supporting risk management and control: management accountants play a critical role in collaborative decision making, execution, and accountability processes in which solid risk management and internal control are fully integrated. But in some organizations, risk management and internal control (RM/IC) activities have deviated from their original purpose: to support management accountants and their business partners in setting and achieving their organization's objectives. Instead, they have almost become objectives in their own right rather than serving as useful support tools. In addition, management accountants are often distracted by typical RM/IC compliance requirements that have little direct relation to their everyday work. Good risk management is good management accounting, not compliance, because risk affects our jobs and the achievement of our organizational objectives.

5. Helping in continuous improvement: Managerial accounting provides companies with quantitative and qualitative information on operational and financial performance. While financial accounting focuses on the external use of this information by creditors and others to assess performance and make decisions, managerial accounting is used internally by owners, managers and employees. A company's managerial accounting system encompasses the processes companies install to control and plan operations and support effective decision-making. Continuous improvement is the constant measurement and effort to improve the effectiveness of processes and systems and the quality of goods and services. Companies do this through continuous tweaking or through major improvements. Continuous improvement involves simplifying where possible, eliminating waste -- wasted time, wasted effort, wasted materials -- and increasing productivity. A key way that managerial accounting systems contribute to continuous improvement in an organization is through the development and integration of cost management systems. Instead of budgeting and controlling solely at the department or functional level, companies do so at the activity level, such as inventory purchasing or the billing and payment receipt process. Companies measure the costs of inputs and reduce or eliminate those costs that add little to no value. They also measure and evaluate the effectiveness of all of their major activities, introducing new activities that enhance performance where possible.

FUNCTIONS OF A MANAGEMENT ACCOUNTANT

The management accountant plays a vital role in the decision-making process of the organization. He is variously known as Controller of Finance, Financial Controller, Financial

Advisor or Chief Accounts Officer, etc. He is responsible for the installation, development and efficient functioning of the management accounting system. He plays an important role in gathering, compiling, reporting and interpreting internal accounting information. He designs the framework of the financial and cost control reports in order to satisfy the information needs of different levels of management. He computes the variances by comparing the actual performance with standards or budget estimates and interprets the results of operations to all levels of management and to the owners of the business. The management accountant occupies a pivotal position in the organization. He performs staff function and also has line of authority over the accountants and other employees in his office. He educates the executives on the need for controlling information and on the ways of using it. He sifts the relevant information from the irrelevant and reports the same in an intelligible form to the management and sometimes to interested external parties. However, his job is limited to provision of required information in a comprehensive as well as reliable form to the management for decision-making purposes. But the actual decision-making responsibility lies with the management.

The functions of management accountant depend upon his status in the organisation, experience and capacity of the management accountant. On this basis, the functions of management accountant are briefly explained below.

1. Planning of Accounting Function: An accounting system is maintained in an organization which should cover standards of costs, sales forecast, production planning, profit planning, allocation of resources, capital budgeting and short term and long term financial planning. Moreover, he has to prepare the necessary procedures to implement the plan effectively.

2. Controlling: The management accountant has to measure the actual performance and compare with standard. Based on this comparison, he has to find the differences and interpret the results of operation and submit the same to all levels of management. This is done through appropriate accounting reports for controlling.

3. Reporting: The top management requests the management accountant to prepare the report for the root causes for an unfavorable event or operations. In this report, the accountant can pin point real reasons and the persons who are responsible.

4. Coordinating: He consults all levels of management for framing a policy or an action program. Such type of consultation brings co-ordination between the accounts department and top management.

5. Interpreting: The accounting information is modified and presented before the management with interpretation. The interpretation is made in different phases. If so, real reasons for the operating results can be understood by the management.

6. Evaluation: He has to evaluate the effectiveness of policies, organization structure and procedures adopted for attaining the objectives. For which, he has to consult the same with functional managers and top executives.

7. Advising: He has to advise the management in order to improve the performance of operations.

8. Administration of Tax: A business organization is liable to pay value added tax, income tax and other taxes to the local government, state government and central government. In this aspect, the management accountant is expected to pay the taxes and maintain the accounting records as the case may be.

9. Government Reporting: He will have to supervise all the statements and returns which are to be submitted to the government periodically within due date.

10. Appraisal of External Effects: There may be changes in the state and central government policy. Sometimes, there may be amendments in the existing laws. These policy changes and amendments have an impact on the attainment of business objectives. The extent of impact has to be assessed by the management accountant.

11. Economic Appraisal: The economic condition of the nation is periodically published by the central government. Now, the management accountant is to make economic appraisal and find the influence of economic condition over the business activities. In this aspect, he can prepare a report and submit before top management along with his/her comments.

12. Protection of Assets: This function is performed through maintenance of separate fixed assets register for each type of fixed assets. Moreover, he can frame the rules and regulation for using each type of fixed assets. He can take insurance coverage to all types of fixed assets.

Try yourself:

1. "Management Accounting is accounting for effective management". Explain the statement.

2. Explain Management Accounting. What are the functions of Management Accounting?

3. What are the differences between Management Accounting and Financial Accounting?

4. Distinguish between Management Accounting and Cost Accounting.

5. Explain the role of Management Accountant in an organization.

Suggested References

Advanced Cost & Management Accounting Saxena, V/ Vashist, C. 4th ed

Cost & Management Accounting Kishore, R. M. 4th ed

Management Accounting Khan .M. Y / Jain P. K 3rd ed

MODULE 2

Performance Measurement: Introduction, Meaning, Definitions, Development, Techniques and Types of Performance Measurement - Financial Performance Measurement - ROI – Residual Income – KPI-Economic Value Added (EVA) – concept and measurement – Cash Flow – Non-Financial Performance Measurement - Balanced Score Card- concepts and objectives- Multiple Score Card measures- New horizons in management control- Responsibility Accounting – Budgeting - Performance Budgeting- Features, Steps, Advantages and Disadvantages, Traditional budgeting Vs. performance Budgeting – ZBB – Meaning, Definition, features, Steps, Advantages and Disadvantages, Traditional Budgeting Vs. ZBB - ABB – Meaning, Definition, Advantages and Disadvantages - Social Cost-benefit Analysis – Meaning, Features, Objectives, Steps, Basic Approaches, Problems and Limitations - Modern Production Management techniques originating from Japan – Flexible Manufacturing Systems (FMS) - Meaning, Approaches, Levels of Manufacturing Flexibility, Basic Components, Advantages and Disadvantages – TQM – Meaning of Quality, Meaning and Definition of TQM, Features, Core concepts of TQM, Principles, Tools, Advantages and Disadvantages, Barriers in Implementation of TQM.

PERFORMANCE MEASUREMENT

Introduction

Effective performance measurement is a key in ensuring that an organization's strategy is successfully implemented. It is about monitoring an organization's effectiveness in fulfilling its own predetermined goals or stakeholder requirements. A company must perform well in terms of cost, quality, flexibility, value and other dimensions. A performance measurement system that enables a company to meet these demands successfully is essential. It helps ensure better informed and more effective decision making at both strategic and operational levels. Performance measurement has evolved from purely financial performance measures such as profit, cash flow or the return on capital employed (ROCE). Today there is greater emphasis on non-financial and multi-dimensional performance measures to understand and manage the performance of the organisation to achieve its goals. Deficiencies in traditional (financial) performance measurement have led to frameworks and techniques being developed in recent years.

MEANING AND DEFENITIONS

Performance measurement is the process of collecting, analyzing and/or reporting information regarding the performance of an individual, group, organization, system or component.

Moullin defines the term with a forward looking organizational focus—"the process of evaluating how well organizations are managed and the value they deliver for customers and other stakeholders".

Neely et al. use a more operational retrospective focus—"the process of quantifying the efficiency and effectiveness of past actions".

CIMA Official Terminology, 2005 -- **"**The process of assessing the proficiency, with which a reporting entity succeeds, by the economic acquisition of resources and their efficient and effective deployment, in achieving its objectives. Performance measures may be based on non-financial as well as on financial information."

Interoperability Clearinghouse Glossary of Terms, 2005 'The process of developing measurable indicators that can be systematically tracked to assess progress made in achieving predetermined goals and using such indicators to assess progress in achieving these goals.'

THE DEVELOPMENT OF PERFORMANCE MEASUREMENTS

Performance measurements in organisations have generated much interest over the years in different business disciplines in different sectors. The developments in performance measurements have been strongly influenced by the increasing level of competition and the changing business environment. Changes in performance measurements have evolved and expanded for the past half century. The first stage began in the late 1880s. In this stage, the emphasis was on traditional financial performance measures such as profits, productivity, and return on investment. The second stage began a century later in the late 1980s arising from changes in the market. Organisations started to face high levels of competition through quality and low cost. Therefore, organisations began to change their strategic priorities to cope with the high level of competition. Organisations also began to implement the new techniques in technology such as JIT and TQM. In this stage, organisations started to use non-financial performance measures such as quality, lead time and delivery and flexibility.

TECHNIQUES OF PERFORMANCE MEASUREMENT

There are several performance measurement tools and techniques and each has its own group of supporters. The techniques have been divided into two categories:

a. Traditional Methods

b. Modern Techniques

1. Traditional Methods: The traditional methods are based on earnings. For years, managers have been using these traditional methods to measure the financial performance. Some of the main traditional measures used in performance measurement are:

1.1. Ratio Analysis
a. Return on Assets
b. Return on Equity
c. Earnings per share

1.2. Net Income

1.3. Market Value Added

1.4. Cash Flow Statement

1.5. Funds Flow Statement

1.6. Financial Statement Analysis
a. Comparative Statements
b. Common Size Statements

1.7. Marginal Costing

1.8. Differential Cost Analysis

1.9. Break Even Analysis

1.10. Standard Costing

1.11. Variance Costing

1.12. Budgetary Control

2. Modern Techniques or Approaches: In a successful total quality organization, performance will be measured by the improvements seen by the customer as well as by the results delivered to other stakeholders, such as the shareholders. Viewing the performance of an organization is also an important step when formulating the direction of the strategic activities. Modern Approaches take into consideration the wealth maximization concept and other non-financial aspects like innovation, customer satisfaction, employees' motivation etc. Some of the modern techniques are as follows:

1. The Balanced Scorecard (Kaplan and Norton, 1993, 1996, 2001)
2. Performance Prism (Neely, 2002) .
3. TPM Process (Jones and Schilling, 2000).
5. 7-Step TPM Process (Zigon, 1999)
6. Total Measurement Development Method (TMDM) (Tarkenton Productivity Group, 2000)
7. Activity- based Costing and Management
8. Economic Value Added (EVA)
9. Quality Management
10. Customer Value Analysis

Performance measurement systems should align with the organization's strategy and senior managers should convey the organization's mission, vision, values and strategic direction to employees and external stakeholders. The performance measures give life to the mission, vision, and strategy by providing a focus that lets each employee know how they contribute to the success of the company and its stakeholders' measurable expectations. Performance measurement is essential for the effective working of an organization as it monitors the weaknesses at the earliest and warns the managers to take the corrective action as soon as possible.

TYPES OF PERFORMANCE MEASURES

Performance measures can be grouped into two basic types: those that relate to results (outputs or outcomes such as competitiveness or financial performance) and those that focus on the determinants of the results (inputs such as quality, flexibility, resource utilization, and innovation). This suggests that performance measurement frameworks can be built around the concepts of results and determinants. All measures of performance may be broadly classified into two – financial measures and non-financial measures.

FINANCIAL PERFORMANCE MEASURES

Financial measures of performance are often used to gauge organizational performance; some firms have experienced negative consequences from relying solely on these measures. Traditional financial measures are better at measuring the consequences of yesterday's actions than at projecting tomorrow's performance. Therefore, it is better that managers not rely on one set of measures to provide a clear performance target. Many firms still rely on measures of cost and efficiency, when at times such indicators as time, quality, and service would be more appropriate measures. To be effective, performance yardsticks should continuously evolve in order to properly assess performance and focus resources on continuous improvement and motivating personnel. In order to incorporate various types of performance measures some firm's develop performance measurement frameworks. These frameworks appear in the literature and vary from Kaplan and Norton's balanced scorecard to Fitzgerald's framework of results and determinants. The important financial performance measures are: ROI, residual income, EVA and amount of cash flows.

1. Return on investment (ROI)

Return on Investment (ROI) is a performance measure used to evaluate the efficiency of an investment or compare the efficiency of a number of different investments. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio. In finance, rate of return (ROR), also known as return on investment (ROI), rate of profit or sometimes just return, is the ratio of money gained or lost (whether realized or unrealized) on an investment relative to the amount of money invested. The amount of money gained or lost may be referred to as interest, profit/loss, gain/loss, or net income/loss. The money invested may be referred to as the asset, capital, principle, or the cost basis of the investment. ROI is usually expressed as a percentage.

Calculation of ROI

The ROI calculation is a straightforward one, and it can be calculated by either of the two following methods.

The first is this:

$$\text{ROI} = \frac{\text{Net Return on Investment}}{\text{Cost of Investment}} \times 100$$

The second is this:

$$\text{ROI} = \frac{\text{Final Value of Investment} - \text{Initial Value of Investment}}{\text{Cost of Investment}} \times 100$$

Advantages of ROI

ROI has the following advantages:

1. Easy comparability with internal and external benchmarks and other divisions who use ROI.

2. Controls for size and deference across plants and divisions.

3. Reduces tendency to overinvest in project by managers (as we hold managers responsible for ROI level).

4. Motivates managers to increase sales, decrease costs, and minimize asset investment.

5. Better Measure of Profitability

6. Achieving Goal Congruence

7. Comparative Analysis

8. Performance of Investment Division

9. ROI as Indicator of Other Performance Ingredients

10. Matching with Accounting Measurements

Disadvantages of ROI

ROI has the following limitations:

1. Satisfactory definition of profit and investment are difficult to find. Profit has many concepts such as profit before interest and tax, profit after interest and tax, controllable profit, profit after deducting all allocated fixed costs.

2. While comparing ROI of different companies, it is necessary that the companies use similar accounting policies and methods in respect of valuation of stocks, valuation of fixed assets, apportionment of overheads, treatment of research and development expenditure, etc.

3. ROI may influence a divisional manager to select only investments with high rates of return (i.e., rates which are in line or above his target ROI).

4. A good or satisfactory return is defined as an ROI in excess of some minimum desired rate of return, usually based on the firm's cost of capital.

5. Discourages managers from investing in projects that reduce a division's ROI (even though may improve ROI of firm,) or have short term negative effects for the divisions, but long term positive effects for the overall firm.

6. Does not incorporate measures of risk (managers may invest in riskier projects that increase ROI, but provides added risk to the entity).

7. Financial accounting causes investment in assets to be understated (especially when value of assets (such as property) has increased. This causes ROI to be overstated.

2. RESIDUAL INCOME

Residual income is excess income generated more than the minimum rate of return. Residual income is a measurement of internal corporate performance, whereby a company's management team evaluates the income generated relative to the company's minimum required return. However, in personal finance, residual income is the level of income an individual has after the deduction of all personal debts and expenses paid. Personal residual income is not the result of a job or hourly wages—it requires an initial investment either of money or time with the primary objective of earning on-going revenue. Residual income is regularly referred to as "passive income" for individuals or businesses. Examples of residual income include real estate investing, stocks, bonds, investment accounts, and royalties. For equity valuations, equity charge is calculated as the equity capital multiplied by the cost of

equity. Corporate residual income is leftover profit after paying all costs of capital. Residual income measures net income after taking into account all required costs of capital related to generating that income. Other terms for residual income include economic value-added, economic profit, and abnormal earnings.

Residual income=Operating income− (Percentage of rate of return / percent of cost of capital× Average operating assets/capital employed)

Notice that **operating income** *and* **average operating assets** used here to calculate RI are the same measures used in the ROI calculation presented earlier. The one new item, percent cost of capital, is the company's percentage cost to obtain investment funds (often called capital). For example, a company that raises funds by issuing bonds would use the interest rate associated with the bonds in establishing its percent cost of capital.

Compared to using return on investment (ROI) as a measure of performance, RI has several advantages and disadvantages:

Advantages

- It encourages investment centre managers to make new investments if they add to RI. A new investment might add to RI but reduce ROI. In such a situation, measuring performance by RI would not result in dysfunctional behaviour, i.e. the best decision will be made for the business as a whole.
- Making a specific charge for interest helps to make investment centre managers more aware of the cost of the assets under their control.
- Does not penalize investment in projects with lower returns than current project returns.
- An advantage of using residual income is that the investment center is evaluated on a dollar return generated, not purely on percentages. Investment centers might reject potentially investments that would cause ROI to decrease.

Disadvantages

- It does not facilitate comparisons between divisions since the RI is driven by the size of divisions and of their investments.

- It is based on accounting measures of profit and capital employed which may be subject to manipulation, e.g. in order to obtain a bonus payment.
- Due to RI being an absolute dollar value, larger subunits will have larger RI's, and thus it is di0cult to compare performance across units.
- RI increases as investment and costs decreases, so managers may cut R&D costs, and employee training costs for higher RI (sacrificing long term benefit for short term).
- Incentive for managers to set lower required rate of return (and thus invest in less-profitable or less risky projects when riskier projects are profitable).
- Residual income is that it is an absolute measure of return and that it does not discourage myopic behavior.

Difference between ROI and RI:

The main points of difference between ROI and RI are given below:

Elements of difference	**ROI**	**RI**
Implementation of method	Is difficult to manipulate because based on absolute figures.	Is prone to manipulation because involves cost of capital percentage which can be changed
Scope	Can be used to calculate percentage return for product, division or the whole organization.	Can show the incremental profitability of an investment especially new investment in monetary terms.
Criteria of decision-making	Can be used for specific investment decisions for new projects or evaluation of current projects.	Can help management understand the efficacy of their investment decisions.
Application	Shows in percentage terms the return on long-term investments for a business.	Shows the incremental income after deducting the notional interest from the operating income of a business.

Both the return on investment and residual income methods are used by the management of companies to make reasonable investment decisions. Where return on investment indicates

the percentage of return an investment or overall capital of a company is earning, residual income highlights the success of an investment. Management of a company may need to consider more factors while taking decision about the investment of long-term capital, but these decisions could be made more accurately if these methods are used but only if reliable variables are inculcated.

3. KEY PERFORMANCE INDICATOR (KPI)

A Key Performance Indicator (KPI) is a quantifiable measurement that shows how well an organization, team, or individual is performing against a predetermined goal or objective.

Meaning and definitions

A Key Performance Indicator is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organizations use KPIs at multiple levels to evaluate their success at reaching targets. High-level KPIs may focus on the overall performance of the business, while low-level KPIs may focus on processes in departments such as sales, marketing, HR, support and others.

- Oxford's Dictionary definition of KPI: A quantifiable measure used to evaluate the success of an organization, employee, etc. in meeting objectives for performance.
- Investopedia's definition of KPI: A set of quantifiable measures that a company uses to gauge its performance over time.
- Macmillan's Dictionary definition of KPI: A way of measuring the effectiveness of an organization and its progress towards achieving its goals.

In terms of developing a strategy for formulating KPIs, your team should start with the basics and understand what your organizational objectives are, how you plan on achieving them, and who can act on this information. This should be an iterative process that involves feedback from analysts, department heads and managers. As this fact finding mission unfolds, you will gain a better understanding of which business processes need to be measured with a KPI dashboard and with whom that information should be shared.

CHARACTERISTICS OF A GOOD KPI

1. KPIs Reflect Strategic Value Drivers: KPIs reflect and measure key drivers of business value. Value drivers represent activities that, when executed properly, guarantee future success. Value drivers move the organization in the right direction to achieve its stated financial and organizational goals. Examples of value drivers might be "high customer satisfaction" or "excellent product quality."

2. KPIs are defined by "Executives": Executives define value drivers in planning sessions which determine the short and long-term strategic direction of the organization. To get the most from these value drivers, executives need to define how they want to measure their organizations' performance against these drivers. Unfortunately, too many executives terminate strategic planning sessions before they define and validate these measurements, otherwise known as KPIs. The results are predictable, giving proof to the adage, "You can't manage what you don't measure."

3. KPIs Cascade throughout an Organization: Every group at every level in every organization is managed by an "executive" whether or not the person carries that title. These executives may be known as "divisional presidents," "managers," "directors," or "supervisors," among other things. Like the CXOs, these "executives" also need to conduct strategic planning sessions that identify the key value drivers, goals, and plans for the group. At lower levels, these elements may be largely defined and handed down by a group higher in the hierarchy.

4. KPIs Are Based on Corporate Standards: The only way cascading KPIs work is if an organization has established standard measurements. This is deceptively hard. It can take organizations months if not years to hash out the meaning of key measures or entities, such as "net profit" or "customer." Functional representatives at a major U.S. airline spent months trying to agree on the meaning of "flight" and "segment" and their entire analytical infrastructure was put on hold until they achieved consensus. In some cases, organizations can only agree to disagree and use metadata to highlight the differences in reports. Only with enough top executive support can organizations overcome the political obstacles associated with standardizing definitions for commonly used KPIs.

5. KPIs Are Based on Valid Data: When pressed, most executives find it easy to create KPIs for key value drivers. In fact, most industries already have a common set of metrics for measuring future success. Unfortunately, knowing what to measure and actually measuring it are two different things. Before executives finalize a KPI, they need to ask a technical analyst if the data exists to calculate the metric and whether it's accurate enough to deliver valid results. Often, the answer is no! In that case, executives need either to allocate funds to capture new data or clean existing dirty data. Or they need to revise the KPI. Providing cost estimates for each approach will help executives decide the best course of action.

6. KPIs Must Be Easy to Comprehend: One problem with most KPIs is that there are too many of them. As a result, they lose their power to grab the attention of employees and modify behavior. According to TDWI research, the median number of KPIs that organizations deploy per user is seven. More KPIs than this makes it difficult for employees to peruse them all and take requisite action.

7 KPIs Are Always Relevant: To ensure that KPIs continually boost performance, you need to periodically audit the KPIs to determine usage and relevance. If a KPI isn't being looked at, it should probably be discarded or rewritten. In most cases, KPIs have a natural lifecycle. When first introduced, the KPI energizes the workforce and performance improves. Over time, KPIs lose their impact and should probably be revised. Most organizations review and revise KPIs quarterly.

8. KPIs Provide Context: Metrics always show a number that reflects performance. But a KPI puts that performance in context. It evaluates the performance according to expectations. The context is provided using 1) thresholds (i.e. upper and lower ranges of acceptable performance), or 2) targets (i.e. predefined gains, such as 10% new customers per quarter), or 3) benchmarks, which can be based on industry wide measures or various methodologies, such as Six Sigma. In addition, most KPIs indicate the direction of the performance, either "up," "down," or "static."

9. KPIs Empower Users: As stated above, you can't manage what you don't measure. But a corollary is that you can't manage what you don't reward. To be effective, KPIs must be reinforced with incentives. Almost 40 percent of organizations surveyed by TDWI say they restructured incentives systems when implementing KPIs. However, it's important not to link

incentives to KPIs until the KPIs have been fully vetted. Often, KPIs must be tweaked or modified before they have the desired effect.

10. KPIs Lead to Positive Action: Finally, KPIs should generate the intended action—improved performance. Unfortunately, many organizations allow groups to create KPIs in isolation. This leads to KPIs that undermine each other. For example, a KPI for a retail store might track stock outs (when it lacks enough merchandise on hand to meet demand) but the regional warehouse has an incentive to carry minimal inventory. If the regional warehouse does too good a job, it may not have enough inventories to keep the retail shelves stocked when there is a surge in demand for certain merchandise.

EXAMPLES OF KPIs

financial Performance

A financial KPI is a measurable value, which is monitored to ensure that a company meets its corporate, financial objectives. Among others, such KPIs enable the finance department to track and optimize expenses, sales, profit, and cash flow. Following are the important KPIs which indicate financial performance:

Gross Profit Margin: How much revenue you have left after COGS?

Operating Profit Margin: How is your EBIT developing over time?

Operating Expense Ratio: How do you optimize your operating expenses?

Net Profit Margin: How well your company increases its net profit?

Working Capital: Is your company in stable financial health?

Current Ratio: Can you pay your short-term obligations?

Quick Ratio / Acid Test: Is your company's liquidity healthy?

Cash Conversion Cycle: How fast can you convert resources into cash?

Accounts Payable Turnover: Are you paying expenses at a reasonable speed?

Accounts Receivable Turnover: How quickly do you collect payments?

Vendor Payment Error Rate: Are you processing your invoices productively?

Budget Variance: Is your budgeting accurate and realistic?

Return on Assets: Do you utilize your company's assets efficiently?

Return on Equity: How much profit do you generate for shareholders?

Human resource performance

A HR KPI is a comprehensible way to track pre-defined organizational goals of the human resources management. HR departments use specific key performance indicators to optimize recruiting processes, workplace management, employee programs, etc. following are the complete list of the most important human resources KPIs:

- Absenteeism Rate: Evaluate the engagement of your employees.
- Overtime Hours: Monitor your employees' workload in detail.
- Training Costs: Analyze the investments in your employees.
- Employee Productivity: Track the overall effectiveness of your workforce.
- Cost per Hire: Analyze what it takes to find the perfect fit.
- Recruiting Conversion Rate: Find the best recruitment method.
- Time to Fill: Monitor how long you need to find a new employee.
- Turnover Rate: See how your retention efforts work.
- Female to Male Ratio: Understand the gender diversity in your company.
- Part-Time Employees: Watch the evolution of part-time workers over time.
- Average Time Stay: See how long your employees stay in your company.

Marketing and sales performance

While some basic sales KPIs remain in place, industry changes have meant that modern sales teams now embrace some newer, more dynamic sales KPIs than in years past. Sales have always, to some extent, been about influencing through relationships. The effectiveness and selection of each KPI should always depend on the business and marketing/sales models in place. When it comes to setting and tracking your marketing KPIs, many marketers and business owners are fully aware of the usual suspects. But there are a number of other KPIs that you should be tracking in order to execute a more successful marketing campaign. No

one wants to support a marketing activity that's losing their company money. By tracking the right marketing KPIs, your company will be able to make adjustments to various strategies and budgets. Without the right ones, however, your company might be reporting and making decisions based on misleading information. Following are the important KPIs which indicate Marketing and sales performance:

1. Sales revenue
2. Cost per lead
3. Customer lifetime value
4. Inbound marketing ROI
5. Traffic-to-lead ratio (new contact rate)
6. Lead-to-customer ratio
7. Landing page conversion rates
8. Organic traffic
9. Social media traffic (and conversion rates)
10. monthly sales growth
11. average profit margin
12. monthly sales bookings
13. sales opportunities
14. sales target
15. quote to close ratio
16. average purchase value
17. monthly calls (or emails) per sales rep
18. sales per rep
19. product performance
20. sales by contact method
21. average new deal size/length
22. lead-to-sale %
23. Average Cost Per Lead

SUPPLY CHAIN AND MANUFACTURING PERFORMANCE

- **Capacity Utilization** – This measures how much of your available capacity you are actually using on your production line. The higher the better. Buildings and

equipment are expensive assets and you want to maximize their use. It also helps to manage what you sell by production center so you do not over or undersell a particular manufacturing line, thereby balancing the workload.

- **On Standard Operating Efficiency** – If you have a piece rate or incentive system in place, you want to measure how employees are performing against the labor standards you used to cost the product. If these numbers are low, it is beneficial to examine methods and do post-production analysis. It is very common for companies to underestimate labor costs, and this KPI can help you identify this.
- **Overall Operating Efficiency** (OOE)– This is one of my favorites because it includes on standard time as well as off standard time. You are trying to maximize this percentage so that employees are adding value the majority of the time they are clocked in and present.

- **Overall Equipment Effectiveness** OEE– This metric measures the overall effectiveness of a piece of production equipment or the entire line. Availability x Performance x Quality. This is a great KPI to maximize to ensure you are running the plant effectively.

- **Machine Downtime** – This KPI and the two below are components of OEE above, but worth measuring on their own. This includes scheduled downtime for maintenance, setups and unscheduled downtime and can include machine changeover.

- **Unscheduled Down Time** – This one can be a killer and one to minimize because it affects other processes in the production chain. Scheduled and predictive maintenance can help minimize unscheduled downtime. There are wireless sensors you can use which can help support predictive maintenance to reduce unscheduled downtime.

- **Machine Set Up Time** - A lot of production time can be lost to set up and changeovers. Implementing SMED (single minute exchange of dies or similar techniques) can really help keep this lost time to a minimum. Look for ways to incorporate parts of the set up so that they are internal to the process to avoid taking machines offline for any longer than you need to. Quick changeover setups also reduce this time.

- **Inventory Turns** – In today's Lean environment and pull approach, keeping inventories to a minimum can really help free up cash and give you the ability to respond to changing customer needs much more efficiently and with better delivery times. It also keeps your on-hand inventory fresh and relevant to avoid obsolescence and mask quality problems.

- **Inventory Accuracy** – There is nothing worse than putting a work order into production only to find your raw goods inventory was inaccurate. This either delays the start of production or causes delays in the line if the order happened to make it into process. I had a rule to never let an order begin production unless everything was available in-house for the order. This helps you manage and maintain your supply chain to keep the right amount of inventory on hand to keep things running.

- **Quality** – This is a no-brainer and table stakes today, but still necessary to measure. There are many ways to measure quality, and I am listing a few below for consideration. Percent defective is one of many ways you can measure quality. Establishing clear and consistent standards goes a long way to reaching your quality goals. The only way to continuously improve is to learn from your mistakes, so don't just measure the quality - determine the root cause and fix it.

- **First Pass Yield** – The percentage of products manufactured correctly and to spec the first time through the process. Getting this number up reduces the next two listed.

- **Rework** – There is no bigger waste of time and raw materials than rework. Implementing quality at the source and effectively training people can go a long way to minimizing this waste.

- **Scrap** – Raw material costs are expensive so minimizing scrap is important. The more robust your processes and training programs are, the less scrap you are likely to produce. When you do produce scrap, do your best to recycle it if possible.

- **Failed Audits** – There is nothing worse than having a shipment ready to go out the door that fails a final quality control audit. Better here than on the

customer's doorstep, but this still leads to rework, scrap and delays. The goal for this KPI should be 0 failed audits, and if it's not, a root cause analysis is in order.

TYPES OF KPIs

There are many types of KPIs that you can use in your business. The common thread is that all of these are objectives and you should use the ones that make most sense for your business strategy. Types of KPIs include:

- **Quantitative indicators** that can be presented with a number.
- **Qualitative indicators** that can't be presented as a number.
- **Leading indicators** that can predict the outcome of a process
- **Lagging indicators** that present the success or failure *post hoc*
- **Input indicators** that measure the amount of resources consumed during the generation of the outcome
- **Process indicators** that represent the efficiency or the productivity of the process
- **Output indicators** that reflect the outcome or results of the process activities
- **Practical indicators** that interface with existing company processes.
- **Directional indicators** specifying whether or not an organization is getting better.
- **Actionable indicators** are sufficiently in an organization's control to effect change.
- **Financial indicators** used in performance measurement and when looking at an operating index.

ADVANTAGES OR IMPORTANCE OF KPIS

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ESSENTIALS OF GOOD KPIs

1. Use metrics, not measures.

And there is a difference. Measures are values found in reports that, on their own, aren't very insightful. Instead, KPIs should be calculated values from measures that are described as ratios, percentages, rates or averages. And they should be evaluated over time.

2. Track granular actions and activities rather than aggregate values.

Setting personal, departmental or corporate goals is fundamental to most people, but measuring how we perform against those values is just not enough. Measuring high-level results such as revenue or the number of customers is a mistake because it doesn't tell you how you got there and what should be done next. To know that, we need to evaluate the events that caused those results.

3. Select KPIs based on your goals, nothing else.

Don't fall into the trap of picking KPIs because others are using them or because they are on a list of popular KPIs. Your key performance indicators must be consistent with your particular needs—and they must always be driven by your business goals

4. KPIs must contain specific actions and be monitored frequently.

If KPIs don't contain specific actions, it's difficult to tell what needs to be changed, boosted or, sometimes, even stopped. Frequent monitoring allows you to make changes—improvements—sooner.

5. Share your KPIs enterprise-wide.

Sharing KPIs throughout the organization gets everyone engaged in the process. Mapping them out is also a key as it shows all team members what activities people are working on and how their work affects the overall goals for the company. Knowing everyone else's KPIs is also motivational if for no other reason than peer pressure. It also encourages employees to take the initiative, creates competitiveness and gives everyone a sense of pride in their accomplishments.

6. Systematically determine actionable metrics

To explain this, let's look at an example: Say you want to increase revenues (who doesn't?). Perhaps you believe that to do that, you must write five blog posts per week.

4. ECONOMIC VALUE ADDED

EVA is a registered trademark by its developer, Stern Stewart & Co. Economic Value Added or EVA is an estimate of true economic profit after making corrective adjustments to GAAP accounting, including deducting the opportunity cost of equity capital. By taking all capital costs into account, including the cost of equity, EVA shows the financial amount of wealth a business has created or destroyed in a reporting period. Economic value added (EVA) is a measure of a company's financial performance based on the residual wealth calculated by deducting its cost of capital from its operating profit, adjusted for taxes on a cash basis. EVA can also be referred to as economic profit, as it attempts to capture the true economic profit of a company. EVA is the incremental difference in the rate of return over a company's cost of capital. Essentially, it is used to measure the value a company generates from funds invested into it. If a company's EVA is negative, it means the company is not generating value from the funds invested into the business. Conversely, a positive EVA shows a company is producing value from the funds invested in it.

EVA can be calculated as follows:

EVA = NOPAT- WACC × CAPITAL EMPLOYED

Where

NOPAT refers to net operating profits after taxes. NOPAT is equal to earnings before interest and tax (EBIT) minus adjusted taxes (AT).

EBIT refers to the earnings before interest and tax. **Following accounting items are not to be considered:**

A. Income

1. Interest income on loans given by the company
2.Dividend income on financial investments made by the company
3. Profit on sale of assets
4. Profit on sale of investments

B. Expenses

1. Loss on sale of fixed assets
2.Loss on sale of investments
3. Expenses by subsidiaries

Others Issues

1. **Brand expenses**: The expenses incurred in brand development should be amortized over a period of years in case the brand is launched and the same survives over the period. The expenses incurred on a brand not subsequently launched should be written off in the same year rather than amortizing the same over a period of years.

2. **Capitalization of R&D expenses**: Similarly, only those R&D expenses which contribute to the revenue in future periods should be deferred. Else, they are written off in these years when they are incurred.

3. **Currency translation**: The reversible currency translation effects should be ignored. The irreversible, periodic and gradual translation effects should be considered to the extent they result in losses. Gains should be ignored to be on conservative side.

4. **Sinking fund depreciation**: The depreciation should be charged in line with the utilized life of assets. However, cases with steady capital investment policy would not require this adjustment.

The objective behind all these adjustments is to reflect the operational efficiency of the company under purview.

AT refers to the adjusted taxes. It is calculated as:

AT = Cash Taxes Paid + Tax Advantage on Interest

WACC refers to weighted average cost of capital. It comprises of following two components:

1. **Cost of debt:** Company's post tax marginal rate of borrowing.

Cost of Debt = Borrowing rate × (1-marginal tax rate)

2. **Cost of equity:** Required rate of return on company's share.

Cost of Equity = Risk free rate + Risk premium × Beta (Capital Asset Pricing Model)

We have used another method of calculating Cost of Equity i.e.

Earnings per Share/Market Price per Share

WACC = D/V × Cost of Debt + E/V × Cost of Equity

Where,

a. D = Average debt

b. E = Average equity (market capitalization)

c. V = D + E (Total value of firm)

d. The risk free rate is equivalent to government's long-term bond yield

e. Beta measures the volatility of share price relative to the market

f. Market risk premium is the extra return investors expect from equity market over and above risk free rate

Capital Employed: Capital employed is taken to be total assets subtracted with non-interest bearing liability in the beginning of the period. This definition does not consider the capital infused into the business at different times during the year and hence has a favorable impact on the resulting values. However, use of average capital employed shall correct this bias. Following points should be remembered:

a. Exclude the profits from the ending balance sheet.

b. Exclude capital work-in-progress since it does not give any returns till commissioned.

c. Funds locked in investments should be excluded.

d. Add customer advance where it is considerable.

e. Average assets can be calculated on average of individual months.

Principles of EVA

EVA was developed to help managers to incorporate two basic principles of finance into their decision making:

1. The primary financial objective of any company should be to maximize the wealth of its shareholders.

2. The value of a company depends on the extent to which investors expect that future profits will differ from the cost of capital. By definition, a sustained increase in EVA will result in an increase in the market value of a company. This approach has proved valid and effective for many types of organizations. This is because the level of EVA isn't what really matters. Current performance already is reflected in share prices. It is the continuous improvement in EVA that brings continuous increases in shareholder wealth.

Objectives of EVA

Economic Value Added is one among various frameworks within value based management framework. EVA is based on the common accounting based items like interest bearing debt, equity capital, net operating profit etc. The idea behind EVA is that shareholder must earn a return that compensates the risks taken by him. The main objectives of EVA are given below:

1. The foremost objective of the EVA is the true performance measurement of an organization after taking into consideration the stakeholders' perspective.

2. The main objective of EVA is to determine which business units' best utilize their assets to generate returns and maximize shareholder value; it can be used to assess a company, a business unit, a single plant, office, or even an assembly line.

3. Economic value added EVA aims at determining a company's true profit, once taxes and the cost of supporting capital have been taken into account. It helps to identify whether a business or project is earning more or less than the capital originally invested in it.

4. Economic Value Added EVA aims to ascertain the financial health of the organization and its capacity to generate shareholder 'value' respectively.

5. EVA aims at the financial assessment of an organization which is important for the company's long range success and planning.

6. Economic Value Added EVA is a financial tool, which signifies the gain, or loss that remains after assessing a charge for the cost for all types of capital employed in an organization. EVA helps in ascertaining the 'value' of the organization in a given time period.

7. The other objective of EVA is to help the managers in setting organizational goals on the basis of financial assessment and keeping into consideration the main motive of shareholders wealth maximization.

8. EVA gives the true economic profit and helps the managers in determining the bonuses, corporation valuation and analyzing equities. It aims at acting as a motivator of the managers and presenter of the true and fair picture of the organization to the investors and the shareholders.

EVA Calculation

The steps appear straightforward and simple, but looks can be deceiving. For starters, NOPAT hardly represents a reliable indicator of shareholder wealth. NOPAT might show profitability according to the generally accepted accounting principles (GAAP), but standard accounting profits rarely reflect the amount of cash left at year-end for shareholders. According to Stern Stewart, dozens of adjustments to earnings and balance sheets—in areas like R&D, inventory, costing, depreciation and amortization of goodwill—must be made before the calculation of standard accounting profit can be used to calculate EVA.

Figuring out the weighted average cost of capital (WACC) is even more difficult. WACC is a complex function of the capital structure (proportion of debt and equity on the balance sheet), the stock's volatility measured by its beta, and the market risk premium. Small changes in these inputs can result in big changes in the final WACC calculation.

There are **four** steps in the calculation of EVA:

1. **Calculate Net Operating Profit After Tax (NOPAT)**

Controllable PAT	X
Add back non-cash items such as:	
accounting depreciation	X
non-cash expenses	X
interest paid net of tax	X
Add back items that add value such as:	
goodwill amortisation	X
development and advertising costs	X
operating lease interest cost	X
Deduct:	
economic depreciation	(X)
impairment to the value of goodwill	(X)
amortisation of development and advertising costs	(X)
= NOPAT	**X**

2. **Calculate Total Invested Capital (TC)**

The main adjustments to the capital employed figure are as follows:

- An adjustment should be made to reflect the replacement cost of non-current assets rather than the book value.
- The net book value of any capitalized operating leases should be added back.
- The net book value of any capitalized development/advertising costs should be added back.

- The value of amortized goodwill should be added.

3. Determine the Weighted Average Cost of Capital (WACC)

WACC stands for weighted average cost of capital:

WACC = (proportion of equity × cost of equity) + (proportion of debt × post tax cost of debt)

For example suppose that a company is 60% financed by equity which has a cost of 10% pa and 40% financed by debt which has an after tax cost of 6%

WACC = (0.60 x 0.10) + (0.40 x 0.06) = 0.084 therefore 8.4%

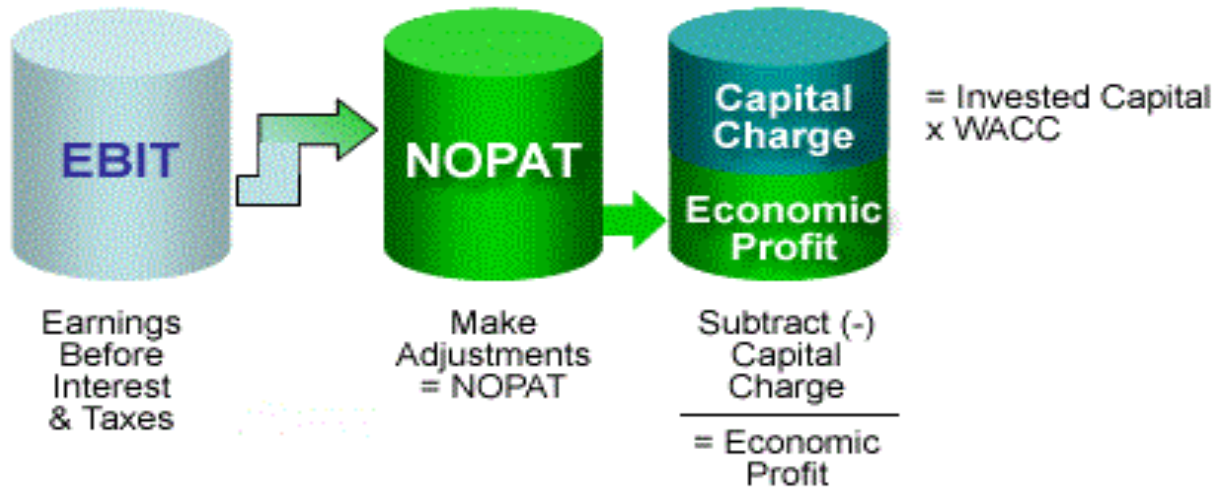
4. Calculate EVA

EVA=NOPAT−WACC∗TC

Where: NOPAT=Net Operating Profit after Tax

WACC=Weighted Average Cost of Capital

TC=Total Invested Capital



ADVANTAGES AND DISADVANTAGES OF EVA

Advantages	Disadvantages
The adjustments made avoid the distortion of results by the accounting policies in place and should therefore result in goal congruent decisions.	Requires numerous adjustments to profit and capital employed figures.
The cost of financing a division is bought home to the division's manager.	Does not facilitate comparisons between divisions since EVA is an absolute measure (as is RI).
	There are many assumptions made when calculating the WACC.
	Based on historical data where as shareholders are interested in future performance.

5. CASH FLOW

Cash flow is a performance measure that measures the difference between cash inflow (i.e. sales remittance or actual sales), and cash outflow (i.e. purchases) net of the accounting measures (i.e. cost vs expenses) and uncertainty and risk. So, cash flow is the less sensitive (for managerial manipulation) accounting performance measure, but doesn't account for liabilities, risk and uncertainties. Profit is a performance measure that accounts to a certain extent for uncertainty and risk, but is susceptible to the manipulation of earnings by the firms' managers. The relationship between cash flow and profitability depends on the used accounting rules and the degree of earnings manipulation of the firm's managers. If the firm cash flow and profit measure are highly correlated, you can very carefully and tentatively assume that the earrings manipulation of the firm is limited.

NON FINANCIAL PERFORMANCE MEASURES

Non-financial performance measures aren't associated with finances, that don't mean they can't be numeric. These types of measures can be either quantitative or qualitative. Many organizations view employees' "soft skills" as the biggest contributors to non-financial performance, which can be measured in various ways. There are two primary reasons non-financial performance measures are important.

First, they help explain and provide context for financial performance measures as we previously mentioned, financial measures are typically lagging indicators, which are fairly easy to collect and analyze because they are backward-looking. Lagging measures report what has already happened, such as revenue generated or orders fulfilled for a specific time period. But finances don't always provide the full story. Why did sales revenue drastically drop in May? Why did the operating cash flow jump in? Non-financial performance measures can fill in the gaps and give answers on monetary fluctuations. For example, if marketing efforts missed the mark one quarter, you can expect sales to be slow the next quarter.

Secondly, non-financial KPIs are easier to link to certain aspects of your overall strategy. More specifically, most organizations don't have finance-based mission and vision statements. If your mission is to provide the best customer service in the industry, revenue numbers aren't a good way to track that—but something like customer satisfaction scores are. The commonly used non-financial performance measures are summarized as below:

Customers	Operations
1. Customer retention ratio	1. Number of new products introduced
2. Customer satisfaction index	2. Time to develop new products
3. Percentage of delivery compliance on time	3. Reduction in operation cycle time
4. Number of customer complaints	4. Turnover per rupee of wage
5. Average time for complaint resolution	5. Productivity
6. Time between a customer order and product delivery	6. Scrap feed per production run
7. Customer preference ranking	7. Overtime 8. Throughput time 9. Inventory turnover
Suppliers	**HR and Safety**
1. Suppliers performance index	1. Number of man-hours trained
2. Number of vendors chosen as strategic partners	2. Reduction in rate of accidents.
	3. Employee satisfaction
Environment	
1. Air pollution level	
2. Water effluent discharge level	

BALANCED SCORE CARD

A balanced scorecard is a strategic management performance metric used to identify and improve various internal business functions and their resulting external outcomes. Balanced scorecards are used to measure and provide feedback to organizations. Data collection is crucial to providing quantitative results as managers and executives gather and interpret the information and use it to make better decisions for the organization.

A balanced scorecard is a performance metric used to identify, improve, and control a business's various functions and resulting outcomes.

It was first introduced in 1992 by David Norton and Robert Kaplan, who took previous metric performance measures and adapted them to include nonfinancial information.

The balanced scorecard involves measuring four main aspects of a business: learning and growth, business processes, customers, and finance. The balanced scorecard shows an organisation’s performance in meeting its objectives relating to stakeholders. Sometimes different stakeholders have different wants. For example, employees depend on an organisation for their employment. Shareholders depend on an organisation to maintain their investment. The organisation must balance those competing wants. Hence, the concept of a

balanced scorecard is to measure how well the organisation is doing in view of competing stakeholder wants.

PERSPECTIVES OF A BALANCE SCORECARD

The Balanced Scorecard is a set of performance targets and results relating to four dimensions of performance—financial, customer, internal process and innovation. It recognizes that organisations are responsible to different stakeholder groups, such as employees, suppliers, customers, community and shareholders. Most organisations use four perspectives or four categories of performance measures. The financial perspective indicates whether the company's strategy and operations add value to shareholders. For organisations that do not have shareholders, the financial perspective indicates how well the strategy and operations contribute to improving the organisation's financial health. The customer perspective indicates how the company's strategy and operations add value to customers. The internal business and production process perspective indicates the ability of the internal business processes to add value to customers and to improve shareholder wealth. Finally, the learning and growth perspective indicates the strength of the infrastructure for innovation and long-term growth. The balanced scorecard framework derives its power by providing a holistic view of business value through its four perspectives.

Hansen and Mowen have referred to balanced scorecard as 'strategic-based responsibility accounting system' which translates the mission and strategy of an organisation into operational objectives and measures for four different perspectives: the financial perspective, the customer perspective, the process perspective and the infrastructure (learning and growth) perspective.

