Information Systems and Engineering Economics

Semester V – Computer Engineering
(Savitribai Phule Pune University)

Strictly as per the New Credit System Syllabus (2015 Course)
Savitribai Phule Pune University w.e.f. academic year 2017-2018

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Syllabus

310244 : Information Systems and Engineering Economics (Comp.)

Teaching Scheme	Credits	Examination Scheme
TH : 03 Hrs/Week	03	In Sem. (Paper) : 30 Marks
		End Sem. (Paper) : 70 Marks

Course Objectives :

- To prepare the students to various forms of the Information Systems and its application in organizations.
- To expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in Information Systems.
- To Prepare engineering students to analyze cost / revenue data and should able to do economic analyses in the decision making process to justify or reject alternatives / projects on an economic basis for an organization.

Course Outcomes :

On completion of the course, student will be able to -

- Understand the need, usage and importance of an Information System to an organization.
- Understand the activities that are undertaken while managing, designing, planning, implementation, and deployment of computerized information system in an organization.
- Further the student would be aware of various Information System solutions like ERP, CRM, Data warehouses and the issues in successful implementation of these technology solutions in any organizations
- Outline the past history, present position and expected performance of a company engaged in engineering practice or in the computer industry.
- Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

Course Contents

Unit I : Basic of Management Theory & Practices **(07 Hrs.)**

Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an e-Commerce Organization. **(Refer Chapter 1)**

Unit II : Management Information System (MIS) **(08 Hrs.)**

Managing Information Systems, Ethical and Social Issues, Information Technology Infrastructure and Choices, Information Systems Security and Control, Case Studies -Information Technology Infrastructure in a Bank, Information Technology Infrastructure in a manufacturing / process industry. **(Refer Chapter 2)**

Unit III : Leveraging Information Systems **(07 Hrs.)**

Information Systems Development and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, ICT for Development and E-Governance, Case Studies - in-house or cloud based ERP implementation, UIDAI Unique Identification Authority of India. **(Refer Chapter 3)**

Unit IV : Money and Economic Value **(08 Hrs.)**

Engineering Economic Decisions, Time Value of Money, Understanding Money Management, Case Studies- Economic decisions done in Multi-national companies. **(Refer Chapter 4)**

Unit V : Economics and Management **(07 Hrs.)**

Equivalence Calculations under Inflation, Present-Worth Analysis, Annual-Equivalence Analysis. Case Studies - comparative analysis of software enterprises from similar domains. **(Refer Chapter 5)**

Unit VI : Understanding Cash Flow and Taxes **(08 Hrs.)**

Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up companies. **(Refer Chapter 6)**

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UNIT I

Chapter 1 : Basics of Management Theory and Practices 1-1 to 1-27

Syllabus : Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an e-Commerce Organization.

UNIT II

Chapter 2 : Management Information Systems 2-1 to 2-24

Syllabus : Managing information systems, Ethical and social issues, Information technology infrastructure and choices, Information system security and control, Case studies - Information technology infrastructure in a bank, Information technology infrastructure in a bank. Information technology infrastructure in a manufacturing / process industry.

UNIT III

Chapter 3 : Leveraging Information Systems

Syllabus : Information Systems Development and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, ICT for Development and E-Governance, Case Studies - in-house or cloud based ERP implementation, UIDAI Unique Identification Authority of India.

UNIT IV

Chapter 4 : Money and Economic Value

Syllabus : Engineering Economic Decisions, Time Value of Money, Understanding Money Management, Case Studies- Economic decisions done in Multi-national companies.

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UNIT - I

CHAPTER 1

Basics of Management Theory and Practices

Syllabus

Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an e-Commerce Organization.

Introduction :

- Management is one of the most imperative and interesting disciplines of business. Times are changing and so are the functions and roles of the manager. Modern managers must be prepared to meet the challenges of a highly dynamic and rapidly changing business environment.
- Management is an act of getting people together to achieve the desired goal or objectives of any business or human organization. It is an effort for the purpose of accomplishing an organization's goal in available resources in the best and most economical way. Different resources include deployment and manipulation of human resources, financial resources, technological resources, and natural resources.
- Management is important for our society, industry and government organizations. The importance of studying management can be explained by looking at the way we interact with organizations every day in our lives. Every product we use, every service we receive, and every action we take is provided or affected by organizations. These organizations require managers. Businesses now days have become very complicated because of continuous changes in market, customer expectations, advancement in technologies and so on.
- Our aim in this book is to study the concept and various functions of management such as planning, organizing, staffing, directing and controlling.

1.1 Definitions of Management :

"Management" is a very wide term and has different meaning at different times and under different situation.

- As a "**noun**" - management refers to all those persons who are concerned with management of the organization. Such persons are given responsibilities with authority to execute policies of business.
- The "**verb**" manage comes from the Italian maneggiare (to handle - especially a horse), which in turn derives from the Latin manus (hand). The French word mesnagement (later ménagement) influenced the development in meaning of the English word management in the 17th and 18th centuries
- As a "**process**" - management refers to what management does. Management is the art of getting things done through others. Management performs "**functions**" like : planning, organizing, directing, staffing, coordinating and controlling.
- MANAGEMENT can also be explained in the **word** itself - Manage Men Tactfully. i.e. MANAGE, MEN, T - the word split into three parts.
- Management as a subject is a "**science**" and a discipline as a "body of knowledge". It can be learnt and practiced. A Professional attitude can be attained through training and applications.
- "Management is art of getting things done through and with people in formally organized groups".
- This definition reveals that a manger works with the cooperation of other employees and through formal organization structure. This highlights the practical side of management. Some other definitions are:

L. Allen - Management is what management does.

Henry Fayol - To manage is to forecast, plan, organize, command, coordinate and control.

James Mooney - Management is the art of directing and inspiring people.

Lawrence Appley - Management is the art of getting things done through others.

Hence a comprehensive definition of management as mentioned above implies that:

(a) It defines aims and objectives of a business.

(b) It set down plans, policies, procedures, programmes, objectives of business.

(c) It brings together various factors of production like : men, money, material, machine, methods, market and management. (the seven "M"s of Mgt.)

(d) It makes the best possible use of all resources and factors of production.

(e) It provides conditions in which persons who are associated with the organization derive maximum benefit and satisfaction.

D. J. Clough - "Management is the art and science of decision making and leadership".

This definition highlights the decision making and leadership. It also emphasizes on the role of decision making in management. According to this definition manager should serve as a leader to prevail the wholehearted co-operation of employees in accomplishment of common objectives of an organization. Management is much wider than these two functions.

E. F. L. Brech - "Management is a social process entailing responsibility for the effective (or efficient) planning and regulation of the operations of an enterprise".

According to this definition management is a social process and its aim is effectiveness. The two major functions of management described here are planning a control.

W. J. Duncan - "Management consists of all organizational activities that involve goal formation and accomplishment, performance appraisal and the development of an operating philosophy that ensures the organization's survival within the social system".

This definition appears to be broad and offers due importance to the social

1.2 Purpose and Importance of Management :

Q. Explain the importance of the management.

The importance of management can be summarized as :

1. Increase efficiency of business
2. Crystallize the nature of management,
3. Improve research and development in management,
4. Attain social goals by way of coordinating the efforts of people so that individual objectives can be translated into social attainments of business.

Responsibilities of Management :

All the three levels of management, i.e. top management, middle management and lower management have obligations towards three social groups:

(a) Those who have appointed them;

(b) Those whom they manage; and

(c) The general community.

Peter Drucker assigns three jobs to management :

1. Managing a business;
2. Managing managers; and
3. Managing workers and work. He feels that management must place economic performance above everything else. It is by the economic results which it produces that it can justify its existence and its authority.

1.3 Management Science or Art ?

Q. Explain management is an art or science or both science and art.

Art entails the practical implementation of personal skills and knowledge to achieve tangible outcome. It is the way of doing specific things. The function of the art is to achieve change and to attain desired results. Art represents the know-how to do work. It is a personalized process and every artist or a human being has his own style.

Art is essentially creative and the success of an artist is measured by the results he achieves. As we know art is practice- based. For perfection it has to be practiced continuously. E.g. Music, dancing, and painting are also arts.

Major elements of an Art are :

1. Personal skills, 2. Practical experience,
3. Result- orientation, 4. Creativity,
5. Constant practice aimed at perfection.

So based on the above Management is an art because of the obvious reasons :

- A manager applies his knowledge and skills to coordinate the efforts of the people to integrate the processes in his organization.
- Management always looks for concrete practical results, e.g. profits, growth, social service, etc. in a solution proposed by the manager.
- Management is creative like any other art. In case any new situation arises, it converts available resources into output and thus works towards the goal achievement earn.
- It is a personalized process. Every manager has his own perception about the problem and accordingly he decides the solution for problem.
- Effective and efficient management leads to understand the organizational and other goals.
- To master in management one needs sufficiently long period of experience in managing. The yardstick use to measure the success of a manager is the results he achieves.

On the other hand Management could be referred to as a science as it includes the essentials of science. As is every Science, Management too is a well organized body of knowledge. There are underlying principles and theories available which can be used as guidelines for various tasks E.g. Delegation of Authority.

The principles of management have evolved over a period of time and after lots of practical experiences and research. The range of applications of management principles is very wide. But Management cannot be referred to as a perfect science like physics or chemistry where universal laws are applicable. Rather it is like a social science which involves studies like economics and human behavior. The variable factors in management are human behavior and environmental dynamics.

One of the enduring questions in the field of management is whether it is an art or a science. Webster's College Dictionary defines an art as "skill in conducting any human activity" and science as "any skill or technique that reflects a precise application of facts or a principle."

Reflected in the differences in these definitions is the use of precision in science, in that there is a particular, prescribed way in which a manager should act. Thus, management as a science would indicate that in practice, managers use a specific body of information and facts to guide their behaviors, but that management as an art requires no specific body of knowledge, only skill.