The balanced scorecard shows an organisation's performance in meeting its objectives relating to stakeholders. Sometimes different stakeholders have different wants. For example, employees depend on an organisation for their employment. Shareholders depend on an organisation to maintain their investment. The organisation must balance those competing wants. Hence, the concept of a balanced scorecard is to measure how well the organisation is doing in view of competing stakeholder wants. The balanced scorecard is used to attain objectives, measurements, initiatives, and goals that result from these four primary functions of a business. Companies can easily identify factors hindering business performance and outline strategic changes tracked by future scorecards.

Four Perspectives of a Balanced Scorecard

		Measures
Financial	Is the company achieving its financial goals?	Operating income Return on assets Sales growth Cash flow from operations 'Reduction of administrative expense.
Customer	Is the company meeting customer expectations?	Customer satisfaction Customer retention New customer acquisition Market share On time delivery Time to fill orders.
Internal Processes	Is the company improving critical internal processes?	Defect rate Lead time Number of suppliers Material turnover Percent of practical capacity.
Innovation	Is the company improving its ability to innovate?	Amount spent on employee training Employee satisfaction Employee retention Number of new products New product sales as a percent of total sales Number of patents

1. Financial Perspective:

The balanced scorecard uses financial performance measures, such as net income and return on investment, because all for-profit organisations use them. Financial performance measures provide a common language for analysing and comparing companies. People who provide funds to companies, such as financial institutions and shareholders, rely heavily on financial performance measures in deciding whether to lend or invest funds. Properly designed financial measures can provide an aggregate view of an organisation's success. Financial

measures by themselves do not provide incentives for success. Financial measures tell a story about the past, but not the future; they have importance, but will not guide performance in creating value.

According to Brown, a sound approach to financial measurement is to make sure that your data base includes three types of information's:

a. Historical Data:

How did we do last month, last week, this year, last year, and so on?

b. Current Data:

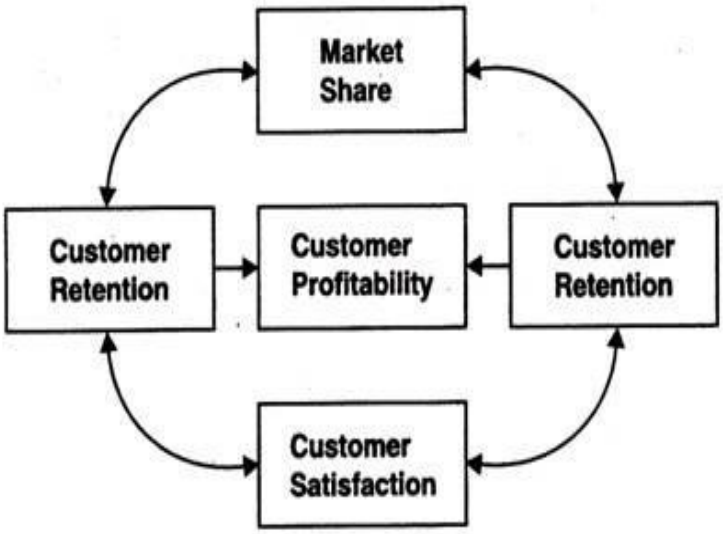
How are we doing right now, today?

c. Future Data:

How will we be doing in the next few months or years?

2. Customer Perspective:

In the customer perspective of the Balanced Scorecard, managers identify the customer and market segments in which the business unit will compete and the measures of the business unit's performance in these targeted segments. This perspective typically includes several core or generic measures of the successful outcomes from a well-formulated and implemented strategy. The core outcome measures include customer satisfaction, customer retention, new customer acquisition, customer profitability, and market share in targeted segments. But the customer perspective should also include specific measures of the value propositions that the company will deliver to customers in targeted market segments.



Market Share	Reflects the proportion of business in a given market (in terms of number of customers, amount spent, or unit volume sold) that a business unit sells.
Customer Acquisition	Measures, in absolute or relative terms, the rate at which a business unit attracts or wins new customers or business.
Customer Retention	Tracks, in absolute or relative terms, the rate at which a business unit retains or maintains ongoing relationships with its customers.
Customer Satisfaction	Assesses the satisfaction level of customers along specific performance criteria within the value proposition.
Customer Profitability	Measures the net profit of a customer, or a segment, after allowing for the unique expenses required to support that customer.

3. Internal-Business-Process Perspective:

In the internal-business-process perspective, managers identify the critical internal processes in which the organization must excel. The key to excellence in any organization is control of its processes to produce reliable and consistent products and services

These processes enable the business organizations to:

i. Deliver the value propositions that will attract and retain customers in targeted market segments, and

ii. Satisfy shareholder expectations of excellent financial returns.

In order to achieve consistently high performance, an organization must control its inputs. The two most important inputs to good performance are knowledge of customer requirements and high- quality goods and services from key suppliers. Process measures provide with the data needed to predict and control the quality of products and services. When a problem occurs with a product or service, the cause is usually found by looking at the process data. Results and outcomes are important for all organizations. In fact, they may be the most important thing. But how those results are achieved—the process measures—is also very important to tract.

Some process variables are even monitored continuously to ensure the production and delivery of high-quality products and services. Achieving good performance levels on process or operational measures leads to high-quality products and services, which, in turn, lead to satisfied or delighted customers, which lead to repeat business and promote an organization's long-term survival and success.

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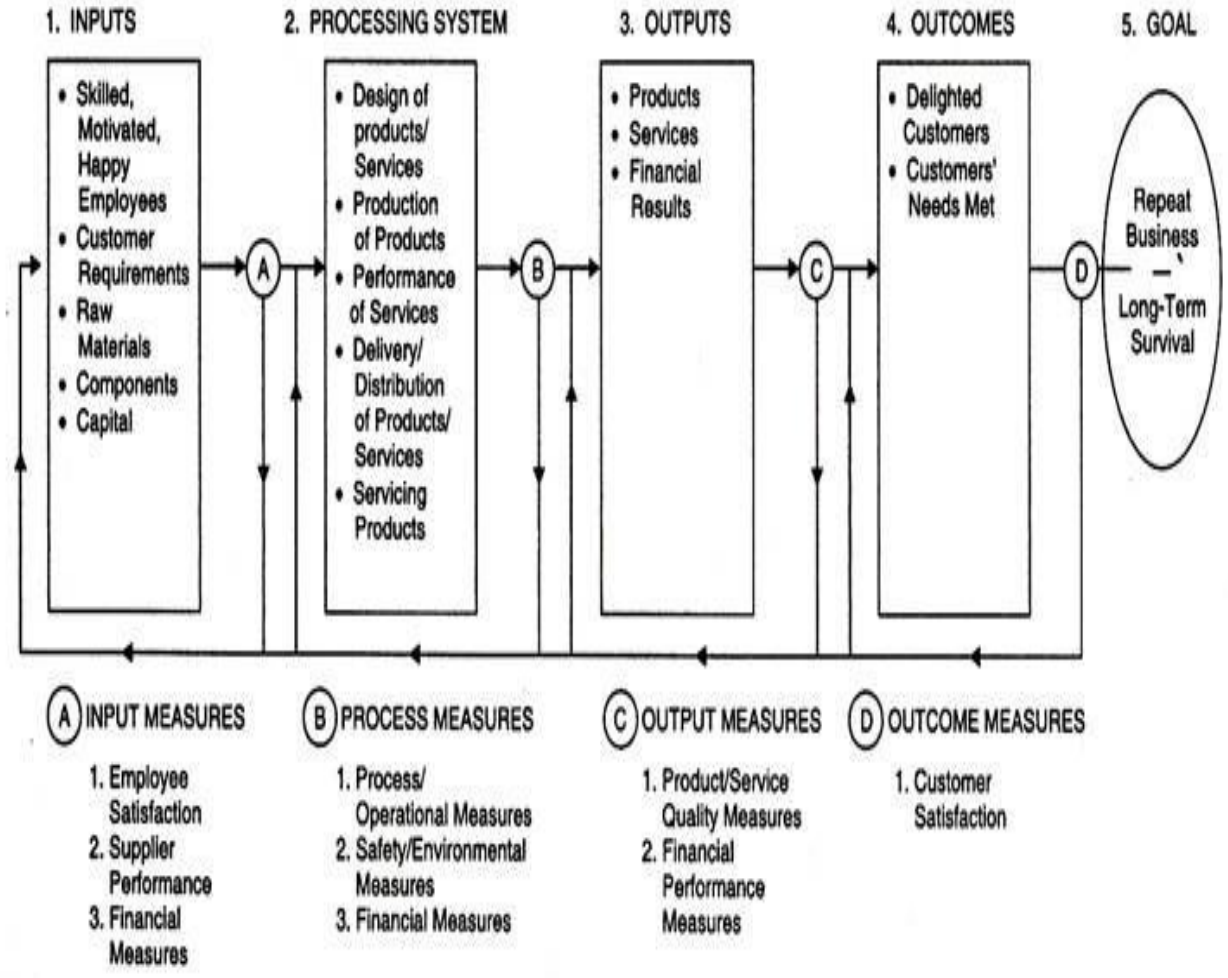


4. The Learning and Growth Perspective:

For incentive purposes, the learning and growth perspective focuses on the capabilities of people. Managers would be responsible for developing employee capabilities. Key measures for evaluating managers' performance would be employee satisfaction, employee retention, and employee productivity.

(a) Employee Satisfaction:

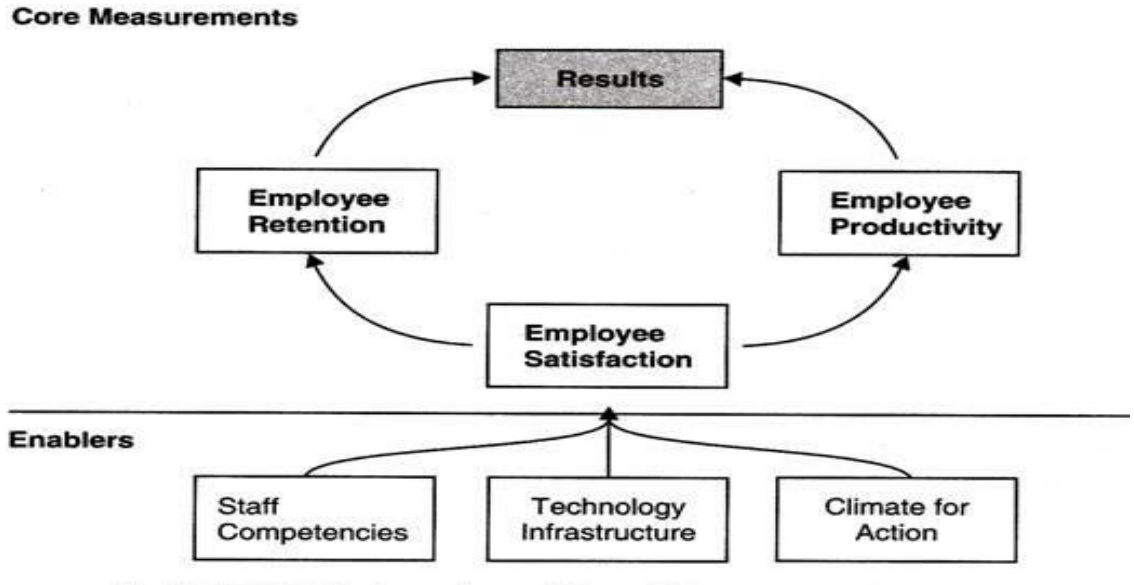
Employee satisfaction recognises the importance of employee morale for improving productivity, quality, customer satisfaction and responsiveness to situations. Managers can measure employee satisfaction by sending surveys, interviewing employees, or observing employees at work.

(b) Employee Retention:

Firms committed to retaining employees recognise that employees develop organisation-specific intellectual capital and provide a valuable non-financial asset to the company. Furthermore, firms incur costs when they must find and hire good talent to replace people who leave. Firms measure employee retention as the inverse of employee turnover—the percent of people who leave each year.

(c) Employee Productivity:

Employee productivity recognises the importance of output per employee. Employees create physical output (i.e., miles driven, pages produced, or lawns mowed), or financial output (i.e., revenue per employee or profits per employee). The number of loans processed per loan officer per month would provide a simple measure of productivity for loan officers at a bank. Within this core, the employee satisfaction objective is generally considered the driver of the other two measures, employee retention and employee productivity.



A good incentive system rewards managers who promote high employee satisfaction, low employee turnover, and high employee productivity.

ADVANTAGES OF BALANCED SCORECARD

1. It Provides a Visual Picture of Strategy

Compare a one-page strategy map (a strategy map with cause-and-effect connections, business goals, initiatives, and metrics) with 100+ pages strategic plan. The strategy map wins. One strategy map with some supporting documentation can include all the details needed for effective strategy execution. To get all the benefits from it, make sure your team knows how to read this type of map.

2. It Works as a Base for the Discussion

The consequence of the previous advantage – a properly designed Balanced Scorecard works as an excellent base to discuss business challenges and how the company is going to respond to them.

3. It Works on Three Levels of Abstraction

The drawbacks of many business frameworks are that they work on one level of abstraction only.

- You might have your list of goals (operational level), but they won't be connected to the company's mission or won't be quantified out of the box.
- You might decide the top level growth priorities, for example using Three Horizons Framework, but those ideas will need to be connected to the performance indicators and specific operational goal.

In this sense, the Balanced Scorecard is more robust as it allows you to work on three levels of abstraction:

- Mission and vision
- Strategic priorities or themes
- Goals (quantified by indicators)
- Action level (initiatives and action plans)

4. Support of the Business Context by Design

One of the challenges of performance management is that stakeholders should understand the business context. It's not enough to define ambitious targets – you need to explain the whys and how.

The Balanced Scorecard framework has a solid base to explain this context:

- The context for the goals on the map is defined by cause-and-effect connections as well as by the strategic themes.
- The context for the measures is defined "by design" as all metrics come aligned with certain business goals.
- The same applies to the initiatives – all action plans have context defined by business goals and are measurable using the performance metrics aligned.

5. Easier Data Collection

As we discussed in the big data article, nowadays, the problem is not about having or processing large sets of data – the main challenge is to focus data mining efforts. In this sense, the Balanced Scorecard framework simplifies data collection as your data scientists know what data you need (the definition of the KPI) as well as the reasons behind (the business goal aligned).

6. Cascading and Alignment Explained

The top-level strategy can be cascaded to the lower levels. The departments and business units can have their own strategy scorecards aligned with overall strategy.

A properly cascaded strategy has its advantages:

- It explains to the stakeholders of different levels how their efforts contribute to the overall strategy.
- The top managers have a better idea about how exactly their strategy is executed.

7. Easier Strategy Reporting

Annual strategic reporting might be time-consuming. With the Balanced Scorecard framework implemented, the strategy map with its supporting documentation is already a strategic report that is updated regularly. Of course, you might want to present it in a different way, share some additional insights, but the core ideas are already there. Software automation solutions help to make the reporting easier.

8. The Framework is well accepted

With the growing number of frameworks, business professionals are getting more skeptical about trying out new frameworks. If there are no big names and proven success records behind the framework, then chances to get a buy in are low. In this sense, the Balanced Scorecard has a strong reputation. The framework adoption figures (third place in the list of the 25 most popular business tools, implemented in more than 50% of Fortune 1000 companies) provide a good chance for a framework to be accepted by the management team.

9. Easy to Get Trained in the Concept

The offer of the Balanced Scorecard training product varies from online training (see our Strategy Execution Training) to the on-site training offers combined with consulting. The number of cases and examples of the strategy scorecards also provide a good starting point for new Balanced Scorecard projects.

10. Software Automation Makes Things Easier

The choice of the software solutions for the Balanced Score cards increases the chances of successful implementation. Automation tools, like our BSC Designer, make it easy to manage performance data, as well as facilitate the maintenance of the strategy maps and dashboards. A good starting point would be clarifying the difference between KPI software and Balanced Scorecard software.

MULTIPLE SCORE CARD MEASURES

Testing the linkage of multiple scorecard measures to a single strategy

Analysis of the balanced scorecard could have yielded more timely information as well as more detail on why the strategy was not working as planned. Multiple measures in a balanced scorecard might systematically be used to test how well different drivers of performance are working to achieve strategic objectives and superior financial performance.

The multiple measures on a properly constructed balanced scorecard should consist of a linked series of goals and measures that are both consistent and mutually reinforcing. In other words, the balanced scorecard should be viewed as the instrumentation for a single strategy. The integrated system of scorecard measures should incorporate the complex set of cause-and-effect relationships among the critical variables that describe the trajectory and the flight plan of the strategy. The linkages should incorporate both outcome measures and performance drivers. Good measurement systems should make the relationships among goals and measures explicit so they can be managed and validated. The chain of cause and effect should pervade all four perspectives of a balanced scorecard.

Analysis of customer preferences may reveal that on-time delivery of orders is highly valued by customers. Thus, improved on-time delivery is expected to lead to higher customer loyalty, which, in turn, is expected to lead to higher financial performance. Therefore, both customer loyalty and on-time delivery are incorporated into the customer perspective of the scorecard. The process continues by asking what internal processes must the company excel at to achieve exceptional on-time delivery. To achieve improved on-time delivery, the business may need to achieve short cycle times in operating processes and high-quality internal processes, both factors that could be scorecard measures in the internal perspective. How do organisations improve the quality and reduce the cycle times of their internal processes? By training and improving the skills of their operating employees, an objective that would be a candidate for the learning and growth perspective. In this manner, an entire chain of cause-and-effect relationships can be established as a vertical vector through the four balanced scorecard perspectives.

NEW HORIZONS IN MANAGERIAL CONTROL

In the area of managerial control some techniques have been developed in the recent years. Some of the important techniques are Transfer pricing, Responsibility accounting, Performance budgeting, Zero Base budgeting, Social cost benefit analysis etc.

RESPONSIBILITY ACCOUNTING

Responsibility accounting is one of the recent developments in the field of management accounting. It is rightly described as modern approach to managerial control and reporting. It lays emphasis performance of individuals where responsibilities are fixed for persons. Responsibility accounting is a system that involves identifying responsibility centers and their objectives, developing performance measurement schemes, and preparing and analyzing performance reports of the responsibility centers. Responsibility accounting involves gathering and reporting revenues and costs by areas of responsibility.

All major planning and operating decisions are made by one or a few individuals of a business, it is considered to be a centralized organization. The larger a business becomes, the more difficult it is to remain centralized. When an organization becomes decentralized, it is divided into separate units. Each of these units is delegated responsibilities for planning and control. Managers are not required to seek approval from upper management for normal operating decision. The level of decentralization varies greatly among companies because each one has specific and unique circumstances. Managerial accountants assist managers of decentralized organizations. Decentralized operations are usually classified according to the scope of responsibility assigned and the decision making authority delegated to managers. The three types of decentralized operations are: 1) cost center, 2) profit center, and 3) investment center.

Meaning and Definition

Responsibility accounting is a kind of management accounting that is accountable for all the management, budgeting, and internal accounting of a company. The primary objective of this accounting is to support all the Planning, costing, and responsibility centres of a company. The accounting generally includes the preparation of a monthly and annual budget for an individual responsibility centre. It also accounts for the cost and revenue of a company,

where reports are accumulated monthly or annually and reported to the concerned manager for the feedback. Responsibility accounting mainly focuses on responsibilities centres.

Responsibility accounting is a system of accounting where specific persons are made responsible for the accounting of specific area and cost control. If that cost increases then the person will be held responsible and answerable In this type accounting system, responsibility is assigned on the basis of a person's knowledge and skills and the proper authority is given to that person so that he can make a decision and show his performance.

"Responsibility accounting is a method of accounting in which cost are identified with persons assigned to their control rather than with products or functions" -Eric L. Kohler.

Responsibility accounting is a system of accounting that recognizes various responsibility centres throughout the organization and reflects the plans and actions of each of the Centres by assigning particular revenues and cost to the one having the pertinent responsibility. It is also called profitability accounting and activity accounting. - Charles THorngren.

A system of management accounting under which accountability is established according to the responsibility delegated to various levels of management and management information and reporting system division or units of an organization under a specified authority in a person are developed a responsibility centres and evaluated individually for their performance.- accountants of India.

Responsibility accounting as that type of management accounting that collects and reports both planned and actual accounting information in terms of responsibility centre. - Robert n Antony.

FEATURES OF RESPONSIBILITY ACCOUNTING

An analysis of the definitions given above reveals the following important features or fundamental aspects of responsibility accounting:

1. Inputs and Outputs or Costs and Revenues:

The implementation and maintenance of responsibility accounting system is based upon information relating to inputs and outputs. The physical resources utilized in an organisation; such as quantity of raw material used and labour hours consumed, are termed as inputs. These

inputs expressed in the monetary terms are known as costs. Similarly outputs expressed in monetary terms are called revenues. Thus, responsibility accounting is based on cost and revenue information.

2. Planned and Actual Information or Use of Budgeting:

Effective responsibility accounting requires both planned and actual financial information. It is not only the historical cost and revenue data but also the planned future data which is essential for the implementation of responsibility accounting system. It is through budgets that responsibility for implementing the plans is communicated to each level of management. The use of fixed budgets, flexible budgets and profit planning are all incorporated into one overall system of responsibility accounting.

3. Identification of Responsibility Centres:

The whole concept of responsibility accounting is focused around identification of responsibility centres. The responsibility Centres represent the sphere of authority or decision points in an organisation. In a small firm, one individual or a small group of individuals, who are usually the owners may possibly manage or control the entire organisation.

4. Relationship between Organisation Structure and Responsibility Accounting System:

A sound organisation structures with clear-cut lines of authority—responsibility relationships are a prerequisite for establishing a successful responsibility accounting system. Further, responsibility accounting system must be so designed as to suit the organisation structure of the organisation. It must be founded upon the existing authority- responsibility relationships in the organisation. In fact, responsibility accounting system should parallel the organisation structure and provide financial information to evaluate actual results of each individual responsible for a function.

5. Assigning Costs to Individuals and Limiting their Efforts to Controllable Costs:

After identifying responsibility centres and establishing authority-responsibility relationships, responsibility accounting system involves assigning of costs and revenues to individuals. Only those costs and revenues over which an individual has a definite control can be assigned to him for evaluating his performance.

6. Transfer Pricing Policy:

In a large scale enterprise having decentralized divisions, there is a common practice of transferring goods and services from one segment of the organisation to another. In such situations, there is a need to determine the price at which the transfer should take place so that costs and revenues could be properly assigned.

7. Performance Reporting:

As stated earlier, responsibility account is a control device. A control system to be effective should be such that deviations from the plans must be reported at the earliest so as to take corrective action for the future. The deviations can be known only when performance is reported.

8. Participative Management:

The function of responsibility accounting system becomes more effective if participative or democratic style of management is followed, wherein, the plans are laid or budgets/ standards are fixed according to the mutual consent and the decisions reached after consulting the subordinates. It provides motivation to the workers by ensuring their participation and self imposed goals.

9. Management by Exception:

It is a well accepted fact that at successive higher levels of management in the organizational chain less and less time is devoted to control and more and more to planning. Thus, an effective responsibility accounting system must provide for management by exception, i.e., it should focus attention of the management on significant deviations and not burden them with all kinds of routine matters, rather condensed reports requiring their attention must be sent to them particularly at higher levels of management.

10. Human Aspect of Responsibility Accounting:

'The aim of responsibility accounting is not to place blame. Instead it is to evaluate the performance and provide feedback so that future operations can be improved'. Goals and objectives are achieved through people and, hence, responsibility accounting system should

motivate people. It should be used in positive sense. It should not be taken as a device to punish subordinates.

Steps involved in Responsibility Accounting

The purpose of all these steps is to assign responsibility to different individuals so that the performance is improved. In case the performance is not up to their targets set, then responsibility may be fixed for it. Responsibility accounting will certainly act as control device and it will help in improving the overall performance of the business. Following are the important steps followed in responsibility accounting:

1. The organisation is divided into various responsibility centres each responsibility centre is put under the charge of a responsibility manager. The managers are responsible for the performance of their departments.

2. The targets of each responsibility centre are set in. The targets or goals are set in consultation with the manager of the responsibility centre so that he may be able to give full information about his department. The goals of the responsibility centres are properly communicated to them.

3. The actual performance of each responsibility centre is recorded and communicated to the executive concerned and the actual performance is compared with goals set and it helps in assessing the work of these centres.

4. If the actual performance of a department is less than the standard set, then the variances are conveyed to the top management. The names of those persons who were responsible for that performance are also conveyed so that responsibility may be fixed.

5. Timely action is taken to take necessary corrective measures so that the work does not suffer in future. The directions of the top level management are communicated to the concerned responsibility centre so that corrective measures are initiated at the earliest.

Requirements of Effective Responsibility Accounting

Responsibility accounting can be exercised by all kinds of business, whether small or large, private or public, manufacturing or nonmanufacturing. However, it can succeed only when an

enterprise is prepared for it. It needs an attitudinal change and a well-united organization. One of the distinctive features of responsibility accounting is that it is concerned with people and hence relates to behavioral and motivational aspects. Thus, in order to implement this system, above mentioned aspect has to be fully understood by the management otherwise; any flaw on this will lead to adverse impacts. Largely, the responsibility accounting does not control but provides or equips the managers with the means of control. It is specifically mentioned and focused because it is people who are controlled through the means and not the reports or financial statements. The following are some of the important requirements of an effective responsibility accounting system:

- A sound and well-designed organization structure with strictly defined authority and responsibility should exist.
- The organization should be divided into well-defined different responsibility centres.
- Development of accurate and effective budgets keeping in view the opinions of the concerned managers as well as requirements.
- The responsibility accounting system so adopted ought to have full support from the higher authorities of the organization.
- The system so designed and implemented should be understood by the managers fully and thus should provide support as well for its effective operation.
- A conducive organizational environment and progressive management attitude should exist.

RESPONSIBILITY CENTRES

A small organization or a firm can be managed by an individual or a small group of people .But the functions and operations of a large organization are difficult to carryout, manage and supervise by an individual or a few individuals. For effective control of its operations, a large organization has to be divided into meaningful segments or Units such as divisions, departments, branches and soon. Each unit has certain activities to perform; the managers of each unit are assigned specific authority and responsibility to carry them out, the units of an enterprise for the purpose of control are called Responsibility Centres or Decision Centres. A Responsibility Centre is a unit of an organization under the supervision of a manager who has the responsibility for the activities of that responsibility centre. In other words, a responsibility centre can be defined as an organizational unit with a specific purpose to be

fulfilled under the supervision of the given manager who solely bears the responsibility for its performance. Responsibility centres can be classified by the scope of responsibility assigned and decision-making authority given to individual managers.

The following are the four common types of responsibility centres:

1. Cost Center: A cost or expense centre is a segment of an organisation in which the managers are held responsible for the cost incurred in that segment but not for revenues. Responsibility in a cost centre is restricted to cost. For planning purposes, the budget estimates are cost estimates; for control purposes, performance evaluation is guided by a cost variance equal to the difference between the actual and budgeted costs for a given period. Cost centre managers have control over some or all of the costs in their segment of business, but not over revenues. Cost centres are widely used forms of responsibility centres. In manufacturing organisations, the production and service departments are classified as cost centre. Also, a marketing department, a sales region or a single sales representative can be defined as a cost centre. Cost centre may vary in size from a small department with a few employees to an entire manufacturing plant. In addition, cost centres may exist within other cost centres.

2. Revenue Centre: A revenue centre is a segment of the organisation which is primarily responsible for generating sales revenue. A revenue centre manager does not possess control over cost, investment in assets, but usually has control over some of the expense of the marketing department. The performance of a revenue centre is evaluated by comparing the actual revenue with budgeted revenue, and actual marketing expenses with budgeted marketing expenses. The Marketing Manager of a product line or an individual sales representative is examples of revenue centres.

3. Profit Centre: A profit centre is a segment of an organisation whose manager is responsible for both revenues and costs. In a profit centre, the manager has the responsibility and the authority to make decisions that affect both costs and revenues (and thus profits) for the department or division. The main purpose of a profit centre is to earn profit. Profit centre managers aim at both the production and marketing of a product. The performance of the profit centre is evaluated in terms of whether the centre has achieved its budgeted profit. A division of the company which produces and markets the products may be called a profit centre. Such a divisional manager determines the selling price, marketing programmes and

production policies. Profit centres make managers more concerned with finding ways to increase the centre's revenue by increasing production or improving distribution methods. The manager of a profit centre does not make decisions concerning the plant assets available to the centre. For example, the manager of the sporting goods department does not make the decisions to expand the available floor space for the department.

4. Investment Centre: An investment centre is responsible for both profits and investments. The investment centre manager has control over revenues, expenses and the amounts invested in the centre's assets. He also formulates the credit policy which has a direct influence on debt collection, and the inventory policy which determines the investment in inventory. The manager of an investment centre has more authority and responsibility than the manager of either a cost centre or a profit centre. Besides controlling costs and revenues, he has investment responsibility too. 'Investment on asset' responsibility means the authority to buy, sell and use divisional assets.

ADVANTAGES OF RESPONSIBILITY ACCOUNTING

The following points highlight the top five advantages of responsibility accounting:

1. Assigning of Responsibility: Each and every individual in the organisation is assigned some responsibility and they are accountable for their work. Everybody knows what is expected of him. The responsibility can easily be identified and satisfactory and unsatisfactory performances of various persons are known. Nobody can shift responsibility to anybody else if something goes wrong. So, under this system responsibility is assigned individually.

2. Improves Performance: The assigning of tasks to specific persons acts as a motivational factor too. The person's in-charge for different activities knows that their performance will be reported to the top management. They will try to improve their performance. On the other hand, it acts as a deterrent for low performance also because persons know that they are accountable for their work and they will have to explain for their low performance.

3. Helpful in Cost Planning: Under the system of responsibility accounting, full information is collected about costs and revenues. This data is helpful in planning of future costs and revenues, fixing of standards and preparing of budgets.

4. Delegation and Control: This system enables management to delegate authority while retaining overall control. The authority is delegated according to the requirements of the task assigned. On the other hand, responsibility of various persons is fixed which is helpful in controlling their work. The control remains with top management because performance of every cost centre is regularly reported to it. So management is able to delegate authority and at the same time to retain control.

5. Helpful in Decision-Making: Responsibility accounting is not only a control device but also helpful in decision-making. The information collected under this system is helpful to management in planning its future actions. The past performance of various cost centres also helps in fixing their future targets. So this system enables management to take important decisions. In the end, we may conclude that the technique of responsibility accounting is useful for all types of enterprises—big and small, profit and nonprofit, government and non-government, etc. But the system of responsibility accounting may differ from organisation to organisation. Further, in spite of so many advantages, it must be remembered that it can never be a substitute for a good management as it is merely a tool to be used effectively by the management.

LIMITATIONS OF RESPONSIBILITY ACCOUNTING

Responsibility accounting suffers from the following-limitations:

1. The prerequisites for a successful responsibility accounting system are:

(a) A sound organizational structure where divisions can be identified clearly as responsibility centre.

(b) Proper delegation of work and responsibility.

(c) A proper system of reporting.

If these conditions are absent it is difficult to have a responsibility accounting system.

2. The traditional way of classification of expenses needs to be subjected to a further analysis which becomes difficult.

3. In introducing the system certain managers may require additional classification particularly if the responsibility reports are different from routine reports.

BUDGETING

The budget is the plan which intends to figure out expected operations revenue and expenses of an organization for a future time period. In other words for business, entity budgeting is the process of preparing a detailed statement of financial results that are projected for a certain period of time. It is to estimate the future while taking the management inputs considering internal and external factors of the organization.

In every organization, the finance department plays a key role in the preparation of the budget in consultation with higher management. It is a document, which is referred for the health check of the organization during the budgeted period.

The budget is prepared to carry out various functions like planning activities, developing projects, testing and implementing programs, etc. There are various such functions for which an entity prepares it. This can increase the chances of making profits within the given environment and help the decision-making process of management. In other terms, a budget is an organizational plan stated in monetary terms.

PERFORMANCE BUDGETING

Performance budgeting is a method of budgeting that provides the purpose and objectives for which funds are needed, costs of programs and related activities proposed to accomplish those objectives and outputs to be produced or services to be rendered under each program (Shah, 2007). Performance budgeting follows the validation that a relaxation of input controls and an increased flexibility enhances managers' performance as long as results are measured and managers are held responsible for their results. The major aim of performance budgeting is to improve the efficiency of public expenditure, by linking the funding of public sector organizations to the results they deliver. It adopts organized performance information (indicators, evaluations, program costing) to make this link. There is a good impact of performance budgeting on organizations in terms of improved prioritization of expenditure, and in improved service effectiveness.

Theoretical literature denotes that as compared to traditional budgeting, performance budgeting facilitates for more flexible use of economic resources and transforms focus from inputs to results. Performance budget focuses on the results to be accomplished. The performance budget, given its program structure, changes the focus of conversation from detailed line items to broader objectives and performance of public programs, and allows more conversant budgetary decision-making. Performance budget presents greater managerial suppleness by providing the program or department manager a fixed lump sum distribution that may be used for various needs in order to accomplish the agreed upon results in service delivery. Performance budgeting is more than introducing performance information into the budget process. Main characteristic of the new performance budgeting procedure is the identification that, if performance is the mater, the objectives of the budget management system must be incorporated with overall responsibility, so that good budgetary performance is compensated, and poor performance is punished.

Performance Based Budgeting tries to resolve issues related to decision making problems. Performance may be judged by certain programs ability to attain objectives that contribute to a more abstract goal as calculated by that programs ability to use resources efficiently by linking inputs to outputs.

Features of performance budgeting

A performance budget has the following features:

1. It is based on functions, programmes and activities.

2. The total operations are subdivided into functions or tasks or activities.

3. For each task or activity the objective is determined.

4. For measuring the work or task, suitable methods or norms are established.

5. Targets are set for each programme or activity both in terms of money value and physical quantities.

6. It introduces a system approach to budgeting.

7. It is widely used in public sector enterprises and in government departments.

STEPS IN PERFORMANCE BUDGETING

Performance budgeting is a technique or a method employed by any agency/department. The first stage is to decide what its goal or objective should be, the next stage is to decide on a set of programmes in order to achieve the goal and then to implement the programme. Final stage is to evaluate the actual performance of each segment and its contribution towards achievement of its goal.

Steps in Performance budgeting:

(a) Formulation of objectives of the agency/department.

(b) Identification of various programmes or projects, which will help the agency to achieve its objective.

(c) Evaluation of the programmes in terms of benefits that they produce compared to the resources that they consume.

(d) Selection of the programmes on the basis of cost benefit analysis in order to utilize the funds in the optimal manner.

(e) Development of performance criteria for the various programmes (suitable work measurement units, norms, yardsticks, standards, and other performance indicators).

(f) Preparation of long-term physical as well as financial plans.

(g) Preparation of the annual budget.

(h) Assessment of performance of each programme and by each responsibility unit and comparison of the same with the budget.

(i) Undertaking periodical review of programmes with a view to assess the strengths and weaknesses and make modification, if necessary.

ADVANTAGES OF PERFORMANCE BUDGET

Performance budgeting presents the following advantages:

(a) All the activities of a firm can easily be analyzed and the unimportant activities may be eliminated.

(b) In case of shortage or insufficient funds, proper allocation of funds can be made to various activities as per importance.

(c) Performance budgeting invites performance audit in the firms;

(d) It helps to attain the objectives of the firm in a scientific manner;

(e) This budgeting system motivates to improve performance since input-output relationship is maintained.

(f) Correct steps can easily be taken since continuous comparisons can be made between the target and the actual performance.

Disadvantages of Performance Budget

The disadvantages of Performance Budgeting are:

(a) The success or failure of performance budgeting depends on a well-established accounting system.

(b) The workers and employees of an organisation are not interested rather resist it for its introduction as they are to work hard and more.

(c) It is not always possible to ascertain appropriate activity in an organisation.

(d) It invites lots of money and time and energy since various activities are expressed in physical units.

Difference between Traditional Budget and Performance Budget

Traditional Budget	Performance Budget
1. The objective of traditional budgeting expresses that the actual expenditure cannot exceed the budgeted allocations for the same.	1. The objective of performance budgeting is, however, to have the performance as shown within the budget allocations.
2. The traditional budget gives more emphasis on the financial aspect rather than physical aspect. So it is difficult to achieve and to measure the performance in relation to physical units and related cost of such units.	2. Performance budget, on' the other hand, aims at establishing the relationship between the inputs and the outputs.
3. Usually traditional budgets are prepared for different items of expenditure viz., Salaries, Stores & Material, Rent, Rates and Taxes etc.	3. In performance budgeting main focus is to be given on the purpose for which the expenditure is incurred and not on each item of expenses.
4. Traditional budget is not so effective while controlling activities at the time of preparing budget. It cannot measure the performance criteria.	4. Performance budgeting is no doubt, more effective to control various activities since it measures the input-output relation-ship.
5. Traditional budget is prepared on the basis of last year's performance with some addition and alterations (i.e., after some adjustments).	5. Performance budget is prepared on the basis of actual need of the organisation i.e., on the basis of job analysis.

ZERO-BASED BUDGETING (ZBB)

Meaning and definition

Zero-based budgeting is a method of budgeting in which all expenses must be justified and approved for each new period. Zero-based budgeting is the method of developing a budget from scratch, or "zero bases", by examining every cost and expense to see if they are essential to the company's operations without regard to prior years' activities. Zero based budgeting in management accounting involves preparing the budget from the scratch with a zero-base. It involves re-evaluating every line item of cash flow statement and justifying all the expenditure that is to be incurred by the department.

Zero-based budgeting defined as a method of budgeting whereby all the expenses for the new period are calculated on the basis of actual expenses that are to be incurred and not on the differential basis which involves just changing the expenses incurred taking into account change in operational activity. Under this method, every activity needs to be justified, explaining the revenue that every cost will generate for the company.

Leonard Mereunit and Stephen Sosmick define, “ZBB is a technique, which complements and links the existing planning, budgeting and review processes, it identifies alternative efficient methods of utilizing limited resources in effective attainment of selected benefits. It is a flexible management approach, which provides credible rationale for reallocating resources by focusing on the systematic review and justification of the funding and performance levels of current programmes or activities.”

Developed by Peter Pyhrr in the 1970s, zero-based budgeting starts from a "zero base" at the beginning of every budget period, analyzing needs and costs of every function within an organization and allocating funds accordingly, regardless of how much money has previously been budgeted to any given line item.

ZBB is a new approach to budgeting, it is defined by Peter A. Pyhor as an “operating planning and budgeting process, which requires each manager to justify his entire budget in detail from scratch (hence zero-base) and shifts the burden of proof to each manager to justify why he should spend any money at all.”

Features of zero base budgeting:

The essential features of ZBB are as follows:

Zero-base: ZBB works on the principle that every year, the projected expenditure for each project/programme must be start from zero. It means all budget requests should be considered freshly for every year with cost-benefit analysis. ZBB never uses the previous year’s amounts so as to eliminate the past mistakes.

Focus is on activities/programmes: The focus is on programs or activities instead of functional departments.

Best suited to discretionary costs: zero base budgeting is the best suited to discretionary costs, for example, advertising, research development and training costs.

Decision packages: A unit makes its budget request by preparing 'decision packages' for each activity it undertakes. Funding decisions are based on activity.

Cost-effective: ZBB helps policy makers to achieve more cost-effective delivery of public services.

Bottom-up approach: ZBB starts from the lowest level activity and then moves upwards.

Accountability: It makes the functionaries accountable for the amount they are responsible for.

ZBB model was formulated to correct certain flaws of traditional budgeting system, which does not allow authorities to discover optional processes.

PROCESS/ STEPS OF ZBB:

The following steps are implied in ZBB:

The managers at all levels have to determine the objective of each programme of activity that they supervise and prepare alternative spending plans as 'decision packages'.

1. Identifying the decision units that need a justification for every line item of expenditure in the proposed budget.

2. Preparing Decision Packages*. Each decision package is an identifiable and separate activity. These decision packages are connected with the objectives of the company.

3. The next step in ZBB is to rank the decision packages. This ranking is done on the basis of cost-benefit analysis.

4. Finally, funds are allocated on the basis of the above findings by following a pyramid ranking system to ensure maximum results.

*Decision packages mean self-contained proposals or module seeking funds. Each decision package comprises the explanation of the activity, the amount involved, the need for the item, the benefit arising from the implementation of the proposal, the expected loss that may be incurred if it is not done and much more.

ADVANTAGES OF ZERO BASED BUDGETING

Efficiency: Zero-based Budgeting helps a business in the allocation of resources efficiently (department-wise) as it does not look at the previous budget numbers, instead looks at the actual numbers.

Accuracy: Against the traditional budgeting method that involves mere some arbitrary changes to the earlier budget, this budgeting approach makes all departments relook every item of the cash flow and compute their operation costs. This methodology helps in cost reduction to a certain extent as it gives a true picture of costs against the desired performance.

Budget inflation: As mentioned above every expense is to be justified. Zero-based budget compensates the weakness of incremental budgeting of budget inflation.

Coordination and Communication: Zero-based budgeting provides better coordination and communication within the department and motivation to employees by involving them in decision-making.

Reduction in redundant activities: This approach leads to identify optimum opportunities and more cost-efficient ways of doing things by eliminating all the redundant or unproductive activities

DISADVANTAGES OF ZERO BASED BUDGETING

High Manpower Turnover: The foundation of zero-based budgeting itself is a zero. Budget under this concept is planned and prepared from the scratch and require the involvement of a large number of employees. Many departments may not have adequate human resource and time for the same.

Time-Consuming: This Zero-based budgeting approach is a highly time-intensive for a company to do annually as against incremental budgeting approach, which is a far easier method.

Lack of Expertise: Providing an explanation for every line item and every cost is a problematic task and requires training for the managers.

TRADITIONAL BUDGETING VS ZERO-BASED BUDGETING

Basis for Comparison	Traditional Budgeting	Zero-Based Budgeting
Meaning	Traditional Budgeting alludes to a technique of preparing budget that takes immediately preceding year's budget as a base.	Zero-based budgeting means a budgeting method, whereby whenever the budget is set, the activities are re-evaluated.
Focuses on	Previous level of Expenditure	New economic appraisal
Orientation	Accounting oriented	Decision or project oriented
Justification	Justification of current project is not required.	Justification of current and proposed projects is required, considering benefits and costs.
Justification Authority	Justification is given by top management for the particular decision unit	Justification is given by the manager for the particular decision unit.
Priority	Mainly to past level of spending, then to demand for inflation and new programs.	Decision unit is divided into comprehensive decision packages, and ranked as per their relevance.
Clarity and Responsiveness	Lower	Comparatively higher
Approach	Routine Approach	Straight forward Approach

ACTIVITY-BASED BUDGETING (ABB)

Meaning: Activity-based budgeting (ABB) is a system that records, researches, and analyzes activities that lead to costs for a company. Every activity in an organization that incurs a cost is scrutinized for potential ways to create efficiencies. Budgets are then developed based on these results. Activity-based budgeting (ABB) is more rigorous than traditional budgeting processes, which tend to merely adjust previous budgets to account for inflation or business development.

Activity-based budgeting (ABB) is a method of budgeting where activities that incur costs are recorded, analyzed and researched. It is more rigorous than traditional budgeting processes, which tend to merely adjust previous budgets to account for inflation or business

development. Using activity-based budgeting (ABB) can help companies to reduce costs and, as a result, squeeze more profits from sales. This method is particularly useful for newer companies and firms undergoing material changes.

Definition: Activity-based budgeting is most often found in cost accounting. Managers prepare budgets and spending propositions based on past production activities. In other words, management examines the costs of performing certain activities, like bending a fender for a car, to budget the overall costs of producing a product.

CIMA Official Terminology describes activity-based budgeting (ABB) as a method of budgeting based on an activity framework, using cost driver data in the budget setting and variance feedback processes.

Activity-Based Budgeting is a budgeting process where the firm first identifies, analyzes and researches the activities that determine the cost the company and thereafter prepares the budget based on the results.

ADVANTAGES OF ACTIVITY-BASED BUDGETING

1. Provides realistic costs of manufacturing for specific products.

2. Allocates manufacturing overhead more accurately to products and processes that use the activity.

3. Identifies inefficient processes and target for improvements.

4. Determines product profit margins more precisely.

5. Discovers which processes have unnecessary and wasted costs.

6. Offers better understanding and justification of costs in manufacturing overhead.

DISADVANTAGES OF ACTIVITY-BASED BUDGETING

1. Collection and preparation of data is time-consuming.
2. Costs more to accumulate and analyze information.

3. Source data isn't always readily available from normal accounting reports.

4. Reports from ABC don't always conform to generally accepted accounting principles and can't be used for external reporting.

5. Data produced by ABC may conflict with managerial performance standards previously established from traditional costing methods.

6. May not be as useful for companies where overhead is small in proportion to total operating costs.

TRADITIONAL BUDGETING VS ACTIVITY-BASED BUDGETING

Traditional budgeting	Activity-based budgeting
Focuses on the cost elements themselves.	Focuses on output and work done.
Employs accounting terminology.	Employs the languages of the activities done.
Considers variable cost and fixed cost.	Considers utilized and utilized capacity.
Controls performance.	Controls processes or activities.
Simple.	Complex**.**

SOCIAL COST-BENEFIT ANALYSIS (SCBA)

Social cost-benefit analysis is a systematic and cohesive economic tool (method) to survey all the impacts caused by an urban development project. It comprises not just the financial effects (investment costs, direct benefits like tax and fees, et cetera), but all the social effects, like: pollution, safety, indirect (labour) market, legal aspects, et cetera. The main aim of a social cost-benefit analysis is to attach a price to as many effects as possible in order to uniformly weigh the above-mentioned heterogeneous effects. As a result, these prices reflect the value a society attaches to the caused effects, enabling the decision maker to form a statement about the net social welfare effects of a project.

Knowledge about economic models/tools such as the social cost-benefit analysis can help the urban planner to systematically survey all the relevant (socio-economic) impact caused by an urban development and security threats. This insight will help the responsible urban planners to make the best choices from a socio-economic point of view. The economic analysis in

project appraisal for evaluating investment projects an important consideration is the analysis of social cost and benefits. In this analysis, the direct economic benefits and cost of the project on distribution of income in society, level of savings and investments in society, the contribution of the project towards fulfillment of certain merit-wants (e.g. employment, social orders, self-sufficiency etc.) are analyzed.

Thus SCBA is also referred to as economic society benefit analysis, is a part of the economic analysis in project appraisal. It is a methodology developed for evaluating investment projects from the point of view of the society (or economy) as a whole.

SCBA is used primarily for evaluating public investments and has received increased emphasis in recent years due to the growing importance of public investments especially in developing countries where government play significant role in economic development. SCBA is also relevant in major private investments, which require governmental approval since these investments have bearing on national considerations.

Meaning of SCBA

The SCBA is a decision support tool that measures and weighs various impacts of a project or policy. It compares project costs (capital and operating expenses) with a broad range of (social) impacts, e.g. travel time savings, travel costs, impacts on other modes, climate, safety, and the environment. Also impacts on property values and economic impacts can be analyzed.

Decision planners and economists have been using and improving Social Cost Benefit Analysis (SCBA) tool for over a decade. The tool supports decision makers in various policy areas like transport economics (individual and collective transport measures, cycling, rail, highways, waterways, and airports), (renewable) energy, spatial development, water management and tourism.

The output of the SCBA tool indicates weather benefits outweigh costs of certain projects and allow for comparison of different (variations of) measures. Outputs indicate which measure has the highest 'social yield', to what extent goals are reached, which side effects occur and to which parties' costs and benefits accrue.

"Social Cost Benefit Analysis" (SCBA) is a tool to determine merits of a project on the basis of current and future socio-economic impacts." SCBA is a systematic and formal method of evaluation of the project in terms of Costs and Benefits. Social cost-benefit analysis refers to cases where the project has a broad impact across society and, as such, is usually carried out by the government.