Conversely, those who believe management is an art are likely to believe that there is no specific way to teach or understand management, and that it is a skill borne of personality and ability. Those who believe in management as an art are likely to believe that certain people are more predisposed to be effective managers than are others, and that some people cannot be taught to be effective managers. That is, even with an understanding of management research and an education in management, some people will not be capable of being effective practicing managers. Hence we can conclude that management is neither a science nor an art but a combination of both.

1.4 Levels of Management :

Q. Indicate the three levels of management.

Every organization or company follows a particular hierarchy. This helps to keep control on the resources and ensures the reporting structure in the organization. There are different management levels in an organization based on the size of the company. **Broadly speaking the management levels are :**

1. Top level management
2. Middle level management
3. Lower level / Operating or supervisory management

1.4.1 Top Level Management :

Top level management comprises; board of directors, chief executive or managing director. The top management is the ultimate authority and it sets goals and policies for an enterprise. They focus on planning and coordinating functions.

The role of the top management can be summarized as :

- Top management sets objectives, strategic plans and design broad policies of the enterprise.
- It issues necessary instructions for preparation of department budgets, procedures, schedules etc.
- The important function of top level management is to provide guidance and direction which helps an enterprise to achieve its goal.
- Appoint of executives for middle level is one of the most important functions executed by the top management.
- The top management is also responsible towards the shareholders for the performance of the enterprise.

1.4.2 Middle Level Management :

Middle level incorporates branch managers and departmental managers. They are accountable for the functioning of their department. They dedicate more time to organizational and directional functions.

In small organization, there is generally only one layer of middle level of management but in big enterprises, there may be senior and junior middle level management. The functions performed by middle level management are:

- Middle level managers execute the plans of the organization in accordance with the goals and policies of the top management.
- Managers make plans for their departments or section of the organization.
- As a department head they participate in employment & training of lower level management.
- One of the important functions of middle managers is to interpret and explain policies from top level management to lower level.
- They need to ensure the coordination and integration among the activities within their division or department.
- They present the data received from the lower level to upper level in a specific format, which helps top management in the process of decision making
- They inspire and even evaluate the performance of junior managers or lower level managers.

1.4.3 Lower Level Management :

Lower level Management is referred to as supervisory / operative level of management. It is consist of supervisors, foreman, section officers, superintendent etc. People working in lower level management are responsible for direction and controlling functions of management. Their major activities include assigning of jobs and tasks to various workers.

- Their main role is to guide and instruct workers for day to day activities.
- They are responsible for the quality as well as quantity of production.

- Lower level managers are mediator between workers and higher level management. They represent workers problems, suggestions, and recommendatory appeals etc to the higher level.
- They ensure discipline and help solve the grievances of the workers.
- To ensure the efficiency and effectiveness of workers
- Supervisors provide training to workers.
- Arrangement of required materials, machines, tools etc for getting things done.
- They prepare periodical reports about the performance of workers and present it to higher level management.

1.5 Features of Management :

Management is concerned with setting guidelines to employees as well as the resources of the organization to achieve the organizational goal. The nature of the management could be explained with the help of its features discussed below:

- **Management is Goal-Oriented :** Management is highly goal oriented activity. The success of management could be measured in terms of the achievement of predetermined goals or objectives of an organization. For example if an organization decides to provide better quality products to their consumers, then management directs the required manpower and resources in the proper direction to get the expected results.
- **Management integrates Human, Physical and Financial Resources :** In any organization the different resources used are humans, machines, materials, financial assets, buildings etc. Humans have to work with non human resources to perform their jobs. The management plays very important role here. It integrates human efforts to those non human resources. It brings harmony among available resources.
- **Management is Continuous :** Management involves continuous handling of problems and issues. It is an ongoing process. It includes the problem identification and finding out the solution by taking appropriate steps. Management is not only concerned with a particular department like production or human resource, it even involves marketing, advertisement and
so on.
- **Management is Time Oriented :** Management is nothing but a race against time. In today's competitive business world everyone wants to outdo the other and the customer is most impressed if he receives services in time. Management has to always ensure that the production schedules are met and the targets are achieved. The other important thing is that targets are always set in accordance with the time and the results are also measured in terms of time so time is the essence of management. The management has to ensure that it manages this particular feature properly and is always relates it to the other features of management.
- **Management is all Pervasive :** Management is required in all types of organizations including political, social, cultural or business, as it assist and directs various efforts towards a definite goal. Thus colleges, hospitals, business firms, clubs, government organizations require management. Irrespective of the size or type of organization where more than one person is involved needs management.
- **Management is a Group Activity :** Management is more concerned with the group activity rather than an individual's performance. The efforts measured are in terms of groups to achieve predetermined goal or objectives. To accomplish the objectives of an organization every individual from the organization needs to work in the team.

1.6 Management, Administration and Organization :

It is very difficult to distinguish between 'administration' and 'management'. There exists a lot of similarity between them. However both these terms have some distinctive qualities in spite of similarities. Both the terms are used inter-changeably.

Administration can be defined as "the guidance, leadership and control of the efforts of a group of individuals towards some common goal". There are specific phrase like "administrative management" and "operative management", the former defined in relation to problem solving and decision-making aspects of the organization, while the latter is concerned with operative aspects of the business.

Administration is that function which is concerned with the determination of policy, the coordination of finance, production, distribution and the establishment of organization and ultimate control of the executives. However, management is the process concerned with execution of the policies within limits set by the administration and application of the goals set by administration.

The administrative process is largely concerned with establishment of objectives of the organization, laying down of broad polices of structuring of the organization, evaluation of the total outcome and looking ahead. Management, on the other hand, is to strive for attaining the aims and objectives as laid down by administration and within the organizational limits set by it. Hence it can be summarized that administration is more important at top management levels.

The basic distinction between the two terms is that administration is a process of laying down broad policies and objectives of the organization, while management directs and guides the operations towards realizing those

objectives. It also implies that administration is a top-level function while management is a lower and middle level function.

Administration and Management can be distinguished in the following way :

- Administration is concerned with policy making whereas management with policy implementation.
- Functions of administration are legislative and largely determinative while management functions are more executive and governing.
- Administration is concerned with planning and organizing, but motivating and controlling functions are involved in management.
- Board of Directors of any company are normally concerned with administration while personnel below that level are in charge of management.

In real sense there hardly is any distinction between both these terms as management process is the same in all enterprises and at all levels in the organization. Management is as much responsible for planning as is the administration. The distinction points out clearly to the fact that no two separate set of personnel are required to discharge the administrative and managerial functions. It is true that planning is more important and broad at higher levels of organization, but it is equally true that every manager irrespective of his position or level in the organization must plan and hence planning process is essentially the same at all levels.

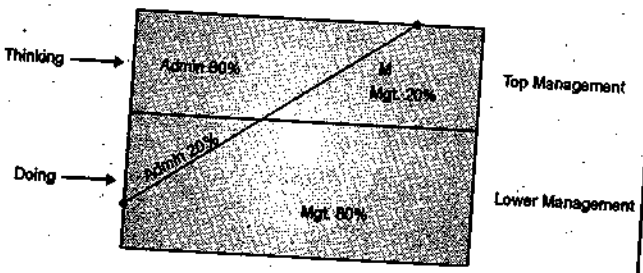

Fig. 1.6.1

Organisation :

It is a concept of combining the work of individuals or a group. It is a structure which helps in execution of duties and also helps in attaining the goals of the business. It provides for :

- Division of activities into logical groups having properly qualified staff.
- Determination of responsibilities in a manner which is easily understood by the group or individual.
- Delegation of duties and responsibilities with authority for each manager or supervisor so that each person performs his function well.
- Coordination of different activities of business for achieving unity in action of all employees.
- Effective communication between management and workers for better understanding and group efforts in fulfilling goals of business.

Hence, to conclude, Administration deal with determination of goals, aims and objectives of the organization and management puts them into practice and application in the organization. Organization is the vehicle in which administrative directions are accomplished by the management.

1.7 Functions of Management :

Q. What are the major functions of management explain?

Managers are responsible people; they just do not go out randomly and execute their responsibility. Good managers discover how to master the basic functions of management i.e. planning, organizing, staffing, leading and controlling.

1. Planning
2. Organizing
3. Staffing
4. Directing or leading
5. Controlling

1. **Planning :** Planning is the process of mapping out what has to be done to achieve a particular goal. In other words we can say that It is set of exact steps to be taken to accomplish organization's goal. The manager has to decide what will be the correct steps to be involved in the plan.

   E.g. if company decides to boost the sale. The necessary steps could be inventory management, advertisement or increase in sales staff etc. Once the proper plan gets ready manager has to execute it step by step. A good plan always gives good results.

2. **Organizing :** Once the plan gets ready, for its execution manager has to organize the resources in terms of manpower as well as material. Assigning work i.e. delegation and granting authority are two important aspects of organizing function.

3. **Staffing :** Staffing is another important function which manager needs to perform. After determining the human resource requirement from the plan, manager has to speed up the process of staffing by selecting, recruiting, training and developing the employees. Manager has to work with the human resource department to execute this function.

4. **Directing or leading :** Beyond planning, organizing and staffing manager has to do many things to achieve the desired goal. A manager has to be a leader as he directs the whole team towards the completion of the organizational goal. It involves motivating, communicating, guiding and encouraging employees.

5. **Controlling :** When all functions are well executed manager is still left with the important function called controlling. He has to continuously take the feedback

and check the results against the predetermined goal. He has to take corrective actions if required to ensure that the plan remains on the track.

1.8 Introduction to Information Systems :

Q. Enumerate the top ten IT-IS related business applications.

- If we were to study the changing business environment over couple of decades, we would be amazed at the impact that information systems have had on the productivity of companies.
- Till the 1990s, companies were using information systems to manage data processing and record keeping activities associated with maintaining business transactions, payroll, billing, inventory management, etc. The focus was mainly on maintaining files and databases related to day-to-day operations.
- Information systems have enabled organizations to innovate thereby providing them with competitive advantage over others in the marketplace. Information systems have transformed the competitive environment in a sector. Information technology (IT) and Information systems (IS) have ushered in significant changes not only in the for-profit sector but also in the not-for-profit sector.
- Today, organizations in both sectors are using IT and IS to enhance outcomes and boost organizational performance.