In Amsterdam the SCBA tool was used to assess the impacts of several options for bridging the IJ-river which divides the city centre and the rapidly growing neighbourhood of Amsterdam North. The current use of ferries is stretched to its limits. Several options for bridges, tunnels, cable cars and extended ferry operations were compared. A combination of a bridge and extended ferry operations proved to be the best option in terms of costs and benefits for all stakeholders and was decided on by City-council. Input Data Depends on the project and expected impacts. Common inputs are cost calculations, traffic forecasts etc.

FEATURES OF SCBA

The main features of SCBA are as follows:

It is the evaluation of project from the social point of view.

It involves the identification and comparison of social costs and benefits.

It involves measurement of costs and benefits.

The selection of project is based on the net economic benefits

The methods used in SCBA are (a) economic rate of return (b) domestic resource cost (c) effective rate of protection (d) investment to employment ratio etc.

OBJECTIVES OF SCBA

The objective of SCBA is to resolute monetary benefits of any project in view of shadow prices, how projects influence savings and investment of people in the society, the influence of the project on the money distribution in the society. It is also essential to review how certain parameters such as employment, self-sufficiency would be fulfilled if the project is executed. For the purpose of SCBA all the costs must be expressed in terms of shadow prices,

by subtracting transfer payments, such as taxes, duties from the financial costs and benefits. This is possible by applying the shadow exchange rate before converting costs into shadow prices.

It is important to identify all direct and indirect economic costs both tangible and intangible as well as benefits to assure a fair and reasonable choice of project and to assure its effective implementation. The same applies to non-quantifiable, intangible costs and benefits. The most obvious are environmental and social costs and benefits, though institutional, political and others are often also not insignificant. The main focus of Social Cost Benefit Analysis is to determine:

1. Economic benefits of the project in terms of shadow prices;
2. The impact of the project on the level of savings and investments in the society;
3. The impact of the project on the distribution of income in the society

4. Correlation to national planning.

5. Consequences on employment and output.

6. Consumption, savings, Foreign exchange earnings, income etc.

7. Distribution and relevant things to national objectives.

8. The contribution of the project towards the fulfillment of certain merit wants (self-sufficiency, employment etc).

STEPS IN SOCIAL COST BENEFIT ANALYSIS

We all know it's quite simple to make an investment decision when the benefits overshadow the costs, but only a few of us know the other key elements that go into the analysis. The steps to create a meaningful social-Cost-Benefit Analysis model are:

1. Set the framework for the analysis. Specify the program or policy change and the current status quo, or the state of the world before implementation compared to after.

2. Decide whose costs benefits should be recognized. You need to determine the geographic scope of the analysis in order to limit the groups impacted by the policy.

3. Identity and categorize costs and benefits. It is important to label costs and benefits as direct (intended costs/benefits)/indirect (unintended costs/benefits), tangible (easy to measure and quantify)/intangible (hard to identify and measure), and real (anything that contributes to the bottom line net-benefits)/transfer (money changing hands) in order to ensure that you understand the effects of each cost and benefit.

4. Project costs and benefits over the life of the program. Assess how costs and benefits will change each year. It is important to do this even before you begin to place numbers on things.

5. Monetize costs. Make sure to place all costs in the same unit.

6. Monetize benefits. Make sure to place all benefits in the same unit.

7. Discount costs and benefits to obtain present values. This means converting future costs and benefits into present value. This is also known as the social discount rate, or the rate at which society makes tradeoffs over time. Every agency tends to have a different discount rate. It generally ranges between 2-7%.

8. Compute net present values. This is done by subtracting costs from benefits. The policy is considered efficient if a positive result is produced; however, it is important to think about the policy's feasibility and social justice.

9. Perform sensitivity analysis. This step allows you to check the accuracy of your estimates and assumptions. This is normally done by altering the social discount rate utilized, by increasing it and decreasing it. If you still get a positive number during this step, then the policy should be accepted. If you get a negative number during this step, then you should calculate where the balancing point is zero.

10. Make a recommendation. Assess all results and account for other qualitative considerations.

BASIC APPROACHES TO SCBA

There are two important approaches in SCBA:

1. UNIDO approach 2. L-M approach

1. UNIDO approach: This approach is mainly based on the publication of UNIDO (United Nation Industrial Development Organization) named Guide to Practical Project Appraisal in 1978. UNIDO approach was first articulated in the Guidelines for Project Evaluation which provides a comprehensive framework for SCBA in developing countries. UNIDO approach is based largely on the latter publication though at places we will draw on the former publication too.

- Measures cost and benefits in terms of domestic rupees
- Measures cost and benefits in terms of consumption.
- Focuses on efficiency, savings and redistribution aspects in different stages.

Stages involved in UNIDO Approach: The UNIDO approach of Social Cost Benefit Analysis involves five stages:¬

1. Calculation of financial profitability of the project measured at market prices.
2. Obtaining the net benefit of the project at shadow (efficiency) prices (Objective of SCBA-1).
3. Adjustment for the impact of the project on Savings & Investment (Objective of SCBA-2).
4. Adjustment for the impact of the project on Income Distribution (Objective of SCBA-3).
5. Adjustment for the impact of the project on Merit and Demerit Goods whose social values differ from their economic values (Objective of SCBA-4).

Calculation of financial profitability of the project¬ a good technical and financial analysis must be done before a meaningful economic (social) evaluation can be made so as to determine financial profitability.¬Financial profitability is indicated by the Net Present Value (NPV) of the project, which is measured by taking into account inputs (costs) and outputs (benefits) at market price.

Obtaining the net benefit of the project at economic (shadow) prices¬ The Commercial Profitability analysis (calculated in stage - 1) would be sufficient only if the Project is operated in perfect market. Because, only in a perfect market, market prices can

reflect the social value. If the market is imperfect (most of the cases in reality), net benefit of the Project is determined by assigning shadow prices to inputs and outputs.¬Therefore, developing shadow prices is very much vital.

Shadow Prices reflect the real value of a resource (input or output) to society.¬Shadow Prices are also referred as economic prices, accounting prices, economic/accounting efficiency prices etc.¬Shadow Prices can be defined as the value of the contribution to the country's basic socio-economic objectives made by any marginal change in the availability of commodities (output) or factor of production (input).Using shadow prices for the resources to arrive at the net benefit of the project at economic prices.

2. L-M approach: The second approach mentioned is the Little - Mirrlees Approach. This approach was developed by Little and James A. Mirrlees who came up with the Manual Industrial Project Analysis in Developing Countries in 1968 for the Development Centre of the Organization for Economic Cooperation and Development (OECD). Students are encouraged to read further into these two different approaches. The LM Approach provides a comprehensive framework for SCBA in developing countries. In this regard there are following two publications:

1. Manual of Industrial Project Analysis in Developing Countries, Vol. II and

2. Project Appraisal and Planning for Developing Countries. The approach has been named on the basis of their developers i.e. L. M. D. Little and J. A. Mirrlees.

Similarities between UNIDO and LM Approaches

The approach developed by Little and Mirrlees for social cost benefit analysis is considerably similar to that of the UNIDO approach. The following are some of the similarities:

1. Calculation of accounting (shadow) prices for foreign exchange savings and unskilled labor.

2. Consideration of factor of equity.

3. Usage of discounted case flow analysis. It means under both the approaches, the cash flows are taken at their present value after applying discount factor

Differences between UNIDO and LM Approaches

The following are the major items of differences between both the approaches.

1. Domestic Prices vs. International Prices: L and m approach measures costs and benefits in terms of international prices (border prices) whereas the UNIDO approach measures cost and benefits in term of domestic rupees.

2. Social Income vs. Consumption: L and m approach measures costs and benefits in terms of uncommitted social income whereas the UNIDO approach measures costs and benefits in terms of consumption.

3.Stage-Wise vs. Efficiency, etc.: The L and M approach considers efficiency, savings and redistribution together for analysis whereas in UNIDO these considerations are looked into and done in different stages.

As a part of SCBA, in order to calculate the costs and benefits of the project, market values of inputs and outputs are used. But these market values may not reflect their true value. That is why shadow prices are used. Now in the process of production of goods and services, domestic as well as imported goods are used. Similarly the benefits may also be in two prices. In order to avoid this problem professor I. M. Little and James Mirrlees advocated the use of world prices.

PRACTICAL PROBLEMS AND LIMITATIONS OF SCBA

The problems with social cost-benefit analysis in three areas -- economics, ethics and politics. Following are the main problems and limitations of SCBA:

Problems in economics are empirical, methodological or theoretical dilemmas that make a social cost-benefit analysis difficult to prepare and interpret.

Problems in ethics stem from the value judgments implicit in a social cost-benefit analysis that may be in conflict with the ethical beliefs of some individuals in society.

Problems in politics stem from the various powers of individuals in a political process and challenge the relevancy of analysis.

It is often challenging for business managers to establish a balance between financial gain and social welfare.

Overstatement of the significance of social benefits.

Conversion of social benefits into monetary units is also a problem area in SCBA

Future will be always uncertain: Natural Uncertainty about the future scenarios and their probabilities•

Evaluation itself consumes resources: Problem of attainability of highly skilled evaluators (auditors), problem of valuation plug-in data and problem of effects forecasts.

MODERN PRODUCTION MANAGEMENT TECHNIQUES ORIGINATING FROM JAPAN

In the post-World War II era a set of Japanese cultural patterns and managerial practices came to be known collectively as the Japanese management style or Japanese management techniques. Many of these techniques were credited with helping vault the Japanese economy to its status as the world's second largest, behind only the United States, and with making Japanese businesses, particularly in the manufacturing sector, more competitive than their international counterparts. In the wake of Japan's prolonged and arduous struggle with recession throughout much of the 1990s, however, many observers—both inside and outside Japan—have called into question the effectiveness of some traditional Japanese management practices. As a result, at the dawn of the 21st century Japanese management techniques are more than ever in a state of flux, as scholars and business leaders alike reconsider which practices work and which don't.

Japanese production management (JPM) became a dominant influence in the field of operations management when, in the early 1980s, knowledge of its main elements became known beyond Japan. Those elements – quick set-up, small lots, cells, kabana, and so on – are well known. Rather than explaining them again, this paper's objective is to explore the sequence of events leading to JPM as a competitive force globally, as well as its impact on theory and practices in operations management. JPM's evolution includes shifting

terminologies, fusions and adulterations; limited extensions from manufacturing into services and innovative enhancements, largely of Western origin. Longitudinal research data, based on inventory trends, provide insights on JPM's diffusions and its uneven results. Latter-day puzzling lapses and disappointments, among Japanese as well as Western companies, raise questions about JPM's sustainability, as well as some of its changing manifestations. While the core of Japanese production management, now over three decades old, appears to have become solidly main stream, its current and future states are problematic.

Several production management techniques have been developed in recent times. Most of these techniques have been originated from Japan.

The important techniques are Flexible Manufacturing System and Total Quality Management.

FLEXIBLE MANUFACTURING SYSTEM (FMS)

This concept is credited to David Williamson, a British engineer during mid- 1960s. In late 1960s the first FMS machining system was installed at Ingersoll-Rand Company in Virginia. Germany implemented its first FMS in 1969, in cooperation with the University of Stuttgart. Russia and Japan implemented FMS in 1972.

In the middle of the 1960s, market competition became more intense. During 1960 to 1970 *cost* was the primary concern. Later *quality* became a priority. As the market became more and more complex, *speed of delivery* became something customer also needed. A new strategy was formulated: *Customizability*. The companies have to adapt to the environment in which they operate, to be more *flexible* in their operations and to satisfy different market segments (customizability).

Thus the innovation of FMS became related to the effort of gaining competitive advantage. First of all, FMS is a manufacturing technology. Secondly, FMS is a philosophy. "System" is the key word. Philosophically, FMS incorporates a system view of manufacturing. The buzz word for today's manufacturer is "agility". An agile manufacturer is one who is the fastest to the market, operates with the lowest total cost and has the greatest ability to "delight" its customers. FMS is simply one way that manufacturers are able to achieve this agility. An MIT study on competitiveness pointed out those American companies spent twice as much

on product innovation as they did on process innovation. Germans and Japanese did just the opposite. In studying FMS, we need to keep in mind what Peter Drucker said: "We must become managers of technology not merely users of technology". Since FMS is a technology, well-adjusted to the environmental needs, we have to manage it successfully.

The concept of flexible manufacturing was developed by Jerome H. Lemelson (1923-97), an American industrial engineer and inventor who filed a number of related patents in the early 1950s. His original design was a robot-based system that could weld, rivet, convey, and inspect manufactured goods. Systems based on Lemelson's FMS inventions debuted on factory floors in the U.S. and Europe in the late 1960s and proliferated in the 1970s. A flexible manufacturing system may include a configuration of interconnected processing workstations with computer terminals that process the end-to-end creation of a product, from loading/unloading functions to machining and assembly to storing to quality testing and data processing. The system can be programmed to run a batch of one set of products in a particular quantity and then automatically switch over to another set of products in another quantity.

MEANING OF FMS

A flexible manufacturing system is an automated machine cell, consisting of a group of processing workstations, interconnected with automated material handling and storage system.

A flexible manufacturing system (FMS) is a manufacturing system in which there is some amount of flexibility that allows the s to react in case of changes, whether predicted or unpredicted. This flexibility is generally considered to fall into two categories, which both contain numerous subcategories.

A flexible manufacturing system (FMS) is a production method that is designed to easily adapt to changes in the type and quantity of the product being manufactured. Machines and computerized systems can be configured to manufacture a variety of parts and handle changing levels of production.

A flexible manufacturing system (FMS) can improve efficiency and thus lower a company's production cost. Flexible manufacturing also can be a key component of a make-to-order

strategy that allows customers to customize the products they want. Such flexibility can come with higher upfront costs. Purchasing and installing the specialized equipment that allows for such customization may be costly compared with more traditional systems.

MEANING OF FLEXIBILITY

Flexibility in manufacturing means the ability to deal with slightly or greatly mixed parts, to allow variation in parts assembly and variations in process sequence, change the production volume and change the design of certain product being manufactured. Today flexibility means to produce reasonably priced customized products of high quality that can be quickly delivered to customers.

When speaking in the context of manufacturing, flexibility is a catch-all term that's used to describe a manufacturing system's ability to make adjustments to better handle nuances like mixed parts, variations in assembly, variations in process sequence, production volume changes, design changes, and other changes. While variations abound in what specifically constitutes flexibility, there is a general consensus about the core elements.

In essence, a FMS is a method used to manufacture and product goods that is able to adapt to changes. Whether these changes involve the addition of a new product types, the modification of existing product types, etc., a FMS can handle these and more. It provides manufacturing companies with a sharp competitive edge over their counterparts who do not use such flexible systems. Even so, however, there are both pros and cons associated with FMS.

Different approaches to flexibility and their meanings are shown in Table:

Approach	**Flexibility meaning**
Manufacturing	The capability of producing different parts without major retooling. A measure of how fast the company converts its process (es) from making an old line of products to produce a new product The ability to change a production schedule, to modify a part, or to handle multiple parts

Operational	The ability to efficiently produce highly customized and unique products
Customer	The ability to exploit various dimension of speed of delivery
Strategic	The ability of a company to offer a wide variety of products to its customers
Capacity	The ability to rapidly increase or decrease production levels or to shift capacity quickly from one product or service to another

The flexibility of a FMS typically falls into two categories: machine flexibility and routing flexibility.

Machine flexibility refers to the system's ability to produce new types of products, and its ability to change the order in which operations are executed.

The second type of flexibility in a FMS, **routing flexibility**, refers to the system's ability to use two or more machines to perform the same task, and the system's ability to handle large-scale changes like significant increase in volume and/or capability.

LEVELS OF MANUFACTURING FLEXIBILITY

There are three levels of manufacturing flexibility. They are as follows:

(a) Basic flexibilities

- Machine flexibility - the ease with which a machine can process various operations.
- Material handling flexibility - a measure of the ease with which different part types can be transported and properly positioned at the various machine tools in a system.
- Operation flexibility - a measure of the ease with which alternative operation sequences can be used for processing a part type.

(**b) System flexibilities**

- Volume flexibility - a measure of a system's capability to be operated profitably at different volumes of the existing part types.
- Expansion flexibility - the ability to build a system and expand it incrementally.
- Routing flexibility - a measure of the alternative paths that a part can effectively follow through a system for a given process plan.
- Process flexibility - a measure of the volume of the set of part types that a system can produce without incurring any setup.
- Product flexibility - the volume of the set of part types that can be manufactured in a system with minor setup.

(c) Aggregate flexibilities

- Program flexibility - the ability of a system to run for reasonably long periods without external intervention.
- Production flexibility - the volume of the set of part types that a system can produce without major investment in capital equipment.
- Market flexibility - the ability of a system to efficiently adapt to changing market conditions.

BASIC COMPONENTS OF FMS

Basic components of an FMS are: workstations, material handling and storage systems, computer control system, and the personnel that manage and operate the system.

Workstations: The types of workstations that may be utilized in FMSs include: load/unload stations, machining and turning stations, other industry-specific processing stations (such as sheet metal fabrication and forging), assembly stations, and supporting stations.

Material handling system: material handling and storage systems for FMS in three sub-sections: functions, equipment, and lay-out configurations. The following functions of the material handling and storage system in FMSs may be noted:

- Allows random, independent movement of work parts between stations so as to allow for various routing alternatives for the different parts in the system.
- Enables handling of a variety of work part configurations by means of pallet fixtures for prismatic parts, and industrial robots for rotational parts.
- Provides temporary storage—small queues of parts awaiting processing may be allowed to build-up in front of each station in the system.
- Provides convenient access for loading and unloading work parts at load and unload stations.
- Creates compatibility with computer control—the handling system must be under the direct control of the computer system which directs it to the various workstations, load/unload stations, and storage areas.

Functions of the material handling and storage system in FMSs include: the allowance of random, independent movement of work parts between stations; the handling of a variety of work part configurations; the provision of temporary storage; the provision of convenient load and unload stations; and the creation of compatibility with computer control.

FMS material handling equipment uses a variety of conventional material transport equipment (see unit 8), in-line transfer mechanisms (see unit 13), and industrial robotics (see unit 6). There is a primary and secondary material handling system used in most FMSs. The primary handling system establishes the FMS lay-out and is responsible for moving parts between stations in the system.

The secondary handling system consists of transfer devices, automatic pallet changers, and other mechanisms to transfer parts from the primary material handling system to the work head of the processing station, or to a supporting station. The secondary handling system is responsible also for the accurate positioning of the part at the workstation, so that the machining process may be performed upon the part in the correct manner. Other purposes of the secondary handling system include: (1) re-orientation of the part if necessary to present the surface that is to be processed; and (2) to act as buffer storage as the workstation, should this be needed.

FMS material handling equipment consists of a primary handling system to establish material handling lay-out, and a secondary handling system to transfer parts from the primary material handling system to the work head of the processing station, or to a supporting station.

There are five categories of FMS layout; these are: in-line layout; loop layout; ladder layout; open field layout; and robot- centered layout.

Computer control system: To operate, the FMS uses a distributed computer system that is interfaced with all workstations in the system, as well as with the material handling system and other hardware components. It consists of a central computer and a series of micro-computers that control individual machines in the FMS. The central computer co-ordinates the activities of the components to achieve smooth operational control of the system. The following control functions may be noted:

- Workstation control—fully automated FMSs use some form of workstation control at each station, often in the form of CNC control
- Distribution of control instructions to workstations—a central computer is required to handle the processing occurring at disparate workstations; this involves the dissemination of part programmes to individual workstations, based upon an overall schedule held by the central computer
- Production control—management of the mix and rate at which various parts are launched into the system is important; alongside data input of a number of essential metrics, such as: daily desired production rates, number of raw work parts available, work-in-progress etc.
- Traffic control—management of the primary handling system is essential so that parts arrive at the right location at the right time and in the right condition
- Shuttle control—management of the secondary handling system is also important, to ensure the correct delivery of the work part to the station's work head
- Work piece monitoring—the computer must monitor the status of each cart or pallet in the primary and secondary handling systems, to ensure that we know the location of every element in the system
- Tool control—this is concerned with managing tool location (keeping track of the different tools used at different workstations, which can be a determinant on where a part can be processed), and tool life (keeping track on how much usage the tool has gone through, so as to determine when it should be replaced) Performance monitoring and reporting—the computer must collected data on the various operations on-going in the FMS and present performance findings based on this
- Diagnostics—the computer must be able to diagnose, to a high degree of accuracy, where a problem may be occurring in the FMS

The computer control system in an FMS has the following functions: workstation control; distribution of control instructions to workstations; production control; traffic control; shuttle control; work piece monitoring; tool control; performance monitoring and reporting; and diagnostics.

Human Resources: Human personnel manage the overall operations of the system. Humans are also required in the FMS to perform a variety of supporting operations in the system; these include: loading raw work parts into the system; unloading finished parts or assemblies from the system; changing and setting tools; performing equipment maintenance and repair; performing NC part programming; programming and operating the computer system; and managing the system.

Although not intrinsically considered as part of the FMS, humans nevertheless manage the overall operations of the system, and perform a number of supporting tasks in the system.

FMS- an example of technology and an alternative layout

The idea of an FMS was proposed in England (1960s) under the name "System 24", a flexible machining system that could operate without human operators 24 hours a day under computer control. From the beginning the emphasis was on *automation* rather than the "reorganization of workflow". Early FMSs were large and very complex, consisting of dozens of Computer Numerical Controlled machines (CNC) and sophisticate material handling systems. They were much automated, very expensive and controlled by incredibly complex software. There were only a limited number of industries that could afford investing in a traditional FMS as described above. Currently, the trend in FMS is toward small versions of the traditional FMS, called flexible manufacturing cells (FMC).

Today two or more CNC machines are considered a *flexible cell* and two or more cells are considered a flexible manufacturing system.

Thus, a **Flexible Manufacturing System** (FMS) consists of several machine tools along with part and tool handling devices such as robots, arranged so that it can handle any family of parts for which it has been designed and developed.

Different FMSs levels are:

Flexible Manufacturing Module (FMM). Example: a NC machine, a pallet changer and a part buffer;

Flexible Manufacturing (Assembly) Cell (F (M/A) C). Example: Four FMMs and an AGV (automated guided vehicle);

Flexible Manufacturing Group (FMG). Example: Two FMCs, a FMM and two AGVs which will transport parts from a Part Loading area, through machines, to a Part Unloading Area;

Flexible Production Systems (FPS). Example: A FMG and a FAC, two AGVs, an Automated Tool Storage, and an Automated Part/assembly Storage;

Flexible Manufacturing Line (FML). Example: multiple stations in a line layout and AGVs.

ADVANTAGES AND DISADVANTAGES OF FMS

Advantages

- Faster, lower- cost changes from one part to another which will improve capital utilization.
- Lower direct labor cost, due to the reduction in number of workers.
- Reduced inventory, due to the planning and programming precision.
- Consistent and better quality, due to the automated control.
- Lower cost/unit of output, due to the greater productivity using the same number of workers.
- Savings from the indirect labor, from reduced errors, rework, repairs and rejects.

Disadvantages

- Limited ability to adapt to changes in product or product mix (ex. machines are of limited capacity and the tooling necessary for products, even of the same family, is not always feasible in a given FMS)
- Substantial pre-planning activity
- Expensive, costing millions of dollars

- Technological problems of exact component positioning and precise timing necessary to process a component
- Sophisticated manufacturing systems

FMSs complexity and cost are reasons for their slow acceptance by industry. In most of the cases FMCs are favored.

TOTAL QUALITY MANAGEMENT

Japanese companies are known for their customer orientation and their high-quality products. Efficient business processes therefore play a major role in Japanese management, and many Japanese management concepts have been adopted and successfully integrated into Western management techniques and businesses. The most famous concept in a Japanese firm is kaizen, or continuous improvement, which is often considered a philosophy and aims at improving and perfecting all management processes within a firm. Another concept, which has become successful in Western firms, is the 5S System, which helps organize business and production processes within the firm. The high qualities with which Japanese products are produced and with which services are performed are based on business practices that are recognized outside of Japan. In this arena, the Japanese have developed and implemented very effective tools for sustaining their competitive quality advantage.

Another famous management practice related to Gemba kaizen is the 5S System. The "5S" refers to five key words all starting with an "S" in Japanese. The words describe how a workplace or production process can be effectively organized. The 5S System consists of five stages of a production process, which are seiri (sort), seiton (set in order), seiso (clean), seiketsu (systematize), and shitsuke (standardize). The words combined do not really make up a system but a set of guidelines regarding how to improve a business or production process, or any kind of standardized process, and maintain lasting, high-quality performance. The 5S system is an organizational system for production processes.

Kaizen is the most prominent Japanese management practice. It refers to continuous improvement and the idea that any managerial process can be perfected. Kaizen is not so much a detailed management practice but a philosophy that should be lived and implemented by every member of a Japanese firm, from the top management to the shop floor. The idea of kaizen does not include radical changes, such as job cuts, but mostly consists of small

changes, often on a daily basis, and is based on constant communication with other group members.

W. Edwards Deming, Armand V. Feigenbaum and Joseph M. Juran jointly developed the concept of TQM. Initially, TQM was originated in the manufacturing sector but it could be applied to all organizations. The concept of TQM states that every employee works towards the improvement of work culture, services, systems, processes and so on to ensure a continuing success of the organization. TQM is a management approach for an organization, depending upon the participation of all its members (including its employees) and aiming for a long-term success through customer satisfaction. This approach is beneficial to all members of the organization and to the society as well.

MEANING AND DEFINITION OF QUALITY

In order to understand "Total quality management", first we have to understand what does 'Quality' actually mean? 'Quality' is generally referred to a parameter which decides the inferiority or superiority of a product or service. It is a measure of goodness to understand how a product meets its specifications. Usually, when the expression "quality" is used, we think in the terms of an excellent product or service that meets or even exceeds our expectations. These expectations are based on the price and the intended use of the goods or services. In simple words, when a product or service exceeds our expectations we consider it to be of good quality. Therefore, it is somewhat of an intangible expression based upon perception.

Quality can be interpreted as "Customer's expressed and implied requirements are met fully". This is a core statement from which some eminent definitions of quality have been derived. They include: "the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need" [ISO, 1994], "fitness for use" [Juran, 1988], and "conformance to requirement" [Crosby, 1979]. It is important to note that satisfying the customers' needs and expectations is the main factor in all these definitions. Therefore, it is an imperative for a company to identify such needs early in the product/service development cycle. The ability to define accurately the needs related to design, performance, price, safety, delivery, and other business activities and processes will place a firm ahead of its competitors in the market. In 1992 Crosby broadened his definition for quality adding an integrated notion to it: "Quality meaning getting everyone to do what they have agreed to do and to do it

right the first time is the skeletal structure of an organisation, finance is the nourishment, and relationships are the soul." Some Japanese companies find that "conformance to a standard" too narrowly reflects the actual meaning of quality and consequently have started to use a newer definition of quality as "providing extraordinary customer satisfaction". There is a trend in modern day competition among Japanese companies to give you rather more in order to 'delight' you. So when you buy a lamp bulb which has a 'mean time between failure' of 1,000 hours, the Japanese manufacturer will try their best to ensure that you can get at least 20% more. Likewise, when you buy a Japanese brand video tape specifying 180 minutes, it can normally record up to 190 minutes. When you buy a 'mink' coat from a department store in Japan, they would invite you to store the fur coat in their temperature-control room during the hot summer season free-of-charge. They call these extra little things as 'extra-ordinary customer satisfaction' or 'delighting the customers'.

There are a number of well-known quality definitions. ISO 8402 [ISO, 1986] defines quality as "the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need". [Crosby, 1979] defines quality as "conformance to requirement". [Juran, 1988] defines quality as "fitness for use". Japanese companies found the old definition of quality "the degree of conformance to a standard" too narrow and consequently have started to use a new definition of quality as "user satisfaction" [Wayne, 1983]. Table below defines quality from the view point of different quality professionals and to provide a conceptual scheme for the discussion of TQM. This can be classified in three sections: Customer-base, Service and Manufacturing-base, and Value-based definition.

Customer-based Definitions

- Edwards [1968] Quality consists of the capacity to satisfy wants...
- Gilmore [1974] Quality is the degree to which a specific product satisfies the wants of a specific consumer. ·
- Kuehn & Day [1962] in the final analysis of the marketplace, the quality of a product depends on how well it fits patterns of consumer preferences.
- Juran [1988] Quality is fitness for use.
- Oakland [1989] the core of a total quality approach is to identify and meet the requirements of both internal and external customers.

Manufacturing & Service-based definitions

- Crosby [1979] Quality [means] conformance to requirements
- Price [1985] Do it right first time

Value-based definitions

- Broh [1982] Quality is the degree of excellence at an acceptable price and the control of variability at an acceptable cost.
- Feigenbaum [1983] Quality is the degree to which a specific product conforms to a design or specification
- Newell & Dale [1991] Quality must be achieved in five basic areas: people, equipment, methods, materials and the environment to ensure customer's need are met.
- Kanji [1990] Quality is to satisfy customers' requirements continually; TQM is to achieve quality at low cost by involving everyone's daily commitment.

MEANING AND DEFINITION OF TQM

Total quality management (**TQM**) consists of organization-wide efforts to "install and make permanent climate where employees continuously improve their ability to provide on demand products and services that customers will find of particular value." "Total" emphasizes that departments in addition to production (for example sales and marketing, accounting and finance, engineering and design) are obligated to improve their operations; "management" emphasizes that executives are obligated to actively manage quality through funding, training, staffing, and goal setting. While there is no widely agreed-upon approach, TQM efforts typically draw heavily on the previously developed tools and techniques of

quality control. TQM enjoyed widespread attention during the late 1980s and early 1990s before being overshadowed by, Lean manufacturing, and Six Sigma.

TQM is a set of management practices throughout the organization, geared to ensure the organization consistently meets or exceeds customer requirements. TQM places strong focus on process measurement and controls as means of continuous improvement.

Total Quality Management (TQM) is an approach that organizations use to improve their internal processes and increase customer satisfaction. When it is properly implemented, this style of management can lead to decreased costs related to corrective or preventative maintenance, better overall performance, and an increased number of happy and loyal customers.

However, TQM is not something that happens overnight. While there are a number of software solutions that will help organizations quickly start to implement a quality management system, there are some underlying philosophies that the company must integrate throughout every department of the company and at every level of management. Whatever other resources you use, you should adopt these seven important principles of Total Quality Management as a foundation for all your activities.

Andy Nichols, Quality Program Manager at the Michigan Manufacturing Technology Center, says that in practical terms, “Total quality management is really a company-wide initiative to get everybody involved in doing the right thing for the customer.”

Total Quality Management is an extensive and structured organization management approach that focuses on continuous quality improvement of products and services by using continuous feedback. Joseph Juran was one of the founders of total quality management just like William E. Deming.

A core definition of total quality management (TQM) describes a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.

Total Quality Management is defined as a customer-oriented process and aims for continuous improvement of business operations. It ensures that all allied works (particularly work of

employees) are toward the common goals of improving product quality or service quality, as well as enhancing the production process or process of rendering of services. However, the emphasis is put on fact-based decision making, with the use of performance metrics to monitor progress.

FEATURES OF TOTAL QUALITY MANAGEMENT

1. It is a management approach that places emphasis on continuous improvement in quality, in the interest of the organization and that of its customers".
2. Customer Focus: - TQM Palaces emphasis in meeting the requirement of both the internal as well as the external customer. In order to meet the requirements for the external customer, it is necessary to meet the needs of the internal customer. The initial focus should be on meeting needs of internal customer before an attempt is made to meet the requirements of the external customers.
3. Continuous Process - TQM is a continuous process. Constant and continuous efforts are made to improve the quality, and to reduce internal costs. Quality improvement helps the organization to face the challenges of the competitors and to meet the requirements of the customers. TQM is a process which goes on forever, because at no time the quality can be 100% right. There is always a possibility for new and better way of doing things.
4. Defect-free Approach: - TQM place emphasis on the defect-free work most of the time. The defect free approach is phrased in various ways as right first time, working smarter or zero defects.
5. Employees Involvement: - in TQM everyone is involved in the process from the management director to the junior clerk or worker in the organization. It is not just manufacturing people, but also the accounting, finance, marketing, and even the canteen people are involved in the TQM process.
6. Recognition and Rewards: - Recognition and rewards is an integral part of company's TQM Programme. Positive reinforcement through recognition and reward is essential to maintain achievement and continuous improvement in quality.
7. Synergy in Team Work: -The Japanese are great believers in synergy (to work together). Engineers, technicians, and workers look upon themselves as equals and communicate easily as they work side by side. They create what professor Okuda has called a 'synergetic Partnership'.

8. Techniques: - TQM can take place by following various techniques such as quality circle, value engineering, statistical process control, etc. Through such techniques it is possible to improve systems and procedures.
9. System Approach: - TQM is a system approach to managing the business and improving the performance. Without the total commitment on the part of chief executive officer and his senior executives.

ADVANTAGES OF TOTAL QUALITY MANAGEMENT

1) **Emphasizing the needs of the market**: QM helps in highlighting the needs of the market. Its application is universal and helps the organization to identify and meet the needs the market in a better way.

2) **Assures better quality performance in every sphere of activity:** Adverse and non-participative attitudes of the employees are the biggest obstacles in the organizational™s success, growth and advancement. TQM stresses on bringing attitudinal changes and improvements in the performance of employees by promoting proper work culture and effective team work

3) **Helps in checking non-productive activities and waste**: Every organization aims at improving productivity as well as reduction in cost so as to result in increase in profitability. Under TQM, quality improvement teams are constituted to reduce waste and inefficiency of every king by introducing systematic approach.

4) **Helpful in meeting the competition**: TQM techniques are greatly helpful in understanding the competition and also developing an effective combating strategy. Due to the cut throat competition, the very survival of many organizations has become very vital issue.

5) **It helps in developing an adequate system of communication**: Faulty and inadequate communication and improper procedures act as stumbling blocks in the way of proper development of an organization. It results in misunderstanding, low- productivity, poor quality, duplication of efforts and low morale. QM techniques bind together members of various related sections, departments and levels of management for effective communication and interaction.

DISADVANTAGES OF TOTAL QUALITY MANAGEMENT

1) **Production Disruption**: Implementing a Total Quality Management system in a company requires extensive training of employees and these requires them to take some time of their day to day work duties. While the improvements do reduce lead time, eliminate waste and improve productivity, the beginning stages of implementing Total Quality Management in an organization can reduce worker output.

2) **Employee Resistance**: Total Quality Management requires change in mindset, attitude and methods for performing their jobs. When management does not effectively communicate the team approach of Total Quality Management, workers may become fearful, which leads to employee resistance. When workers resist the program, it can lower employee morale and productivity for the business.

3) **Quality is Expensive**: TQM is expensive to implement. Implementation often comes with additional training costs, team-development costs, infrastructural improvement costs, consultant fees and the like.

4) **Discourages Creativity**: TQM as focus on task standardization to ensure consistency discourages creativity and innovation. It also discourages new ideas that can possibly improve productivity.

5. Problem of Labour Management Relations: Success of TQM depends on the relationships between labour and management; because participation of people at all levels is a pre-requisite for TQM programme implementation. In many organisations, here and abroad, labour-management relations are quite tense. As such, launching, acceptance and implementation of TQM programme is nothing more than a dream for such organisations.

KEYS TO SUCCESS OF TQM/ CORE CONCEPTS OF TQM

TQM has been coined to describe a philosophy that makes quality the driving force behind leadership, design, planning, and improvement initiatives. For this, TQM requires the help of those eight key elements. These elements can be divided into four groups according to their function.

The groups are:

I. Foundation – It includes: Ethics, Integrity and Trust.

II. Building Bricks – It includes: Training, Teamwork and Leadership.

III. Binding Mortar – It includes: Communication.

IV. Roof – It includes: Recognition.

I. Foundation

TQM is built on a foundation of ethics, integrity and trust. It fosters openness, fairness and sincerity and allows involvement by everyone. This is the key to unlocking the ultimate potential of TQM. These three elements move together, however, each element offers something different to the TQM concept.

1. **Ethics** – Ethics is the discipline concerned with good and bad in any situation. It is a two-faceted subject represented by organizational and individual ethics. Organizational ethics establish a business code of ethics that outlines guidelines that all employees are to adhere to in the performance of their work. Individual ethics include personal rights or wrongs.

2. **Integrity** – Integrity implies honesty, morals, values, fairness, and adherence to the facts and sincerity. The characteristic is what customers (internal or external) expect and deserve to receive. People see the opposite of integrity as duplicity. TQM will not work in an atmosphere of duplicity.

3. **Trust** – Trust is a by-product of integrity and ethical conduct. Without trust, the framework of TQM cannot be built. Trust fosters full participation of all members. It allows empowerment that encourages pride ownership and it encourages commitment. It allows decision making at appropriate levels in the organization, fosters individual risk-taking for continuous improvement and helps to ensure that measurements focus on improvement of process and are not used to contend people. Trust is essential to ensure customer satisfaction. So, trust builds the cooperative environment essential for TQM.

II. Bricks

Basing on the strong foundation of trust, ethics and integrity, bricks are placed to reach the roof of recognition. It includes:

4. **Training** – Training is very important for employees to be highly productive. Supervisors are solely responsible for implementing TQM within their departments, and teaching their employees the philosophies of TQM. Training that employees require are interpersonal skills, the ability to function within teams, problem solving, decision making, job management performance analysis and improvement, business economics and technical skills. During the creation and formation of TQM, employees are trained so that they can become effective employees for the company.

5. **Teamwork** – To become successful in business, teamwork is also a key element of TQM. With the use of teams, the business will receive quicker and better solutions to problems. Teams also provide more permanent improvements in processes and operations. In teams, people feel more comfortable bringing up problems that may occur, and can get help from other workers to find a solution and put into place. There are mainly three types of teams that TQM organizations adopt:

Quality improvement teams or excellence teams (QITs) – These are temporary teams with the purpose of dealing with specific problems that often recur. These teams are set up for period of three to twelve months.

Problem solving teams (PSTs) – These are temporary teams to solve certain problems and also to identify and overcome causes of problems. They generally last from one week to three months.

Natural work teams (NWTs) – These teams consist of small groups of skilled workers who share tasks and responsibilities. These teams use concepts such as employee involvement teams, self-managing teams and quality circles. These teams generally work for one to two hours a week.

6. **Leadership** – It is possibly the most important element in TQM. It appears everywhere in organization. Leadership in TQM requires the manager to provide an inspiring vision, make strategic directions that are understood by all and to instill values that guide subordinates. For TQM to be successful in the business, the supervisor must be committed in leading his employees. A supervisor must understand TQM, believe in it and then demonstrate their belief and commitment through their daily practices of TQM. The supervisor makes sure that strategies, philosophies, values and goals are transmitted down throughout the organization to

provide focus, clarity and direction. A key point is that TQM has to be introduced and led by top management. Commitment and personal involvement is required from top management in creating and deploying clear quality values and goals consistent with the objectives of the company and in creating and deploying well defined systems, methods and performance measures for achieving those goals.

III. Binding Mortar

7. **Communication** – It binds everything together. Starting from foundation to roof of the TQM house, everything is bound by strong mortar of communication. It acts as a vital link between all elements of TQM. Communication means a common understanding of ideas between the sender and the receiver. The success of TQM demands communication with and among all the organization members, suppliers and customers. Supervisors must keep open airways where employees can send and receive information about the TQM process. Communication coupled with the sharing of correct information is vital. For communication to be credible the message must be clear and receiver must interpret in the way the sender intended.

There are different ways of communication such as:

Downward communication – This is the dominant form of communication in an organization. Presentations and discussions basically do it. By this the supervisors are able to make the employees clear about TQM.

Upward communication – By this the lower level of employees are able to provide suggestions to upper management of the affects of TQM. As employees provide insight and constructive criticism, supervisors must listen effectively to correct the situation that comes about through the use of TQM. This forms a level of trust between supervisors and employees. This is also similar to empowering communication, where supervisors keep open ears and listen to others.

Sideways communication – This type of communication is important because it breaks down barriers between departments. It also allows dealing with customers and suppliers in a more professional manner.

IV. Roof

7. **Recognition** – Recognition is the last and final element in the entire system. It should be provided for both suggestions and achievements for teams as well as individuals. Employees strive to receive recognition for themselves and their teams. Detecting and recognizing contributors is the most important job of a supervisor. As people are recognized, there can be huge changes in self-esteem, productivity, quality and the amount of effort exhorted to the task at hand. Recognition comes in its best form when it is immediately following an action that an employee has performed. Recognition comes in different ways, places and time such as,

    - Ways – It can be by way of personal letter from top management. Also by award banquets, plaques, trophies etc.
    - Places – Good performers can be recognized in front of departments, on performance boards and also in front of top management.
    - Time – Recognition can give at any time like in staff meeting, annual award banquets, etc.

We can conclude that these eight elements are key in ensuring the success of TQM in an organization and that the supervisor is a huge part in developing these elements in the work place. Without these elements, the business entities cannot be successful TQM implementers. It is very clear from the above discussion that TQM without involving integrity, ethics and trust would be a great remiss, and in fact it would be incomplete. Training is the key by which the organization creates a TQM environment. Leadership and teamwork go hand in hand. Lack of communication between departments, supervisors and employees create a burden on the whole TQM process. Last but not the least; recognition should be given to people who contributed to the overall completed task. Hence, lead by example, train employees to provide a quality product, create an environment where there is no fear to share knowledge, and give credit where credit is due is the motto of a successful TQM organization.

OBSTACLES/BARRIERS IN IMPLEMENTATION OF TQM

Many organizations, especially small ones with a niche, are comfortable with their current state. They are satisfied with the amount of work being performed, the profits realized and

the perception that the customers are satisfied. Organizations with this culture will see little need for TQM until they begin to lose market share.

Robert J. Masters after an extensive research mention 9 obstacles in implementation of TQM in the organization. The obstacles are given as below

1. Lack of management commitment

In order for any organizational effort to succeed, there must be a substantial management commitment of management time and organizational resources. The purpose must be clearly and continuously communicated to all personnel management must consistently apply the principle of TQM.

2. Inability to change organizational culture

Changing an organization's culture is difficult and will require as much as five years. Individuals resist change--they become habituated to doing a particular process and it becomes the preferred way. Management must understand and utilize the basic concepts of change. They are;

1. People change when they want to and to meet their own needs
2. Never expect anyone to engage in behaviour that serves the organization's values unless adequate reason (why) has been given.
3. For change to be accepted, people must be moved from a state of fear to trust.

It is difficult for individuals to change their way of doing things; It is much more difficult for an organization to make cultural change. Organization that spends more planning for the cultural aspects of implementing a TQM program will improve their chance of success.

E.g. concern to India, Chandigarh is the first smoke free city of India, this is the cultural change.

3. Improper planning

All constituents of the organization must be involved in the development of the implementation plan and any modifications that occur as the plan evolves. The Two-way communication of ideas is the matter of great importance and should be taken by all

personnel during the development of the plan and its implementation. Customer satisfaction should be the goal rather than financial or sales goals.

4. Lack of continuous training and education

Training and education is an ongoing process for everyone in the organization. Needs must be determined and a plan developed to achieve those needs. Training and education are most effective, when senior management conducts the training on the principles of TQM. External trainer can be hired for communicating the TQM effort to all personnel on a continual basis. Lack of training in group discussion and communication techniques, quality improvement skills, problem identification, and the problem-solving method was the second most important obstacle.

5. Incompatible organizational structure and isolated individuals and departments

Difference between departments and individuals can create implementation problems. The use of multifunctional teams will help to break down long-standing barriers. Restructuring to make the organization more response to customer needs may be needed. Individuals who do not embrace the new philosophy can be required to leave the organization.

6. Ineffective measurement techniques and lack of access to data and results

Key characteristics of the organization should be measured for effective decision making. To improve a process are you need to measure the effect of improvement ideas. Access to data and quick retrieval is necessary for effective processes. Find the root cause, correct the problem and eliminate the root cause to prevent recurrence of the problem.

7. Paying inadequate attention to internal and external customers

Organizations need to understand the changing needs and expectations of their customers. Effective feedback mechanisms that provide data for decision making are necessary for this understanding. Give the right people (who are directly working on the product) direct access to the customers. When an organization fails to empower individuals and teams, it can't hold them responsible for producing results.

8. Inadequate use of empowerment and team work

Teams need to have the proper training and at least in the beginning by a facilitator. Individuals should be empowered to make decisions that affect the efficiency of their process or the satisfaction of their customer.

9. Failure to continuously improve

It is tempting to sit back and rest on your laurels. However, a lack of continuous improvement of the process, product and service will even leave the leader of the pack in the dust.

PRINCIPLES OF TQM

Whatever other resources you use, you should adopt these seven important principles of Total Quality Management as a foundation for all your activities.

1. Quality can and must be managed

Many companies have wallowed in a repetitive cycle of chaos and customer complaints. They believe that their operations are simply too large to effectively manage the level of quality. The first step in the TQM process, then, is to realize there is a problem and that it can be controlled.

2. Processes, not people, are the problem

If your process is causing problems, it won't matter how many times you hire new employees or how many training sessions you put them through. Correct the process and then train your people on these new procedures.

3. Don't treat symptoms, look for the cure

If you just patch over the underlying problems in the process, you will never be able to fully reach your potential. If, for example, your shipping department is falling behind, you may find that it is because of holdups in manufacturing. Go for the source to correct the problem.

4. Every employee is responsible for quality

Everyone in the company, from the workers on the line to the upper management, must realize that they have an important part to play in ensuring high levels of quality in their products and services. Everyone has a customer to delight, and they must all step up and take responsibility for them.

5. Quality must be measurable

A quality management system is only effective when you can quantify the results. You need to see how the process is implemented and if it is having the desired effect. This will help you set your goals for the future and ensure that every department is working toward the same result.

6. Quality improvements must be continuous

Total Quality Management is not something that can be done once and then forgotten. It's not a management "phase" that will end after a problem has been corrected. Real improvements must occur frequently and continually in order to increase customer satisfaction and loyalty.

7. Quality is a long-term investment

Quality management is not a quick fix. You can purchase QMS software that will help you get things started, but you should understand that real results won't occur immediately. TQM is a long-term investment, and it is designed to help you find long-term success.

Before you start looking for any kind of quality management software, it is important to make sure you are capable of implementing these fundamental principles throughout the company. This kind of management style can be a huge culture change in some companies, and sometimes the shift can come with some growing pains, but if you build on a foundation of quality principles, you will be equipped to make this change and start working toward real long-term success.

8. Everyone has a customer and is a supplier.
9. Goals are based on requirements, not negotiated.
10. Life cycle costs, not front end costs.
11. Management must be involved and lead.
12. Plan and organize for quality improvement.

BASIC TQM TOOLS FOR PROCESS IMPROVEMENT

Quality pros have many names for these seven basic tools of quality, first emphasized by **Kaoru Ishikawa**, a professor of engineering at Tokyo University and the father of "quality circles." Start your quality journey by mastering these tools, and you'll have a name for them too: indispensable.

Cause-and-effect diagram (also called Ishikawa or fishbone diagrams): Identifies many possible causes for an effect or problem and sorts ideas into useful categories. This diagram allows you to visualize all possible causes of a problem or effect and then categorize them.

Check sheet: A structured, prepared form for collecting and analyzing data; a generic tool that can be adapted for a wide variety of purposes. This is a pre-made form for gathering one type of data over time, so it's only useful for frequently recurring data.

Control chart: Graph used to study how a process changes over time. Comparing current data to historical control limits leads to conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation). This chart is a graphical description of how processes and results change over time.