The top ten most important IT-IS related business application would be to :

- Improve customer service
- Establish service continuity and availability
- Ensure compliance to legal aspects of business
- Manage IT related business risks
- Enable business entity to offer competitive products and services
- Maintain and improve business process functionality
- Provide good return on investments made in IT-IS related products
- Recruit, maintain and develop skilled and motivated people
- Create agility in responding to changing business requirements
- Obtain reliable and useful information for strategic business decisions

From the above applications it is evident that Information systems have now grown well beyond their traditional role of merely serving the internal requirements of the company.

- The main focus of companies is to leverage the capabilities of information systems. To remain one step ahead of competitors, companies are investing in modern information systems like Enterprise Resource
- Planning (ERP) which integrates the different functional areas of the business and provides real time information for faster decision making.
- In this chapter, we shall be discussing the ever evolving role of information systems in organizations and the challenges faced by information system manager in harvesting the capabilities of such a dynamic system. However, before we proceed it is necessary to understand a few terms that we shall be using frequently in the course of this book.

1.9 Data, Information and Knowledge :

Q. Differentiate between Data, Information and Knowledge.

- Although data, information and knowledge sound synonymous they are different and it is essential from information systems point of view to understand what constitutes knowledge and what falls under the category of information or data and also how they interact with one another.
- Whenever, we use the term knowledge in everyday language, we are referring either to wisdom or information. Knowledge, although different, has a deep relationship with data and information to the extent that both data and information are referred to as lower denominations of knowledge. However, the exact relationship between the three varies from one example to another.
- When it comes to information systems, knowledge is often treated very similar to information. IT plays a pivotal role in codifying and sharing knowledge.
- According to Theirauf, of the three components, data is the lowest point, an unstructured collection of facts and figures; information is the next level, and is regarded as structured data, finally knowledge is defined as "information about information".

1.9.1 Data :

- Let us consider the case of a retail store that is trying to increase sales. Some of the data available includes sales levels for the last 36 months, advertising expenses, and customer comments from surveys. By itself, this data may be interesting, but it must be organized and analyzed to be useful in making a decision.
- For example, a manager might use economic and marketing models to forecast patterns and determine relationships among various advertising expenses and sales.

Definition :

- According to Theirauf, "data is nothing but unstructured facts and figures that have the least impact on the typical manager." Although, data is an unorganized assimilation of facts and figures it has the potential to relay something specific.
- In simple words. Data is the raw material for information. It can be defined as groups of non random symbols which are used to represent quantities, actions or objects or entity, attribute or value.

- Data items that are used in information systems are formed of characters. Data items cannot be used as they are for the information systems they need to be organized into data structures, file structures and databases.

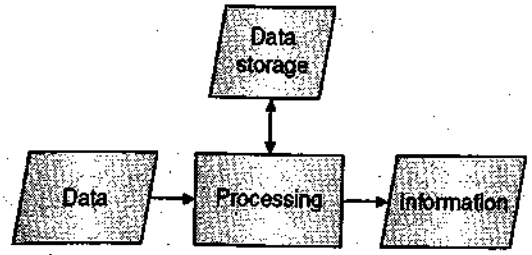

Fig. 1.9.1 : Transformation of data into information

- The basic distinction between Data and Information is that Data Items in their raw form cannot be used as information, they need to be processed before they can be used as information.
- The other important point that needs to be considered is that, what is information at one stage could be raw data items for the next stage which needs to be processed for it to be considered to be information.

1.9.2 Information :

- Information is data with relevance and purpose. Thus, for data to become information, it must be contextualized, categorized, calculated and condensed. Information conveys a trend or pattern for a given period of time.
- Information is nothing but data that is processed into a form that is as per the needs of the receiver and has value within a specific decision making context. This decision making could be within the present context or within the context of future decisions and actions.
- Information is processed data that is used to trigger certain action or gain more knowledge on what the data implies.
- Information as it is used is not a precise term and is used in various contexts in an information system.
- Information adds to a representation.
- Information is useful in confirming or correcting the previous information that was available.
- Information tells things which were previously not known to the receiver and therefore adds to his knowledge.
- Information adds to the certainty factor in the decision making.
- Like stated earlier that information has value in the decision making context by way of attaching or changing the probabilities of the expected outcomes in the decision making.
- Like data information is also represented by entity, attribute and value.
- Information that is as per the requirements of the receiver has value in specific decisions as well as for some future decisions and actions.
- The biggest advantage that information has is that it can be stored and can be used at a later stage or can be reused despite it having been used before.
- Information can be retrieved and used it always retains its value and in some cases it could gain some value due to repetitive use.
- The resulting information (presented in equations, charts, and tables) would clarify relationships among the data and would be used to decide how to proceed. It requires knowledge to determine how to analyze data and make decisions.