Histogram: The most commonly used graph for showing frequency distributions, or how often each different value in a set of data occurs. This shows the frequency of a problem's cause, as well as how and where results cluster.

Pareto chart: A bar graph that shows which factors are more significant. In order to measure which, have priority? · Can be scheduled over select periods of time to track changes. They can also be created in retrospect, as a before and after analysis of a process change. The chart posits that 80 percent of problems are linked to 20 percent of causes. It helps you identify which problems fall into which categories.

Scatter diagram: Graphs pairs of numerical data, one variable on each axis, to look for a relationship. This diagram plots data on the x and y axes to determine how results change as the variables change.

Stratification: A technique that separates data gathered from a variety of sources so that patterns can be seen (some lists replace stratification with flowchart or run chart). Follows a process over a specific period of time, such as accrual rates, to track high and low points in its run, and ultimately identify trends, shifts and patterns. This represents how different factors join in a process.

Benchmarking: Benchmarking is referred to as the process by which an organization measures their products, services, and practices against its most difficult competitors, or those organizations recognized as leaders in the same industry. Managers of various organizations use this tool to determine whether their organization is providing their specific functions and activities and the need for improvement in their business processes.

PRACTICAL PROBLEMS

Illustration 1

Green View is a lawn services company whose operations are divided into two districts. The District 1 manager controls Rs.12, 600,000 of operating assets. District 1 produced Rs.1, 512,000 of operating income during the year. The District 2 manager controls Rs.14, 200,000 of operating assets. District 2 reported Rs.1, 988,000 of operating income for the same period. Use return on investment to determine which manager is performing better?

Answer

District 1 ROI = Operating income / Operating assets

= 1,512,000 / 12,600,000 = 12%

District 2 ROI = Operating income / Operating assets

= 1,988,000 / 14,200,000 = 14%

Because the higher ROI indicates the better performance, the District 2 manager is the superior performer. This conclusion is based solely on quantitative results. In real-world practice, companies also consider qualitative factors.

Illustration 2

Tambour Incorporated (TI) earned operating income of Rs.4, 730,400 on operating assets of Rs.26, 280,000 during 2011. The Western Division earned Rs.748, 000 on operating assets of Rs.3, 400,000. TI has offered the Western Division Rs.1, 100,000 of additional operating assets. The manager of the Western Division believes he could use the additional assets to generate operating income amounting to Rs.220, 000. TI has a desired return on investment (ROI) of 17 percent. Determine the ROI and RI for TI, the Western Division, and the additional investment opportunity.

Answer

Return on investment (ROI) = Operating income / Operating assets

ROI for TI = 4,730,400 /26,280,000 = 18%

ROI for Western Division = 748,000 / 3,400,000 = 22%

ROI for Investment Opportunity =220,000 /1,100,000 = 20%

Residual income (RI) = Operating income - (Operating assets x Desired ROI)

RI for TI = 4,730,400 - (26,280,000 x 0 .17) =262,800

RI for Western Division = 748,000 - (3,400,000 x 0 .17) = 170,000

RI for Investment Opportunity = 220,000 - (1,100,000 x 0.17) = 33,000

Illustration 3

Adam Co's summarized income statements for the past two years are shown below:

	2010	2009
	('000)	('000)
Operating profit	6,500	5,500
Interest expenses	1,000	900
Profit before tax	5,500	4,600

Tax at 25%	1,375	1,150
Profit after tax	4,125	3,450

Further information is as follows:

1. The allowance for doubtful debts was Rs.300, 000 at 1 January 2009, Rs.250, 000 at 31 December 2009 and Rs.350, 000 at 31 December 2010.

2. Research and development costs of Rs.500, 000 were incurred during each of the years 2009 and 2010 on Project Z. These costs were expensed in the income statement, as they did not meet the requirements of financial reporting standards for capitalization. Project Z is not complete yet.

3. At the end of 2008, the company had completed another research and development project, Project X. Total expenditure on this project had been Rs.1, 500,000, none of which had been capitalized in the financial statements. The product developed by Project X went on sale on 1 January 2009, and the product was a great success. The product's lifecycle was only two years, so no further sales of the product are expected after 31 December 2010.

4. The company incurred non-cash expenses of Rs.15, 000 in both years.

5. Capital employed (equity plus debt) per the statement of financial position was Rs.33, 500 at 1 January 2009, and Rs.37, 000 at 1 January 2010.

6. The pre-tax cost of debt was 5% in each year. The estimated cost of equity was 12% in 2009 and 14% in 2010. The rate of corporate income tax was 25% during both years.

7. The company's capital structure was 60% equity and 40% debt.

8. There was no provision for deferred tax.

Calculate Economic Value Added

Solution.

1. Calculation of NOPAT	2010	2009
	(‘000)	(‘000)
Operating profit	6,500	5,500
Add research costs expensed (Project Z)	500	500
Less amortization of prior year		
Expenses (Project X)	(750)	(750)
Add expense relating to increase in		
Allowance for doubtful debts	100	(50)
Add non-cash expenses	15	15
Less cash taxes (working)	(1,625)	(1,375)
NOPAT	4,740	3,840

2 Calculation of adjusted capital employed at 1 January

	2010	2009
	(‘000)	(‘000)
Capital at 1 January as per statement		
of financial position	37,000	33,500
Add: Allowance for bad and doubtful debts	250	300

Add capitalization of research and development:

Project Z	500	0
Project X	750	1,500
Add non-cash expenses incurred during 2009	15	0
Adjusted capital employed at 1 January	38,515	35,300

3. Weighted average cost of capital

2010: (60% x 14%) + (40% x 5% x (1- 25%)) = 9.9%

2009: (60% x 12%) + (40% x 5% x (1-25%)) = 8.7%

4. EVA

EVA = NOPAT−WACC∗TC

2010: 4,740 – (9.9% x 38,515) = 927

2009: 3,840– (8.7% x 35,300) = 769.

Working – calculation of net tax

	'000	'000
Tax charge per income statement	1,375	1,150
Add tax relief on interest		
(Interest charge x 25%)	250	225
Cash taxes	1,625	1,375

Note: The research and development expenditure on both Project X and Project Z was expensed in the income statement in accordance with financial reporting standards. Since it is considered to be market building expenditure, however, it is added back to profits in the year it was incurred, and added back to capital employed at the end of the year in which it was incurred, when calculating EVA. Such capitalization should also be amortized over the period that it brings benefits. Therefore, in the case of Project X, this has been amortized over the two years during which the company sold products based on it. Project Z has not been completed yet, so no amortization has taken place.

Illustration 4

F Company supplied following data is for the latest year of operations:

Sales Rs.24, 480,000

Operating income Rs.1, 738,080

Average operating assets Rs. 6,000,000

Required rate of return 16%

a) What is the division's return on investment (ROI)?

b) What is the division's residual income?

Solution

a) ROI = Operating Income / Operating assets

= 1,738,080 / 6,000,000 =28.97%

b) Operating assets 6,000,000

Desired rate of return 14%

Target operating income 840,000

Actual operating income 1,738,080

Residual income 778, 08

Illustration 5

W Company's electronics division provided the following data are for the latest year of operations:

Sales RS.14, 720,000

Operating income Rs.1, 000,960

Average operating assets RS.4, 000,000

Required rate of return 14%

a) What is the division's profit margin?

b) What is the division's turnover?

c) What is the division's ROI?

d) What is the division's residual income?

Solution

(a) Operating Income / Sales = Margin

1,000,960 / 14,720,000 = 6.8%

b) Sales /Operating assets = Turnover

14,720,000 / 4,000,000 = 3.68

c) Operating Income / Operating assets = ROI

1,000,960 / 4,000,000 = 25.02%

d) Operating assets	4,000,000
Desired rate of return	14%
Target operating income	560,000
Actual operating income	1,000,960
Residual income	440,960

Illustration 6

For last year, one division of the N Company reported operating assets of $5,000,000 and operating income of Rs.750, 000. N Company has established a target return on investment (ROI) of 14% for the division.

a) Calculate the division's ROI for the year. Did it achieve the target?

b) Assuming that operating assets for the next year increase by 10%. How much would operating income have to increase to reach the target?

Solution

(a) Operating Income / Operating assets = ROI

750,000 / 5,000,000 = 15%

Yes, the division exceeded the company target.

b) Operating assets Rs.5, 000,000 + 10%	Rs.5, 500,000
Desired rate of return	14%
Target operating income	Rs.770, 000
Actual operating income	RS. 750,000
Increase required	RS. 20,000.

Illustration 7

P Company provided the following selected information about its consumer products division for the year:

Residual income Rs.25, 000

Operating income RS.230, 000

Desired rate on investment 14%

Based on this information, calculate the company's investment amount.

Solution

$$\frac{\text{Operating Income - Residual income}}{\text{Desired ROI}} = \text{Investment}$$

$$\frac{235{,}000 - 25{,}000}{14\%} = 1{,}464{,}286$$

QUESTIONS

1. Differentiate between traditional and performance budgeting?

2. What are the features of zero base budgeting?

3. What are the steps involved in zero base budgeting?

4. Define zero base budgeting? What are the advantages and disadvantages of zero base budgeting?

5. What are the differences between conventional budgeting and zero base budgeting?

6. Define social cost benefit analysis? What are its features? Discuss its need and importance?

7. What are steps involved in social cost benefit analysis?

8. Discuss the various methods of measuring the performance of the company? What are the problems in connection with performance measurement?

9. Define ROI? What are its advantages and limitations?

10. Define EVA? What are the superiority features of EVA? What are its limitations?

11. What do you understand by Balance Score Card? Identify and examine its components?

12. Define Responsibility Accounting? What are the features of Responsibility Accounting? What are the advantages and disadvantages of Responsibility Accounting?

13. Define Performance budgeting? What are its advantages and disadvantages?

14. Define KPIs? Discuss its importance?

15. Define ABB? Discuss its advantages and disadvantages?

16. Define FMS? Discuss its advantages and disadvantages?

17. Define TQM? Discuss its advantages and disadvantages? Discuss its principles and concepts?

Suggested References

Atrill, P., & McLaney, E. (2009). Management Accounting for Decision Makers (6th ed.).

Bhimani, A., Horngren, C.T., Datar, S.M. (2013), Management and Cost Accounting.

Drury, C. (2012). Management and Cost Accounting (8th ed.)

Hansen, D.R. and Mowen, M.M. (2006), Cost Management: Accounting and Control

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MODULE 3

Decision making under Risk and Uncertainty: Introduction**,** Meaning and Definition of Risk, Nature and Types of risk - Techniques for decision making under risk and uncertainty- Benefits of Risk analysis, Steps and Techniques - Optimistic and Pessimistic estimates- Risk adjusted Discount Rate- Certainty Equivalent Co-Efficient Method- Sensitivity technique- Probability Technique- Standard Deviation method- Co-efficient of Variation method- Simulation Technique- Decision Tree Analysis

DECISION MAKING UNDER RISK AND UNCERTAINTY

Introduction

Decision is nothing but a conclusion reached after consideration or it is the tendency of people to become certain about anything which they want to do, whereas decision making is a process of selecting the best among the different alternatives. Decision-making involves the selection of a course of action from among two or more possible alternatives in order to arrive at a solution for a given problem. Risk and uncertainty is incorporated during the decision making. Risk is nothing but the situation involving exposure to danger. Also the uncertainty is the lack of certainty, a state of having limited or incorrect knowledge where it is impossible to exactly describe the existing state, a future outcome. The sources of risk and uncertainty in decision making are discussed, emphasizing the distinction between uncertainty and risk. In case of decision-making under uncertainty the probabilities of occurrence of various states of nature are not known. When these probabilities are known or can be estimated, the choice of an optimal action, based on these probabilities, is termed as decision making under risk.

As any gambler knows, risks come with benefits. But there is an additional benefit of risks: when something terrible happens as a result of human planning, we can learn something about how to do better the next time. In this course sequence we explore what we know about how people make decisions about technologies and new media and apply our understanding of risk to the design of safe, secure technologies. We consider cases such as eBay and the Deepwater Horizon oil platform disaster, as well as examples of resilient engineering, to discover what can go wrong and how to make technology more beneficial and safe. The course sequence considers diverse approaches to safety, security and risk. It focuses in-depth on decision theory, risk and trust in social media, and the analysis and control of societal risk.

In addition to becoming more rational decision makers, students can expect to learn how to anticipate risks as engineers, and to understand its scientific, social, and normative implications in an information society.

Meaning of Risk

The English word *risk* derived from the Latin words *resicum, risicum* and *riscus* which mean *cliff* or *reef.* Likewise, Latin word comes from a Greek navigation term *rhizikon, rhiza* which meant "root, stone, cut of the firm land" and was a metaphor for "difficulty to avoid in the sea"

The Oxford English Dictionary (OED) cites the earliest use of the word in English (in the spelling of *risque* from its French original, 'risque') as of 1621, and the spelling as *risk* from 1655. While including several other definitions, the OED 3rd edition defines *risk* as: (Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility.

ISO Guide 73:2009 defines risk as: effect of uncertainty on objectives

Note 1: An effect is a deviation from the expected – positive or negative.

Note 2: Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3: Risk is often characterized by reference to potential events and consequences or a combination of these.

Note 4: Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

Note 5: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.

In the simple manner risk is the probability of deciding the method or the opportunities for the better output. The objective of risk assessment is to conduct an assessment to bode

negative effects so that adverse outcome can be minimized. In much literature the word "risk" defines as comprising of following two elements:

1) The probability (or likelihood) of occurrence of a negative event during the lifetime of operation of a facility

2) The resultant consequence when a negative event has taken place.

The first term involves risk assessment, whilst the second term is risk management. Risk assessment is a scientific task and risk management is the subject of finding out regulatory measures based on risk assessment and considerations of a legal, political, social, economic, environmental and engineering nature risk issues

Although it is often used in different contexts, risk is the possibility that an outcome will not be as expected, specifically in reference to returns on investment in finance. However, there are several different kinds or risk, including investment risk, market risk, inflation risk, business risk, liquidity risk and more. Generally, individuals, companies or countries incur risk that they may lose some or all of an investment. Risk implies a degree of uncertainty and an inability to fully control the outcomes or consequences of such an action. Risk or the elimination of risk is an effort that managers employ. Risk means future uncertainty about deviation from expected earnings or expected outcome. Risk measures the uncertainty that an investor is willing to take to realize a gain from an investment.

NATURE AND TYPES OF RISK

Nature (Characteristics) of Business Risk:

"Risk is the chance of loss. It is the possibility of some un-favourable occurrence. -B.O.Wheeler.

"Risk may be defined as uncertainty in regard to cost, loss, or damage." -C.O. Hardy

Nature of business risks could be highlighted with reference to its following features:

1. Opportunities for Gains are hidden in Business Risks: If the management of the business enterprise is able to successfully handle and manage business risks; these provide many opportunities for gains to the business enterprise.

2. Business Risks Depend on Time: In ancient times, business risks were less and limited. In the present-day-times-characterized by intense competition, advanced technology and globalization of the economy; business risks are quite severe. Further, in times to come, business risks are likely to increase in intensity.

3. Business Risks Depend on Size of the Business Enterprise: Small businesses are less exposed to business risks; because they enjoy flexibility of operations and can easily adapt themselves to changing circumstances. On the other hand, the bigger is the size of business; the lesser is the flexibility possessed by it. Hence bigger businesses are more exposed to business risks.

4. Business Risks depend on the Nature of Business: In case of business enterprises engaged in the manufacture/purchase of necessary items e.g. salt, sugar, oil, cloth etc. there is lesser risk, because demand for most of the necessary item is inelastic or less elastic. On the other hand, business enterprises engaged in the manufacture/purchase of luxury items are more exposed to business risks; because demand for luxury items is highly elastic.

5. Business Risk Depends on Terms of Sales: In case of business enterprises conducting sales only on cash basis, business risks are nil; so far as the possibility of bad debts is concerned. On the other hand, business enterprises conducting large scale credit sales are severely exposed to the risk of bad debts.

6. Business Risk Depends on the Degree of Competition: In those lines of business activities, where there is intense competition; business enterprises are exposed to severe risks caused by the actions and reactions of competitors. As such, business enterprises characterized by monopolistic situations face little risk on account of competition. Actually in a perfectly monopolistic situation, the business enterprise has no risk caused by competition.

7. Business Risks Depend on Competence of Management: The more competent the management of business enterprises is; the lesser is the possibility of losses to be caused as a result of business risks, and vice-versa.

8. It is Difficult, if not Impossible, to forecast the Possibility of the Occurrence of Business Risks.

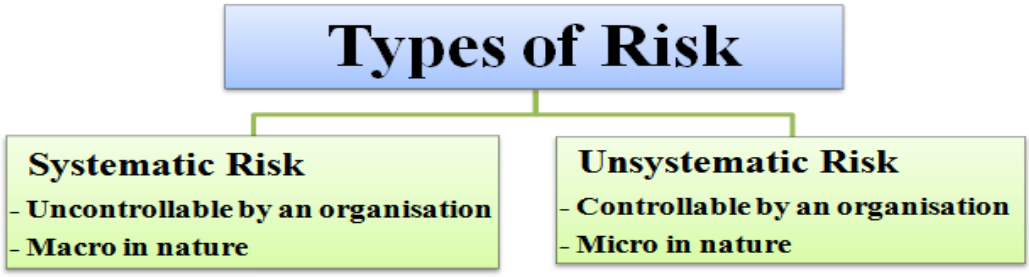
9. Business risks are, by and large, unavoidable though the possibility of the un-favourable consequences associated with business risks could be minimized.

10. Business Risks, to a Large Extent may depend on the Age of the Business Enterprise:

From this viewpoint, old business enterprises are less exposed to business risks, because of the experience of successfully handling business risks, in the past. New business concerns are more exposed to business risks, because of the lack of experience.

TYPES OF RISK

In finance, different types of risk can be classified under two main groups, viz.



1. Systematic risk.
2. Unsystematic risk.

The meaning of systematic and unsystematic risk in finance:

1. Systematic risk is uncontrollable by an organization and macro in nature.
2. Unsystematic risk is controllable by an organization and micro in nature.

A. Systematic Risk

Systematic risk is due to the influence of external factors on an organization. Such factors are normally uncontrollable from an organization's point of view.

It is a macro in nature as it affects a large number of organizations operating under a similar stream or same domain. It cannot be planned by the organization.

The types of systematic risk are depicted and listed below.

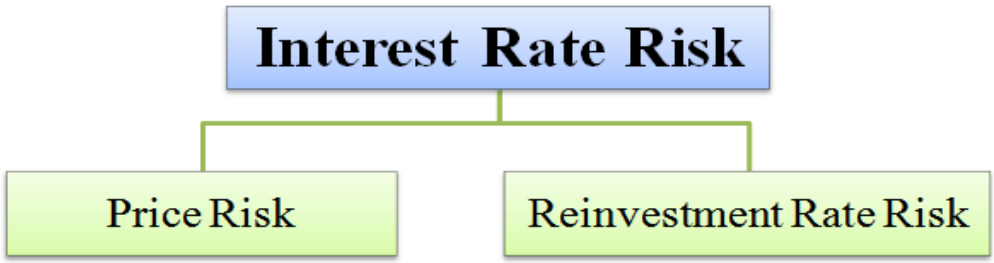
* Note: In context of types of risk in finance, purchasing power risk and inflationary risk are same.

1. Interest rate risk,
2. Market risk and
3. Purchasing power or inflationary risk.

1. Interest rate risk

Interest-rate risk arises due to variability in the interest rates from time to time. It particularly affects debt securities as they carry the fixed rate of interest.

The types of interest-rate risk are depicted and listed below.



1. Price risk and
2. Reinvestment rate risk.

The meaning of price and reinvestment rate risk is as follows:

1. Price risk arises due to the possibility that the price of the shares, commodity, investment, etc. may decline or fall in the future.
2. Reinvestment rate risk results from fact that the interest or dividend earned from an investment can't be reinvested with the same rate of return as it was acquiring earlier.

2. Market risk

Market risk is associated with consistent fluctuations seen in the trading price of any particular shares or securities. That is, it arises due to rise or fall in the trading price of listed shares or securities in the stock market.

The types of market risk are depicted and listed below.

1. Absolute risk,
2. Relative risk,
3. Directional risk,
4. Non-directional risk,
5. Basis risk and
6. Volatility risk.

The meaning of different types of market risk is as follows:

Absolute risk is without any content. For e.g., if a coin is tossed, there is fifty percentage chance of getting a head and vice-versa.

Relative risk is the assessment or evaluation of risk at different levels of business functions. For e.g. a relative-risk from a foreign exchange fluctuation may be higher if the maximum sales accounted by an organization are of export sales.

Directional risks are those risks where the loss arises from an exposure to the particular assets of a market. For e.g. an investor holding some shares experience a loss when the market price of those shares falls down.

Non-Directional risk arises where the method of trading is not consistently followed by the trader. For e.g. the dealer will buy and sell the share simultaneously to mitigate the risk

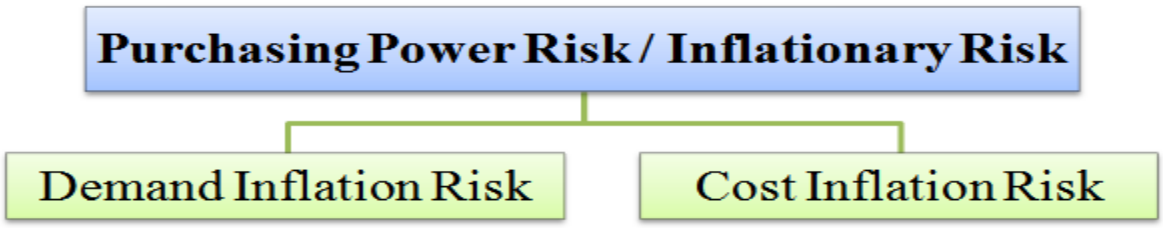
Basis risk is due to the possibility of loss arising from imperfectly matched risks. For e.g. the risks which are in offsetting positions in two related but non-identical markets.

Volatility risk is of a change in the price of securities as a result of changes in the volatility of a risk-factor. For e.g. it applies to the portfolios of derivative instruments, where the volatility of its underlying is a major influence of prices.

3. Purchasing power or inflationary risk

Purchasing power risk is also known as inflation risk. It is so, since it emanates (originates) from the fact that it affects a purchasing power adversely. It is not desirable to invest in securities during an inflationary period.

The types of power or inflationary risk are depicted and listed below.



1. Demand inflation risk and
2. Cost inflation risk.

The meaning of demand and cost inflation risk is as follows:

Demand inflation risk arises due to increase in price, which result from an excess of demand over supply. It occurs when supply fails to cope with the demand and hence cannot expand anymore. In other words, demand inflation occurs when production factors are under maximum utilization.

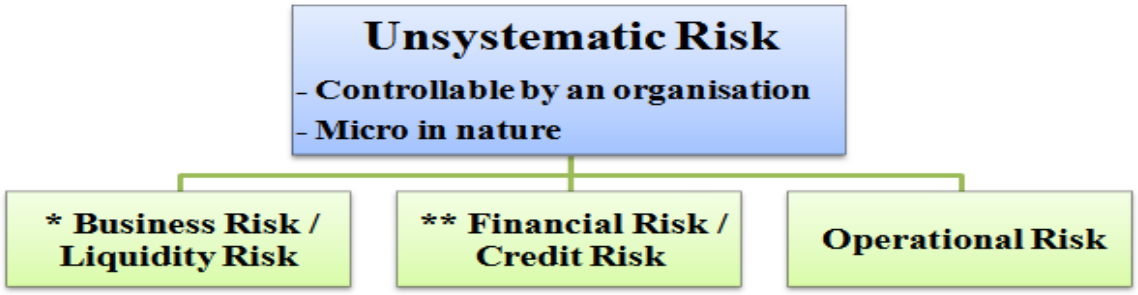
Cost inflation risk arises due to sustained increase in the prices of goods and services. It is actually caused by higher production cost. A high cost of production inflates the final price of finished goods consumed by people.

B. Unsystematic Risk

Unsystematic risk is due to the influence of internal factors prevailing within an organization. Such factors are normally controllable from an organization's point of view.

It is a micro in nature as it affects only a particular organization. It can be planned, so that necessary actions can be taken by the organization to mitigate (reduce the effect of) the risk.

The types of unsystematic risk are depicted and listed below.



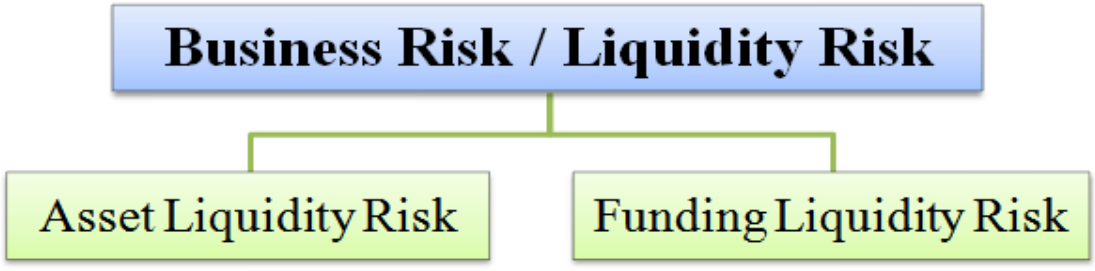
* Note: In context of types of risk in finance, business risk and liquidity risk are same.
** Note: In context of types of risk in finance, financial risk and credit risk are same.

1. Business or liquidity risk,
2. Financial or credit risk and
3. Operational risk.

1. Business or liquidity risk

Business risk is also known as liquidity risk. It is so, since it emanates (originates) from the sale and purchase of securities affected by business cycles, technological changes, etc.

The types of business or liquidity risk are depicted and listed below.



1. Asset liquidity risk and
2. Funding liquidity risk.

The meaning of asset and funding liquidity risk is as follows:

1. **Asset liquidity risk** is due to losses arising from an inability to sell or pledge assets at, or near, their carrying value when needed. For e.g. assets sold at a lesser value than their book value.
2. **Funding liquidity risk** exists for not having an access to the sufficient-funds to make a payment on time. For e.g. when commitments made to customers are not fulfilled as discussed in the SLA (service level agreements).

2. Financial or credit risk

Financial risk is also known as credit risk. It arises due to change in the capital structure of the organization. The capital structure mainly comprises of three ways by which funds are sourced for the projects. These are as follows:

1. Owned funds. For e.g. share capital.
2. Borrowed funds. For e.g. loan funds.
3. Retained earnings. For e.g. reserve and surplus.

The types of financial or credit risk are depicted and listed below.

1. Exchange rate risk,
2. Recovery rate risk,
3. Credit event risk,
4. Non-Directional risk,
5. Sovereign risk and
6. Settlement risk.

The meaning of types of financial or credit risk is as follows:

Exchange rate risk is also called as exposure rate risk. It is a form of financial risk that arises from a potential change seen in the exchange rate of one country's currency in relation to another country's currency and vice-versa. For e.g. investors or businesses face it either when they have assets or operations across national borders, or if they have loans or borrowings in a foreign currency.

Recovery rate risk is an often neglected aspect of a credit-risk analysis. The recovery rate is normally needed to be evaluated. For e.g. the expected recovery rate of the funds tendered (given) as a loan to the customers by banks, non-banking financial companies (NBFC), etc.

Sovereign risk is associated with the government. Here, a government is unable to meet its loan obligations, reneging (to break a promise) on loans it guarantees, etc.

Settlement risk exists when counterparty does not deliver a security or its value in cash as per the agreement of trade or business.

3. Operational risk

Operational risks are the business process risks failing due to human errors. This risk will change from industry to industry. It occurs due to breakdowns in the internal procedures, people, policies and systems.

The types of operational risk are depicted and listed below.

1. Model risk,
2. People risk,
3. Legal risk and
4. Political risk.

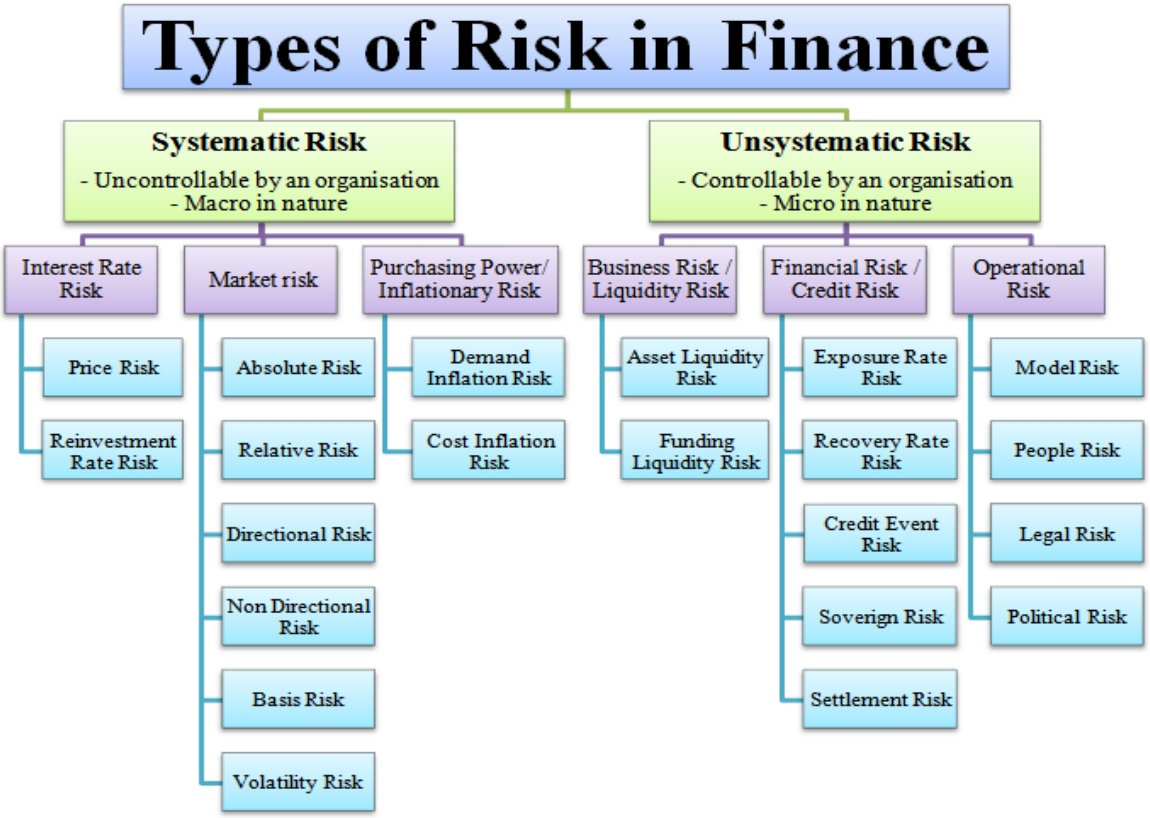
The meaning of types of operational risk is as follows:

Model risk is involved in using various models to value financial securities. It is due to probability of loss resulting from the weaknesses in the financial-model used in assessing and managing a risk.

People risk arises when people do not follow the organization's procedures, practices and/or rules. That is, they deviate from their expected behavior.

Legal risk arises when parties are not lawfully competent to enter an agreement among them. Furthermore, this relates to the regulatory-risk, where a transaction could conflict with a government policy or particular legislation (law) might be amended in the future with retrospective effect.

Political risk occurs due to changes in government policies. Such changes may have an unfavorable impact on an investor. It is especially prevalent in the third-world countries.



TECHNIQUES FOR DECISION MAKING UNDER RISK AND UNCERTAINTY

Risk Analysis

Risk analysis is the process of assessing the likelihood of an adverse event occurring within the corporate, government, or environmental sector. Risk can be analyzed using several approaches including those that fall under the categories of quantitative and qualitative. Risk analysis is still more of an art than a science.

Risk analysis is the process of identifying and analyzing potential issues that could negatively impact key business initiatives or critical projects in order to help organizations avoid or mitigate those risks. Performing a risk analysis includes considering the probability of adverse events caused by either natural processes, like severe storms, earthquakes or floods, or adverse events caused by malicious or inadvertent human activities; an important part of risk analysis is identifying the potential for harm from these events, as well as the likelihood that they will occur.

Enterprises and other organizations use risk analysis to:

- anticipate and reduce the effect of harmful results from adverse events;
- evaluate whether the potential risks of a project are balanced by its benefits to aid in the decision process when evaluating whether to move forward with the project;
- plan responses for technology or equipment failure or loss from adverse events, both natural and human-caused; and
- Identify the impact of and prepare for changes in the enterprise environment, including the likelihood of new competitors entering the market or changes to government regulatory policy.

Benefits of risk analysis

Organizations must understand the risks associated with the use of their information systems to effectively and efficiently protect their information assets.

Risk analysis can help an organization improve its security in a number of ways. Depending on the type and extent of the risk analysis, organizations can use the results to help:

- identify, rate and compare the overall impact of risks to the organization, in terms of both financial and organizational impacts;
- identify gaps in security and determine the next steps to eliminate the weaknesses and strengthen security;
- enhance communication and decision-making processes as they relate to information security;
- improve security policies and procedures and develop cost-effective methods for implementing these information security policies and procedures;
- put security controls in place to mitigate the most important risks;
- increase employee awareness about security measures and risks by highlighting best practices during the risk analysis process; and
- Understand the financial impacts of potential security risks.

Done well, risk analysis is an important tool for managing costs associated with risks, as well as for aiding an organization's decision-making process.

Steps in risk analysis process

The risk analysis process usually follows these basic steps:

Conduct a risk assessment survey: This first step, getting input from management and department heads, is critical to the risk assessment process. The risk assessment survey is a way to begin documenting specific risks or threats within each department.

Identify the risks: The reason for performing risk assessment is to evaluate an IT system or other aspect of the organization and then ask: What are the risks to the software, hardware, data and IT employees? What are the possible adverse events that could occur, such as human error, fire, flooding or earthquakes? What is the potential that the integrity of the system will be compromised or that it won't be available?

Analyze the risks: Once the risks are identified, the risk analysis process should determine the likelihood that each risk will occur, as well as the consequences linked to each risk and how they might affect the objectives of a project.

Develop a risk management plan: Based on an analysis of which assets are valuable and which threats will probably affect those assets negatively, the risk analysis should produce control recommendations that can be used to mitigate, transfer, accept or avoid the risk.

Implement the risk management plan: The ultimate goal of risk assessment is to implement measures to remove or reduce the risks. Starting with the highest-priority risk, resolve or at least mitigate each risk so it's no longer a threat.

Monitor the risks: The ongoing process of identifying, treating and managing risks should be an important part of any risk analysis process.

The focus of the analysis, as well as the format of the results, will vary depending on the type of risk analysis being carried out.

IMPORTANT TECHNIQUES

All methods or techniques for decision making under risk and uncertainty can be classified into two- General or traditional methods and Modern or quantitative methods.

GENERAL OR TRADITIONAL METHODS

Under these techniques some appropriate adjustments are made to the estimated cash flows to make them more reliable. The following are the important traditional techniques:

1. RISK ADJUSTED DISCOUNT RATE

When analyzing investments or projects for profitability, cash flows are discounted to present value to ensure the true value of the undertaking is captured. Typically, the discount rate used in these applications is the market rate. However, based on circumstances related to the project or investment, it may be necessary to utilize a risk-adjusted discount rate. The concept of the risk-adjusted discount rate reflects the relationship between risk and return. In theory, an investor willing to be exposed to more risk will be rewarded with potentially higher returns, since greater losses are also possible. This is shown in the risk-adjusted discount rate as the adjustment changes the discount rate based on the risk faced. The expected return on an investment is increased because there is increased risk in the project.

The risk-adjusted discount rate is based on the risk-free rate and a risk premium. The risk premium is derived from the perceived level of risk associated with a stream of cash flows for which the discount rate will be used to arrive at a net present value. The risk premium is adjusted upward if the level of investment risk is perceived to be high. When a high risk-adjusted discount rate is applied to a stream of cash flows, the net present value of those cash flows will be greatly reduced. Conversely, a low risk-adjusted discount rate will result in a higher net present value. A proposed investment with a higher net present value is more likely to be accepted. Thus, the discount rate is used to judge whether a proposed investment is acceptable. Other types of risks must also be considered, such as currency risk when a foreign investment is being evaluated.

The most common adjustment relates to uncertainty to the timing, dollar amount or duration of cash flows. For long-term projects, there is also uncertainty relating to future market conditions, profitability of the investment and inflation levels. The discount rate is adjusted for risk based on the projected liquidity of the company, as well as the risk of default from other parties. For projects overseas, currency risk and geographical risk are items to consider. A company may adjust the discount rate to reflect Investments with the potential to damage a company's reputation, lead to a lawsuit or result in regulatory issues. Finally, the risk-adjusted discount rate is altered based on projected competition and the difficulty of retaining a competitive advantage.

In short, Risk-adjusted discount rate is the rate used in the calculation of the present value of a risky investment, such as the real estate or a firm. In fact, the risk-adjusted discount rate represents the required return on investment. The risk-adjusted discount rate is the total of the risk-free rate, i.e. the required return on risk-free investments, and the market premium, i.e. the required return of the market. Financial analysts use the risk-adjusted discount rate to discount a firm's cash flows to their present value and determine the risk that investor should accept for a particular investment. The difference between the market premium, which is often used as a discount rate in valuation analysis is that the risk-adjusted discount rate takes into consideration the future market conditions, the level of inflation and the value of money at the end of the investment horizon.

Merits

It is easy to understand and easy to calculate

Risk-adjusted rates prepare investors to face any uncertainties.

Risk-adjusted discount rates appeal to an investor's institution, especially any investor that is averse to taking risks

It can be used along with both NPV and IRR.

It considers time value of money.

It involves risk by making discount rate as a function of proposal risk.

It helps in finding future wealth generated by risky project.

Demerits

It does not adjust future cash flow which is risky and uncertain.

It does not show the level of risk involve in project.

To begin with, the process of obtaining an adjusted rate is not a straightforward process, especially since capital asset pricing model have limited practical applications.

Such an adjustment is based on the fundamental assumption that all investors are averse to taking risks, which is not true.

There is no scientific way of determining the risk premium.

It assumes that risk increases with time at a constant rate. This is not valid.

Decision Rule

An estimation of the present value of cash for high risk investments is known as risk-adjusted discount rate. Example: A very common example of risky investment is the real estate. It is generally calculated as a sum of risk free rate and risk premium.

. Risk-adjusted discount rate = Risk free rate + Risk premium.

The variation of risk premium is depending on the risk aversion of investor and the perception of investor about the size of property's investment risk.

Risk free rate: it is the rate at which the future cash in-inflows should be discounted, if they had no risk.

Risk premium rate: it is the extra return expected by the investors over the normal rate on the account of project being risk.

For higher risk investment project a higher rate will be used and for a lower risk investment project, a low rate will be used. The risk adjusted discount rate can be used with IRR and NPV methods. If NPV is positive, then the project may be considered. In the case of IRR method, the internal rate of, return is compared with the risk adjusted rate of return and if the former exceeds the latter, the project can be accepted.

Illustration 1: Find out the NPV with nominal discount rate and risk-adjusted discount rate. The information given is as follows-

- Discount rate is 9% and risk premium rate is 6%.
- Cash flows for 5 years are- Rs.60, 000, Rs.85000, Rs.52000, Rs.89000 and Rs.93000 respectively.
- Initial investment is Rs.2, 00, 000.

Solution: Calculate NPV with Risk free rate-

Year	Cash flows	Discount rate@9%	Present Value
1	60000	1.09	55045.87
2	85000	1.18	72033.89
3	52000	1.29	40310.07
4	89000	1.41	63120.56
5	93000	1.53	60784.31
Total			291294.7

NPV = Present value of cash flows- Initial investment

= 291294.7-2, 00,000 = **Rs.91294.7**

NPV is positive. So, this project is acceptable.

Calculate NPV with risk-adjusted discount rate-

Year	Cash flows	Risk-adjusted discount rate@15%	Present Value
1	60000	1.15	52173.91
2	85000	1.32	64393.93
3	52000	1.52	34210.52
4	89000	1.74	51149.42
5	93000	2.01	46268.65
Total			2, 48,196.43

NPV = Present value of cash flows- Initial investment

= 2, 48,196.43-2, 00, 000

= Rs.48, 196.43

NPV is also positive in risk-adjusted discount rate. So, this project is acceptable even if the NPV with risk free rate shows negative results. But if it gives negative result then this project is not acceptable because in that case company suffer losses which affect the goodwill of the company.

Illustration 2: Suppose Company A has three projects (C, D and E) which show positive NPV. But Company does not have enough money to invest in all three projects. So, it decides by the management to know which project increases financial position of the company. Find out the NPV with the help of risk-adjusted discount rate.

Particulars	Initial investment	1st year	2nd year	3rd year	Risk free rate	Risk premium
Project C	56, 000	25, 000	10, 000	15, 000	2	5
Project D	50, 000	32, 000	12, 000	41, 000	1.2	4
Project E	85, 000	12, 000	30, 000	53, 000	3	7

Solution:

Project C

Risk-Adjusted Discount rate = 2+5 = 7%

Project D = 1.2+4 = 5.2%

Project E = 7+3 = 10%

Particulars	**Initial investment**	**1st year**	**2nd year**	**3rd year**	**Total**
Project C	56, 000	25, 000	20, 000	15, 000	60, 000
Present Value		23, 364	17, 544	12, 195	53, 103
Project D	68, 000	32, 000	12, 000	35, 000	79, 000
Present Value		30, 418	10, 810	30, 172	71, 400
Project E	85, 000	12, 000	30, 000	53, 000	95, 000
Present Value		10, 909	24, 793	39, 850	75, 552

NPV = Present value of cash flow – Initial investment

Project C = Rs. (53, 103 – 56, 000) = -Rs.2, 897

Project D = Rs. (71, 400 – 68, 000) = Rs. 3, 400

Project E = Rs. (75, 552 – 85, 000) = -Rs. 9, 448

Project D has positive NPV. So, this project is beneficial for the Company.

2. CERTAINTY EQUIVALENT CO-EFFICIENT METHOD

The certainty equivalent is a guaranteed return that someone would accept now, rather than taking a chance on a higher, but uncertain, return in the future. Put another way, the certainty equivalent is the guaranteed amount of cash that a person would consider as having the same amount of desirability as a risky asset. Under the CE approach, the decision maker must first

evaluate a cash flow's risk and then specify how much money, to be received with certainty, will make him or her indifferent between the riskless and the risky cash flows. Riskless cash flows mean the cash flow which the management is prepared to accept in case there is no risk involved. It assumes a value between 0 and 1.

Certainty-Equivalent: It is a **method** in which uncertain cash flows are converted into certain cash flows by multiplying with probability of occurrence such cash flows. Certainty Equivalent factor (CEF) is the ratio of assured cash flows to uncertain cash flows. Under this approach, the cash flows expected in a project are converted into risk-less equivalent amount. The adjustment factor used is called CEF. This varies between 0 and 1. A co-efficient of 1 indicates that cash flows are certain. The greater the risk in cash flow, the smaller will be CEF 'for receipts', and larger will be the CEF 'for payments'. While employing this method, the decision maker estimates the sum she must be assured of receiving, in order that she is indifferent between an assured sum and expected value of a risky sum.

Formula:

$$CEF = CCF/UCF$$

In this equation, the term CCF refers to the amount, which decision-maker is willing to receive as an assured sum in lieu of an unassured sum (Risk free cash flow). The term UCF means uncertain cash flows (Risky cash flow).

Formula of Certainty Coefficient:

Certainty Coefficient = Expected Cash Flows (Certain cash Flows) / Risky Cash Flows

= Expected Cash Flows (Certain cash Flows)/ (1+risk premium rate)

Method of Computation under CE approach:

Step 1: Convert uncertain cash flows to certain cash flows by multiplying it with the CEF. (Calculate the certainty equivalent cash flows. Multiply each cash flow by its corresponding certainty equivalent coefficient.)

Step 2: Discount the certain cash flows at the risk free rate to arrive at NPV. (Calculate the net present value, or NPV. Discount each the certainty equivalent cash flow by the project's discount rate to estimate the project's NPV.)

Decision rule: If the resultant NPV is positive project can be accepted. Determine the certainty equivalent coefficients. Select a coefficient between zero and one that reflects the riskiness of each cash flow. A coefficient of zero indicates that you do not expect to receive the cash flow at all, and a coefficient of one indicates full confidence that you will receive the cash flow. Unfortunately, there is no precise way of estimating certainty equivalents. The adjustments should reflect your judgment about the project's riskiness. For example, a coefficient of 0.5 would indicate 50 percent confidence in receiving a cash flow.

By using NPV method	**By using IRR method:**
NPV > 0 project accepted	IRR > r project accepted
NPV < 0 project rejected	IRR < r project rejected
NPV = 0 project may be accepted or rejected.	IRR = 0 project may be accepted or rejected.

Advantages

The certainty equivalent method is simple and easy to apply.

It can easily accommodate differential risk among cash flows.

It is useful when comparing a number of project appraisals in decision-making as it is based on the probability of the combined NPVs occurring.

It recognises risk by modifying the cash flows which are subject to risk, i.e. conceptually it is superior to the earlier method, viz., and time-adjusted discount rate method.

Disadvantages

In actual practice, it is very difficult to implement.

This approach depends on the utility preference to the management and intuitive recognition of the investors since it is a subjective estimate, i.e., it can neither be objective nor be precise and consistent.

It does not recognise the probability distribution of possible cash flows.

It is very difficult to calculate and understand.

Sometimes the forecasts are to pass through several levels of management; in that case, the effect may be to exaggerate the original forecast.

Illustration 3: In below table years, cash inflows and certainty coefficient are given which shows the probability of occurrence of cash flows.

Year	Cash inflows	Certainty Coefficient
1	28,000	0.8
2	32,000	0.6
3	46,000	0.4
4	58,000	0.2

The initial cost of investment is Rs.65, 000 and the discount rate is 8% annually. Find out the NPV with the help of certainty-equivalent method.

Solution:

Year	Cash inflows	Certainty Coefficient	Certain-Equivalent Cash flows	Discount Rate 8%	Present Value
1	28,000	0.8	22400	1.08	20,740.74
2	32,000	0.6	19200	1.17	16,410.26
3	46,000	0.4	18400	1.26	14,603.17
4	58,000	0.2	11600	1.36	8529.41
Total					60,283.58

NPV = Present cash Inflows-Cash outflows

= Rs. (60,283.58-65, 000)

= - Rs.4, 716.42

NPV is negative which means project is not acceptable.

Illustration 4 by using IRR method:

Let's assume r =10%

Year	Certain-Equivalent Cash flows	Discount rate 10%	Present Value
1	22400	1.1	20,363.63
2	19200	1.21	15,867.76
3	18400	1.33	13,834.58
4	11600	1.46	7,945.20
Total			58011.17

NPV = Present Value of cash inflows – Cash Outflows

= Rs. (58011.17-65000)

=- Rs.6988.83

Let's assume r = 4%

Year	Certain-Equivalent Cash flows	Discount rate 10%	Present Value
1	22400	1.04	21,538.46
2	19200	1.08	17,777.77
3	18400	1.12	16,428.57
4	11600	1.16	10,000
Total			65744.8

NPV = Present Value of cash inflows – Cash Outflows

= Rs. (65744.8-65000)

= Rs. 744.8

IRR = lower rate+ (NPV at lower rate/ (NPV at lower rate-NPV at higher rate))*(higher rate-lower rate)

= 4+ (744.8/ (744.8- (6988.83))*(10-4)

= 4.57%

So, this project is rejected due to IRR (4.57%) < risk free rate (8%).

3. OPTIMISTIC AND PESSIMISTIC ESTIMATES

An optimistic estimate is what a team hopes will be the amount of time to complete their project, assuming everything goes as planned. The pessimistic estimate is the worst case scenario and is an estimate that a team would give if everything goes wrong. The first one is Optimistic activity duration. This estimation is provided for the best case scenario. Estimator considers that everything will go smoothly during the activity and provides estimation for this case. The next one is Pessimistic activity duration. This estimation is provided for the worst case scenario. Estimator considers all possible issues that could happen during the activity and provides an estimate that the activity could be finished in the worst case.

PERT (Program Evaluation Review Technique) is an estimation technique which was first developed and applied by United States Defense establishment for their Ballistic Missile development program. It was one of their most ambitious programs. Completion of this in time, ahead of the other nations was critical for them. Such missile development program was filled with huge amount of uncertainty, as it required large number supplier agencies working on new technology development. This method of estimation which helped them build-in all the uncertainties in their estimates and helped them to complete this program ahead of their expected schedule.

PERT uses a three-point estimation approach for a task. Any task filled with uncertainties can have a wide range of estimate in which the task actually will get completed. Uncertainties include both favourable conditions (opportunities) as well as unfavorable conditions (threats).

PERT includes statistical analysis.

The 3 points of estimates are as below:

- **Optimistic estimate –** Estimate when all favourable things will happen (all opportunities happen and no threats take place).
- **Pessimistic estimate –** Estimate when all unfavorable conditions happen (all threats happen and no opportunities take place).
- **Most Likely estimate –** Estimate when both favourable and unfavorable conditions will happen.

MODERN OR QUANTITATIVE METHODS (QUANTITATIVE TECHNIQUES)

These methods are based on mathematical or statistical principles. These methods are generally considered as more reliable. The following are the important quantitative techniques:

1. SENSITIVITY TECHNIQUE

A sensitivity analysis determines how different values of an independent variable affect a particular dependent variable under a given set of assumptions. This model is also referred to as a what-if or simulation analysis. Sensitivity analysis can be used to help make predictions in the share prices of publicly-traded companies or how interest rates affect bond prices. Sensitivity analysis allows for forecasting using historical, true data.

The technique used to determine how independent variable values will impact a particular dependent variable under a given set of assumptions is defined as **sensitive analysis**. Its usage will depend on one or more input variables within the specific boundaries, such as the effect that changes in interest rates will have on a bond's price. It is also known as the what – if analysis. Sensitivity analysis can be used for any activity or system. All from planning a family vacation with the variables in mind to the decisions at corporate levels can be done through sensitivity analysis.

Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be divided and allocated to different sources of uncertainty in its inputs. A related practice is uncertainty analysis, which has a greater focus on uncertainty quantification and propagation of uncertainty; ideally, uncertainty and sensitivity analysis should be run in tandem. The process of recalculating outcomes under alternative assumptions to determine the impact of a variable under sensitivity analysis can be useful for a range of purposes,

Sensitivity analysis is one of the tools that help decision makers with more than a solution to a problem. It provides an appropriate insight into the problems associated with the model under reference. Finally the decision maker gets a decent idea about how sensitive is the optimum solution chosen by him to any changes in the input values of one or more parameters. Sensitivity analysis works on the simple principle: **Change the model and observe the behavior.**

The parameters that one needs to note while doing the above are:

A) Experimental design: It includes combination of parameters that are to be varied. This includes a check on which and how many parameters need to vary at a given point in time, assigning values (maximum and minimum levels) before the experiment, study the correlations: positive or negative and accordingly assign values for the combination.

B) What to vary: The different parameters that can be chosen to vary in the model could be:
a) the number of activities
b) the objective in relation to the risk assumed and the profits expected
c) technical parameters
d) number of constraints and its limits

C) What to observe:
a) the value of the objective as per the strategy
b) value of the decision variables
c) value of the objective function between two strategies adopted

Measurement of sensitivity analysis

Below are mentioned the steps used to conduct sensitivity analysis:

1. Firstly the base case output is defined; say the NPV at a particular base case input value (V1) for which the sensitivity is to be measured. All the other inputs of the model are kept constant.
2. Then the value of the output at a new value of the input (V2) while keeping other inputs constant is calculated.
3. Find the percentage change in the output and the percentage change in the input.

4. The sensitivity is calculated by dividing the percentage change in output by the percentage change in input.

This process of testing sensitivity for another input (say cash flows growth rate) while keeping the rest of inputs constant is repeated until the sensitivity figure for each of the inputs is obtained. The conclusion would be that the higher the sensitivity figure, the more sensitive the output is to any change in that input and vice versa.

Methods of Sensitivity Analysis

There are different methods to carry out the sensitivity analysis:

- Modeling and simulation techniques
- Scenario management tools through Microsoft excel

There are mainly two approaches to analyzing sensitivity:

- Local Sensitivity Analysis
- Global Sensitivity Analysis

Local sensitivity analysis is derivative based (numerical or analytical). The term local indicates that the derivatives are taken at a single point. This method is apt for simple cost functions, but not feasible for complex models, like models with discontinuities do not always have derivatives. Mathematically, the sensitivity of the cost function with respect to certain parameters is equal to the partial derivative of the cost function with respect to those parameters. Local sensitivity analysis is a ***one-at-a-time*** (OAT) technique that analyzes the impact of one parameter on the cost function at a time, keeping the other parameters fixed.

Global sensitivity analysis is the second approach to sensitivity analysis, often implemented using Monte Carlo techniques. This approach uses a global set of samples to explore the design space.

The various techniques widely applied include:

Differential sensitivity analysis: It is also referred to the direct method. It involves solving simple partial derivatives to temporal sensitivity analysis. Although this method is computationally efficient, solving equations is intensive task to handle.

One at a time sensitivity measures: It is the most fundamental method with partial differentiation, in which varying parameters values are taken one at a time. It is also called as local analysis as it is an indicator only for the addressed point estimates and not the entire distribution.

Factorial Analysis: It involves the selection of given number of samples for a specific parameter and then running the model for the combinations. The outcome is then used to carry out parameter sensitivity.

Through the sensitivity index one can calculate the output % difference when one input parameter varies from minimum to maximum value.

- ***Correlation analysis*** helps in defining the relation between independent and dependent variables.
- ***Regression analysis*** is a comprehensive method used to get responses for complex models.
- ***Subjective sensitivity analysis:*** In this method the individual parameters are analyzed. This is a subjective method, simple, qualitative and an easy method to rule out input parameters.

Using Sensitivity Analysis for decision making

Definition of sensitivity analysis: As per CIMA terminology,
"A modeling and risk assessment procedure in which changes are made to significant variables in order to determine the effect of these changes on the planned outcome. Particular attention is thereafter paid to variables identifies as being of special significance".

Sensitivity analysis, in simple terms, is a modeling technique which is used in Capital Budgeting decisions which is used to study the impact of changes in the variables on the outcome of the project. In a Project, several variables like weighted average cost of capital, consumer demand, price of the product, cost price per unit etc. operate simultaneously. The changes in these variables impact the outcome of the project. However, it is very difficult to assess change in which variable impacts the project outcome in a significant way. In Sensitivity Analysis, the project outcome is studied after taking into change in only **one** variable. The more sensitive is the NPV, the more critical is that variable.

One of the key applications of Sensitivity analysis is in the utilization of models by managers and decision-makers. All the content needed for the decision model can be fully utilized only through the repeated application of sensitivity analysis. It helps decision analysts to understand the uncertainties, pros and cons with the limitations and scope of a decision model.

Most if not all decisions are made under uncertainty. It is the optimal solution in decision making for various parameters that are approximations. One approach to come to conclusion is by replacing all the uncertain parameters with expected values and then carries out sensitivity analysis. It would be a breather for a decision maker if he/she has some indication as to how sensitive will the choices is with changes in one or more inputs.

Uses or merits of Sensitivity Analysis

The key application of sensitivity analysis is to indicate the sensitivity of simulation to uncertainties in the input values of the model.

They help in decision making.

Sensitivity analysis is a method for predicting the outcome of a decision if a situation turns out to be different compared to the key predictions.

Critical Issues: This analysis identifies critical factors that impinge on a project's success or failure. It helps in assessing the riskiness of a strategy.

Helps in identifying how dependent the output is on a particular input value. Analyses if the dependency in turn helps in assessing the risk associated.

Helps in taking informed and appropriate decisions

Aids searching for errors in the model

Demerits of Sensitivity Analysis

Based on Assumptions: Sensitivity analysis is based on historical data & management assumptions. If these assumptions itself are wrong, the whole analysis will be wrong and the future forecast will not be accurate.

Not Relative in Nature: Sensitivity analysis considers each variable individually and tries to determine the outcome. In the real world, all variables are related to each other.

It does not provide clear cut results. The terms optimistic and pessimistic could mean different things to different people.

Not a solution in standalone form.

Ignore probability: This analysis does not look to the probability of changes in the variables. It fails to focus on the interrelationship between underlying variables. For example sales volume may be related to price and cost but we analyse each variable differently.

2. PROBABILITY TECHNIQUE

Probability can be understood as a chance of happening or not happening something. Its value always lies between 0 to1 and always expressed in decimals or fractions. Probability distributions are theoretical frequency distributions that explain how the outcomes of an event are expected to vary. These distributions are very useful in drawing inferences and making decisions under conditions of uncertainly. Take a case of an investor who would like to invest in a company's stock if it gives him or her return of 10%. The current cost of each share of this company is 150 Rs. Also assume that through some past analysis he has been able to find the possible return as Rs. 0, 10, 15, 25, 50 with their respective probabilities as 0.20, 0.25, 0.30, 0.15 and 0.10 for the mentioned stock. With the given probability distribution the investor will be able to take a decision to invest or not invest in the company's stock. All he needs to do is compare the required return of Rs. 15 (10% of 150 Rs) with expected return Rs. 15.75 (0 x 0.20 + 10 x 0.25 + 15 x 0.30 + 25 x 0.15 + 50 x 0.10) to go in the favor of investing in the stock.

Illustration 5

You can invest in one only of shares X, Y or Z. The outcomes in terms of rates of return R over the next year are risky, but have specific probabilities:

	Rate of return R	Probability p(R)
Share X	8%	0.6
	10%	0.2
	12%	0.2
Share Y	9.6%	0.5
	7%	0.4
	13%	0.1
Share Z	7.5%	0.3
	11%	0.6
	14%	0.1

So Share X can have a rate of return of 8 per cent with probability 0.6 or a rate of return of 10 per cent with probability 0.2 or a rate of return of 12 per cent with probability 0.2. You do not know which outcome will be realized at the end of the year, but you must make a decision now. What decision will you make?

SOLUTION

This is decision making under risk. Although you don't know the outcomes with certainty, you do have probability distributions of the random variables R. This allows you to use statistical and probabilistic tools to make decisions. Under conditions of risk, you can analyse the situation by calculating expected (mean) values of returns and a measure of risk. Risk for financial products is usually measured by the volatility of the product's value – that is, the standard deviation of returns. Expected values of returns Share X: Expected return = R = ∑Rp(R) summed over returns R = 0.08(0.6) + 0.10(0.2) + 0.12(0.2) = 0.092 = 9.2% Share Y: Expected return = R = ∑Rp(R) summed over returns R = 0.096(0.5) + 0.07(0.4) + 0.13(0.1) = 0.089 = 8.9% Share Z: Expected return = R = ∑Rp(R) summed over returns R = 0.075(0.3) + 0.11(0.6) + 0.14(0.1) = 0.1025 = 10.25%. You may decide to invest in share Z because it has the highest mean return. However, it would be wise to calculate the respective volatilities (risks) before finalizing the decision. Do this in the following activity.

The concept of probability is fundamental to the use of the risk analysis techniques. It may be defined as the likelihood of occurrence of an event. If an event is certain to occur, the

probability of its occurrence is one but if an event is certain not to occur, the probability of its occurrence is zero. Thus, probability of all events to occur lies between zero and one. Probability distribution can be used to compute expected values. For this purpose following procedure is adopted:

Step 1: establish probability distribution

Step 2: Multiply values with probability of each outcome

Step 3: aggregate the result of step 2.

Illustration 6

X ltd. is considering starting a new project for which it has gathered following data:

Cash flow	Probability
30,000	0.1
60,000	0.4
1, 20,000	0.4
1, 50,000	0.1

Calculate the expected cash flow.

Solution:

Cash flow	probability	expected Cash flow
3,000	0.1	300
6,000	0.4	2,400
12,000	0.4	4,800
15,000	0.1	1,500
	CF =	9, 000

3. STANDARD DEVIATION METHOD

Standard deviation is a statistical technique used in capital budgeting decisions to determine the variation or deviation from the mean of cash flows of the project. The capital investment decision will be taken keeping in view the variation in the expected value where two projects have the same expected value. The project with lesser standard deviation in cash flows carries less risk and uncertainty. Standard deviation is a statistical measure of dispersion. It measures the deviation from a central number i.e. mean. By calculating standard deviation in capital budgeting, we can measure in each case the extent of variation. Higher the standard deviation, higher is the risk associated with the project.

Probability distribution provides the basis for measuring the risk of a project. The rule set down in this connection is "the higher the probability distribution of expected future return, the smaller the risk of a given project and the vice versa." To measure the rightness or dispersion of the probability distribution the most widely used statistical technique of standard deviation is employed. Risk is measured by the possible variation of outcomes around the expected value. The capital investment decision will be taken keeping in view the variation in the expected value where two projects have the same expected value. The decision maker will choose the project which has smaller variation in expected value. In case if the life of the project and initial cash outflow of the two projects are similar, then standard deviation of both the projects can be used in selection of the project. But when the life of the projects and their cash outflows differ, the selection of the project will be done by ascertaining the coefficient of variation instead of standard deviation.

The following steps are involved in computing standard deviation:

(i) Calculate the mean of expected value of the distribution.

(ii) Calculate the deviation from each possible outcome.

(iii) Square each deviation.

iv) Multiply the squared deviations by the probability of occurrence for its related outcome.

(v) Sum all the products. This is called variance.

The standard deviation is determined by taking the square root of the variance.

Standard deviation is smaller, the higher the probability distribution and accordingly the lower the riskiness of the project. Procedure to calculate standard deviation can be explained with the help of following illustration:

Illustration 7:

X ltd. is considering starting a new project for which it has gathered following data:

NPV	Probability
80,000	0.3
1, 10,000	0.3
1, 42,500	0.2

Compute the risk associated with the project i.e. standard deviation.

Solution:

NPV	probability	expected NPV
80,000	0.3	24,000
1, 10,000	0.3	33,000
1, 42,500	0.2	28,500
	NPV =	85,500

Calculation of standard deviation of Project A:

NPV	D	D^2	P	PD^2
80,000	- 5,500	3, 02, 50,000	0.3	90, 75,000
1, 10,000	24,500	60, 02, 50,000	0.3	18, 00, 75,000
1, 42,500	57,000	3,24,90,00,000	0.2	64, 98, 00,000
			$\sigma 2$ =	83, 89, 50,000
			σ =	28,965

ADVANTAGES

Standard deviation has its own advantages over any other measure of spread.

- It measures the deviation from the mean, which is a very important statistic (Shows the central tendency)
- It squares and makes the negative numbers Positive
- The square of small numbers is smaller (Contraction effect) and large numbers larger (Expanding effect). So it makes you ignore small deviations and see the larger one clearly.
- The square is a nice function.

DISADVANTAGES

There are several disadvantages to using standard deviation as a summary measure for risk.

1. As you point out, standard deviation assumes normality of returns. In fact, returns are leptokurtosis (i.e. exhibit fat tails). So the normality assumption leads to under-estimates of risk.

2. If returns are auto-correlated standard deviation will further under estimate risk

3. Standard deviation penalizes positive deviation as opposed to only downside deviation. Most people would be quite happy with returns that were skewed positively even if lumpy.

4. Standard deviation is highly sensitive to outliers in the returns data.

These issues with standard deviation apply with equal force to the use of variance as a risk-measure, and variance-covariance as a tool for measuring portfolio risk.

4. CO-EFFICIENT OF VARIATION METHOD

The standard deviation helps in calculating the risk associated with the estimated cash inflows from an Investment. However, in Capital Budgeting decisions, the management in several times is faced with choosing between many investments avenues. Under such situations, it becomes difficult for the management to compare the risk associated with

different projects using Standard Deviation as each project has different estimated cash flow values. In such cases, the Coefficient of Variation becomes useful.

The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from one another. The coefficient of variation formula or calculation can be used to determine the variance between the historical mean price and the current price performance of a stock, commodity, or bond.

In short, The Coefficient of Variation calculates the risk borne for every percent of expected return. The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a data series around the mean. In finance, the coefficient of variation allows investors to determine how much volatility, or risk, is assumed in comparison to the amount of return expected from investments. The ratio of the standard deviation to mean return, is lower, the better risk-return trade-off.

It is calculated as:

Co−efficient of variation = Standard Deviation ÷ Expected Return or Expected Cash Flow.

$CV = \sigma \div \mu$ where σ = standard deviation μ = mean

Please note that if the expected return in the denominator of the coefficient of variation formula is negative or zero, the result could be misleading. When a selection has to be made between two projects; the management would select a project which has a **lower** Coefficient of Variation.

Illustration 8:

Adman estimates that if there are enough rains (which has a probability of 0.7), the return on sugar cane could be as high as 25%. However, in case of low rain, the return could be as low as 5%. He estimates that standard deviation of return on sugar cane crop is 14%. In case of enough rains, return on cotton could be only 12%, but in case of low rain, the return could be 20%. Standard deviation of return on cotton is expected to be 9%. In the risk-return perspective, which crop is better for Akbar?

Solution

Expected return on sugar cane = 0.7 × 25% + 0.3 × 5% = 19%

Coefficient of Variation of Sugar Cane Cultivation =

= Standard Deviation on Sugar Cane ÷ Expected Return on Sugar Cane

= 16% ÷ 19% = 0.74

Expected return on cotton = 0.7 × 12% + 0.3 × 20% = 14.4%

Coefficient of Variation of Cotton Cultivation =

= Standard Deviation on Cotton ÷ Expected Return on Cotton

= 9% ÷ 14.4% = 0.625

Since cotton cultivation has the lower coefficient of variation, it offers less risk per unit of return. Akbar should prefer cotton over sugar cane.

ADVANTAGES OF THE COEFFICIENT OF VARIATION

The principal advantage of the COV is that it is unit-less. A COV can be run for any given quantifiable data, and otherwise unrelated COVs can be compared to one another in ways that other measures cannot.

In fact, the unit-less quality of COV is what separates it from a standard deviation analysis. The standard deviation of the two variables cannot be compared in any meaningful way. By comparing the standard deviation and the mean, however, the COV makes every dispersion relative and yet independent of the underlying unit.

As a measure of risk, the COV is used to measure volatility in the prices of stocks and other securities. It allows analysts to assess and compare the risks associated with different potential investments. Therefore, it can be used to measure and manage investment risks.

A diversified portfolio of assets is always recommended to reduce the risk of major fluctuations in returns on a single investment. Therefore, risk and diversification are negatively related; that is, as diversification increases, risk decreases.

5. SIMULATION TECHNIQUE

A simulation model is a mathematical model that represents a simplified form of a complex system whose equations are solved by simulation. The main goal of simulation models is to provide mechanisms for experimentation and behavior prediction, the resolution of questions such as "What would occur if?" and learning more about the system represented, among others. They allow one to understand how systems behave over time and to compare their performance under different conditions. Simulation modeling is very frequently used to support decision making in different business areas, and it provides solutions to a wide range of issues at strategic, operational and tactical level.

There are different simulation approaches, such as, state-based process models, discrete-event simulation, System Dynamics, agent-based simulation, Petri-net models, queuing models, Monte Carlo simulation, probabilistic simulation, and traditional mathematical simulation.

Monte Carlo simulation (also known as the Monte Carlo Method) lets you see all the possible outcomes of your decisions and assess the impact of risk, allowing for better decision making under uncertainty. Monte Carlo Simulation is an analytics technique that could be explored to better understand the range of possible outcomes. Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. The technique is used by professionals in such widely disparate fields as finance, project management, energy, manufacturing, engineering, research and development, insurance, oil & gas, transportation, and the environment.

Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action. It shows the extreme possibilities—the outcomes of going for broke and for the most conservative decision—along with all possible consequences for middle-of-the-road decisions. The technique was first used by scientists working on the atom bomb; it was named for Monte Carlo, the Monaco resort town renowned for its casinos. Since its introduction in World War II, Monte Carlo simulation has been used to model a variety of physical and conceptual systems.

Monte Carlo simulation ties together sensitivities and probability distributions.

- This analysis starts with carrying out a simulation exercise to model the investment project.
- It involves identifying the key factors affecting the project and their inter relationships.
- This analysis specifies a range for a probability distribution of potential outcomes for each of model's assumptions.
- Monte Carlo simulation is a computerized mathematical technique that allows decision makers to calculate risk and uncertainty in decision making.
- Monte Carlo simulation generates a range of possible outcomes and their probabilities associated with those outcomes.
- It also shows the probabilities of extreme possibilities like the probability of best case and the worst case along with the probabilities of a range of outcomes.
- The technique is widely used in fields as finance, project management, Portfolio Management, Stock Return Analysis etc.

Under Simulation NPV can be calculated as

$$NPV = \Sigma NCFt\ (1+kt)\ tnt = 0 - I$$

Where,

$NCFt$ = Net Cash flow

Kf = Risk free rate

I = Initial Investment

The following list down **the different steps involved in Simulation** Analysis:

1. Identification of variables that influence cash inflows and outflows.
2. Specify values of parameters and probability distributions of variables.
3. Select a value at random from probability distribution of each of the variables.
4. Determine NPV corresponding to the randomly generated value of variables.
5. Repeat steps (3) & (4) a large number of times to get a large number of simulated NPVs.
6. Plot probability distribution of NPVs.

The different **applications of simulation** analysis are mentioned as below:

1. It is used in Project Finance to model the random Variables with which uncertainty is associated viz., Cash flows, and variable expenses.

2. It is used for Options Pricing where the various factors like implied volatility, price of the underlying asset are the random variables and the different ranges of these individual random variables can be calculated using Monte Carlo Simulation.

3. It is used for making a judgment of the return out of a Stock or a Stock Portfolio. Thus it is of significant importance in Portfolio Management and Retirement Planning.

ADVANTAGES

Monte Carlo simulation has the following advantages for analysis of results where uncertainty is associated:

1. Monte Carlo simulation provides useful inputs for Sensitivity Analysis by helping to understand variability in which inputs affects the outcome to the biggest extent.

2. Using Monte Carlo simulation, a judgment can be made as to the range in which the input lies under a particular scenario. Thus using the results of Monte Carlo Simulation, different scenarios can be studied.

3. The results produced by Monte Carlo Simulation also show the associated probability of the results occurring. Thus it simplifies the decision making process of the management.

4. In a complex decision making environment, different variables are inter- dependent on each other and that impacts the end result out of
a project. Monte Carlo simulation helps to understand the interdependency between input variables. Understanding this inter dependability, enables to reduce the complexity of decision.

DISADVANTAGES

The limitations of simulation analysis are mentioned as below:

1. Difficult to model the project and specify probability distribution of various variables.

2. Simulation provides only rough approximation of probability distribution of NPV.

3. Simulation model is complex and can be constructed by management expert and not by the decision maker.

4. Determine NPV in simulation run, risk free discount rate is used which may not give correct picture.

6. DECISION TREE ANALYSIS

Practically investment decisions may have implications for future or further investment decisions, and may also impact future decision and events. Such situation can be handled by taking a sequence of decisions over a period of time. The technique to handle this type of sequential decisions is done through "Decision Tree" technique. A Decision tree is a graphical representation of relationship between future decisions and their consequences. The sequence of events is shown in a format resembling branches of tree, each branch representing a single possible decision, its alternatives and the probable result in terms of NPV, ROI etc. The alternative with the highest amount of expected monetary value is selected.

The decision tree analysis approach assumes that there are only two types of situation that a finance manager has to face:

1. The first situation is where the manager has control or power to determine what happens next. This is known as "Decision", as he can do what he desires to do.

2. The second situation is where finance manager has no control over what happens next. This is known as "Event". Since the outcome of the events is not known, a probability distribution needs to be assigned to the various outcomes or consequences.

3. When a finance manager faced with a decision situation, he is assumed to act rationally. For example, in a commercial business, he will choose the most profitable course of action and in non-profit organization; the lowest cost may be rational choice.

Steps involved in decision tree analysis are mentioned as below:

Step 1: Define Investment:

- Decision three analyses can be applied to a variety of business decision-making scenarios.
- Normally it includes following types of decisions.

- ❖ Whether or not to launch a new product, if so, whether this launch should be local, national, or international.
- ❖ Whether extra production requirement should be met by extending the factory or by out sourcing it to an external supplier.
- ❖ Whether to dig for oil or not if so, up to what height and continue to dig even after finding no oil up to a certain depth.

Step 2: Identification of Decision Alternatives:

- ❖ It is very essential to clearly identify decision alternatives.
- ❖ For example, if a company is planning to introduce a new product, it may be local launch, national launch or international launch.

Step 3: Drawing a Decision Tree:

- ❖ After identifying decision alternatives, at the relevant data such as the projected cash flows, probability distribution expected present value etc. should be put in diagrammatic form called decision tree.
- ❖ While drawing a decision tree, it should be noted that NPVs etc. should be placed on the branches of decision tree, coming out of the decisions identified.
- ❖ While drawing a decision tree, it should be noted that:-
- ❖ The decision point (traditionally represented by square □), is the option available for manager to take or not to take. This is known as decision node.
- ❖ The event or chance or outcome (traditionally represented by circle O) which are dependent on chance process, along with the probabilities thereof, and monetary value associated with them. This is known as chance node.
- ❖ This diagram is drawn from left to right.

Step 4: Evaluating the Alternatives:

- ❖ After drawing out the decision the next step is the evaluation of alternatives.
- ❖ The various alternatives can be evaluated as follows:

i. This procedure is carried out from the last decision in the sequence (extreme right) and goes on working back to the first (left) for each of the possible decision.

ii. At each final stage decision point, select the alternative which has the highest NPV and truncate the other alternatives. Each decision point is assigned a value equal to the NPV of the alternative selected at the decision point.

iii. Proceed backward in the same manner calculating the NPV at chance or event or outcome points (O) selecting the decisions alternative which has highest NPV at various decision points rejecting the inferior decision option, assigning NPV to the decision point, till the first decision point is reached.

ADVANTAGES

The advantages of using decision tree analysis are mentioned as below:

1. The Decision nodes enable to set out the various options available thus ensuring that no option is left out to be considered.

2. All the options available can are considered simultaneously thus allowing comparison.

3. Risk is addressed in an objective manner by use of probabilities.

4. Decision Trees enable the evaluation of the options by considering the Cash Outflows and the Cash Inflows. Thus it enables to evaluate the different options on the basis of the Net benefit arising out of that project.

5. Simple to understand and apply.

DISADVANTAGES

The limitations of using decision tree analysis are mentioned as below:

1. Probabilities cannot be calculated objectively.

2. Decision Trees use only that data which can be quantified. It ignores qualitative aspects of decisions.

3. Assignment of probabilities and expected values do not have any relevant basis as it pertains to a future outcome which is uncertain.

Illustration 9

A limited company is considering the purchase of a new plant requiring a cash outlay of Rs.50, 000. The plant is expected to have useful life of 2years without any salvage value. The cash flows and their associated probabilities for the 2 years are as follows:

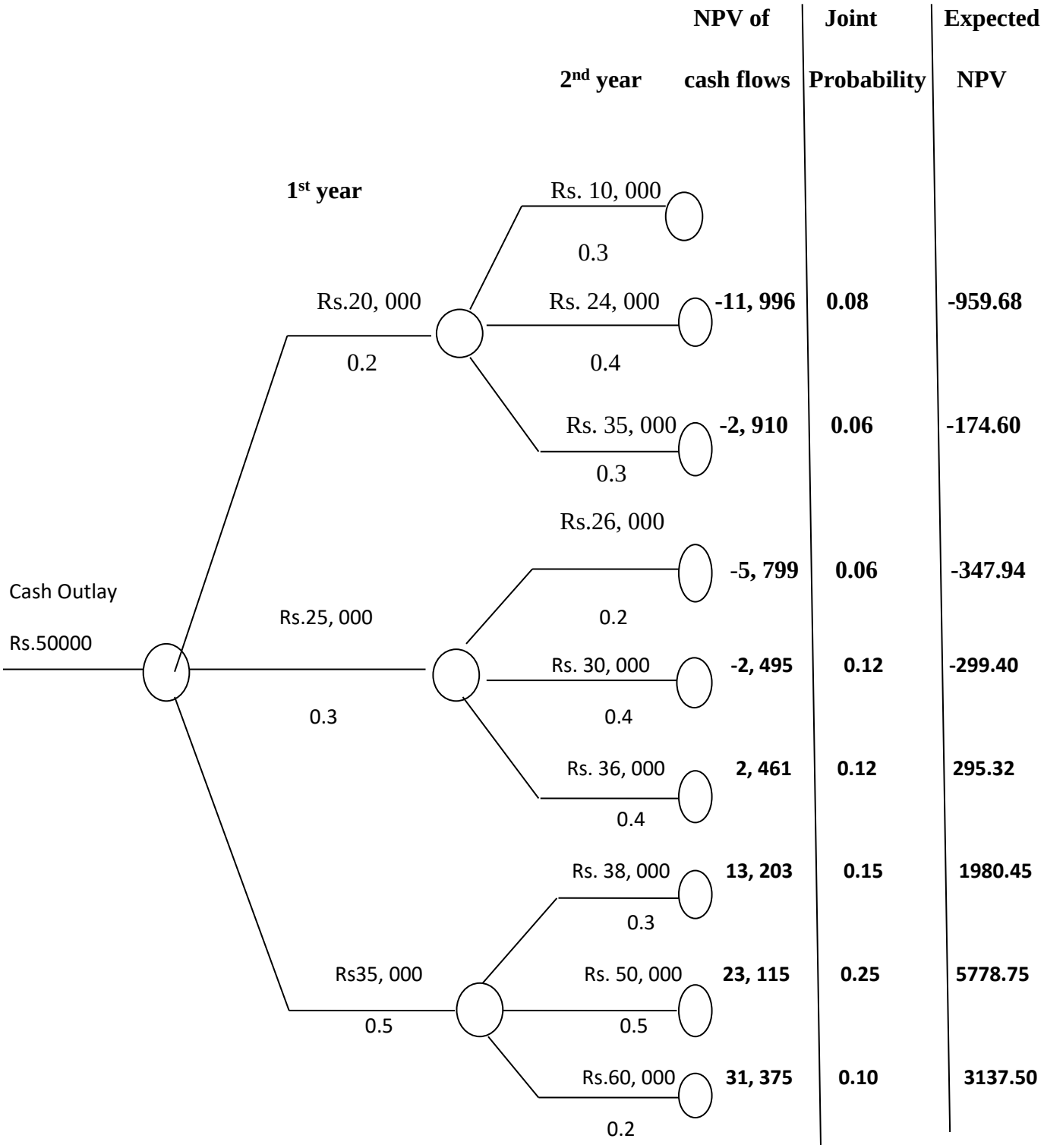
1st Year	cash flow	probability
1	20, 000	0.2
2	25, 000	0.3
3	35, 000	0.5

2nd year: If cash flows in the 1st year are

2nd year	20, 000		25, 000		35, 000	
	Cash flow	probability	Cash flow	probability	Cash flow	probability
1	10, 000	0.3	26, 000	0.2	38, 000	0.3
2	24, 000	0.4	30, 000	0.4	50, 000	0.5
3	35, 000	0.3	36, 000	0.4	60, 000	0.2

Assume that cost of capital is 10%. Plot the above data in the form of a decision tree and suggest whether the project should be accepted or not.

SOLUTION


NPV of
Joint
Expected
2nd year
cash flows
Probability
NPV
1st year
Rs. 10, 000
0.3
Rs.20, 000
Rs. 24, 000
-11, 996
0.08
-959.68
0.2
0.4
Rs. 35, 000
-2, 910
0.06
-174.60
0.3
Rs.26, 000
-5, 799
0.06
-347.94
Cash Outlay
Rs.50000
Rs.25, 000
0.2
Rs. 30, 000
-2, 495
0.12
-299.40
0.3
0.4
Rs. 36, 000
2, 461
0.12
295.32
0.4
Rs. 38, 000
13, 203
0.15
1980.45
0.3
Rs35, 000
Rs. 50, 000
23, 115
0.25
5778.75
0.5
0.5
Rs.60, 000
31, 375
0.10
3137.50
0.2

Working note:

Calculation of NPV

	Cash flow		PV at 10%		Total PV	NPV
Alternatives	**1st year**	**2nd year**	**1st year**	**2nd year**		
(a)1	**20, 000**	**10,000**	**18, 180**	**8, 260**	**26, 440**	**-23, 560**
2	**20, 000**	**24, 000**	**18, 180**	**19, 824**	**38, 004**	**-11, 996**
3	**20, 000**	**35, 000**	**18, 180**	**28, 910**	**47, 090**	**-2, 910**
(b)1	**25, 000**	**26, 000**	**22, 725**	**21, 476**	**44, 201**	**-5, 799**
2	**25, 000**	**30, 000**	**22, 725**	**24, 780**	**47, 505**	**-2, 495**
3	**25, 000**	**36, 000**	**22, 725**	**29, 736**	**52, 461**	**2, 461**
(c)1	**35, 000**	**38, 000**	**31, 815**	**1, 388**	**63,203**	**13, 203**
2	**35, 000**	**50, 000**	**31, 815**	**41, 300**	**73, 115**	**23, 115**
3	**35, 000**	**60, 000**	**31, 815**	**49, 560**	**81, 375**	**31, 375**

The discount factor for the first year at 10% is 0.909. All cash flows of the first year are to be multiplied with this discount factor to get PV. Similarly the discount factor for the second year is 0.826. All cash flows of the second year are to be multiplied with this discount factor to obtain PV. Total PV minus initial cash outlay will give NPV. Probability of the first year and probability of the second year are multiplied in order to get joint probability. Expected NPV is obtained by multiplying the NPV with joint probability.

The decision Tree given above shows that there are nine possible outcomes.

The project yields an expected NPV of Rs. 7, 996.80 at a discount factor of 10%. Hence, the Project should be accepted.

Practical Problems

Problem: 1

Blue Prints Ltd., having 10% cost of capital is considering a project with the following expected cash flows. The risk free rate is 8%. The NPV at 10% is found to be positive.

Year	Cash Flows
0	-22500
1	17500
2	12500
3	12500

Due to uncertainties about the future cash receipts, the management decides to adjust these cash flows to certainty equivalent, by taking only 60%, 55% and 50% 0f cash flows for years 1 to 3 respectively. Assess the validity of project

Solution:

We compute the certain cash flows and NPV at 8%

Year	**Cash Flow**	**CF**	**CCCF**	**Present Value factor @ 8%**	**PV**
0	-22500	1	-22500	1	-22500
1	17500	0.6	10500	0 .926	9723
2	12500	0 .55	6875	0 .857	5892
3	12500	0 .5	6250	0.794	4963
				NPV	**-1922**

Since NPV is negative project should be rejected.

Problem 2

NZ ltd. is considering taking a new project. The management of the company use Certainty Equivalent (CE) approach to evaluate such type of projects.

Following information is available for the project:

Year	CFAT	CE
1	1,15,0000	.90
2	1,15,0000	.85
3	1,15,0000	.75
4	1,15,0000	.70
5	1,15,0000	.65

Projects requires initial investment of ` 3, 00,000. The Company's cost of capital is 12% and risk free borrowing rate is 7%.Advise the company whether it should take project or not?

Solution:

Year	CFAT	CE	Adjusted CFAT	PV Factor 7%	PV
1	1,15,000	.90	1,03,5000	.935	96,772
2	1,15,000	.85	97, 7500	.873	85,336
3	1,15,000	.75	86, 2500	.816	70,380
4	1,15,000	.70	80, 5000	.763	61,422
5	1,15,000	.65	74, 7500	.713	53,297
			Total Present Valve		3, 67,207
			(-) Initial Investment		(3, 00,000)
			Net present value		67,207

Since NPV is positive, project can be accepted.

Problem: 3

A company X is undertaking a project for a period of 3 years. The cash out flow for this project is 1, 10,000. The cash inflows for each year are 35,000; 42,500; 50,000 respectively. The risk free rate is 8% and the risk premium rate is 4%. Consider NPV method, can we accept the project?

Solution

Total rate of discount is rate of discount=8+4 =12%

Calculate NPV with Risk free rate-

Year	Cash flows	Discount rate@12%	Present Value
1	35,000	0.935	32,725
2	42,500	0.873	39460
3	50,000	0.816	40800
Total			1,12,985

NPV = Present value of cash flows- Initial investment

1, 12,985 - 1, 10,000 = 2,985.

NPV is positive. So, this project is acceptable.

Problem: 4

Company X wants to invest in project A. Find out the certainty equivalent cash flows and NPV of that project if the discount rate is 6% and the expected cash flows for five year are as follows:

Cash flows	Certainty Coefficient
5, 000	08
8, 000	0.6
8, 900	0.7
12, 000	0.3
14, 400	0.4

Solution:

Year	Cash flows	Certainty Coefficient	Certain equivalent cash flows	Discount rate 6%	Present Value
1	5, 000	0.8	4, 000	1.06	3, 773.58
2	8, 000	0.6	4, 800	1.12	4, 285.71
3	8, 900	0.7	6, 230	1.19	5, 235.29
4	12, 000	0.3	3, 600	1.26	2,857.14
5	14, 400	0.4	5, 760	1.34	4, 298.51
Total					20, 450.23

NPV = Present value of cash flows – Initial investment

= 20, 450.23 – 20, 000

= Rs. 450.23

The NPV of this project is positive. So, the project A is accepted by the company X.

Problem: 5

From the data presented below, state which project is better?

Cash Flows year end :	Project X Rs.	Project Y Rs.
0	–20,000	–20,000
1	8,000	10,000
2	8,000	14,000
3	4,000	4,000

Riskless discount rate is 5%. Project X is less risky as compared to Project Y. The management considers risk premium rates at 5% and 10%, respectively, for discounting the cash inflows.

Solution :

Calculation of Risk-Adjusted Discount Rate

Project X = 5% + 5% = 10%

Project Y = 5% + 10% = 15%

	Project X			Project Y		
Years	Cash Flow	Discount Factor at 10%	P.V. of N.C.F.	Cash Flow	Discount Factor at 15%	P.V. of N.C.F.
	Rs.		Rs.	Rs.		Rs.
0	– 20,000	1	– 20,000	–20,000	1	– 20,000
1	8,000	0.909	7,272	10,000	0.870	8,700
2	8,000	0.827	6,616	14,000	0.756	10,584
3	4,000	0.751	3,004	4,000	0.658	2,632
			– 3,108			1,916

Here, Project Y is superior to Project X since it has positive NPV.

Problem: 6

Considering the data presented in Illustration 48, state which project is better if certainty- equivalent coefficients are:

	Project X	Project Y
1st year	.90	.80
2nd year	.80	.60
3rd year	.60	.50

Solution :

Discounted Cash Flow at 5%

Determination of NPV

Project X

Years	Cash Flow	Certainty Equivalent Co-efficient	Certain Cash Flow	Discount Factor at 5%	P.V.
	Rs.		Rs.		Rs.
0	– 20,000	1.00	– 20,000	1.000	– 20,000
1	8,000	.90	7,200	0.952	6,854
2	8,000	.80	6,400	0.907	5,804
3	4,000	.60	2,400	0.864	2,074
			Net Present Value		– 5,268

Project Y

Years	Cash Flow	Certainty Equivalent Co-efficient	Certain Cash Flow	Discount Factor at 5%	P.V.
	Rs.		Rs.		Rs.
0	– 20,000	1.00	– 20,000	1.000	– 20,000
1	10,000	.80	8,000	0.952	7,616
2	14,000	.60	8,400	0.907	7,619
3	4,000	.50	2,000	0.864	1,728
			Net Present Value		– 3,037

Hence, Project Y is better than Project X. Since NPV is negative in both cases, none of them can be accepted.

Problem: 7

A company is seized with the problem of choosing one of the two investment proposals with the following probability distribution of expected cash flows in each of the next three years. Determine which project is more risky.

Table 20.3

Calculation of expected value of cash flows

Proposal A		Proposal B	
Probability	Cash Flows Rs.	Probability	Cash Flows Rs
0.10	1,500	0.10	1,000
0.20	1,750	0.25	1,500
0.40	2,000	0.30	2,000
0.20	2,250	0.25	2,500
0.10	2,500	0.10	3,000

Solution:

The expected value of cash flows in each of the next three years for the proposal *A* is

$$\bar{R} = 0.10\,(1{,}500) + 0.20\,(1{,}750) + 0.40\,(2{,}000) \times$$
$$0.20\,(2{,}250) + 0.10\,(2{,}500) = \text{Rs. } 2{,}000$$

The expected value of cash flows in each of the next three years for proposal B is

$$\bar{R} = 0.10\,(1{,}000) + 0.25\,(1{,}500) + .30\,(2{,}000) + 0.25\,(2{,}500)$$
$$+ 0.10\,(3{,}000) = \text{Rs. } 2{,}000$$

Standard deviation in the case of proposal A :

$$\sigma = [0.10\,(1{,}500\text{-}2{,}000)^2 + 0.20\,(1{,}750 - 2{,}000)^2$$
$$+ 0.40\,(2{,}000 - ,000)^2 + 0.20\,(2{,}250 - 2{,}000)^2 + 0.10\,(2{,}500 - 2{,}000)^2]1/2$$
$$= \sqrt{(15{,}000)1/2} = \text{Rs.}387$$

Standard deviation in the case of proposal *B* :

$$\sigma = [0.10\,(1{,}000 - 2{,}000)^2 + 0.25\,(1{,}500 - 2.000)^2 + 0.30 +$$
$$(2{,}000 - 2{,}000)^2 + 0.25\,(2{,}500 - 2{,}000)^2 + 0.10\,(3{,}000 - 2{,}000)^2]1/2$$
$$= \sqrt{(6{,}50{,}000)1/2} = \text{Rs.}806$$

Thus, proposal B has significantly higher standard deviation, indicating a greater dispersion of possible outcomes. Hence, project B is riskier.

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MODULE 4

Standard Costing and Variance Analysis: Introduction, Meaning and Definition of Standard cost – Standard Costing – Meaning, Definition, Features, Historical costing Vs. Standard costing. Standard cost and Estimated cost, Components or Elements of Standard costing, Types of Industries used, used as a Management Tool, Advantage and Limitations – Standard Costing and Budgetary Control (Similarities and Differences) - Types of Standards – Setting standards- Variance Analysis- Importance- Material, Labour, Overhead, Sales and Profit Variance – Interpretation of variance - Control and Efficiency Ratios- Investigation of Variance – Techniques and Methods of interpretation of variance.

STANDARD COSTING AND VARIANCE ANALYSIS

Introduction

In fast growing business world, major goal of organizations is to reduce the cost of production and control the cost as there are limited resources in business and manufacturing concern. Cost accounting has numerous significant tools in order to attain these goals such as standard costing.

Historical cost systems are principally associated with recording of historical, or as they are commonly called, actual costs. Historical costing is the ascertainment of costs after they have been incurred. The recording of historical costs is useful as it determines the cost of resources used towards achieving organizational objectives.

Historical costs, however, have the following limitations:

(1) Historical costs are collected after they have been incurred and therefore are ineffective in cost control. The costs have been incurred, they cannot be undone and no steps can be taken to correct inefficiencies.

(2) Historical costs are not helpful in cost reduction since they contain no standards or goals towards which employees can work.

(3) Historical costs do not provide reliable guides to management in the tasks of budgeting, planning and decision-making. Historical costs reflect a situation in a previous period. But the company, in facts, may be working under conditions different from those prevailing

during that previous period. Therefore, historical costs are not useful in budget making, performance evaluation, detecting above or below—standard performance.

MEANING AND DEFINITION STANDARD COST

Standard: It's a norm or bench mark. It is useful for comparison. It may indicate minimum quality. The term "standard", has been called by different names in accounting, e.g., "a norm", "a model or example or comparison", "a measure of comparison", "a criterion of excellence", "a yardstick", "a benchmark", "an index of waste or potential saving", "a sea level from which to measure cost altitudes", "a gauge." A standard may be a norm or a measure of comparison in terms of specific items such as pounds or kilograms of materials, labour hours required, hours of plant capacity used.

Standard Cost: An estimated or pre-determined cost of performing an operation or producing a good or service, under normal conditions. It is used as a basis for cost control through variance analysis. Realistic estimates of cost based on analyses of both past and projected operating costs and conditions.

It is chosen to serve as a benchmark in the standard costing/ budgetary control system. It is a budget for the production of one unit of product or service. It is a pre-determined cost which is calculated from management's standards of efficient operation and the relevant necessary expenditure.

A standard cost is a planned cost for a unit of product or service rendered. Standard costs are highly detailed, scientifically predetermined costs of material, labour and overhead chargeable to a product or service. Standard costs represent excellent target costs that should be obtained.

CIMA Official Terminology, 2005 defines standard cost as 'The planned unit cost of the product, component or service produced in a period. The standard cost may be determined on a number of bases. The main use of standard costs is in performance measurement, control, stock valuation and in the establishment of selling prices.'

The Chartered Institute of Management Accountants (U.K.) defines standard costs as "a predetermined cost which is calculated from management's standards of efficient operation

and the relevant necessary expenditure. It may be used as a basis for price fixing and for cost control.

H. J. Weldon "Standard costs are pre-determined or forecast estimates of the cost to manufacture a single unit or a number of units of product, during a specific immediate future period.

Bloker and Weltmer "Predetermined costs, based upon engineering specifications and representing highly efficient productions for quantity standard and forecast of future market trends and price standards, With a fixed amount expressed in dollars for material, labor and for an estimate quantity of production.

MEANING AND DEFINITION STANDARD COSTING

Standard costs are extensively recognized in all countries of world. It is an effectual procedure to control cost and assist to accomplish organizational goal. Standard costs are realistic estimates of cost based on analyses of both past and projected operating costs and conditions. In this procedure, standard cost of the product and services is determined in advance and comparing it with actual cost variance to ascertain and analyse.

Standard costing is the establishment of cost standards for activities and their periodic analysis to determine the reasons for any variances. Standard costing is a tool that helps management account in controlling costs. It is a cost accounting technique for cost control where standard costs are determined and compared with actual costs, to initiate corrective action. It is a control method involving the preparation of detailed cost and sales budgets. A management tool used to facilitate management by exception. Standard costing is a control system that enables any variances from standard cost or budget to be analyzed in some detail. This allows for more effective cost control.

Standard costing is the practice of substituting an expected cost for an actual cost in the accounting records. Standard costing involves the creation of estimated (i.e., standard) costs for some or all activities within a company. The core reason for using standard costs is that there are a number of applications where it is too time-consuming to collect actual costs, so standard costs are used as a close approximation to actual costs.

Standard costing is the setting of predetermined cost estimates in order to provide a basis for comparison with actual costs. The Chartered Institute of Management Accountants (UK) defines standard costing as "the preparation and use of standard cost, their comparison with actual cost and the analysis of variance to their causes and points of incidence."

Standard costing is the preparation and use of standard costs, their comparison with actual cost and the analysis of variance to their causes and points of incidence (ICMA, London).