1.9.3 Knowledge :

- Knowledge implies know-how and understanding. Knowledge is a mix of experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information.
- Organizational knowledge is not only embedded in documents but also in organizational routines, practices and norms.
- Now, that we have established clear boundaries between data, information and knowledge it will help us in looking at forms in which they exist and how they can be accessed, shared and combined in information systems.

Syllabus Topic : Role of Information Systems in Organizations

1.10 Role of Information Systems in Organizations :

Q. State the role of Information Systems in an organization.

- The objective of every organization is to be the market leader in their given industry however, increased competition can hamper this objective.
- Organizations are always on the search of strategies that could provide them with the required competitive advantage over their competitors. One such strategy is the adoption of information systems that could enable them to make adequate use of its data while reducing workload and assist in the compliance of various mandatory regulations.

The three primary roles that information systems play in an organization are :

(1) **Information Storage and Analysis :** Gone are the days when companies used to manage their data and information with physical registers. By adopting information systems, companies can make full use of state of the art databases that contain all the required data. Information systems provide its users with information that they can utilize to solve business problems and take decisions. Modern information systems do not limit themselves with data and information that is internal to the organization, these

systems can integrate data from various internal and external sources and keep the user abreast with the most relevant information.

Such systems provide the user information not only of the internal performance but also looming threats and business opportunities.

(2) **Assist in Decision Making :** Perhaps the most important role of information systems is the assistance that they provide in the decision making process. In the current competitive business environment, the long term success of a company depends upon its strategic plans. Information systems are used to formulate strategic plans and assist in the decision making process. The information made available by various sources needs to be evaluated by the information systems before it is used in the decision and strategic planning process.

(3) **Assist with Business Processes :** Another relevant role of information systems is their ability to integrate with the various business processes of the organization to ensure that the output produced adheres to the quality standards. Thus, information systems can be used in developing various value added systems. Integrating the information system with the various business processes simplifies and helps reduce the number of activities and invariably the time spent on these activities. Repetitive tasks are totally eliminated from the system and greater accuracy is provided. Also, information systems ensure that access is provided to only authorised employees. Information system plays a very critical role in project management as they facilitate effective monitoring and control as well as comparison with standards.

However, the entire capacity of the information system needs to be harnessed to gain maximum benefits from the company's information system. The effectiveness of the information system can be increased by either adding more data to make the information more accurate or use the information in new ways. In addition to the above mentioned roles information systems play the following roles:

- Information systems can gather and distribute information thereby enabling managers to communicate more efficiently and rapidly.
- Information systems can be used to store documents that can be accessed by other employees who need the information in the documents.
- Changes in the original document can be made by authorised employees that can be tracked by the system tracker. Once the process is complete the manager can send the revised document to the final recipient for approval. Thus, information systems enable employees to collaborate in a more efficient and systemic manner.
- Information systems provide more complete and current information enabling the management to better manage the company.
- The information provided by information system can be used to gain a competitive advantage over competitors.
- Information systems provide all the relevant information needed for decision making.
- The information provided is current and thus instils confidence in the decision maker. The system can also run different scenarios if more than one choice looks appealing.
- Information systems are used to store documents, communication records and operational data. This can be processed by the system and presented as useful information to prepare cost estimates and forecasts.

Syllabus Topic : The Information Systems Manager and his Challenges

1.11 The Information Systems Manager and his Challenges :

Q. What are the challenges that an information system manager faces in an organization ?

- Information systems are computer based infrastructures that are used to process, store, transmit and disseminate information. The use of computer based information systems has increased across all industries.
- In fact, information systems have become a critical part in the successful running of the modern organization. Modern information systems have evolved over the years to meet the changing organizational challenges from being simple operational tools to being used for strategic planning.
- Although, it is without dispute that without information systems, organizations will not be able to cope with changing organizational challenges and fail, their implementation faces many challenges which may vary from context to context. These challenges have contributed to high failure rate in the development and implementation of information systems.
- The example of Hershey Chocolate's failure successful implementing in an information system and the loss it had to incur on account of implementation failure is fresh and for everyone to learn from. Thus, it is critical for the information systems manager to identify these challenges and manage change appropriately or risk being edged out of the competition. The challenges that an information manager encounters during the course of development and implementation can be attributed to:

(1) Human Challenges
(2) Operational Challenges
(3) Technical Challenges
(4) Financial Challenges
(5) Managing the Data Flow
(6) Data Security Challenges
(7) Environmental Challenges

(1) Human Challenges :

- Although, other resources such as materials, facilities, tools and equipment are also vital to the development and implementation of information system, the primary resource in information systems is its people.
- The information systems manager will need the support of his people to ensure the smooth sailing of the system. The human factor is the factor that is related to every person in the organization. Humans create perhaps the biggest obstacle when it comes to implementing information systems.
- The primary challenge for an information system is the lack of resources to engage in user education, inability in recruiting appropriate staff and experts who can suitably accomplish the development and implementation process.
- Another challenge facing the information system manager is to be able to fulfil the expectations of users. Also, the lack of computer skill has been identified as key challenge and major difficulty to the development of information systems.
- There is a lack of general computer skill amongst the uneducated employees of the organization. It has been observed that the older employees in the organization lack the interest and willingness to adopt the new system and may create obstacles in its implementation. It will always be a challenge for the information systems manager to get everybody on board and ensure that the change is accepted by all.
- It is necessary for the information system to impress upon every user that the change in system will in no way affect their job. Reluctance to accept change stems from insecurity and it is upto the manager to ensure that this insecurity is addressed.