According Weldon, standard costing is the method of ascertaining the costs whereby statistics are prepared to show standard cost, actual cost, and the difference between these costs which is termed as variance. Other theorists like Brown and Howard described that standard costing is a technique of accounting which compares the standard cost of product and services with actual cost to determine the efficiency of operations so that remedial actions can be taken immediately (Gupta, et, al., 2006).

W. B. Lawrence "A standard cost system is a method of cost accounting in which standard costs are used in recording certain transactions and the actual costs are compared with the standard costs to learn the amount and reason for any variation from standard."

Features of Standard Costing

The important features of Standard Costs are as.

1. Cost determination: Determination of standard costs of various elements of costs such as standard cost of direct material, direct labor and various overheads.

2. Cost comparison: Comparison of standard costs and actual costs of production.

3. Control on variances: Finding differences (variances) between actual costs and standard costs. These variances may be favorable as well as unfavorable or adverse.

4. Verification of variances: Analyzing the variances to find the cause of variances.

5. Revision: Remedial steps are suggested so that unfavorable variances may not be repeated in the future.

6. Reporting: Reporting these variances to top management for remedial action.

DIFFERENCE BETWEEN HISTORICAL COSTING AND STANDATRD COSTING

BASE	HISTORICAL COSTING	STANDATRD COSTING
(i) Recording:	Historical Cost is related to the past transactions i.e. the financial transactions are recorded after the actual performance.	Standard Cost is determined and recorded before actual performance.
(ii) High Degree of Efficiency:	Historical Cost is actual and real cost i.e. it is related to past.	Standard Cost is an ideal cost which can be attained under normal conditions. Standard Cost is a predetermined cost related to future.
(iii) Evaluation of Efficiency:	Historical cost fails to provide any helps the management to compare the budgeted cost with that of actual cost.	Standard cost serves as a measure of evaluation of efficiency since it helps the management to compare the budgeted cost with that of actual cost.
(iv) Cost Control:	Historical Cost fails to provide any technique for cost control. Since it fails to make any comparison and fails to provide any yardstick for pointing out the possible causes for rises in cost.	Standard cost is very important for cost control. Standard cost can be used as an yardstick for pointing out the centre of responsibility through the analysis of variations.
(v) Planning and Control:	Historical cost has its own value and carries historical significance. The actual financial position of the concern is made known through it. But it has no practical significance. It is not helpful to the management for planning for variance purposes and control.	Standard cost is considered to be an effective managerial tool of cost control, future planning.

STANDARD COSTS AND ESTIMATED COSTS

The standard costs and estimated costs both are used to determine price in advance. The purpose of both of them is to control cost. They follow the same accounting principles. Despite similarities, they differ in terms of objects and purpose. Estimated costs are based on historical accounting. It is an estimate of what the cost will be. It is a cost of guesswork or reasonable estimate for the costs in future. On the other hand standard costs are based on scientific analysis and engineering studies. Standard costing determines what the cost should be. Standard costs are used as device for measuring efficiency. The standards are predetermined and a comparison of standards with actual costs enables to determine the efficiency of the concern. Estimated costs cannot be used to determine efficiency. It only determines the expected costs. An effort is made that estimated cost should almost be near to actual costs. The purpose of determining estimated costs is to find out selling price in advance to take a decision whether to produce or to make and also to prepare financial budgets. Estimated costs do not serve the purpose of cost control. On the other hand standard costs are helpful in cost control. The analysis of variance enables to take corrective measures, if necessary. Standard costs are not easily changed. The standards are set in such a way that small changes in conditions do not require a change in standards. Estimated costs are revised with the change in conditions. They are made more realistic by incorporating changes in prices. Standard costs are more static than estimated costs. Estimated costs are used by the concern using historical costing. Standard costing issued by those concerns which use standard costing system. Standard costing is a part of cost accounting process while estimated costs are statistical in nature and as such they may not become a part of accounting.

COMPONENTS OR ELEMENTS OF STANDARD COSTING

A standard costing system consists of the following four elements:

1. Setting standards for each operation.

2. comparing actual with standard performance.

3. Analyzing and reporting variances arising from the difference between actual and standard performance.

4. Investigating significant variances and taking appropriate competitive action.

TYPE OF INDUSTRIES WHERE STANDARD COSTING IS MORE SUITABLE:

Standard costing is a system or technique of cost accounting, which can be used in conjunction with process, job or operating costing without any difficulty, whatsoever.

Industries where standard costing is more suitable and used can be listed as under:

1. Process industries where the method of production and nature of output are the same.

Examples: Chemical works, Paper mills, Oil refineries, etc.

2. Industries where the methods of manufacture are repetitive and products are homogeneous.

Examples: Agricultural and food products.

3. Service industries where operating or operation costing system is also applicable.

Examples: Transport, Water, Gas, and Electricity, etc.

4. Engineering and textile industries where a large range of products are produced.

5. Extraction industries such as coal, oil, and timber, etc.

UTILITY OF STANDARD COSTING AS A MANAGEMENT TOOL:

Standard costing aids management in making correct predictions and provides a framework for judging business performance. The utility of standard costing to management is as follows:

1. It acts as a valuable guide to management in the formulation of price and production policies. For example, it assists management in the field of inventory pricing, product pricing and profit planning, etc.

2. It provides a stable and sound basis for comparison of actual costs with standard costs according to different elements of costs separately. It also shows places where remedial action is necessary and how far improvement is possible in the long run.

3. It creates an atmosphere of cost consciousness among the office and managerial staff and workmen of the business. It also provides incentives to workers, middle and top-level executives for efficiency.

4. It helps to formulate tighter, more accurate and effective budget for the coming years.

5. Standard costing assists management in the delegation of authority and responsibility to control the affairs of various departments.

6. With the use of standard costing, the principle of 'management by exception' can be practiced with ease and more effectively.

7. It assists management to put the men, machines and materials more effectively and reap the benefits of better economy, efficiency, and higher productivity.

8. Budgetary control system becomes far more effective when used in conjunction with the standard costing system. Standard costs being scientifically determined are very much useful for better planning and control.

ADVANTAGES OF STANDARD COSTING

The main advantages of standard costing are:

1. Reduce the limitations of historical costing system: Compiling standard costs more carefully can eliminate the weakness of the traditional costing system.

2. Cost control: Standard costs can be used as a yardstick against which actual costs can be compared. It is an effective tool for planning production costs. Hence, cost control is greatly facilitated.

3. Management by exception: Variance analysis helps management to have regular as well as better checks over costs incurred. It makes the application of the principle of management by exception more easy. That is, the management can concentrate its attention on variances only, leaving the other aspects of cost control to be taken care of at the lower level.

4. Valuable guide to management: It is a valuable guide to management in the formulation of production and price policies in advance with certainty. It also assists management in the areas of profit planning, product pricing, and inventory pricing, etc.

5. Quick reporting: Standard costing makes the reporting of operating data more meaningful and also fast. This makes the interpretation of management reports easy.

6. Cost consciousness: As the emphasis of standard costing is more on cost variations, it makes the entire organization cost conscious. It makes the employees to recognize the importance of efficient operations so that costs can be reduced by joint efforts.

7. Economy: Men, machines and materials can be effectively used, and economies can be affected in addition to increased productivity. Standards may also be used as the basis for introducing incentive schemes. Wastage and inefficiency are curtailed, eliminated and reduced in all aspects of manufacturing process over a period of time if standard costing is in continuous operation.

8. Easy fixing of responsibility: Management can easily fix up responsibility through variance analysis. Variance analysis can determine the persons responsible for each variance; shifting or evading responsibility is not so easy under this system.

9. Budgeting*:* A budget is always composed of standard costs, since it would be impossible to include in it the exact actual cost of an item on the day the budget is finalized. Also, since a key application of the budget is to compare it to actual results in subsequent periods, the standards used within it continue to appear in financial reports through the budget period.

10. Inventory valuation: It is extremely easy to print a report showing the period-end inventory balances (if you are using a perpetual inventory system), multiply it by the standard cost of each item, and instantly generate an ending inventory valuation.

11. **Overhead application*:*** If it takes too long to aggregate actual costs into cost pools for allocation to inventory, then you may use a standard overhead application rate instead, and adjust this rate every few months to keep it close to actual costs.

12. Price formulation*:* If a company deals with custom products, then it uses standard costs to compile the projected cost of a customer's requirements, after which it adds a

margin. This may be quite a complex system, where the sales department uses a database of component costs that change depending upon the unit quantity that the customer wants to order. This system may also account for changes in the company's production costs at different volume levels, since this may call for the use of longer production runs that are less expensive.

LIMITATIONS OF STANDARD COSTING

The important limitations of standard costing are as follows:

1. Difficulty in fixing standards: Setting of standards is a very difficult task. It requires a lot of scientific studies such as time-study, motion- study, fatigue study etc. and therefore it is very costly. Small firms may find it very difficult to operate such system.

2. Lack of frequent revisions: Standards are very rigid estimates and once set, are not changed for a considerable time. This makes the standards highly unrealistic in certain industries, which face fluctuations in prices of products due to frequent changes in material and labour costs. Revision of standards is also not easy; in case of revision, costs would be high.

3. Labour problems: The utility of variance analysis depends much more on the standards set. While a loosely set standard may be ridiculed, the very high standards may create frustration in the minds of workers. At the same time setting of correct standards is also very difficult.

4. Unsuitable: It is not suitable for industries producing non-standardized products. It is of little value in job or contract costing. Also it is difficult to apply this system when production takes more than one accounting period.

5. Failure: Fixation of responsibility to a particular person, process or production becomes very difficult as it may not be possible to identify the controllable and non-controllable factors easily.

6. Adverse effect on morale: Normally the system is strongly opposed by managers and others as they see it as a threat to their freedom of action. Standards may sometimes create adverse psychological effects on managers and workers, who are operating the system.

7.* Cost-plus contracts*: If you have a contract with a customer under which the customer pays you for your costs incurred, plus a profit (known as a cost-plus contract), then you must use actual costs, as per the terms of the contract. Standard costing is not allowed.

8. Drives inappropriate activities*:* A number of the variances reported under a standard costing system will drive management to take incorrect actions to create favorable variances. For example, they may buy raw materials in larger quantities in order to improve the purchase price variance, even though this increases the investment in inventory. Similarly, management may schedule longer production runs in order to improve the labor efficiency variance, even though it is better to produce in smaller quantities and accept less labor efficiency in exchange.

9. Fast-paced environment*:* A standard costing system assumes that costs do not change much in the near term, so that you can rely on standards for a number of months or even a year, before updating the costs. However, in an environment where product lives are short or continuous improvement is driving down costs, a standard cost may become out-of-date within a month or two.

10. Slow feedback: A complex system of variance calculations is an integral part of a standard costing system, which the accounting staff completes at the end of each reporting period. If the production department is focused on immediate feedback of problems for instant correction, the reporting of these variances is much too late to be useful.

11. Unit-level information*:* The variance calculations that typically accompany a standard costing report are accumulated in aggregate for a company's entire production department, and so are unable to provide information about discrepancies at a lower level, such as the individual work cell, batch, or unit.

BUDGETARY CONTROL AND STANDARD COSTING

Budgetary control and standard costing are comparable systems of cost accounting in that they are both predetermined and forward-looking. The common objective is of controlling business operations by establishing pre-determined targets. The modus operandi is also the same for both the systems where the actual performance is compared with the pre-determined targets (standards or budgets) in order to ascertain variance. The causes of such variances are

then investigated and appropriate actions taken wherever necessary. However, there are few distinctions between these two systems.

SIMILARITIES BETWEEN BUDGETING AND STANDARD COSTING

The following are the points of similarity between standard cost and budget cost:

	Standard Costing	Budgeting Cost
Predetermined cost	Standard costs are predetermined costs fixed according to estimates.	Budget costs are also estimated costs.
Advance cost	Standard costs are estimated in advance, these are compared to actual costs.	These costs are also estimated in advance and these are compared to actual costs.
Both aim at cost control	Standard cost is designed to control costs and bring efficiency.	Budgeting costs also aim at cost control and assure addition in employee's efficiency.
Cost comparison	Standard costs are designed well in advance and compared to actual costs.	These advance estimated costs and compared to actual costs.
Reporting	Standard costs are periodically reported to top management	Budgetary costs are also reported to management periodically.
Corrective action	Standard cost lays stress on check of adverse variation and effort is made for correction.	Budgetary control lays stress on check of adverse variances.

DIFFERENCES BETWEEN STANDARD COSTING AND BUDGETARY COSTING

Basis of difference	**Standard Costing**	**Budgetary Costing**
Base	Standard costs are predetermined or planned costs.	Budgetary costs are based on past experiences
Technique	Standard costs are based on technical estimates.	The budgetary costs are based on historical data and adjusted to the future.
Scope	The standards are set for elements of costs.	The budgets are prepared for every business activity.
Limited use	Standard costs can be used for estimation or forecasting.	Budgets are used for men, material and money.
Conditions	Standard costs are used in ideal conditions or situations.	Budgets are made and used, in own situation or situations.
Per unit	Standard costs can be calculated per unit.	Budgetary cost cannot be calculated per units.
Nature	Standards are set only for expenditure.	Budgets are compiled for both income and expenditure.
Coverage	Standard cost is not comprehensive; it is only limited to cost operations.	Budgetary cost coverage is much more than standard costs.
Parts	Standard costs cannot be in parts.	Budget can be in parts: only Cash budget.

TYPES OF STANDARDS

Ideal Standards: These represent the level of performance attainable when prices for material and labour are most favorable, when the highest output is achieved with the best equipment and layout and when maximum efficiency in utilization of resources results in maximum output with minimum cost.

Normal Standards: These are the standards that may be achieved under normal operating conditions. The normal activity has been defined as number of standard hours which will produce normal efficiency sufficient goods to meet the average sales demand over a term of years.

Basic or Bogey standards: These standards are use only when they are likely to remain constant or unaltered over long period. According to this standard, a base year is chosen for comparison purposes in the same way as statistician use price indices. When basic standards are in use, variances are not calculated as the difference between standard and actual cost. Instead, the actual cost is expressed as a percentage of basic cost.

Current Standard: These standards reflect the management's anticipation of what actual cost will be for the current period. These are the costs which the business will incur if the anticipated prices are paid for goods and services and the usage corresponds to that believed to be necessary to produce the planned output.

Expected standard: This is the standard which is actually expected during a specified budget period. In setting this standard, a reasonable allowance is made for normal wastage and normal idle time. It is, therefore, more realistic than ideal standard. It is also called attainable standard.

STEPS INVOLVED IN STANDARD COSTING

As Standard Costing is an important management tool, important should be given in its installation. The following steps are involved for establishing standard costing system in an organization.

1. Determination of Cost Centre

The cost centre is necessary for fixing costs and fixation of responsibility. In the manufacturing concern, cost centres are created according to the number of products produced and the number of sections, departments or divisions is involved in the production process.

A cost center is a location, person or item of equipment (or a group of these) for which costs may be ascertained and used for the purpose of cost control. The cost center may be classified into a personal cost center, which relates to persons, or impersonal cost center, which relates to equipment or location. Cost centers are set up for cost ascertainment and cost control. A cost centre relating to a person is called personnel cost centre and a cost centre relating to products and equipment is called impersonal cost centre.

In many cases, the department or functions will form natural cost centers, but it may happen that there are a number of cost centers in a department. For example, if there are five machine groups in a production department, each group may be taken as a cost center. Cost centers are essential for establishing standards and analyzing the variances.

2. Classification of Accounts

The costs are incurring at various stages of production process. These costs should be recorded properly for accurate calculation of total costs incurred. Hence, there is a need of classification of accounts for cost control under standard costing system. The accounts are classified for the purpose of collection and analysis. Codes and symbols are used to facilitate this purpose.

3. Codification of Accounts: The different accounts can be codified and different symbols can be used to facilitate speedy collection, communication and reporting. The following codes can be used for elements of cost.

Codes	Elements of Cost
000-100	Direct Materials
101-150	Indirect Materials
151-200	Direct Labor

Codes	Elements of Cost
201-250	Indirect Labor
251-300	Direct Expenses
301-400	Factory overhead
401-500	Office and administration overhead
501-600	Selling and distribution overhead

4. Setting of Standards

A standard is an ideal which is anticipated and can be attained over a future period of time, normally in the next accounting year. The success of standard costing system is based on the genuineness, reliability and acceptance of these standards.

There are three types of standards. They are current standard, basic standard and normal standard. The current standard is divided into two i.e. ideal standard and expected or attainable standard.

The standards are set mainly for the elements of cost, viz., Direct Materials, Direct Labour, and Overheads. Details of the elements of cost must be ascertained.

5. Establishing Standard Costs

Standard costs are established for each elements of cost separately. Generally, elements of cost are grouped as material, labor and overhead. Moreover, standard cost is set for the sales also. The standard is the level of attainment accepted by the management as the basis upon which standard costs are determined.

6. Preparing Standard Cost card or Standard Cost Sheet: Standard cost card or standard cost sheet is prepared separately for product wise or process wise.

7. Organization for Standard Costing

A committee is formed to set the standards. If so, the objectives of standard costing system can be easily achieved. The success of the standard costing system depends upon the

reliability of standards. Hence, the responsibility for setting standards should be entrusted to a specific person or a committee. It consists of following team:

a. Purchase Manager
b. Production Manager
c. Personnel Manager
d. Time and Motion Study Engineers
e. Marketing Manager and Cost Accountant

The following elements are used in determining a standard cost per unit:

Direct materials ------ price standard

Direct materials ----- quantity standard

Direct labor ------ rate standard

Direct labor ------ time standard

Standard variable overhead ------ variable overhead rate

Standard fixed overhead ------- fixed overhead rate

WAYS OF DEVELOPING STANDARDS

The direct materials price standard is based on a vigilant estimate of all possible price increases, changes in available quantities, and new sources of supply in the next accounting period.

The direct materials quantity standard is based on product engineering specifications, the quality of direct materials, the age and productivity of machines, and the quality and experience of the work force.

The direct labour rate standard is defined by labour union contracts and company personnel policies.

The direct labour time standard is based on current time and motion studies of workers and machines and records of their past performance.

The standard variable overhead rate and standard fixed overhead rate are found by dividing total budgeted variable and fixed overhead costs by an appropriate application base.

VARIANCE ANALYSIS

Variance analysis is the procedure of computing the differences between standard costs and actual costs and recognizing the causes of those differences. Studies indicated that variance is the difference between standard performance and actual performance. It is the process of scrutinizing variance by subdividing the total variance in such a way that management can assign responsibility for off-Standard Performance.

Variance Analysis, in managerial accounting, refers to the investigation of deviations in financial performance from the standards defined in organizational budgets. Variance analysis typically involves the isolation of different causes for the variation in income and expenses over a given period from the budgeted standards.

The difference between standard cost and actual cost of the actual output is defined as Variance. A variance may be favourable or unfavourable. If the actual cost is less than the standard cost, the variance is favourable and if the actual cost is more than the standard cost, the variance will be unfavourable. It is not enough to know the figures of these variances in fact it is required to trace their origin and causes of occurrence for taking necessary remedial steps to reduce / eliminate them. Variance Analysis is very important as it helps the management of an entity to control its operational performance and control direct material, direct labor, and many other resources.

The divergence between standard costs, profits or sales and actual costs, profits or sales respectively will be known as variances. The variances may be favourable and unfavourable. If actual cost is less than the standard cost and actual profit and sales are more than the standard profits and sales, the variances will be favourable. On the contrary if actual cost is more than the standard cost and actual profit and sales are less than the standard profits and sales, the variances will be unfavourable. The variances are related to efficiency. If variances

are favourable, it will show efficiency and if variances are unfavourable it will show inefficiency.

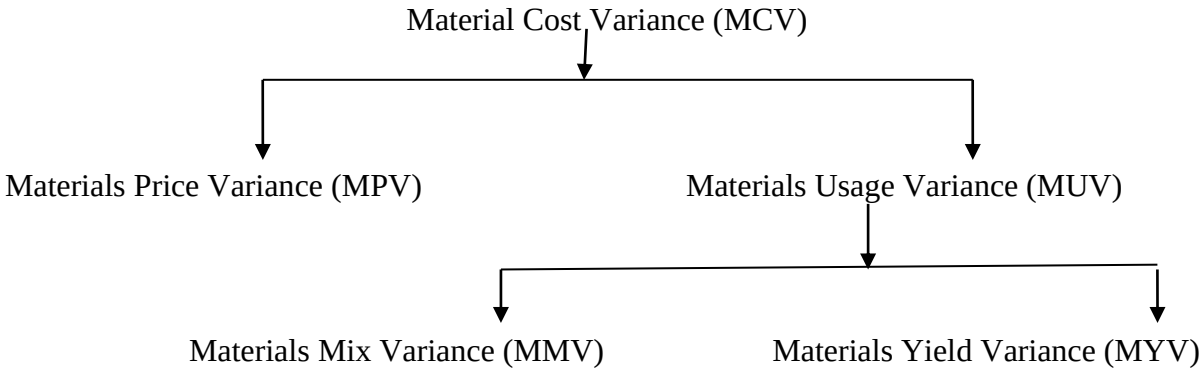
The variances may be classified into **four** categories such as **Direct Materials Variances, Direct Labour Variances, Overheads Cost Variances and Sales or Profit Variances.**

1. DIRECT MATERIAL VARIANCES

Direct material variances are also known as material cost variances. The material cost variance is the difference between the standard cost of materials that should have been incurred for manufacturing the actual output and the cost of materials that has been actually incurred.

Material Cost Variance comprises of: (i) Material Price Variance and (ii) Material Usage Variance: Material usage variance may further be subdivided into material Mix Variance and Material Yield Variance.

The Chart depicts the divisions and subdivisions of material variances.



The following equations may be used for verification of material cost variances.

(i) MCV=MPV+MUV or MPV+MMV+MYV

(ii) MUV=MMV+MYV

(a) Materials Cost Variance: Material cost variance is the difference between standard materials cost and actual materials cost. Material cost variance arises due to change in price of materials and variations in use of quantity of materials. Material cost variance is ascertained as such:

Materials Cost Variance = Standard Material Cost – Actual Material Cost

Standard Material Cost = Standard Price per unit x Standard Quantity of materials

Actual Material Cost = Actual price per unit x Actual quantity of materials.

If the standard cost is more than the actual cost, the variance will be favourable and on the other hand, if the actual cost is more than the standard cost, the variance will be unfavourable or adverse.

(b) Materials Price Variance: Materials price variance arises due to the standard price specified and actual price paid. It may also arise due to:

(i) Changes in basic prices of materials,

(ii) Failure to purchase the quantities anticipated at the time when standards were set,

(iii) Failure to secure discount on purchases,

(iv) Failure to make bulk purchases and incurring more on freight, etc.,

(v) Failure to purchase materials at proper time, and

(vi) Not taking cash discount when setting standards.

Materials Price Variance= Actual Quantity (Standard price–Actual price)

In this case actual quantity of materials used is taken. The price of materials is taken per unit. If the answer is in plus, the variance will be favourable and it will be unfavourable if the result is in negative.

(c) Material Usage Variance. Material usage (or quantity) variance arises due to the difference in standard quantity specified and actual quantity of materials used. This variance may also arise due to:

(i) Negligence in use of materials,

(ii) More wastage of materials by untrained workers or defective methods of production,

(iii)Loss due to pilferage,

(iv) Use of material mix other than the standard mix,

(v) More or less yield from materials than the standard set, and

(vi) Defective production necessitating the use of additional materials.

Materials usage variance= Standard Price (Standard Quantity – Actual Quantity)

The quantities of material specified and actually used are taken and standard price per unit is used. If the answer from the above mentioned formula is in plus, the variance will be a

favourable variance but if the answer is in minus the variance will be unfavourable or adverse. .

Illustration.1: Following is the data of a manufacturing concern. From the figures given below, calculate (i) Materials Cost Variance, (ii) Material Price Variance, and (iii) Material Usage Variance. The standard quantity of materials required for producing one ton of output is 40 units. The standard price per unit of materials is Rs.3. During a particular period 90 tons of output was undertaken. The materials required for actual production were 4,000 units. An amount of Rs. 14,000 was spent on purchasing the materials.

Solution:

Standard quantity of material (SQ) = (90 x 40) = 3600 units

Standard price per unit = Rs. 3

Actual price per unit = 14000/4000 = Rs. 3.50

(i) Material Cost Variance = Standard material cost – Actual material cost

Standard material cost = Standard quantity x Standard price = 3,600 x 3 = Rs. 10,800

Material Cost Variance = 10,800 – 14,000 = (–) Rs. 3,200 Adverse

(ii) Material Price Variance = Actual Quantity (Standard price per unit – Actual price per unit)

= 4,000 (3.00 – 3.50)

= 4,000 (–0.50)

= (–) Rs. 2,000 Adverse

(iii) Material Usage Variance = Standard Price per unit (SQ – AQ)

. = 3 (3,600 – 4,000)

= 3 (–400) = (–) Rs. 1,200 Adverse

Verification: MCV = MPV + MUV

– 3,200 = – 2,000 – 1,200

– 3,200 = – 3,200

Illustration.2: From the data given below, calculate: (i) Material Cost Variance, (ii)Material Price Variance, and (iii) Material Usage Variance.

Product	Standard Quantity (Units)	Standard Price Rs.	Actual Quantity (Units)	Actual Price Rs.
A	1,050	2.00	1,100	2.25
B	1,500	3.25	1,400	3.50
C	2,100	3.50	2,000	3.75

Solution:

(i) Material Cost Variance = Standard Cost – Actual Cost

Or (SQ x Std. Rate) – (AQ. x Actual Rate)

Material A = (1,050 x 2) – (1,100 x 2.25)

= 2,100–2,475 = – Rs. 375

Material B = (1,500 x 3.25) – (1,400 x 3.50)

= 4,875–4,900= – Rs. 25

Material C = (2,100 x 3.50) – (2000 x 3.75)

= 7,350–7,500 = – Rs. 150

Material Cost Variance = Rs. 550 Unfavourable

(ii) Material Price Variance = Actual Quantity (Standard Price – Actual Price)

Material A = 1,100 (2.00 – 2.25)

= 1,100 (–0.25) = Rs. 275

Material B = 1,400 (3.25 – 3.50)

= 1,400 (–0.25) = – Rs. 350

Material C = 2,000 (3.50 – 3.75)

= 2,000 (–0.25) = – Rs. 500

Material Price Variance = Rs. 1,125 Unfavourable

(iii) Material Usage Variance = Standard Price (SQ – AQ)

Material A = 2 (1.050 – 1,100)

= 2 (–50) = Rs. 100

Material B = 3.25 (1,500–1,400)

= 3.25 (100) = Rs. 325

Material C = 3.50 (2,100 – 2,000)

= 3.50 (100) = Rs. 350

Material Usage Variance = Rs. 575 Favourable

Verification: MCV = MPV + MUV

– Rs.550= – Rs. l125 + Rs. 575

– Rs. 550 = – Rs. 550

(d) Material Mix Variance: Materials mix variance is that part of material usage variance which arises due to changes in standard and actual composition of mix. Materials mix variance is the difference between standard price of standard mix and standard price of actual mix. The standard price is used in calculating this variance. The variance is calculated under two situations:

(i) When actual weight of mix is equal to standard weight of mix, and

(ii) When actual weight of mix is different from the standard mix.

(i) When Actual Weight and Standard Weight of Mix is Equal

In this case the formula for calculating mix variance is:

Standard cost of standard mix – Standard cost of actual mix

(Standard Price x Standard Quantity) – (Standard Price x Actual Quantity)

Or Standard unit cost (Standard Quantity – Actual Quantity)

In case standard quantity is revised due to shortage of one material, the formula will be equal to Standard unit cost (Revised Standard Quantity – Actual Quantity).

Illustration.3: Calculate material mix variance from the data given as such:

	Standard		Actual	
Materials	Quantity (Units)	Price per unit Rs.	Quantity (Units)	Price per unit Rs.
A	50	2.00	60	2.25
B	100	1.20	90	1.75

Due to the shortage of material A, the use of material A was reduced by 10% and that of material B increased by 5%.

Solution:

In this question the standards will be revised. Revised standards will be:

Material A = 50 – 5 (50 x 10/100) = 45

Material B = 100 + 5 (100 x 5/100) = 105

Material Mix Variance = Standard Unit Price (Revised Standard Quantity – AQ)

Material A = 2 (45 – 60)

= 2 (– 15) = – Rs. 30

Material B = 1.20 (105 – 90)

= 1.20(15) = Rs. 18

Material Mix Variance= – Rs. 12 Unfavourable

(ii) When Actual Weight and Standard Weight of Mix are Different

When quantities of actual material mix and standard material mix are different, the formula will be:

$$\left\{\frac{\text{Total Weight of Actual mix}}{\text{Total Weight of Standard mix}} \times \text{Standard cost of Standard}\right\} \text{--- (Standard cost of actual mix)}$$

In case the standard is revised due to the shortage of one material then revised standard will be used instead of standard, the formula will become:

$$\left\{ \frac{\text{Total Weight of Actual mix}}{\text{Total Weight of Revised Standard mix}} \times \text{Standard cost of Revised Standard mix} \right\}$$

-- (Standard cost of Actual Mix)

Illustration.4: From the following data calculate various material variances:

	Standard		Actual	
Material	Quantity (Units)	Price per unit Rs.	Quantity (units)	Price per unit Rs.
A	80	8.00	90	7.50
B.	70	3.00	80	4.00

Solution:

(a) Material Cost Variance= Standard Material Cost– Actual Material Cost

(Standard Qty. x Standard Price) – (Actual Qty. x Actual Price)

Material A = (80 x 8) – (90 x 7.50)

= 640–675 = – Rs. 35

Material B = (70 X 3) – (80 X 4.00)

=210–320 = – Rs. 110

Material Cost Variance = Rs. 145 Unfavourable

(b) Material Price Variance= Actual Quantity (Standard Price – Actual Price)

Material A = 90 (8.00 – 7.50)

= 90 (0.50) = + Rs. 45

Material B = 80 (3.00 – 4.00)

= 80 (–1.00) = – Rs. 80

Material Price Variance = Rs. 35 Unfavourable

(c) Material Usage Variance= Standard Price (Standard Quantity – Actual Quantity)

Material A = 8 (80 – 90)

= 8 (–10) = – Rs. 80

Material B = 3 (70 – 80)

= 3 (–10) = – Rs. 30

Material Usage Variance = Rs. 110 Unfavourable

(d) Material Mix Variance: In this question standard weight of mix is different from the actual weight of mix, so the formula will be:

$$\left\{\frac{\text{Total Weight of Actual mix}}{\text{Total Weight of Standard mix}} \times \text{Standard cost of Standard}\right\} \text{--- (Standard cost of actual mix)}$$

$$\left[\frac{170}{150} \times 80 \times 8 + 70 \times 3\right] - [90 \times 8 + 80 \times 3]$$

= 963.3 – 960 = Rs. 3.3 Favourable

(e) Materials Yield Variance. This is the sub-variance of material usage variance. It results from the difference between actual yield and standard yield. It may be defined as that portion of the direct materials usage variance which is due to the standard yield specified and the actual yield obtained. It may arise due to low quality of materials, defective methods of production, carelessness in handling materials, etc. Material yield variance is calculated with the following formula:

Standard Rate (Actual yield – Standard yield)

Standard Rate is calculated as follows:

$$\text{Std. Rate} = \frac{\text{Standard Cost of Standard mix}}{\text{Net standard output i.e., Gross output – Standard Loss}}$$

There may be a situation where standard mix may be different from the actual mix. In this case the standard is revised in relation to actual mix and the question is solved with the

revised standard and not with the original standard. The standard rate will be calculated as follows:

$$\text{Std. Rate} = \frac{\text{Standard Cost of revised Standard mix}}{\text{Net standard output}}$$

In the earlier variances if the standard was more than the actual, the variance was favourable. But, in case of material yield variance the case is different. When actual yield is more than the standard yield, the variance will be favourable.

Illustration.5: The standard mix of a product is as under:

A	60 units at 15 P. per unit	Rs. 9
B	80 units at 20 P. per unit	Rs. 16
C	100 units at 25 P. per unit	Rs. 25
	240	Rs. 50

Ten units of finished product should be obtained from the above .mentioned mix. During the month of January, 1996 ten mixes were completed and the consumption was as follows:

A	640 units at 20 P. per unit	Rs. 128
B	960 units at 15 P. per unit	Rs. 144
C	840 units at 30 P. per unit	Rs. 252
	2,440	Rs. 524

The actual output was 90 units. Calculate various material variances.

Solution:

(i) Material Cost Variance:

The standard has been given for producing 10 units in one mix. Ten mixes have been completed, so standard production will be 100 units.

Standard cost for 100 Units = 50 x 10 = Rs. 500

Actual yield is 90 units, so standard cost will be adjusted accordingly.

Standard cost for actual yield = 100 X 90 = Rs. 450

Material Cost Variance = Standard Cost – Actual Cost

= 450 – 524 = Rs. 74 unfavourable

(ii) Material Price Variance= Actual Quantity (Standard Price – Actual Price)

Material A = 640 (0.15 – 0.20)

= 640 (–0.05) = Rs. 32 unfavourable

Material B = 960 (0.20 – 0.15)

= 960 (0.05) = Rs. 48 favourable

Material C = 840 (0.25 – 0.30)

= 840 (–0.05) = Rs. 42 unfavourable

Material price Variance (A + B + C) = Rs. 26 unfavourable

(iii) Material Usage Variance:

The standard quantity will be revised in proportion to actual production. Revised quantity will be :

Standard Price (Standard Quantity – Actual Quantity)

Material A: 15 P. (540 – 640)

15 (– 100) = Rs. 5 unfavourable

Material B: 20 P. (720 – 960)

20 (– 240) = Rs. 48 unfavourable

Material C: 25 P. (900 – 840)

25 (60) = Rs. 15 favourable

Material usage Variance = Rs. 48 unfavourable.

(iv) Material Mix Variance

There is a difference between standard quantity (240 x 10= 2,400) and actual quantity (2,440), so the standard will be revised first.

Revised standard quantity will be:

$$A = \frac{60}{240} \times 2,440 = 610$$

$$B = \frac{80}{240} \times 2,440 = 813$$

$$C = \frac{100}{240} \times 2,440 = 1,017 \text{(approx)}$$

Material Mix Variance: Standard Price (Revised Standard Quantity – AQ)

Material A: 15 P. (610 – 640)

15 (–30) = Rs. 4.50 unfavourable

Material B: 20 P. (813 – 960)

20 (–147) = Rs. 29.40 unfavourable

Material C: 25 P. (1017 –840)

25 (177) = Rs. 44.25 favourable

Material Mix Variance = Rs. 10.35 favourable

(V) Material Yield Variance= Standard Rate (Actual Yield – Standard–Yield)

$$\text{Std. Rate} = \frac{\text{Standard Cost of Standard mix}}{\text{Net standard output i.e., Gross output – Standard Loss}}$$

= 50/10 = Rs. 5

Standard Yield =10/240 x 2440 = 101.67 units

Yield Variance = 5 (90 – 101.67) = Rs. 58.35 unfavourable.

Verification: (i) MCV=MPV+MUV or –74=–26–48 =–74

(ii) MUV = MMV+MYV or –48 = 10.35 – 58.35 = – 48

2. DIRECT LABOUR VARIANCES

Labour Variances are discussed as follows:

(a) Labour Cost Variance

Labour Cost Variance or Direct Wage Variance is the difference between the standard direct wages specified for the activity and the actual wages paid. It is the function of labour rate of pay and labour time variance. It arises due to a change in either a wage rate or in time or in both. It is calculated as follows:

Labour Cost Variance = Standard Labour Cost – Actual Labour Cost

(Standard time x Standard Wage Rate) – (Actual Time x Actual Wage Rate)

(b) Labour Rate of Pay or Wage Rate Variance

It is that part of labour cost variance which arises due to a change in specified wage rate. Labour rate variance arises due to (i) change in basic wage rate or piece-work rate, (ii) employing persons of different grades then specified, (iii) payment of more overtime than fixed earlier, (iv) new workers being paid different rates than the standard rates, and (v) different rates being paid to workers employed for seasonal work or excessive work load.

The wage rates are determined by demand and supply conditions of labour conditions in labour market, wage board awards, etc. So, wage rate variance is generally uncontrollable except if it arises due to the development of wrong grade of labour for which production foreman will be responsible. This variance is calculated by the formula: Labour Rate of Pay Variance = Actual time (Standard Rate – Actual Rate) The variance will be favourable if actual rate is less than the standard rate and it will be unfavourable or adverse if actual rate is more than the standard rate.

(c) Labour Efficiency or Labour Time Variance

It is that part of labour cost variance which arises due to the difference between standard labour hours specified and the actual labour hours spent. It helps in controlling efficiency of workers. The reasons for this variance are: (i) lack of proper supervision, (ii) defective machinery and equipment, (iii) insufficient training and incorrect instructions, (iv) increase in labour turnover, (v) bad working Conditions, (vi) discontentment along workers due to unsatisfactory personnel relations, and (vii) use of non-standard material requiring more time

to complete work. Labour efficiency variance is calculated as: Labour efficiency variance = Standard Wage Rate (Standard Time–Actual Time).

If actual time taken for doing a work is more than the specified standard time, the variance will be unfavourable. On the other hand, if actual time taken for a job is less than the standard time, the variance will be favourable.

(d) Idle Time Variance

This variance is the standard cost of actual time paid to workers for which they have not worked due to abnormal reasons. The Reasons for idle time may be power failure, defect in machinery, and non-supply of materials, etc. Idle time variance should be segregated from the labour efficiency variance otherwise it will show inefficiency on the part of workers though they are not responsible for this. Idle time variance is always adverse and needs investigation for its causes. This variance is calculated as:

Idle Time Variance = Idle Hours x Standard Rate

(e) Labour Mix or Gang Composition Variance

This variance arises due to change in the actual gang composition than the standard gang composition. This variance shows to the management how much labour cost variance is due to the change in labour composition. It may be calculated in two ways:

(i) When standard and actual times of the labour mix are same. In this case the variance is calculated as follows:

Labour Mix Variance = Standard Cost of Standard Labour Mix – Standard Cost of Actual Labour Mix.

Due to the non-availability of one grade of labour, there may be a change in standard labour mix, and then revised standard will be used for standard mix. The formula will be:

Labour Mix Variance = Standard cost of Revised Standard Labour Mix – Standard Cost of Actual Labour Mix.

(ii) When standard and actual time of labour mix are different:

In this case the variance will be calculated as follows:

$$\left(\frac{\text{Total Time of Actual Labour Mix}}{\text{Total Time of Standard Labour Mix}} \times \text{Standard Cost of Revised Standard} \right) \text{--- (Standard Cost of Actual Labour Mix)}$$

As in the earlier case, if labour composition is revised because of non–availability of one grade of labour then revised standard mix will be used instead of standard mix and the formula will become:

$$\left(\frac{\text{Total Time of Actual Labour Mix}}{\text{Total Time of Standard Labour Mix}} \times \text{Standard Cost of Revised Standard} \right) \text{--- (Standard Cost of Actual Labour Mix)}$$

Illustration: 6: The information regarding the composition and the weekly wage rates of labour force engaged on a job scheduled to be completed in 30 weeks:

	Standard		Actual	
Category of Workers	No. of workers	Weekly Wage rate per worker	No. of workers	Weekly Wage rate per worker
		Rs.		Rs.
Skilled	75	60	70	70
Semi–skilled	45	40	30	50
Unskilled	60	30	80	20

The work was completed in 32 weeks. Calculate various labour variances.

Solution:

(i) **Labour Cost Variance**= Standard Labour Cost– Actual labour Cost

Standard Labour Cost:	Rs.
Skilled:	75 x 60 x 30 = 1, 35,000
Semi–skilled:	45 x 40 x 30 = 54,000
Unskilled:	60 x 30 x 30 = 54,000
Total	2, 43,000

Actual Labour Cost:	
Skilled:	70 x70 x 32 = 1, 56,800
Semi Skilled:	30 x 50 x 32 = 48,200
Unskilled:	80 x 20 X 32 = 51.000
Total	2, 56,000

Total Labour Cost Variance: 2, 43,000 – 2, 56,000 = Rs. 13,000 Adverse

(ii) **Labour Rate Variance=** Actual Time (Standard Rate – Actual Rate)

Skilled:	2,240 (60 – 70)
	2,240 (– 10) = Rs. 22,400 Adverse
Semi-Skilled:	960 (40 – 50)
	960 (–10) = Rs. 9,600 Adverse
Unskilled:	2,560 (30 – 20)
	2,560 (10) = Rs. 25,600 Favourable

Labour Rate Variance =Rs. 6,400 Adverse

(iii) **Labour Efficiency Variance**= Standard Rate (Standard Time – Actual Time)

Skilled:	60(2,250 – 2,240)
	60(10) = Rs. 600 Favourable
Semi-Skilled:	40(1,350-960)
	40(390) = Rs. 15,600 Favourable
Unskilled:	30(1,800 – 2,560)
	30 ((-760) =Rs. 22,800 Adverse.

Labour Efficiency Variance =Rs. 6,600 Adverse

Verification:

Labour Cost Variance = Labour Rate Variance + Labour Efficiency Variance

– 13,000 = – 6,400 – 6,600

–13,000= –13,000.

Illustration 7: The following data is taken out from the books of a manufacturing company:

Budgeted labour composition for producing 100 articles

20 Men @ Rs. 125 per hour for 25 hours

30 women @ 1.10 per hour for 30 hours

Actual labour composition for producing 100 articles

25 Men @ Rs. 1.50 per hour for 24 hours

25 Women @ Re.l.20 per hour for 25 hours

Calculate: (i) Labour Cost Variance, (ii) Labour Rate Variance, (iii) Labour Efficiency Variance (iv) Labour Mix Variance

Solution:

(i) Labour Cost Variance= Standard Labour Cost – Actual Labour cost

Men: (20 x 25 x 1.25) – (25 x 24 x 1.50)

625 – 900 = Rs.275 Adverse

Women: (30 x 30 x 1.10) – (25 x 25 x 1.20)

990 – 750 = Rs. 240 Favourable

Labour Cost Variance = – 275 + 240 =Rs. 35 Adverse.

(ii) Labour Rate Variance= Actual Time (Standard Rate – Actual Rate)

Men: 600 (1.25 –1.50)

600 (–0.25) = Rs. 150.00 Adverse

Women: 625 (1.10– 1.20)

625 (–0.10) = Rs. 62.50 Adverse

Labour Rate Variance = Rs. 212.50 Adverse.

(iii) Labour Efficiency Variance= Standard Rate (Standard Time – Actual Time)

Men: 1.25 (500 – 600)

1.25 (– 100) = Rs. 125 Adverse

Women: 1.10(900-625)

1.10 (275) = Rs. 302.50 Favourable

Labour Efficiency Variance = Rs. 177.50 Favourable

(iii) **Labour Mix Variance**:

Standard time for Men and Women = 1,400 hours

Actual time for Men and Women = 1,225 hours

When standard time of labour mix is different from the actual time of labour mix, the formula for calculating labour mix variance is:

$$\left(\frac{\text{Total Time of Actual Labour Mix}}{\text{Total Time of Standard Labour Mix}} \times \text{Standard Cost of Revised Standard} \right) \text{--- (Standard Cost of Actual Labour Mix)}$$

1225/1440 x (20 x 25 x 1.25) + (30 x 30 x 1.10) – (25 x 24 x 1.25) + (25 x 25 x 1.10)

1413.12- 1437.50 = Rs. 24.38 Adverse.

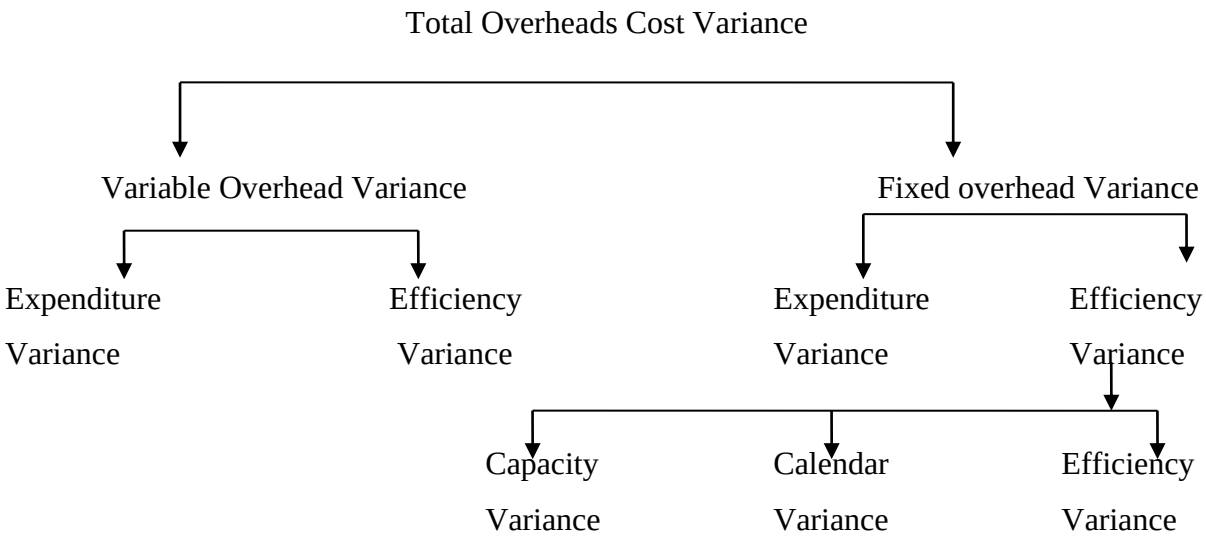
3. OVERHEAD VARIANCES

Overhead is the aggregate of indirect material cost, indirect wages (indirect labour cost) and indirect expenses. Thus, overhead costs are indirect costs and are important for the management for the purposes of cost control. Under cost accounting, overhead costs are absorbed by cost units on some suitable basis. Under standard costing, overhead rates are predetermined in terms of either labour hours (per hour) or production units (per unit of output). The formula for the calculation of overhead cost variance is given below:

Overhead Cost Variance = Actual Output x Standard Overhead Rate per unit Actual overhead Cost

Or, = Standard Hours for Actual Output x Standard Overhead Rate per hour Actual Overhead Cost

An analytical study of the behaviour of overheads in relation to changes in volume of output reveals that there are some items of cost which tend to vary directly with the volume of Output whereas, there are others which remain unaffected by variations in the volume of output achieved or labour hours spent. The former costs represent the variable overhead and the latter fixed overheads. Therefore, overhead cost variances can be classified as:



(i) Variable overhead variance: Variable overheads vary directly with the volume of output and hence, the standard variable overheads very directly with the volume of output and

hence, the standard variable overhead rate remains uniform. Therefore, computation of variable overhead variance, also known as variable overhead cost variance parallels the material and labour cost variances. Thus, variable overhead cost variance (VOCV) is the difference between the standard variable overhead cost for actual output and the actual variable overhead cost. It can be calculated as follows:

VOCV = (Actual Output x Standard Variable Overhead Rate per unit) – Actual Variable Overheads

Or, = (Standard Hours for Actual Output X Standard Variable Overhead Rate per hour) – Actual Variable Overheads.

In case information relating to standard hours allowed, for actual output and the actual time (hours) taken is available, variable overhead cost variance can be further analysed into:

(a) Variable Overhead Expenditure or Spending Variance, and

(b) Variable Overhead Efficiency Variance.

(a) **Variable Overhead Expenditure or Spending Variance**: It is the difference between the standard variable overheads for the actual hours and the actual variable overheads incurred and can be calculated as:

Variable Overhead Expenditure Variance = (Actual Hours x Standard Variable Overhead Rate per hour)–Actual Variable Overhead

Or, = Actual Hours (Standard Variable Overhead Rate– Actual Variable Overhead Rate)

(b) **Variable Overhead Efficiency Variance**. It represents the difference between the standard hours allowed for actual production and the actual hours taken multiplied with the standard variable overhead rate. Symbolically:

Variable Overhead Efficiency Variance = Standard Variable Overhead Rate (Standard Hours) – Actual Hours for Actual Output.

Illustration 8: Calculate variable overhead variances from the following data:

Budgeted Production for January, 1996	3000 units
Budgeted Variable Overhead	Rs. 15,000
Standard Time for One Unit	2 hours
Actual Production for January, 1996	2,500 units
Actual Hours Worked	4500 hours

Actual Variable Overhead Rs. 13, 500

Solution:

1. Variable Overhead Cost Variance (VOCV) = Actual Output x Standard Variable Overhead Rate– Actual Variable Overhead

= Rs. (2500 x 5) – 13500

= Rs. 1000 (Adverse)

(Standard Variable Overhead Rate = 15000/3000= Rs. 5 per unit).

2. Variable Overhead Expenditure or Spending Variance (VOSV) = (Actual Hours x Standard Variable Overhead Rate) – Actual Variable Overhead

= Rs. (4500 x 2.50) – 13500

= Rs. 11250 – 13500 = Rs. 2250 (Adverse)

3. Variable Overhead Efficiency Variance (VOEV) = Standard Variable Overhead Rate (Standard Hours for Actual Output–Actual Hours)

= Rs. 2.50 (5000 – 4500)

= Rs. 1250 (Favourable)

Verification:

VOCV = VOSV + VOEV

–1000 = – 2250 + 1250

Or – 1000 = –1000

(ii) FIXED OVERHEADS VARIANCE

This variance is calculated as:

Actual Output x Standard Fixed Overheads Rate–Actual Fixed Overheads.

(The standard fixed overhead rate is calculated by dividing budgeted fixed overheads by standard output specified). It may be divided into expenditure and volume variances.

(a) Expenditure Variance = Budgeted Fixed Overheads – Actual fixed Overheads

(b) Volume Variance: This variance shows a variation in overhead recovery due to budgeted production being more or less than the actual production. When actual production is more than the standard production, it will show an over–recovery of fixed overheads and the variance will be favourable. On the other hand, if actual production is less than the standard production it will show an under recovery and the variance will be unfavourable. Volume

variance may arise due to change in capacity, variation inefficiency or change in budgeted and actual number of working days.

Volume variance is calculated as:

Actual Output x Standard Rate– Budgeted Fixed Overheads

Volume variance is sub-divided into following variances:

(i) Capacity Variance: It is that part of volume variance which arises due to overutilization or under-utilization of plant and equipment. The working in the factory is more or less than the standard capacity. This variance arises due to idle time caused by strikes, power failure, and non-supply of materials, breakdown of machinery, absenteeism etc.

Capacity variance is calculated as:

Standard Rate (Revised Budgeted Units– Budgeted Units) or, Standard Rate (Revised Budgeted Hrs- Budget Hrs).

(ii) Calendar Variance: This variance arises due to the difference between actual number of days and the budgeted days. It may arise due to more public holidays announced than anticipated or working for more days because of change in holidays schedule, etc. If actual working days are more than budgeted, the variance will be favourable and it will be unfavourable if actual working days are less than the budgeted number of days Calendar variance can be expressed as:

Decrease or Increase in number of units produced due to the difference of budgeted and actual days x Standard Rate per unit.

(iii) Efficiency Variance: This is that portion of the volume variance which arises due to increased or reduced output because of more or less efficiency than expected. It signifies deviation of standard quantity from the actual quantity produced. This variance is related to the efficiency variance of labour. Efficiency variance is calculated as: Standard Rate (Actual Quantity – Standard Quantity) or, Standard Rate per hour (Standard Hours Produced – Actual Hours). If Actual quantity is more than the budgeted quantity, the variance will be favourable and it will be vice versa if actual quantity is less than the budgeted quantity.

Illustration 9: From the following information calculate various overhead variances:

	Budget	Actual
Output in units	12,000	14,000

Number of working days	20	22
Fixed Overheads	36,000	49,000
Variable Overheads	24,000	35,000

There was an increase of 5% in capacity.

Solution:

Standard Fixed Overheads Rate = 36000/12000 = Rs. 3

Standard Variable Overheads Rate = 24000/12000 = Rs. 2

(i) Total Overheads Cost Variance= Actual Output x Standard Rate – Actual Overheads

=14,000 x (3 + 2) – (49,000+ 35,000)

= 70,000 – 84,000 = Rs. 14,000 Adverse.

(ii) Variable Overheads Variance= Actual output x Standard Variable Overheads Rate – Actual Variable Overheads

=14,000 x 2 – 35,000 = 28,000 – 35,000 = Rs. 7,000 Adverse.

(iii) Fixed Overheads Variance= Actual Output x Standard Fixed Overheads Rate – Actual Standard Overheads

=14,000 x 3 –49,000

=42,000 – 49,000 = Rs. 7,000 Adverse.

(iv) Expenditure Variance = Budgeted Fixed Overheads – Actual Fixed Overheads

=36,000 – 49,000 = Rs. 13,000 Adverse.

(v) Volume Variance= Actual Output x Standard Rate – Budgeted Fixed Overheads

= 14,000 x 3 – 36,000

= 42,000 – 36,000 = Rs. 6,000 Favourable.

(vi) Capacity Variance= Standard Rate (Revised Budgeted Units – Budgeted Units)

=3 (12,600–12,000)

=3 (600) = Rs. 1,800 Favourable.

(Revised Budgeted Units = 12,000 + 12,000 x 5/100 = 12,600)

(vii) Calendar Variance:

Change in Number of units by change in actual and standard number of days x Standard Rate.

There is an increase of 2 working days than budgeted.

Increase in units in 2 days = 12600/20 x 2 = 1,260 units

Calendar Variance = 1,260 x 3 = Rs. 3,780 Favourable.

(viii) Efficiency Variance= Standard Rate (Actual Quantity – Standard Quantity)

Standard Quantity	=	12,000
Increase in production due to change in capacity	=	600
Increase in production due to increase in working days	=	1,260
Standard Quantity (Revised)	=	13,860

3 (14,000 – 13,860) = Rs. 420 Favourable.

4. SALES VARIANCES

A sales value variance exposes the difference between actual sales and budgeted sales. It may arise due to change in sales price, sales volume or sales mix. It is important to study profit variances. It may be classified as follows:

1. Sales Value Variance: A Sales Value Variance is the difference between budgeted sales and actual sales. It is calculated as:

Sales Value Variance = Actual Value of Sales – Budgeted Value of Sales.

If actual sales are more than the budgeted sales, the variance will be favourable and on the other hand, the variance will be unfavourable if actual sales are less than the budgeted sales.

2. Sales Price Variance: A sales price variance arises due to the difference between the standard price specified and the actual price charged. It is calculated as:

Sales Price Variance = Actual Quantity (Actual Price– Standard Price).

3. Sales Volume Variance: It is the difference between actual quantities of sales and budgeted quantity of sales. It is calculated as:

Sales Volume Variance = Standard Price (Actual Quantity of Sales – Standard Quantity of Sales).

4. Sales Mix Variance. It is the difference of standard value of revised mix and standard value of actual mix.

Illustration 10: The budget and actual sales for a period in respect of two products are as follows:

	Budgeted		Actual	
	Quantity (Units)	Price Value (Rs.)	Quantity (Units)	Price Value (Rs.)
Product A	800	10	1,000	12
Product B	1,200	6	1,400	5

Calculate Sales Variances.

Solution:

Sales Value Variance **=** Actual Value of Sales – Standard Value of Sales

Actual Value of Sales:

	Product A	1,000 x 12	= 12,000
	Product B	1,400 x 5	= 7,000
	Total		Rs. 19,000

Standard Value of Sales:

	Product A	800 x 10	= 8,000
	Product B	1,200 x 6	= 7,200
	Total		Rs. 15,200

Sales Value Variance = 19,000–15,200 = Rs. 3,800 Favourable.

(ii) Sales Price Variance= Actual Quantity Sold (Actual Price– Standard Price)

Product A	=	1,000 (12 – 10)
	=	1,000 (2)
	=	Rs. 2,000 Favourable
Product B	=	1,400 (5 – 6)
	=	1,400 (–1)
	=	Rs. 1400 Unfavourable
Sales Price Variance	=	Rs. 600 Favourable

(iii) Sales Volume Variance = Standard Price (Actual Units Sold – Standard Units)

Product A	=	10 (1,000 – 800)
	=	10(200)
	=	Rs. 2,000 Favourable
Product B	=	6 (1,400 – 1,200)
	=	6 (200)
	=	Rs. 1200 Favourable
Sales Volume Variance	=	Rs. 3,200 Favourable.

(iv) Sales Mix Variance: There is a difference between standard quantity and actual quantity, so the standard will be revised in proportion to actual quantity of sales.

Revised Standard:

Product A = 800/2000 x 2,400 = 960 Units

Product B = 1200/2000 x 2,400 = 1,440Units

Sales Mix Variance = Standard Value of Actual Mix – Standard Value of Revised Standard Mix

Standard Value of Actual Mix:		Rs.
Product A	= 10 x 1,000	= 10,000
Product B	=6x 1,400	= 8,400
	Total	= 18,400

Standard Value of Revised Standard Mix:

Product A	= 10 x 960	= Rs. 9,600
Product B	= 6 x 1,440	= Rs. 8,640
	Total	=Rs. 18,240

Sales Mix Variance = 18,400 – 18,240 = Rs. 160 Favourable.

Verification:

Sales Value Variance = Sales Price Variance + Sales Volume Variance

Rs. 3,800 (Fav.) = Rs. 600 (Fav.) + Rs. 3,200 (Fav.)

Rs. 3,800 (Fav.) = Rs. 3, 00 (Fav.)

PROFIT AND TURNOVER METHODS OF CALCULATING SALES VARIANCES

A businessman may be interested more in knowing variations in profits and sales. The profit and turnover methods of calculating sales variances will be useful for this purpose. The variances are analysed as follows:

(a) Total Sales Margin Variance: Actual Profit – Budgeted Profit.

Actual Profit = Actual quantity sold x Actual profit per unit.

Budgeted Profit = Budgeted quantity of Sales x Budgeted profit per unit.

(b) Sales Margin Variance due to Selling Price. This variance arises due to the difference between actual selling price and standard selling price. This variance is calculated as:

Actual Quantity (Actual Price – Standard Price)

(c) Sales Margin Variance due to Volume. This Variance arises due to the difference between actual quantity of sales and budgeted quantity of sales. It is calculated as: Standard Profit per Unit (Actual Quantity of Sales – Standard Quantity of Sales).

(d) Sale Value Variance= Budgeted sales Value-Actual sales value.

(e) Sales Volume Variance= Standard selling price per Unit (Actual Quantity of Sales – Standard Quantity of Sales).

(f) Selling Price Variance= Actual Quantity (Budgeted selling Price – Actual Selling Price).

(g) Sales Quantity Variance = Budgeted sale Value-Revised standard sales value.

Budgeted sale value = Budgeted quantity x budgeted selling price per Unit

Standard sales value = Actual Quantity x budgeted selling price per Unit

Actual sales value = Actual Quantity x Actual selling price per Unit

Revised Standard sales value = Total Standard sales value x budgeted proportion.

(h) Sales Mix Variance = Revised Standard sales value -Standard sales value

Illustration 11: S. M. Ltd., has given the following budgeted and actual sales figures:

	Budgeted			Actual		
	Quantity	Sale Price	Value	Quantity	Sales Price	Value
		Rs.	Rs.		Rs.	Rs.
Product A	500	60	30,000	600	65	39,000
Product B	700	40	28,000	650	38	24,700

The cost per unit of product A and B was Rs. 55 and Rs. 32 respectively. Compute variances to explain difference between budgeted and actual profit.

Solution:

(i) Total Sales Margin Variance= Actual Profit– Budgeted Profit

Or Actual Quantity x Actual Profit per Unit – Budgeted Quantity x Budgeted Profit per Unit

Actual Profit per Unit

Actual Sales Price – Actual Cost

Product A = 65 – 55 = Rs. 10

Product B = 38 – 32 = Rs. 6

Budgeted Profit per Unit

Budgeted Sale Price – Actual Cost

Product A = 60 – 55 = Rs. 5

Product B = 40– 32 = Rs. 8

Actual Profit

Product A	= 600 x 10	= Rs. 6,000
Product B	= 650 x 6	= Rs. 3,900
		Rs. 9,900

Budgeted Profit

Product A:	500 x 5	= Rs. 2,500
Product B:	700 x 8	= Rs. 5,600
		Rs. 8,100

Sales Margin Variance = 9,900– 8,100 = Rs. 1,800 Favourable

(ii) Sales Margin Variance due to Selling Price:

Actual Quantity (Actual Price– Standard Price)

Product A	= 600 (65-60)	= Rs. 3,000 Favourable
Product B	= 650 (38–40)	= Rs. 1,300 Unfavourable

Sales Margin Variance due to Selling Price = Rs. 1,700 Favourable

(iii) Sales Margin Variance due to Volume:

Standard Profit per unit (Actual Quantity– Standard Quantity)

Product A:	5(600–500)	= Rs. 500 Favourable
Product B:	8(650–700)	= Rs. 400 Unfavourable
Sales Margin Variance due to Volume		= Rs. 100 Favourable

(iv) Sale Value Variance= Budgeted sales value - Actual sales value.

= (500 x 60+700 x 40)- (600 x 65+650 x 38) = 5700 (F)

(v) Sales Volume Variance = Standard selling price per Unit (Actual Quantity of Sales – Standard Quantity of Sales).

	Budgeted Qty	Actual Qty	Diff.	Budgeted Price (Rs.)	Variance Rs
Product A	500	600	100 (F)	60	6000 (F)
Product B	700	650	50 (A)	40	2000 (A)
					4000 (A)

(vi)Selling Price Variance= Actual Quantity (Budgeted selling Price – Actual Selling Price).

	B. P (Rs.)	A. P. (Rs.)	Diff.	AQ	Variance
Product A	60	65	05 (F)	600	3000 (F)
Product B	40	38	02 (A)	650	1300 (A)
					1700 (F)

(vii) Sales Quantity Variance = Budgeted sale value-Revised standard sales value.

	BSV (Rs)	AQ	B. P (Rs.)	SSV OF AQ	Revised SSV OF AQ	Var.
Product A	30000	600	60	36000	62000 x 30000/58000 = (32069)	2069(F)
Product B	28000	650	40	26000	62000 x 28000/58000 = (29931)	1931 (F)
						4000 (F)

(viii) Sales Mix Variance= Revised Standard sales value -Standard sales value

	AQ	B. P (Rs.)	SSV OF AQ	Revised SSV OF AQ	Var.
Product A	600	60	36000	62000 x 30000/58000 = (32069)	3991 (F)
Product B	650	40	26000	62000 x 28000/58000 = (29931)	3991 (A)
					Nil

INTERPRETATION OF VARIANCE

Variance analysis involves breaking down the total variance to explain:

1. How much of it is caused by the usage of resources differing from the standard
2. How much is caused by cost of resources differing from the standard

Together, variances can help to reconcile the total cost difference by comparing actual and standard cost. The main purpose of variances is to provide reasons for off-standard performance. In this way, management can improve operations, correct errors and deploy resources more effectively to reduce costs.

Direct material standards and variance analysis: Direct material standards are derived from the amount of material required for each product or operation. This should take into account the most suitable material for the product specification and design. It should also include any anticipated wastage or losses in the process.

Direct material standards should also consider the standard price of the material, based on the most suitable and competitive price as required by the most suitable quality of material. These prices should also include economic order quantity, discounts and credit terms offered by suppliers.

The standard material used and the standard cost of the material are combined to calculate the standard material cost. By comparing the actual material price and the actual material used with the standards calculated, the material price and the material usage variance can be determined.

Material mix and yield variances: The direct material usage variance measures the change in total material cost caused by using a non-standard amount of material in production. It is also possible to subdivide this variance into a direct material mix variance and a direct material yield variance. This is mostly undertaken in process industries where a standard input mix is the norm.

Identifiable components of input are combined during production to produce an output in which the individual components are no longer separately identifiable. It is sometimes necessary to vary the input mix. As a result, this may lead to an output from the process that will differ from what was expected.

The material mix variance therefore measures the change in cost caused by an alteration to the constituents of the input mix. The material yield variance measures the change in cost brought about by any deviation in output from the standard process output.

Direct labour standards and variance analysis: Direct labour standards are derived from the analysis of activities required for different operations. Often a time and motion study is carried out to determine the most efficient production method, including operating conditions, equipment required and best practice.

Following this, the time is analysed to determine the standard hours required to complete an operation. Standard wage rates are identified using rates of pay for employees required to

carry out the operation, which are normally set by the company. This standard time and standard wage rate are combined to calculate the standard labour rate.

Overhead standards – variable overheads

Where overheads vary with activities, a standard variable overhead rate is used. However, several different activity measures exist and it is important for the organisation to identify which measure influences overhead cost the most. For example, volume related variable overheads could vary with direct labour, machine hours, material quantities or number of units. In practice, the most frequently used are direct labour hours or machine hours.

The variable overhead rate per unit is applied to the standard labour or machine usage to calculate a standard variable cost per unit. The two variances calculated for variable overheads are:

1. The variable overhead expenditure variance, which is equal to the difference between the budgeted flexed variable overheads for the actual direct labour or machine hours of input, and the actual variable overheads incurred.

2. The variable overhead efficiency variance, which is the difference between the standard hours of input and the actual hours of input for the period, multiplied by the standard variable overhead rate.

Overhead standards – fixed overheads

These overheads are largely independent of changes in activity and remain unchanged in the short term over wide ranges of activity. The budgeted annual fixed overhead is divided by the budgeted level of activity to determine the standard fixed overhead rate per unit of activity.

Machine hours are normally used for machine-related overheads and direct labour hours are used for more labour-related overheads. This standard rate is applied to the standard labour or machine usage per unit to calculate the standard fixed overhead cost for a product. The total fixed overhead variance is the difference between the standard fixed overhead charged to production and the actual fixed overhead incurred. An under- or over-recovery of overheads may occur because the fixed overhead rate is calculated by dividing budgeted fixed overheads by budgeted output. If actual output or fixed overhead expenditure differs from budget, then an under or over recovery will occur.

Therefore, under- or over-recovery may be due to a fixed overhead expenditure variance arising from actual expenditure differing from budgeted expenditure. Alternatively, a fixed overhead volume variance may arise from actual production differing from budgeted production.

Other variances – sales variances

Sales variances can be used to analyse the performance of the sales function in a similar way to those for manufacturing costs. Sales variances are calculated in terms of profit or contribution margin, rather than on sales value.

Other variances – Planning and Operational variances.

Some variances will arise due to factors that are almost or entirely within the control of management. These are referred to as operational variances.

Variances that occur from changes in factors external to the business are referred to as planning variances. As planning variances are not under the control of operational management, it cannot be held accountable for them.

In practice, Standard costing and variance analysis in practice

In a recent CIMA research study on Contemporary Management Accounting Practices in UK Manufacturing, over 70% of UK manufacturing companies studied employed standard costing practices. All companies which used standard costing set standards for material costs, while 90% set standards for labour costs and nearly 70% set standards for overheads. Available from: **www.cimaglobal.com/researchexecsummaries** [Accessed 14 March 2008]

However, standard cost variances often do not appear as part of profit and loss information. Over half of companies using standard costing based their reports on actual costs. Some companies added back variances, while others updated material standards so that they approximated actual costs. Despite not appearing in the account, most of the standard cost companies calculated some material and labour variances for control purposes. Overhead variances were much less well used and reported and only one company sub-divided both variable and fixed overheads.

The conclusion from the report was that although most manufacturing companies do use standard costing, they tend to be very selective in their use of variance analysis, especially overhead variances. The use of fixed overheads was particularly scarce.

The analysis of variances facilitates action through 'management by exception'. Here managers concentrate on business areas that are performing below or above expectations. Managers can largely ignore those that appear to be conforming to expectation.

The setting of standards and revision and monitoring encourages reappraisal of methods, materials and techniques. This leads to cost reductions and process improvement.

A properly developed and understood standard costing system with full participation and involvement creates a positive attitude towards cost control throughout the organisation.

Modern technology and reporting software has allowed for variance analysis to be undertaken automatically without the need for complex manual calculations. Microsoft Excel Work Essentials is a commonly used tool to undertake variance analysis.

CONTROL AND EFFICIENCY RATIOS

Control ratios are used by the management to know whether the deviations of the actual performance from the budgeted performance are favourable or unfavourable. If the ratio is 100% or more, the performance is considered as favourable and if the ratio is less than 100%, the performance is considered as unsatisfactory. The actual performances are compared with budgeted performances so as to determine the deviations or variances. The deviations or variances may be favorable or unfavorable and may be expressed in terms of absolute figures or in terms of ratios. The ratios in terms of which the deviations or variances are expressed are known as Control Ratios.

Three important ratios are commonly used by the management to find out whether the deviations of actual from budgeted results are favourable or otherwise in respect of labour activity. These ratios are expressed in terms of percentages. If the ratio is **100%** or more, the trend is taken as favourable. The indication is taken as unfavourable if the ratio is less than **100%**. These ratios are:

Activity ratio: It is a measure of the level of activity attained over a period. It is obtained when the number of standard hours equivalent to the work produced is expressed at a percentage of the budgeted hours. Activity Ratio is the number of standard hours equivalent to the work produced, expressed as a percentage of the budgeted standard hours. This ratio measured the level of activity at which a business concern is operating and may be expressed as follows:

Formula to Calculate Activity Ratio

Activity Ratio = (Actual Production in terms of Standard Hours / Budgeted Production in terms of Standard Hours) x 100

Capacity ratio: This ratio indicates whether and to what extent budgeted hours of activity are actually utilized. It is the relationship between the actual number of working hours and the maximum possible number of working hours in a budget period. It is also known as Actual Usage of Budgeted Capacity Ratio. It denotes the relationship between the actual number of working hours and the budgeted number of working hours. This ratio indicates the extent to which the available facilities were actually utilized during the budget period.

Capacity Ratio Calculation Formula

Capacity Ratio may be expressed or calculated as follows:

Capacity Ratio = (Actual Hours / Budgeted Hours) x 100

Efficiency ratio: This ratio indicates the degree of efficiency attained in production. It is obtained when the standard hours equivalent to the work produced, are expressed as a percentage of the actual hours spent in producing that work: Efficiency Ratio is the number of standard hours equivalent to the work produced, expressed as a percentage of the actual hours spent in producing that work. This ratio measures the efficiency of the operation of the firm and may be expressed as follows:

Formula to Calculate Efficiency Ratio

Efficiency Ratio = (Actual Production in terms of Standard Hours / Actual Hours worked) x 100

Interpretation of the Results of Control Ratios

The results of control ratios may be interpreted as follows:

Results	Interpretation
(i) 100%	No deviation

(ii) Above 100% Favorable deviation

(iii) Below 100% Unfavorable deviation

Illustration 12

Product X takes 5 hours to make and Y requires 10 hours. In a month of 25 effective days of 8 hours a day, 1,000 units of X and 600 units of Y were produced. The company employs 50 workers in the production department. The budgeted hours are 1, 02,000 for the year. Calculate the Control Ratios, i.e., Capacity Ratio, Activity Ratio and Efficiency Ratio.

Solution

Given: Budgeted hours for the year	1,02,000 hrs.
Budgeted hours for the month = (1,02,000 / 2)	8,500 hrs.
Actual hours worked (50 worked x 25 days x 8 hrs. per days)	10,000 hrs.
Standard hours for Actual output	
(i) Hours allowed for 1,000 units of product 'X' (1,000 units x 5 hrs.	5,000
(ii) Hours allowed for 600 units of Product Y. (600 units x 10 hrs.)	6,000
	11,000

(a). Capacity Ratio = (Actual Hours / Budgeted Hours) x 100

= (10,000 hrs. / 8,500 hrs.) X 100 = 117.65%

(b). Activity Ratio = (Actual Production in terms of standard hours / Budgeted Production in terms of standard hours) x 100

= (11,000 / 8,500) x 100 = 129.41%

(c). Efficiency Ratio = (Actual Production in terms of standard hours / Actual Hours worked) x 100

= (11,000 / 10,000) x 100 = 110%

INVESTIGATION OF VARIANCE

Investigating variances is a key step in using variance analysis as part of performance management.

When should a variance be investigated - factors to consider

Size: A standard is an average expected cost and therefore small variations between the actual and the standard are bound to occur. These are uncontrollable variances and should not be investigated.

In addition, a business may decide to only investigate variances above a certain amount. The following techniques could be used:

- Fixed size of variance, e.g. investigate all variances over $5,000
- Fixed percentage rule, e.g. investigate all variances over 10% of the budget
- Statistical decision rule, e.g. investigate all variances of which there is a likelihood of less than 5% that it could have arisen randomly.

Favourable or adverse: Firms often treat adverse variances as more important than favourable and therefore any investigation may concentrate on these adverse variances.

Cost: For investigation to be worthwhile, the cost of investigation must be less than the benefits of correcting the cause of the variance.

Past pattern: Variances should be monitored for a number of periods in order to identify any trends in the variances. A firm would focus its investigation on any steadily worsening trends.

The budget: The budget may be unreliable or unrealistic. Therefore, the variances would be uncontrollable and call for a change in the budget or an improvement in the budgeting process, not an investigation of the variance.

Reliability of figures: The system for measuring and recording the figures may be unreliable. If this is the case, the variances will be meaningless and should not be investigated.

Possible Control Action

The control action which may be taken will depend on the reason why the variance occurred. The variance may be a result of a measurement error, e.g. wastage has been unrecorded, scales have been misread or employees may adjust their records to 'improve' their performance.

Control action is required to improve the accuracy of the recording system so that measurement errors do not occur. In periods of high inflation or where operations are subject to technological development, price standards are likely to become out of date.

In such cases, there is the need to frequently review and update standards. Spoilage and wastage will both negatively affect the efficiency of operations. It is important to highlight the cause of the inefficiency that will lead to control action to eliminate the efficiency being repeated. A standard is an average figure, representing the midpoint of different values. Actual results are likely to deviate from this standard. As long as the variance falls within this range, it will be classified as a random or chance fluctuation and control action will not be necessary.

Factors to Consider

When deciding which variances to investigate, the following factors should be considered

1. Reliability and accuracy of the figures.

   Mistakes in calculating budget figures, or in recording actual costs and revenues, could lead to a variance being reported where no problem actually exists (the process is actually 'in control').

2. Materiality.

   The size of the variance may indicate the scale of the problem and the potential benefits arising from its correction.

3. Possible interdependencies of variances.

   Sometimes a variance in one area is related to a variance in another.

For example, a favourable raw material price variance resulting from the purchase of a lower grade of material may cause an adverse labour efficiency variance because the lower grade material is harder to work with.

These two variances would need to be considered jointly before making an investigation decision.

4. The inherent variability of the cost or revenue.

   Some costs, by nature, are quite volatile (oil prices, for example) and variances would therefore not be surprising.

   Other costs, such as labour rates, are far more stable and even a small variance may indicate a problem.

5. Adverse or favourable?

   Adverse variances tend to attract most attention as they indicate problems.

   However, there is an argument for the investigation of favourable variances so that a business can learn from its successes.

6. Trends in variances.

   One adverse variance may be caused by a random event.

   A series of adverse variances usually indicates that a process is out of control.

7. Controllability/probability of correction.

   If a cost or revenue is outside the manager's control (such as the world market price of a raw material) then there is little point in investigating its cause.

8. Costs and benefits of correction.

   If the cost of correcting the problem is likely to be higher than the benefit, then there is little point in investigating further.

TECHNIQUES OF INVESTIGATION OF VARIANCE

A standard is an average expected cost and therefore small variations between the actual and the standard are bound to occur. These are uncontrollable variances and should not be investigated. In addition, a business may decide to only investigate variances above a certain amount. All business planning, whether in the form of budgets or standards, is based on estimates of prices, volumes, costs, etc., and any outcome can only be expected to approximate these estimates. Outcomes will not necessarily equal the original estimates, even if the estimates were 'accurate' and the process has been 'under control'. Some variation around the estimate or expected outcome is inevitable. Thus, when a variance is reported, the manager should ask whether it represents a significant deviation from the budget or whether it is simply a random fluctuation around the expected outcome. Variance investigation models are concerned with decisions to investigate the cause of particular variances and in particular, to distinguish significant deviations from random fluctuations.

A variance is an investigation of two comparable data points. There are three major types of variance reviews:

1. **estimated versus planned**
2. **planned versus actual**
3. **Estimated versus actual**.

An **estimate** is a quote, and can often come from an external source or partner. For example, you are in charge of planning your company holiday party and you are told by human resources there are 100 employees.

A **plan** is determined internally, based on the estimate. You select a location that can accommodate at least 200 people, accounting for each employee to bring a guest.

The **actual** is based on what happens. It turns out that 150 people were present at the party.

The **estimated versus planned** variance is the difference between the quote, which you find out included employees working remotely in other cities. The planner assumed all employees would bring a guest. This variance between estimated and planned is +100, while the variance between planned and actual is -50.

Following techniques are generally used in investigation of variances:

METHODS OF INVESTIGATING VARIANCE

1. THE SIMPLE RULE OF THUMB INVESTIGATION METHOD: Managers use simple models based on arbitrary criteria such as investigating if the absolute size of the variance is greater than a certain amount or if the variance exceeds the standard costs by some predetermined percentage.

- Fixed size of the variance Investigation is done if the absolute size of the variance is greater than a specified amount, say 6000. The main advantage of using an absolute figure is that it is simple for managers to interpret and implement.

- Fixed percentage rule this comes as a remedy to the use of absolute figure. That variance should be investigated if it is more than say 10% of the standard cost.

The main advantage of these simple methods is their simplicity and ease of implementation. The disadvantages of these methods include:

- They do not adequately take into account the statistical significance of the reported variances.

- They do not consider the costs and benefits of the investigation.

- They only rely on managerial judgment and intuition when selecting cut off values

2. TREND ANALYSIS: Variance analysis is a quantitative review of the differences between what we thought would happen versus what actually happened. While trend analysis is a quantities review of what happens over a period of time. In most cases, variance and trends go hand in hand and are reported at the same time for the same metrics. There are many types of metrics that are reviewed in a company to determine opportunities for improvement.

3. STATISTICAL CONTROL CHART: According to W. Edwards Deming, the main problem in management and leadership is the failure to understand the concept of variation. This is because effective management requires an understanding of the concept of control which requires the realization that there will always be variation in any cost or process measurement. Control involves an evaluation to determine if the object to be controlled, such as a cost, or process measurement, is inside or outside an acceptable range, i.e., whether

it is considered to be "in control", or "out of control". A cost, or process measurement (e.g., a quantity of input or output) that is outside an acceptable range, is viewed as potentially out of control.

Control charts, also known as Shewhart charts (after Walter A. Shewhart) or process-behavior charts, are a statistical process control tool used to determine if a manufacturing or business process is in a state of control. It is more appropriate to say that the control charts are the graphical device for Statistical Process Monitoring (SPM). Traditional control charts are mostly designed to monitor process parameters when underlying form of the process distributions is known. However, more advanced techniques are available in the 21st century where incoming data streaming can-be monitored even without any knowledge of the underlying process distributions. Distribution-free control charts are becoming increasingly popular Statistical process control or SPC is a method developed by Walter Shewhart that has been used extensively by Deming and others in the area of quality control and extended to the area of cost control by accounting researchers. The method is applied by establishing a range based on upper and lower limits, rather than establishing a single point estimate as a measure of acceptable performance. These limits are based on the observed variability within a stable, i.e., "in control" system.

Statistical Process Control is an analytical decision making tool which allows you to see when a process is working correctly and when it is not. Variation is present in any process, deciding when the variation is natural and when it needs correction is the key to quality control**. T**he foundation for Statistical Process Control was laid by Dr. Walter She wart working in the Bell Telephone Laboratories in the 1920s conducting research on methods to improve quality and lower costs. He developed the concept of control with regard to variation, and came up with Statistical Process Control Charts which provide a simple way to determine if the process is in control or not. Dr. W. Edwards Deming built upon Shewart's work and took the concepts to Japan following WWII. There, Japanese industry adopted the concepts whole-heartedly. The resulting high quality of Japanese products is world-renowned. Dr. Deming is famous throughout Japan as a "God of quality".

Today, SPC is used in manufacturing facilities around the world. Process control charts are fairly simple-looking connected-point charts. The points are plotted on an x/y axis with the x-axis usually representing time. The plotted points are usually averages of subgroups or ranges

of variation between subgroups, and they can also be individual measurements. Some additional horizontal lines representing the average measurement and control limits are drawn across the chart. Notes about the data points and any limit violations can also be displayed on the chart. Control charts are an essential tool of continuous quality control. Control charts monitor processes to show how the process is performing and how the process and capabilities are affected by changes to the process. This information is then used to make quality improvements. Control charts are also used to determine the capability of the process. They can help identify special or assignable causes for factors that impede peak performance. Control charts show if a process is in control or out of control. They show the variance of the output of a process over time, such as a measurement of width, length or temperature. Control charts compare this variance against upper and lower limits to see if it fits within the expected, specific, predictable and normal variation levels. If so, the process is considered in control and the variance between measurements is considered normal random variation that is inherent in the process. If, however, the variance falls outside the limits, or has a run of non-natural points, the process is considered out of control.

Variation is the key to statistical process control charts. The extent of variation in a process indicates whether a process is working as it should. When the variation between the points is large enough for the process to be out of control, the variation is determined to be due to non-natural or assignable (special) causes. An out of control process, there is no way of predicting whether the results will meet the target. An out of control process is like driving a bus in which the brakes may or may not work and you have no way of knowing. If a process is out of control, the next step is to look for the assignable causes for the process output, to look for the out-of-controlees. If this out-of-controlees is considered negative, such as multiple defects per part, the reasons for it are investigated and attempts are made to eliminate it. The process is continuously analyzed to see if the changes work to get the process back in control. On the other hand, sometimes the out-of-control outcomes are positive, such as no defects per part Then the assignable cause is sought and attempts are made to implement it at all times. If successful, the averages are lowered and a new phase of the process is begun. A new set of capabilities and control limits is then calculated for this phase.

4. DECISION TREE APPROACH: **A** Decision Tree is "**a decision support tool that uses a tree-like graph or model of decisions and their possible consequences**". Decision Trees are tricky analysis because it is sometimes confusing to understand when to

use them. Generally, decision trees can be used when data is quite bad in quality. A **decision tree** is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm that only contains conditional control statements. A decision tree is a flowchart-like structure in which each internal node represents a "test" on an attribute, each branch represents the outcome of the test, and each leaf node represents a class label. The paths from root to leaf represent classification rules. Decision tree methodology is a commonly used data mining method for establishing classification systems based on multiple covariates or for developing prediction algorithms for a target variable. This method classifies a population into branch-like segments that construct an inverted tree with a root node, internal nodes, and leaf nodes.

Common terms used with Decision trees:

Decision Node: Any node that gets split is known as the decision node.

Root Node: This is the top-most decision node and represents the entire sample which further gets divided.

Leaf Node: Also known as the Terminal node, this is a node that does not split further.

Splitting: The process of dividing a node is known as splitting.

Pruning: It is the opposite of splitting. Here we remove sub-nodes of a decision node.

5. GAME THEORY APPROACH: Game theory approach can be used for investigating variances. This technique helps in recognizing that the process may be under control even though a variance is reported. When a variance arises, it may be either "in control" or "out of control". If it is "in control", it does not require investigation. If it is "out of control", it require investigation.

QUESTIONS:

1. Define standard costing? Differentiate between standard costing and historical costing?

2. State the advantages and disadvantages of standard costing?

3. Discuss the procedure for standard setting?

4. Mention the different types of standard.

5. Distinguish between current standard and basic standard?

6. What is variance analysis? Discuss the importance in marginal decision making?

7. Explain the various material variances with suitable examples.

8. What is meant by interpretation of variance? What are the various causes of variances?

9. What are control ratios? Explain important control ratios.

10. What is meant by investigation of variances? What are the different techniques of investigation variance?

Suggested References

- Advanced **Cost** Accounting **Book** by Jain.
- Advanced **Cost** & Management Accounting **book** by Saxena V.
- Advanced **Cost** Accounting **book** by Jain S.
- **Cost** & Management Accounting by Inamdar S M.
- **Cost** & Management Accounting Kishore R. M.

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MODULE 5

Marginal Costing and its Application: Introduction, Meaning of Marginal Cost and Marginal Costing, Features of Marginal Costing, Advantages and Disadvantages of Marginal Costing – Important Terms in Marginal Costing – Marginal cost Equation, Contribution, PV Ratio, Breakeven Analysis, Angle of Incidence, Margin of Safety, Cash Breakeven Point, Composite Breakeven Point , Breakeven Chart and Its construction - CVP analysis and decision making – PV Chart and Its construction - Managerial applications of CVP analysis - make or buy decision- Alternative methods of production- Buy or Lease Decision- Shut down or continue- Repair or replace – Accepting bulk orders for Idle capacity utilization- pricing under different situations- suitable product mix and Key Factor.

MARGINAL COSTING AND ITS APPLICATION

Introduction

The basic objectives of Cost Accounting are cost ascertainment and cost control. In order to help management in cost control and decision making, cost accounting has developed certain tools and techniques. Marginal costing and Break even analysis are important techniques used for cost control and decision making.

Marginal Cost

The term Marginal cost means the additional cost incurred for producing an additional unit of output. It is the addition made to total cost when the output is increased by one unit.

Marginal cost of nth unit = Total cost of nth unit- total cost of n-1 unit.

E.g. When 100 units are produced, the total cost is Rs. 5000.When the output is increased by one unit, i.e., 101 units, total cost is Rs. 5040.Then marginal cost of 101th unit is Rs. 40[5040-5000]

Marginal cost is also equal to the total variable cost of production or it is the aggregate of prime cost and variable overheads. The chartered Institute of Management Accountants [CIMA] England defines Marginal as “the amount at any given volume of output by which aggregate costs are changed if the volume of output is increased or decreased by one unit

MARGINAL COSTING

It is the technique of costing in which only marginal costs or variable are charged to output or production. The cost of the output includes only variable costs .Fixed costs are not charged to

output. These are regarded as 'Period Costs'. These are incurred for a period. Therefore, these fixed costs are directly transferred to Costing Profit and Loss Account.

According to CIMA, marginal costing is "the ascertainment, by differentiating between fixed and variable costs, of marginal costs and of the effect on profit of changes in volume or type of output. Under marginal costing, it is assumed that all costs can be classified into fixed and variable costs. Fixed costs remain constant irrespective of the volume of output. Variable costs change in direct proportion with the volume of output. The variable or marginal cost per unit remains constant at all levels of output.

FEATURES OF MARGINAL COSTING (ASSUMPTIONS IN MARGINAL COSTING)

1. All costs can be classified into fixed and variable elements. Semi variable costs are also segregated into fixed and variable elements.
2. The total variable costs change in direct proportion with units of output. It follows a linear relation with volume of output and sales.
3. The total fixed costs remain constant at all levels of output. These are incurred for a period and have no relation with output.
4. Only variable costs are treated as product costs and are charged to output, product, process or operation
5. Fixed costs are treated as 'Period costs' and are directly transferred to Costing Profit and Loss Account.
6. The closing stock is also valued at marginal cost and not at total cost.
7. The relative profitability of product or department is based on the contribution it gives and not based on the profit
8. It is also assumed that the selling price per unit remains the same i.e., any number of units can be sold at the current market price.
9. The product or sales mix remains constant over a period of time.

ADVANTAGES OF MARGINAL COSTING

Following are the advantages of Marginal costing

1. It is simple to understand and easy to apply to any firm

2. There is no arbitrary apportionment of fixed cost in this system. Fixed costs are transferred to costing profit and Loss account.

3. It also prevents the illegal carry forward in stock valuation of some proportion of current years fixed cost.

4. The effect of different sales mix on profit can be ascertained and management can adopt the optimum sales mix

5. It is used in control of cost by concentrating on variable cost of production.

6. It helps in profit planning by break even and cost volume profit analysis

7. It helps management to take a number of short term decisions like pricing, output, closing down of department, sales mix, make or buy etc..

DISADVANTAGES

Important disadvantages of marginal costing are;

1. All Assumptions of marginal costing are not appropriate. The assumption fixed cost remains constant for all levels may not hold good in the long run.

2. The assumption that changes in direct proportion with the volume of also do not hold good under all circumstances.

3. It is difficult to segregate all costs into fixed and variable elements.

4. The exclusion of fixed costs in ascertaining cost of production may give misleading results and lead to non recovery of total costs.

5. The exclusion of fixed costs from inventories affect profit and financial statements may not reflect true and fair view of financial affairs.

CONCEPT OF CONTRIBUTION

Contribution is the excess of sales over marginal cost. It is not purely profit. It is the profit before recovery of fixed assets. Fixed costs are first met out of contribution and only the remaining amount is regarded as profit. Contribution is an index of profitability. It has a fixed relationship with sales. Larger the sales more will be the contribution and vice versa.

Contribution = Sales – Marginal cost

Marginal cost equation

Sales-Marginal cost = Contribution

Contribution = Fixed costs + Profit

Therefore, Fixed cost = Contribution – Profit'

PROFIT VOLUME RATIO [P/V RATIO].

Contribution is an absolute measure of profitability but it cannot be used for comparison of two products or departments. Therefore, the contribution is related to volume of sales. It is called Contribution / Sales Ratio or Profit/Volume Ratio [P/V Ratio].

$$\text{P/V Ratio} = \frac{\text{Contribution}}{\text{Sales}} \times 100$$

When the P/V Ratio is higher, profitability of the product will also be higher. It is an index of relative profitability of products or departments.

$$\text{Sales} = \frac{\text{Contribution}}{\text{P/V Ratio}}$$

$$\text{Contribution} = \text{Sales} \times \text{P/V Ratio}$$

P/V Ratio can also be finding out by the following formula: -

$$\text{P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100$$

Or

$$\text{P/V Ratio} = \frac{\text{Fixed Cost}}{\text{Break even sales}} \times 100$$

BREAK EVEN ANALYSIS

Every business is interested in ascertaining the breakeven point. It is the level of operation where total revenue or sales are equal to total cost. It is the point of no profit or no loss. The contribution received at breakeven point is just sufficient to meet the fixed costs, leaving nothing as profit. The firm ceases to incur losses at this point or it starts to earn a profit from this point. Breakeven point can be expressed in algebraic method or graphical method.

Algebraic Method

Breakeven point may be expressed in terms of number of units to be produced, or in terms of volume of sales or in terms of the capacity of operation. It can be calculated by the following formula.

1. Breakeven point in units = $\frac{\text{Total Fixed costs}}{\text{Contribution per unit}}$

2. Breakeven point in value = $\frac{\text{Total Fixed costs}}{\text{P/V Ratio}}$

Or

= $\frac{\text{Total Fixed cost x sales}}{\text{Contribution}}$

3. Breakeven point (in % of capacity utilization) = $\frac{\text{Total Fixed Costs}}{\text{Contribution}}$ x 100

Illustration 1

From the following information calculate

1. P/V Ratio
2. Breakeven point in Units
3. Breakeven point in Value

Given:

Selling price per unit	Rs.20
Variable cost per unit	Rs.12
Fixed costs	Rs.32000

Solution

1. P/V Ratio = Contribution / Sales x 100

= 20-12/20x100 = 40 %

2. Breakeven point in units = Fixed costs / Contribution per unit

= 32000/8 = 4000 units

3. Breakeven point in value = $\frac{\text{Fixed costs}}{\text{P/V Ratio}}$

= 32000/40 x100 = Rs.80000

Target Profit

The Breakeven analysis can guide an organization to determine the volume of sales required to earn a desired level of profit. The firm can decide upon the target return or profit in advance. To achieve this profit, efforts would be taken to increase the volume of sales. The volume of sales required to achieve the desired level of profit may be computed as follows: -

$$\text{Number of units to be sold} = \frac{\text{Fixed costs + desired Profit}}{\text{Contribution per unit}}$$

$$\text{Sales volume required} = \frac{\text{Fixed costs+ Desired Profits}}{\text{P/V Ratio}}$$

Illustration 2

Product A is sold at a unit selling price of Rs. 40 and the variable cost incurred per unit is Rs.32. The firm's fixed cost are Rx. 40000.Find out

1. The number of units to be produced to break even
2. The number of units to be sold to earn a profit of Rs.10000

Solution

Contribution = SP-VC

= 40-32 = 8 per unit

1. Number of units to be produced to Break even

BEP = Fixed cost/ Contribution per unit

= 40000/8 = 5000 units.

2. Number of units to be sold to earn a profit of Rs.10000

$$\frac{\text{Fixed Cost + Desired Profit}}{\text{Contribution per unit}} = \frac{40000+10000}{8} = 6250 \text{ units}$$

ANGLE OF INCIDENCE

It is the angle caused by the intersection of the total sales line and total cost line at the breakeven point. The width of the angle represents the rate of profitability i.e., the larger the angle the greater will be the profit the business is making on additional sales.

MARGIN OF SAFETY

Margin of safety represents the strength of the business to face an adverse market condition. It is the excess of actual sales over break even sales. Higher the Margin of safety, better the position of the firm.

Margin of safety = Actual sales - b Break even sales

Margin of safety = Profit / P/V Ratio

Or

Profit = margin of safety x P/V Ratio

Illustration 3

The following data have been obtained from the records of a manufacturing firm.

	Period I	Period II
Sales	300000	320000
Total cost	260000	272000

Calculate

1. Break even sales
2. Profit when sales are Rs.360000.
3. Sales required earning a profit of Rs.50000

Solution:

P/V Ratio = Change in Profit x 100 / Change in Sales

Change in profit = 48000-40000 = 8000

Change in Sales = 320000-300000 = Rs.20000

P/V Ratio = 8000/20000x 100 = 40%

Contribution = Sales x P/V Ratio

Period I = 300000 x 40/100 = Rs.120000

Fixed cost = Contribution – Profit = 120000- 40000

= Rs.80000

1. BEP = Fixed cost /P/V Ratio = 8000/40 x 100

= 200000

2. Profit when sales are Rs.360000

Contribution = 360000x40/100

= 144000

Profit = Contribution – Fixed cost = 144000-80000

= Rs.64000

3. Sales required earning a profit of Rs.50000

Contribution required = Fixed cost + Profit required = 80000+50000

= 130000

Sales = Contribution requires/ P/V ratio

= 130000/40x100

= Rs.325000

CASH BREAK EVEN POINT

Total fixed costs include depreciation. Depreciation is a non cash expense. Therefore, cash breakeven point is the number of units to be produced to give a contribution equal to cash fixed costs.

$$\text{Cash Breakeven point} = \frac{\text{Fixed cost – Depreciation}}{\text{Contribution per unit}}$$

Illustration 4

Calculate cash breakeven point for the following:

Selling price per unit	Rs.40
Variable cost per unit	Rs.32
Fixed cost [including depreciation of Rs.20000]	Rs.60000 per annum

Solution

Contribution per unit = S- VC = 40-32 = 8

Cash breakeven point = Fixed cost – depreciation

Contribution per unit = 60000-20000/8 = 5000 units

COMPOSITE BREAK EVEN POINT

In the case of companies producing more than one product an overall or composite breakeven point is calculated.

$$\text{Composite Breakeven point} = \frac{\text{Total Fixed Costs}}{\text{Composite P/V Ratio}}$$

$$\text{Composite P/V Ratio} = \frac{\text{Total contribution}}{\text{Total Sales of all products}} \times 100$$

Break Even Chart [Graphic Method]

It is the graphical presentation of breakeven point. It shows the relationship between sales volumes, variable and fixed costs. It also shows the profit or loss at different levels of output or volume of sales.