(2) Operational Challenges :

- Information systems were originally designed to support the accounting function within the organization and once it had proved its use there, it was rolled out to the other functions within the organizations. However, this meant that the implementation was fragmented thereby creating data silos that supported various functions but failed to support cross functional business processes.
- For example, in an online business taking customer order is an easy process, but the order fulfilment process which involves moving product from warehouse to customer, collecting payment if not done earlier, packing the product, pasting the address, shipping the product and informing the customer is a rather tedious process.
- For such a process to work smoothly the data flows between departments need to be coordinated else it will result in delays, errors in shipments, customer grievances and end in losses for the company.
- Hence, integration of the information system has been one of the biggest challenge for the information systems manager. However, integration the company simply does not mean combining the data silos within the company.
- Integration demands a redefinition of how data is stored, accesses, shared, and archived. The information systems manager must provide a detailed description of how the integration process will work and improve the system.
- Integrated information systems give organizations the technology to improve data-access efficiency and reduce infrastructure costs. Integrating all aspects of the organizations data architecture to achieve these goals can pose new challenges.
- In such a scenario the information systems manager should make an assessment of the company's requirement rather than surveying the off-the shelf software. The information systems manager should quantify what the integration must accomplish, who needs to access which information, the expansion plans the system must accommodate, and the shortcomings of the current technology.
- The challenge before the information systems manager is to design a system to manage business data on an integrated basis that would in turn mean configuring the data architecture to ensure that information is available companywide.
- However, it is difficult for the current network to provide access to user's companywide without compromising on the security of the information. The systems manager should ensure that the security of the information is not compromised in any manner.

(3) Technical Challenges :

- Technical challenges are very much similar to operational challenges and are related to hardware and software issues of the information system as well as barriers such as telecommunication issues.
- The transition from the old system to the new system in terms of hardware, software and training also poses a major challenge to the information systems manager.

(4) Financial Challenges :

- Once the information systems strategy has been developed it needs the approval of the top management. An approval would mean the sanctioning of budget, personnel and time.

- Sometimes the senior management may fail to understand the purpose or raise doubts on the proposed strategy. Therefore it is recommended that the top management should be convinced of the strategy before the allotment of the budget. The top management has to ensure the information system strategy is aligned with its business strategy.
- Rising project costs have always been a challenge for the manager. Many a times it has been observed that a new information system is being developed when the existing system is not being utilized to its full potential.
- Thus, the information system manager has to take the call before proceeding with the development of the new system and ensure that the existing system is being utilised to the fullest before undertaking any further cash outlay.
- For this the information systems manager may need to ask what the primary challenge is with the existing system. There may be many untapped resources of the existing system that may provide solution to the problem in hand. The information systems manager needs to work with the users to understand their problems and arrive at solutions.

(5) Managing the Data Flow :

- The flow of information is irregular and subject to strong fluctuations. This poses challenge to the manager as he has to control the flow of information. Information controlling is the analysis, evaluation and importance attached to the data that is collected and provided.
- The first step in this direction is to make employees aware of the importance of the data they help gathering. The manager should ensure the accuracy of the data being collected by employees. Accuracy of the data will help in improving speed, quality of the system while reducing costs.

(6) Data Security Challenges :

- With increasing complexity of the information system there is always a likelihood of compromise of data security.
- Compromise of data security not only poses problems of breach but may also have legal ramifications in some cases. The information security manager has to ensure that all protective measures are in place and all its data is secure.

(7) Environmental Challenges :

- Environmental challenges include organizational culture, change management, resource capabilities, coordination, distribution of responsibilities, unaligned organizational systems and resources, etc.
- Other less important environmental challenges include political environment, lack of commitment to strategy on the part of top management and confusion of the strategies.

Syllabus Topic : Concepts of Information Systems

1.12 Concepts of Information Systems :

- The concept of information systems has evolved over the years and now covers every facet of the organizational functions. Information systems have now emerged as an absolute necessity for every organization.
- The initial concept of information systems was to process data existing within the organization and present in the form of reports at regular intervals to those concerned. The systems were capable of handling the data from collection to processing.
- However, the systems were impersonal and required each individual to pick the processed data and use it as per his requirement. This meant that the user was being provided with a mass of data and not information.
- The concept of information systems underwent a transformation when a distinction was made between data and information. Systems developers felt it necessary to analyse the data and provide the user with relevant information. But data can be analysed in number of ways producing information in different forms. This meant that the same data could be analysed in different ways to derive information that would suit different users.
- Therefore, the systems concept should be aimed at addressing the requirements of all its users on a customised basis as each user may have different orientation towards the information.
- In this section we shall be discussing the basic concept of Information Systems. However, before we begin our study of Information Systems and their role in organizations, we need to first understand the concept of systems.