Construction of Breakeven Chart

A Break even chart shows the total sales line, total cost line and the point of intersection called the breakeven point. It is constructed using a database of variable costs, fixed costs, total costs and sales at different levels of output. The units of output or sales revenue are plotted along the X axis, using suitable scale of measurement. The costs and sales are plotted along the Y axis. The fixed costs line is plotted first. It forms a parallel line to the X axis indicating that the fixed cost remains constant at all levels of output. The variable cost line is plotted next, starting from zero it progresses continuously indicating that the variable cost increase with the volume fixed cost line of sales. The total cost line is plotted above the variable cost line. It starts from the fixed cost line on the Y axis and follows the same pattern of variable cost line. The sales line is plotted finally. It starts from the zero and progresses continuously, indicating that the sales increase with larger units of output. The point of intersection of sales line and total cost line indicates the breakeven point. A vertical line drawn to the X axis from this point shows the volume of output required to break even.

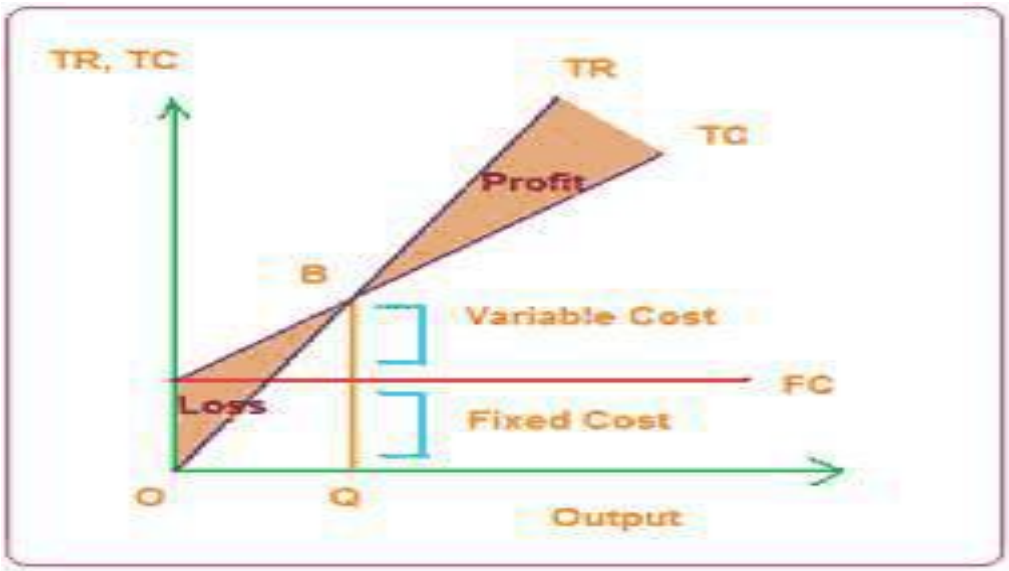
Illustration 5

Draw a Break even chart using the following data

Selling price per unit	Rs.12
Variable cost per unit	Rs.7
Fixed costs	Rs. 2000
Budgeted output	800 units

Solution

Output [units]	Variable costs	Fixed costs	Total costs	Sales
200	1400	2000	3400	2400
400	2800	2000	4800	4800
600	4200	2000	6200	7200
800	5600	2000	7600	9600



COST-VOLUME PROFIT ANALYSIS [CVP ANALYSIS]

Meaning of Cost Volume Profit

Cost-volume-profit (CVP) analysis is used to determine how changes in costs and volume affect a company's operating income and net income. Key calculations when using CVP analysis are the contribution margin and the contribution margin ratio. The contribution margin represents the amount of income or profit the company made before deducting its fixed costs. Said another way, it is the amount of sales rupees available to cover (or contribute to) fixed costs. When calculated as a ratio, it is the percent of sales dollars available to cover fixed costs. Once fixed costs are covered, the next rupee of sales results in the company having income. CVP analysis provides managers with the advantage of being able to answer specific pragmatic questions needed in business analysis. Questions such as what the company's breakeven point is help managers project how future spending and production will contribute to the success or failure of the company. For instance, when a manager knows the breakeven point, he can decide for spending and increase production efforts to increase profitability. Because CVP analysis is based on statistical models, decisions can be broken down into probabilities that help with the decision-making process.

Another major benefit of CVP analysis is that it provides a detailed snapshot of company activity. This includes everything from the costs needed to produce a product to the amount of the product produced. This helps managers determine, very specifically, what the future will hold if variables are altered. For instance, transportation expenses and costs for materials can change. These variable costs can affect the bottom line. CVP analysis allows the manager

to plug in variable costs to establish an idea of future performance, within a range of possibilities. This, however, can be a disadvantage to managers who are not detail-oriented and precise with the data they record. Projections based on cost estimates, rather than precise numbers, can result in inaccurate projections.

Even though CVP analysis is based on specific data and requires tremendous attention to detail, the best that it can do is provide approximate answers to questions, rather than ones that are exact. It answers hypothetical questions better than it provides actual answers for solving problems. It leaves the business manager to decide how to act on the CVP analysis data he has at hand. For this reason, the manager has to exercise extreme caution when making decisions about changes to business operations and finance. Judgments have to be made after careful investigation and deliberation — and not just be based solely on statistics. Investigation may involve, for instance, interviewing employees and carefully observing their daily activities, as opposed to simply treating them as part of a statistical model. In performing this analysis, there are several assumptions made, including:

· Sales price per unit is constant.
· Variable costs per unit are constant.
· Total fixed costs are constant.
· Everything produced is sold.
· Costs are only affected because activity changes.
· If a company sells more than one product, they are sold in the same mix.

COST-VOLUME PROFIT (CVP) ANALYSIS

Profits of business firms are the result of many factors such as:

(i) Selling prices, (ii) volume of sales (iii) unit variable costs (iv) total fixed costs, (v) combinations in which the various product lines are sold, etc. To do an effective planning, management must analyse how profits will be affected by a change in any one of these factors. A cost volume profit (CVP) analysis is useful to management in knowing how profit is influenced by sales volume, sales price, variable expenses and fixed expense. Broadly, CVP analysis uses the techniques of (i) Break-even analysis and (ii) Profit-Volume (P/V) analysis.

It was observed that in marginal costing, marginal cost varies directly with the volume of production or output. On the other hand, fixed cost remains unaltered regardless of the volume of output within the scale of production already fixed by management. In case if cost behavior is related to sales income; it shows cost-volume profit relationship. In net effect, if volume is changed, variable cost varies as per the change in volume. In this case, selling price remains fixed, fixed remains fixed and then there is a change in profit.

Being a manager, one constantly strive to relate these elements in order to achieve the maximum profit. A part from profit projection, the concept of Cost-Volume-Profit (CVP) is relevant to virtually all decision making areas, particularly in the short run. The relationship among cost, revenue and profit at different levels may be expressed in graphs such as breakeven charts, profit volume graphs, or in various statement forms. Profit depends on a large number of factors, most important of which are the cost of manufacturing and the volume of sales. Both these factors are interdependent. Volume of sales depends upon the volume of production and market forces which in turn is related to costs. Management has no control over market. In order to achieve certain level of profitability, it has to exercise control and management of costs, mainly variable cost. This is because fixed cost is a non-controllable cost. But then, cost is based on the following factors:

· Volume of production
· Product mix
· Internal efficiency and the productivity of the factors of production
· Methods of production and technology
· Size of batches
· Size of Plant

Thus, one can say that cost-volume-profit analysis furnishes the complete picture of the profit structure. This enables management to distinguish among the effect of sales, fluctuations in volume and the results of changes in price of product/services.

It is the study of the impact of a change in cost, price and volume on profit. Break even analysis is a narrow interpretation of cost volume profit analysis. But it is mainly confined to finding out the breakeven point. In CVP analysis the relationship between cost, volume and profit is studied in detail. It helps management in profit planning, decision making and cost control.

Objectives of Cost-Volume-Profit Analysis

1. In order to forecast profits accurately, it is essential to ascertain the relationship between cost and profit on one hand and volume on the other.

2. Cost-volume-profit analysis is helpful in setting up flexible budget which indicates cost at various levels of activities.

3. Cost-volume-profit analysis assists in evaluation performance for the purpose of control.

4. Such analysis may assist management in formulating pricing policies by projecting the effect of different price structures on cost and profit.

Assumptions and Terminology

Following are the assumptions on which the theory of CVP is based:

1. The changes in the level of various revenue and costs arise only because of the changes in the number of product (or service) units produced and sold. The number of output (units) of be sold is the only revenue and cost driver. Just as a cost driver is any factor that affects costs, a revenue driver is any factor that affects revenue.

2. Total costs can be divided into a fixed component and a component that is variable with respect to the level of output. Variable costs include the following:

a. Direct materials

b. Direct labour

c. Direct chargeable expenses

Variable overheads include the following:

a. Variable part of factory overheads

b. Administration overheads

c. Selling and distribution overheads

3. There is linear relationship between revenue and cost.

4. When put in a graph the behavior of total revenue and cost is linear (straight line) i.e.

$Y = mx + C$ holds good which is the equation of a straight line.

5. The unit selling price, unit variable costs and fixed costs are constant.

6. The theory of CVP is based upon the production of a single product. However of late, management accountants are functioning to give a theoretical and a practical approach to multi- product CVP analysis.

7. The analysis either covers a single product or assumes that the sales mix sold in case of multiple products will remain constant as the level of total units sold changes.

8. All revenue and cost can be added and compared without taking into account the time value of money.
9. The theory of CVP is based on the technology that remains constant.
10. The theory of price elasticity is not taken into considerations.

LIMITATIONS OF CVP ANALYSIS

CVP analysis is a useful planning and control device, usually in the form of a chart, showing how revenue, costs, and profit fluctuate with volume. The CPV technique is useful to management in areas of budgeting, cost control and decision making. In spite of CVP being a useful technique, it suffers from some limitations. Firstly, because of the many assumptions, CVP is only an approximation at best. If prices, unit costs, sales-mix, operating efficiency, or other relevant factors change, then the overall CVP analysis and relationship also must be modified. Because of these assumptions, cost data are of limited significance.

In a multi-product situation, different products typically yield different contribution margins and are produced in various volumes with differing costs. As a result neither the revenue curve nor the cost curve is necessarily straight and the break-even point in difficult to find. Therefore, while preparing or interpreting cost-volume profit analysis, all assumptions and limitations should be carefully considered. A series of CVP analysis based on different sets of assumptions and circumstances may be prepared to reflect situations prevailing in different business enterprises. When circumstances change, CVP analysis should also be revised to reflect the changing situations. It is also necessary to have up-to-date analysis so that it can act as a useful device in profit forecast, budgeting. Cost control and managerial decision making. The CVP analysis is generally made under certain limitations and with certain assumed conditions, some of which may not occur in practice. Following are the main limitations and assumptions in the cost volume profit analysis:

1. It is assumed that the production facilities anticipated for the purpose of cost-volume profit analysis do not undergo any change. Such analysis gives misleading results if expansion or reduction of capacity takes place.
2. In case where a variety of products with varying margins of profit are manufactured, it is difficult to forecast with reasonable accuracy the volume of sales mix which would optimize the profit.

3. The analysis will be correct only if input price and selling price remain fairly constant which in reality is difficult to find. Thus, if a cost reduction program is undertaken or selling price is changed, the relationship between cost and profit will not be accurately depicted.

4. In cost-volume profit analysis, it is assumed that variable costs are perfectly and completely variable at all levels of activity and fixed cost remains constant throughout the range of volume being considered. However, such situations may not arise in practical situations.

5. It is assumed that the changes in opening and closing inventories are not significant, though sometimes they may be significant.

6. Inventories are valued at variable cost and fixed cost is treated as period cost. Therefore, closing stock carried over to the next financial year does not contain any component of fixed cost. Inventory should be valued full cost in reality.

PROFIT VOLUME CHART OR [P/V CHART]

It shows the amount of profit or loss at different levels of output. When the output is zero, total loss will be equal to fixed costs. The fixed costs are recovered gradually when the volume of output is increased. When the output reaches the breakeven point, the whole fixed costs are recovered. The firm incurs no loss or earns no profit. Thereafter, the firm makes a profit and the amount of profit increases with the increase in sales volume.

CONSTRUCTION OF P/V CHART

The same data used for drawing a Break even chart may be used for constructing a P/V chart. The following steps may be followed for constructing a P/V chart.

1. Sales or units of output are plotted along the X axis
2. The Y axis is used for marking fixed costs losses and profits
3. Points of Profits or losses are marked at different levels of sales and these points are joined to get the profit or loss line.
4. The point where the profit or loss line intersects the X axis is marked as the breakeven point.
5. The angle at the BEP measures the angle of incidence
6. The distance between BEP and actual sales on the X axis measures the margin of safety

APPLICATIONS OF MARGINAL COST TECHNIQUE (CVP ANALYSIS)

Marginal costing is the most powerful and popular technique in aid of managerial decision making, As already seen, It reveals the cost, volume profit relationship in all its ramifications which is useful in profit planning, selling price determination, selection of optimum volume of production etc. Marginal costing, with its focus on variability of costs and avoidance of overhead apportionment, is so versatile that it is applied in varied circumstances and to tackle diverge problems by those in charge of such situations. The following are some of the more popular areas of application of marginal costing.

1. Fixation of Selling Price

Price is one of the most significant factors that determine the market for the products as well as the volume of profit for the organization. Under, normal circumstances, the price of a product must cover the total costs of the product plus a margin of profit. However, under certain special circumstances, price has to be fixed even below the total cost. For instance, when there is a general trade depression (or) exploring new markets (or) accepting additional orders, the producer has to cut the price even below the total costs of the concerned product. Under these special circumstances, the concept of marginal cost is usefully applied to fit the prices.

2. Accepting Bulk Orders (or) Foreign Market Orders

Some bulk orders may be received from local dealers (or) foreign dealers asking for a price which is below the market price. This calls for a decision to accept (or) reject the order. The order from a local dealer should not be accepted at a price below the market price because it will affect the normal market and goodwill of the company on the other hand, the order from the foreign dealer should be accepted because it will give additional contribution, as the fixed costs have already been met.

3. Make (or) Buy Decision

In a make (or) buy decision, the price quoted by the outside suppliers should be compared with the marginal cost of producing the component parts. If the outside price of the component is lower than the marginal cost of producing it, it is worth buying. On the other hand, if the outside price is higher than the marginal cost, making the component in the factory may be preferred.

4. Selection of Suitable Product Mix

When a factory manufactures more than one product, a problem is faced by the management as to which product will give maximum profits. The solution is the products which give the maximum contribution are to be retained and their production should be increased.

5. Key Factor

It is also known as limiting factor (or) governing factor or scarce factor. A key factor is one which restricts production and profit of a business. It may arise due to the shortage of material, labour, and capital plant capacity (or) sales. Normally, when there is no limiting factor, the selection of the product will be on the basis of the highest P/V ratio. But, when there are limiting factors, selection of the product will be on the basis of the highest contribution per unit of the key factor.

6. Maintaining a Desired Level of Profit

Management may be interested in maintaining a desired level of profits. The sales required to earn a desired level of profits can be ascertained by the marginal costing techniques.

7. Alternative methods of Production

Marginal costing is helpful in comparing the alternative methods of production i.e., machine work (or) hand work. The method which gives maximum contribution is to be adopted keeping in mind the limiting factor.

8. Determination of Optimum Level of Activity

The technique of marginal costing helps the management in determination the optimum level of activity. To make such a decision, contribution at different levels of activity can be found. The level of activity which gives the highest contribution will be the optimum level. The level of production can be raised till the marginal cost does not exceed the selling price.

9. Evaluation of Performance

Evaluation of performance efficiency of various departments or product lines can be made with the help of marginal costing. The management has to discontinue the production of non-profitable products or department so as to maximize the profits. In such cases, decision to discontinue will be on the basis of the lowest contribution or P/V Ratio.

10. Cost Control

The two types of costs-variable and fixed are controllable and non-controllable respectively. The variable cost is controlled by production department and the fixed cost is controlled by the management.

11. Closure of a Department or Discontinuing a Product

Marginal costing technique shows the contribution of each product to fixed costs and profit. If a department or a product contributes the least amount, then the department can be closed (or) its production can be discontinued. It means the product which gives a higher amount of Contribution may be chosen and the rest should be discontinued.

12. Profit Planning

Profit planning is a plan for future operation (or) or planning budget to attain the given objective or to attain the maximum profit. The volume of sale required to maintain a desired profit can be ascertained.

13. Introduction of a New Product

A production firm may add additional products with the available facility. The new product is sold in the market at a reasonable price, in order to sell it in large quantities. It may become popular. If favourable, the sales can be increased. Thus, the total cost comes down and contributes some amount towards fixed costs and profits.

14. Choice of Technique

Every management wishes to manufacture the products at the most economical way. For this, the marginal costing is a good guide as to the products at different stages of production, that is to say whether the management has to adopt hand operated system (or) semi-automatic system or complete automatic system. When operations are done manually, fixed cost will be lower than the fixed cost incurred by machines and in complete automatic system, fixed costs are more than variable cost.

15. Decision Making

Price must not be less than total cost under normal conditions, Marginal costing acts as a price fixer and a high margin will contribute to the fixed cost and profit. But this principle cannot be followed every time. Price should be equal to marginal cost plus a reasonable amount, which depends upon demand and supply, competition, policy of pricing etc. If the price is equal to marginal cost, then there is a loss equal to fixed costs. Sometimes, the businessman has to face loss when:

(a) There is cut-throat competition

(b) There is the fear of future market

(c) That goods are of perishable nature d) the employees cannot be removed

(e) A new product is introduced in the market

(f) Competitors cannot be driven out etc.

16. Introduction of New Product (or) Product Line

The technique to assess the profitability of a line extension product is the incremental contribution estimates. The same technique of contribution analysis would be followed in assessing the profitability of a new product line sales forecast would result from a market survey and market research.

FIXATION OF SELLING PRICE UNDER DIFFERENT MARKET CONDITIONS

Marginal cost of a product represents the minimum price for that product and any sale below the marginal cost would entail a cash loss. The price for the product should be fixed at a level which not only covers the marginal cost but also makes a reasonable contribution towards the common fund to cover fixed overheads. The fixation of such a price for a product would be easier if its marginal cost and overall profitability of the concern is known.

Illustration 6

The Cost Sheet of a product is given as under:

		Rs.
Direct Materials		5.00
Direct Wages		3.00
Factory Overheads :		
Fixed	Re. 0.50	
Variable	Re. 0.50	
		1.00
Administrative Expenses		0.75
Selling and Distribution Overheads :		
Fixed	Re. 0.25	
Variable	Re. 0.50	
		0.75
		10.50

The selling price per unit is Rs. 12.

The selling price-per unit is Rs. 12.

The above figures are for an output of 50,000 units, the capacity for the firm is 65,000 units. A foreign customer is desirous of buying 15,000 units at a price of Rs. 10 per unit. Advise the

manufacturer whether the order should be accepted. What will be your advice if the order were from a local merchant?

SOLUTION

MARGINAL COST OR ADDITIONAL COST FOR ADDITIONAL 15,000 UNITS

	Per unit Rs.	*For 15,000 units* Rs.
Direct Materials	5.00	75,000
Direct Wages	3.00	45,000
Prime Cost	8.00	1,20,000
Variable Overheads :		
Factory	0.50	7,500
Selling and Distribution	0.50	7,500
Marginal Cost	9.00	1,35,000
Sales	10.00	1,50,000
Contribution	1.00	15,000

The order from the foreign customer will give an additional contribution of Rs. 15,000. Hence, the order should be accepted because additional contribution of Rs. 15,000 will increase the profit by this amount because fixed expenses have already been met from the internal market.

The order from the local merchant should not be accepted at a price of Rs. 10 which is less than normal price of Rs. 12. This price will affect relationship with other customers and there will be a general tendency of reduction in the price.

Illustration 7

ABC Ltd is working below the normal capacity due to adverse market conditions. The present sales and costs of the firm are:

Normal capacity	5000 units
Actual output	3000 units
Direct Materials	Rs.30000
Direct Labour	Rs.12000
Variable overheads	Rs.3000
Fixed overheads	Rs.25000
Selling price per unit	Rs.20

It is difficult to sell additional units in the market over the present level of output. The company has received enquiries for supply of additional units below the current market price. You are advising to suggest the minimum price to be charged for additional units?

Solution:

Calculation of Marginal cost

Direct Materials	Rs.30000	
Direct Labour	Rs.12000	
Variable overheads	Rs.3000	
Marginal Cost	**Rs.45000**	
Marginal cost per unit	= 45000/3000	= Rs.15

Therefore, the minimum price to be charged is Rs.15.Any price above the marginal cost will reduce the present loss by recovery of fixed costs.

ACCEPTING SPECIAL OFFER / EXPORT OFFER

Sometimes a firm may receive an offer for supply of additional units at a price lower than the current selling price. According to Marginal costing technique, any price quoted above marginal cost can be accepted. This is because the firm is already selling maximum units in the domestic market and making a profit. If the new offer is accepted, the contribution from such offer is purely profit and therefore the total profit of the firm is increased. However, before accepting the offer, it should be confirmed that it is within the capacity and there is no increase in fixed costs as a result of increasing the output.

Illustration 8

A company manufacturing electric motors at a price of Rs. 6,900 each, made up as under:

	Rs.
Direct materials	3,200
Direct labour	400
Variable overheads	1,000
Fixed overheads	200
Depreciation	200
Variable selling overheads	100
Royalty on production	200
Profit	1,000
	6,300
Central exercise duty	600
	6,900

(i) A foreign buyer has offered to buy 200 such motors at Rs. 5,000 each. As a cost accountant of the company would you advise acceptance of the offer?

(ii) What should the company quote for a motor to be purchased by a company under the same management if it should be at cost?

SOLUTION

		Rs.	Rs.
	Sale price offered		5,000
Less :	Variable costs :		
	Direct materials	3,200	
	Direct labour	400	
	Variable overheads	1,000	
	Variable selling overheads	100	
	Royalty	200	4,900
	Contribution		100

From the above, it is clear that the offer gives Rs. 100 as contribution towards the recovery of fixed cost besides covering marginal cost. As it is an export order so there will be no incidence of central excise. Moreover, there will also be government incentive for export order, which will help the company to recover- further the fixed cost and balance, if any, the depreciation. If the order is not accepted, the capacity remains unutilized. Other non-monetary aspects may also be viewed.

(ii) If the motor is sold at cost price, the price to be quoted will be the total price less selling overheads and profit i.e., Rs. 6,300 – Rs. 1,100 = Rs. 5,200. Central excise duty may be added where payable.

Illustration 9

MNP ltd is working at 60% of capacity producing 6000 units of output. The following details are available from its cost records.

Direct materials	Rs.24000
Direct labour	Rs.12000
Variable overheads	Rs.6000
Fixed overheads	Rs.15000

The output is sold at a price of Rs 10 per unit. The company receives an offer to export 4000 units' @Rs.8.50 per unit. Should the export order be accepted?

Solution

Output 60% of capacity 6000 units	Per unit Rs.	Total Rs.
Sales 6000 units @ Rs.10	**10**	**60000**
Less: Marginal costs		
Direct materials	4	24000
Direct labour	2	12000
Variable overhead	1	6000
Total marginal cost	**7**	**42000**
Contribution	**3**	**18000**
Less: Fixed over heads		15000
Profit		**3000**

The marginal cost of the product is Rs. 7 per unit. Since the price quoted by the exporters is higher than the marginal cost, the export offer should be accepted. There is a contribution of Rs.1.50 per unit [8.50-7] from every unit of export. Therefore, the total profit will increase by Rs.6000 [4000 unit's x1.50] by accepting the offer as shown below.

Profitability statement [after accepting export offer]

Capacity 100 % output 10000 units	per unit Rs.	Total Rs.
Sales: Domestic 6000@ Rs.10	10	60000
Export 4000@Rs.8.50	8.5	34000
		94000
Less: marginal cost		
Direct materials	4	40000
Direct labour	2	20000
Variable overheads	1	10000
Total marginal cost		**70000**
Contribution		**24000**
Less; fixed costs		**15000**
Profit		**9000**

SELECTION OF A PRODUCT/ SALES MIX

The marginal costing technique is useful for deciding the optimum product/sales mix. The product which shows higher P/V ratio is more profitable. Therefore, the company should produce maximum units of that product which shows the highest P/V ratio so as to maximize profits.

Illustration 10

Present the following information to show to the management:

(i) The marginal product cost and the contribution per unit.

(ii) The total contribution and profits resulting from each of the following sales mixtures.

(iii) The proposed sales mix to earn a profit of Rs. 250 and Rs. 300 with total sales of A and B being 300 units.

	Product A Rs.	*Product B* Rs.
Direct materials (per unit)	10	9
Direct wages (per unit)	3	2
Sales price (per unit)	20	15
Fixed expenses Rs. 800 (Variable expenses are allocated to products as 100% of direct wages)		

Sales mixtures:

(a) 100 units of Product A and 200 of B

(b) 150 units of product A and 150 of B

(c) 200 units of product A and 100 of B

Recommend which of the sales mixtures should be adopted.

SOLUTION

(i) STATEMENT OF MARGINAL COST AND UNIT CONTRIBUTION

	Product A		Product B	
	Per unit	Per unit	Per unit	Per unit
	Rs.	Rs.	Rs.	Rs.
Sale Price		20		15
Less : Variable Cost :				
Direct Materials	10		9	
Direct Wages	3		2	
Variable Overheads	3	16	2	13
Contribution		4		2

(ii)

	Mix (a)			Mix (b)			Mix (c)		
	A	B	Total	A	B	Total	A	B	Total
Sales (units)	100	200	300	150	150	300	200	100	300
Contribution per unit (Rs.)	4	2		4	2		4	2	
Total Contribution (Rs.)	400	400	800	600	300	900	800	200	1,000
Less : Fixed Cost			800			800			800
Profit (Rs.)			—			100			200

Mix (c) should be adopted as it gives the maximum contribution and profit.

(iii) Proposed Mixes.

	Case I	Case II
	Rs.	Rs.
Required profit	250	300
Fixed cost	800	800
Contribution	1,050	1,100

Case I

Let p nos. of A be sold.
Then $(300 - p)$ nos. of B are to be sold.
Equating $4p + 2(300 - p) = 1{,}050$
$4p + 600 - 2p = 1{,}050$
$2p = 450$
$\therefore \quad p = 225$
Proposed Mix A = 225 units
B = 75 units (*i.e.* 300 – 225)

Case II

Say 'x' nos. of A to be sold then $(300 - x)$ nos. of B are to be sold.
Equating, $4x + 2(300 - x) = 1{,}100$

Illustration 11

ABC Ltd produces and sells two products A and B. the cost and sales data are given as

	Product A	product B
Selling price	20	30
Direct material	10	15
Direct labour	4	5

Fixed overheads Rs.1200

Variable overheads are absorbed at 50% of direct labour

The proposed sales mixes are

a. 100 units of A and 200 units of B

b. 150 units of A and 150 units of B

c. 200 units of A and 100 units of B

Recommend which of the above sales mix the company should adopt

Solution

Marginal cost statement

	PRODUCT A	PRODUCT B
SELLING PRICE	20	30
Less: marginal costs		
Direct materials	10	15
Direct labour	4	5
Variable overheads	2	2.5
[50% of direct labour]	16	22.5
Contribution	4	7.5
P/V ratio = contribution/sales x 100	20%	25%

Since product B gives a higher P/V ratio. Sales mix with the highest units of product B should be adopted. Therefore, the proposal [a], 100 units of A and 200 units of B is recommended. The profit will be the maximum as shown below

[a]100 units of A and 200 units of B

Contribution	\	A	100 x 4 = 400
		B	200x7.5 = 1500
			1900
Less: fixed cost			1200
Profit			700

[b] 150 units of A and 150 units of B

Contribution	A	150 x 4 = 600
	B	150x7.5 = 1125
		1725
Less: fixed cost		1200
Profit		525

[c] 200 units of A and 100 units of B

Contribution	A	200 x 4 = 800
	B	100x7.5 = 750
		1550
Less: fixed cost		1200
Profit		350

MAKE OR BUY DECISION

Marginal costing helps the management in deciding whether to make a component part within the factory or to buy it from an outside supplier. Here, the decision is taken by comparing the marginal cost of producing the component part with the price quoted by the supplier. If the marginal cost is below the supplier's price, it is profitable to produce the component within the factory. Whereas, if the supplier's price is less than the marginal cost of producing the component, then it is profitable to buy the component from outside.

Illustration 12

A television manufacturing company finds that while the cost of making component part No. X05 is Rs.4 per unit, the same is available in the market at Rs. 350 per unit with assured supply. The cost details are:

Material	1.50
Labour	1.00
Variable OH	0.50
Fixed cost allocated	1.00

Total	4.00

Should the component part be made or bought? What would be your suggestion if the component part is available at 2.50 in the market?

Solution

Calculation of marginal cost of component

Material1	.50
Labour	1.00
Variable overhead	0.50
Marginal cost	3.00

The marginal cost of producing the component part is Rs. 3 where as the market price is Rs.3.50 per unit. Therefore, the company should continue to produce the component. There is a saving of Rs.0.50 in every unit manufactured by the company. If the market price is Rs.2.50, it is profitable to buy the component part from the market. There is a saving of Rs.50 on every unit bought from the market.

Illustration 13

LMN Ltd. purchases 20,000 bells per annum from an outside supplier at Rs. 5 each. The management feels that these be manufactured and not purchased. A machine costing Rs. 50,000 will be required to manufacture the item within the factory. The machine has an annual capacity of 30,000 units and life of 5 years.

The following additional information is available:

Material cost per bell	₹ 2.00
Labour cost per bell	₹ 1.00
Variable overheads	100% of labour cost

(a) The company should continue to purchase the bells from outside supplier or should make them in the factory, and

(b) The company should accept an order to supply 5000 bells to the market at a selling price of Rs. 4.50 per unit?

Solution:

Additional Fixed cost of manufacture p.a. Depreciation (50,000 × 1/5) = Rs. 10,000

Marginal cost of manufacture per bell	₹
Material	2.00
Labour	1.00
Variable Overheads (100% of Direct Labour)	1.00
	4.00

Since the marginal cost of manufacturing the bell is less than the supplier's price of Rs. 5, there shall be a saving of Rs. (Rs. 5-4) or Re. 1 per bell if the bell is manufactured within the factory. Manufacturing will however result in an additional fixed cost of Rs. 10,000 p.a. Hence the total saving will have to be compared with this additional cost.

(*a*) Total savings (contribution) for 20,000 bells	= ₹ 20,000 × 1.00 = ₹ 20,000
Less : Additional fixed cost	= ₹ 10,000
Profit (Net Savings)	₹ 10,000

Thus, it is advisable to manufacture these bells within the factory.

(*b*) If the company accepts the order to supply 5000 bells at ₹ 4.50 per unit, it will result into an additional contribution (profit) of ₹ 2,500 as calculated below :

Selling price per unit	₹ 4.50
Marginal cost per unit	₹ 4.00
Contribution per unit	₹ 0.50
Total contribution on 5000 bells	₹ 5,000 × 0.50
	= ₹ 2,500
Total Net savings (*a* + *b*)	₹ 10,000 + 2,500 = ₹ 12,500

Hence, the company should manufacture the bells within the factory and accept the order to supply 5000 bells at Rs. 4.50 each

CLOSING DOWN OF A DEPARTMENT OR DISCONTINUING A PRODUCT

Marginal costing is very helpful in determining the level of activity to achieve the planned profits. The separation of costs in to fixed and variable aid management further in planning and evaluating the profit resulting from a change in volume, a change in selling price, a change in fixed costs and variable costs. The firm that has several departments or products may be faced with this situation, where one department or product shows a net loss. Should this product or department be eliminated? In marginal costing, so far as a department or product is giving a positive contribution then that department or product shall not be discontinued. If that department or product is discontinued the overall profit is decreased.

Illustration 14

XYZ Ltd. is manufacturing and selling a product whose cost data is as follows:

	Per Unit Rs.	**Total Rs.**
Current Sale (20,000 units)	20	400,000
Variable Cost (20,000 units)	10	200,000
Fixed Cost		
Profit		100,000
		100,000

It is proposed to reduce the selling price due to competition by 10 per cent. How many units are to be sold to maintain the present profit level?

Solution

New selling price after 10% reduction = Rs. 18

Contribution = Selling price – Variable Cost

= Rs.18 – Rs.10 = Rs. 8 per unit

Desired Contribution = Fixed Cost + Profit

= Rs. 100,000 + Rs.100, 000 = Rs. 200,000

$$\text{Sales required to earn desired profit (units)} = \frac{\text{Desired Contribution}}{\text{Contribution per Unit}}$$

$$= \frac{\text{Rs. 2, 00,000}}{\text{Rs. 8}} = 25{,}000 \text{ units}$$

$$\text{Desired Sales (Value)} = \frac{\text{Fixed Cost + Desired profit}}{\text{P/V ratio}}$$

$$= \frac{\text{Rs. 2, 00,000} \times \text{Rs. 18}}{\text{Rs. 8}}$$

= Rs. 4, 50,000

Illustration 15

MNP LTD is producing and selling three products A,B and C. the result of operation for the period are as under :-

	A	B	C
Sales	10000	15000	25000
Variable cost	6000	8000	12000

Contribution	4000	7000	13000
Fixed cost	3000	8000	6500
Net profit	1000	[1000]	6500

On the above basis management is thinking of dropping product B. You are asked to advice management whether the product B should be dropped or not?

Solution

Presently the firm is making a total profit of Rs.6500. product B is giving a contribution of 7000. Therefore, if product B is dropped total profit will decrease by Rs.7000 or will be incurring a net loss of Rs.500. therefore, the product B should not be dropped. Fixed cost are to be incurred whether product B is produced or not.

Profitability statement [after dropping product B]

	A	**C**	Total
Sales	10000	25000	35000
Less: Variable cost	6000	12000	18000
Contribution	4000	13000	17000
Less: Fixed cost			17500
Net profit			[500]

It is recommended to continue product B

LIMITING FACTOR OR KEY FACTOR

The marginal costing technique provides that the product with highest contribution per unit is preferred. This inference holds true so long as it is possible to sell as much as it can produce. But sometimes an organisation can sell all it produces but production is limited due to scarcity of raw material, labour, electricity, plant capacity or capital. These are called key factors or limiting factors. A key factor or limiting factor puts a limit on production and profit

of the firm. In such situation, management has to take a decision whose production is to be increased, decreased or stopped. In such cases, selection of the product is done on the basis of contribution per unit of scarce factor of production. The key factor or scarce factor should be utilized in such a manner that contribution per unit of scarce resource is the maximum.

Mathematically,

$$\text{Profitability} = \frac{\text{Contribution}}{\text{Key Factor}}$$

For example, if raw material is the limiting factor, the profitability of each product is determined by contribution per Kg of raw material. If machine capacity is a limiting factor then contribution per machine hour is calculated. It electricity is the limiting factor, then contribution per unit of electricity of each product is calculated.

Illustration 16

A company produces two products X and Y. The cost information is as follows:

Product	**X**	**Y**
Sale Price	Rs. 20	Rs. 15
Variable Cost	Rs. 10	Rs. 8
Required Machine hours per unit	2	1
Sales Potential (Units)	1000	1200
Available production hours	2000	

Calculate and find the best product mix.

Solution

Product	**X**	**Y**
Sale Price	Rs. 20	Rs. 15
Variable Cost	Rs. 10	Rs. 8
Contribution	Rs. 10	Rs. 7
Required machine hours per unit	2	1
Contribution per machine hour	Rs. 5	Rs. 7

Product Y gives the highest contribution per machine hours. The best solution would be to produce Y to the maximum extent that can be sold and remaining hours should be devoted for

production of X. Hence 1200 units of Y be produced and remaining 800 hours be devoted to product X which means 400 units of X. Thus the optimum mix is 400 units of X and 1200 units of Y.

A limiting factor or key factor is defined as the factor which restricts the volume of operation of the firm. Sometimes a firm may be confronted with scarce supply of materials, labour hours or production capacities. When there is a limiting factor in operation, the product that gives a higher contribution per unit of the limiting factor is more profitable than other products. Therefore, contribution is related to unit of the limiting factor and chooses the product mix based on higher contribution per unit of the limiting factor.

Illustration 17

A toy manufacturing company produces two type of toys. The skilled labour required for the production of these toys is in short supply. You are given the following details of cost:-

	Toy A	Toy B
Direct materials	20	16
Standard time required		
For one unit [hrs.]	4 Hrs	16 Hrs
Direct labour cost @2/Hr	8	6
Variable overhead	4	3
Selling price	50	40

Which type of toy is more profitable to produce and why?

The skilled labour available during a month is only 1200 Hrs. and maximum sales possible of each toy are only 200 units per month. In such a case what would be the optimum product mix of toys?

Marginal cost statement

	Toy A	Toy B
Selling price	**50**	**40**
Less: marginal cost Direct materials	20	16
Direct labour	8	6
Variable overhead	4	3
	32	**25**

Contribution	**18**	**15**

Contribution for Direct labour hour = $\frac{\text{contribution per unit}}{\text{Direct labour hour percent}}$

Toy A = Rs.4.5 / hr

Toy B = Rs.4.5/hr

Toy B is more profitable since it gives a contribution of Rs. 5 per hour against Rs.4.50 per hour of Toy A. Since Toy B is more profitable maximum units of toy B are to be produced. The balance of direct labour hours is utilized for producing toy A. Thus optimum product mix is:

200 units of Toy B requiring 600 hours [200 x 3 hrs]. The balance hours i.e., 1200-600 =600 is used for producing toy A. it is sufficient to produce 150 units of Toy A [600/4 hrs].

Thus the optimum product mix is 150 units of toy A and 200 units of toy B.

PRACTICAL PROBLEMS

PROBLEM 1

Two companies A Ltd. and B Ltd. sell the same type of product. Their income statement are as follows:

	A Ltd.	**B Ltd.**
	Rs	. Rs
Sales	2, 40,000	2, 40,000
Less Variable Cost	96,000	1, 20,000
Fixed Costs	64,000	40,000
Profit	80,000	80,000

State which company is likely to earn greater profit if there is: (i) heavy demand,

(ii) Poor demand for its products.

Solution

	A Ltd.	**B Ltd.**
	Rs.	Rs.
Sales	2, 40,000	2, 40,000
Variable Cost	96,000	1, 20,000
Contribution	1, 44,000	1, 20,000
P/V Ratio (Contribution ÷ Sales)	**0.60**	**0.50**

In case of A Ltd., every sale of Rs. 100 gives a contribution of Rs. 60 whereas in case of B Ltd. every sale of Rs. 100 provides a contribution of Rs. 50. In case of heavy demand, profit of A Ltd. will rise much faster in comparison to B Ltd. During poor demand or decline in sales of Rs. 100 will lead to decline in contribution in A Ltd. and B Ltd. by Rs. 60 and Rs. 50 respectively.

PROBLEM 2

The company is operating at 60% of the installed capacity (total capacity of 10,000 units per month). Its monthly fixed expenses are Rs. 6 lakhs per month. The other costs are:

Direct Material Rs. 55 per unit

Direct Labour Rs. 10 per unit

Variable Expenses Rs. 25 per unit

The company has invested Rs. 1 crore in the business and is currently earning a return of 7.2 per cent per annum before taxes. The managing director is prepared to accept new business at any price which will raise the return on investment to 20 per cent before taxes. A special offer was received for 4000 units every month if the product is supplied at Rs. 120 per unit. Would you advise the company to accept the offer?

Solution

Total Capacity	=	10,000 units per month
Present Production	=	6000 units per month
Fixed Cost	=	Rs. 6 lakhs per month
Marginal Cost	=	Rs. 90 per unit
Return on Investment	=	7.2 per cent
Annual Profit	=	Rs. 7, 20,000
Profit per month	=	Rs. 60,000

The selling price per unit will be

	Output 6000 units	
	Per Unit (Rs.)	**Total (Rs.)**
Direct Cost	90	5,40,000
Fixed Cost	100	6,00,000
Total Cost	190	11,40,000
Profit	10	60,000
Selling Price	200	12,00,000

The total cost of the product is Rs. 190 per unit. The company has received the offer at Rs. 20 per unit. It appears that if the offer is accepted, the company will lose Rs. 70 per unit. Hence the offer is rejected. But this analysis is fallacious as fixed cost will not change when production is increased. Here only variable cost which changes. Thus the selling price should be compared with the marginal cost which is Rs. 90 per unit. If the order is accepted each unit will provide Rs. 30 contributions towards profit. If the order is accepted, then the profit position will be as follows:

Output	**Present 6000 units**		**Order 4000 units**		**10,000 units Total RS.**
	Per Unit	**Total Rs.**	**Per Unit**	**Total Rs.**	
Sales	200	12,00,000	120	4,80,000	16,80,000
Variable Cost	90	5,40,000	90	3,60,000	9,00,000
Contribution	110	6,60,000	30	1,20,000	7,80,000
Fixed Costs	100	6,00,000	----	----	6,00,000
Profit	10	60,000	30	1,20,000	1,80,000

$$\text{Return on Investment} = \frac{180,0000 \times 12 \times 100}{1 \text{ crore}} = 21.6\%$$

The above statement provides that if the company accepts the offer, it will earn additional Rs. 1, 20,000 per month. The return on investment is enhanced from 7.2 per cent to 21.6%. Before accepting the offer, following factors must be evaluated

- The lower selling price for this offer, should not affect adversely the regular customers and goodwill of the company.
- Decrease in price should not create a doubt in the customer's mind about the quality of the product.
- No possibility of any other more profitable use of unutilized capacity.

PROBLEM 3

State which of the following sales mix you would recommend to the management?

Elements of cost	**X Rs.**	**Y Rs.**
Sale Price	200	150
Direct Material	100	80
Direct Labour	40	30
Variable Overheads	20	20

Fixed Overheads: Rs. 100,000

Alternative Sales Mix:

a) 2000 units of X and 2000 units of Y

b) 3000 units of X and 1000 units of Y

c) 4000 units of X and Nil units of Y

Solution

Product	**X**	**Y**
	Rs.	**Rs.**
Sale Price	200	150
Direct Material	100	80
Direct Labour	40	30
Variable Overheads	20	20
Contribution per unit	40	20

Choice of Sales Mix:

Sales Mix (1): Contribution on Rs.

2000 units of X @ Rs. 40 per units = 80,000

2000 units of Y @ Rs. 20 per units = 40,000

Total Contribution = Rs. 120,000

Sales Mix (2): Contribution on Rs.

3000 units of X @ Rs. 40 per unit	=	120,000
1000 units of Y @ Rs. 20 per unit	=	20,000
Total Contribution	**= Rs. 140,000**	

Sales Mix (3): Contribution on

4000 units of X @ Rs. 40 per unit	**=**	**Rs. 1, 60,000**

Sales mix 3 gives the highest contribution and is the best mix among the above alternatives.

PROBLEM 4

XYZ Ltd. produces a variety of products and components. Their cost information and purchase prices are as follows:

	X	**Y**	**Z**
	Rs.	**Rs.**	**Rs.**
Direct Material	12	4	2
Direct Labour	4	16	6
Variable Overhead	2	4	4
Fixed Cost	6	20	10
Bought out price	15	45	25

One of these products can be produced in the factory and rest two are to be bought from outside. Select the component which should be bought from outside?

Solution

Comparative Cost Sheet

	X	**Y**	**Z**
	Rs.	**Rs.**	**Rs.**
Direct Material	12	4	2
Direct Labour	4	16	6
Variable Overhead	2	4	4
Marginal Cost	18	24	12
Bought out price	15	45	25
Saving (--) or increase (+)	---3	+21	+13

It is clear from the above statement that Y should be produced in its own unit as its marginal cost is much lower than the purchase price and other two components i.e., X and Z be purchased from the market.

PROBLEM 5

A company manufactures three products whose cost data is given below.

Product	**X**	**Y**	**Z**
	(Rs.)	**(Rs.)**	**(Rs.)**
Selling Price	100	80	90
Direct Material	20	12	16
Direct Labour	16	16	16
Variable Overhead	16	12	15

The management wants to drop out Product Y as it is not profitable. What advice would you like to give the management?

Solution

Comparative Cost Statement

Product		**X**		**Y**		**Z**
		(Rs.)		**(Rs.)**		**(Rs.)**
Selling Price		10 0		80		90
Less Marginal Cost:						
Direct Material	20		12		16	
Direct Labour	16		16		16	
Variable Overhead	16	52	12	40	15	47
Contribution		48		40		43
P/v ratio		48%		50%		47.77%

Product Y is the most profitable product line as its P/V ratio is the highest when compared to products X and Z.

PROBLEM 6

XYZ Ltd. is manufacturing 200,000 boxes per annum when working at normal capacity. The cost information is as follows:

		Rs.
Direct Material	=	8.00
Direct Labour	=	2.00
Variable Overheads	=	3.00
Fixed Overheads	=	3.00
Total Cost	=	16.00

The selling price is Rs. 20 per unit. It is estimated that in the next quarter only 10,000 units can be produced and sold. Management plans to shut down the plant and estimating that fixed cost can be reduced to Rs. 80,000 for the quarter. The fixed overheads are incurred uniformly throughout the year. Additional cost of plant shut down is Rs. 10,000. From the above information you are requested to decide the following:

a) Whether the plant should be shut down for a period of three month

b) Calculate the shutdown point for three months.

Solution

				Rs.
a) **Sale Price**				16
Marginal Costs:		Rs.		
Direct Material		8		
Direct Labour		2		
Variable Overheads		3		13
Contribution:				Rs. 3 per unit.
Fixed Overhead	=	Rs. 3 × 200,000	=	Rs. 600,000 per annum
Fixed overheads for quarter	=	Rs. 600,000 / 4		= Rs. 1, 50,000

If plant is operated, the loss is:		Rs.
Total contribution on 10,000 units (10,000 units' × Rs. 3)	=	30,000
Fixed Cost	=	150,000
Loss (Fixed cost – Contribution)	=	**120,000**

If plant is closed, then loss will be:		
Inescapable fixed cost	=	Rs. 80,000
Addition shut down cost	=	Rs. 10,000

Total Loss = Rs. 90,000

As is evident from the above calculations that the plant should be closed down for the quarter, so that the loss will be reduced by Rs. 30,000

b) **Shut down point**

Net Escapable Fixed Cost = Total Fixed Cost for the period – Shut down costs + additional costs.

= Rs. 150,000 – Rs. 80,000 + Rs. 10,000

= Rs. 80,000

$$\text{Shut down point} = \frac{\text{Net Escapable Fixed Cost}}{\text{Contribution per Unit}}$$

$$= \frac{\text{Rs. 80,000}}{\text{Rs. 3}}$$

= 26,667 units per quarter

For suspension of business activity, only costs should not be taken into consideration, there are other factors also like, employees interest, fear of plant obsolescence, loss of customers in future, government action, perishable raw material and company is having a huge stock of material, etc.

- **Suggested References**

- Advanced **Cost** & **Management Accounting** by Saxena
- **Cost** & **Management Accounting** by Inamdar
- **Cost** & **Management Accounting** by Kishore.
- Text **Book** of **Management Accounting** by Sanjay Patankar
- **Management Accounting** & Financial Analysis by Kishore.
- **Management Accounting**: Text, Problems & Cases by Khan & Jain.

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