1.12.1 System :

- We use the term System on a regular basis in our lives. We encounter the use of the terms like the transportation system, education system and many others on a daily basis.
- The systems concept is useful in understanding the framework of many organizations. So before we proceed any further let us understand what systems are.

Definition :

- There are various systems that we encounter, some are abstract and some are physical.
- Abstract systems are those which cannot be defined or framed like the system of faith while on the other hand

a physical system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process.

- The important factor here is that the system functions within a clearly defined boundary.
- The definition clearly indicates that a system is a purposeful assembly of elements which have assembled because of a goal or objective which is to be achieved. The components of the system interact with each other to achieve the goal.
- We have spoken about boundary let us now understand what we mean by that. A boundary defines the system what is inside the boundary is the system and what is outside is the environment.
- Every system is made up of sub-systems which further comprise of other sub-systems each sub-system is delineated form the other sub-system by boundaries.
- As the sub-systems are part of a larger system, they need to interact and connect with the other sub-systems in a defined manner which is made possible by from Interfaces.
- The general model of a system comprises of input, process and output. While there may be various inputs and various outputs in the system.

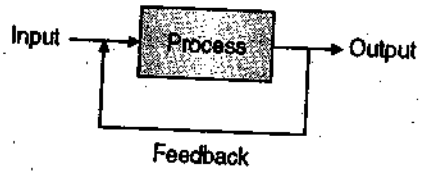

Fig. 1.12.1 : Basic Model of a System

- System will have the following basic interacting components (functions) :
  (1) **Input** : The input process involves the assembling of the elements that will be processed to deliver the required output. Therefore input is the raw material of the system.
  (2) **Processing** : Processing involves the transformation of the input elements into output elements.
  (3) **Output** : The process of output involves the delivery of the output elements to the desired destination.
  (4) **Feedback** : The data of the evaluation of how the system as a whole has functioned.
  (5) **Control** : Control involves the monitoring and evaluation of the feedback and to point out the areas which have not performed as per expectations and need to exercise control.

The Systems Concept :

- The systems approach considers two basic components: elements and processes. **Elements** are measurable things that can be linked together. They are also called objects, events, patterns, or structures. **Processes** change elements from one form to another. They may also be called activities, relations, or functions.
- In a system the elements or processes are grouped in order to reduce the complexity of the system for conceptual or applied purposes.
- Depending on the system's design, groups and the interfaces between groups can be either elements or processes. Because elements or processes are grouped, there is variation within each group. Understanding the nature of this variation is central to the application of systems theory to problem-solving.
- This systems approach looks upon the management as a 'System' of as an organized whole make up of sub-systems integrated into a unity or orderly totality. The attention should be given to overall effectiveness of the system rather than effectiveness of any sub-system if isolation. It took where management process school left off in attempting to unify management theory.
- It emphasizes the inter-relatedness and inter-dependence of all activities within an organization. It is based on system analysis. It attempts to identify the nature of relationships of various parts of the system. A system is a set of inter-connected elements or component parts to achieve certain goals.
- A System can be defined as a set of interrelated and interdependent components operating within defined boundaries to achieve a common objective by accepting inputs and delivering outputs with the help of an organized transformation process.
- Systems can be either abstract or physical. An abstract system though not our area of study can be defined as the orderly arrangements of interdependent ideas such as the various relations amongst people in the society. While a physical system as defined above is a set of interrelated and interdependent components or elements that aim to achieve a common objective.
- We come across various examples of the physical system in our day to day life like the Public Transportation System, Computer System, Accounting System, Education System etc.
- What the System's approach to studying any subject does is that it provides a framework within which the subject could be described, understood and studied. It provides logic, principles, rules and regulations to the subject that is being studied and makes studying and understanding the subject easier.
- Let us consider a Computer System which is designed to undertake designing activities then such a system along with the regular equipment like the CPU, Hard Disk, Monitor will consist of software's that will assist in achieving the objective of designing and drawing.

- Hence it is important to have a clear picture of the objectives that are to be achieved as this will enable the designer of the system to select the appropriate elements and arrange them accordingly.
- It is upto the designer of the system to set it in right order as any disorder would affect the final outcome i.e. is the accomplishment of the objectives that the system is to achieve.

A System has three basic functions ;

(1) **Input :** The elements that are in raw form and need to be processed to attain the form for which the system has been designed. The input process involves the capturing and assembling the elements that are to be processed. The input elements could be raw material, data, human efforts etc. In a system there could be several input elements. The input functions main activity is to secure or capture the elements and organize or arrange them for processing.

(2) **Processing :** The input elements need to be processed to convert them into output. The processing function is a transformation activity which converts the raw input elements into processed and usable output. Examples of the processing functions are the manufacturing process in a industry,

(3) **Output :** The processed elements have to be transferred to its correct destination where they will be put to correct use. In some cases these processed elements may act as input to another system and therefore may be treated as raw. Examples of output are finished products, information etc.

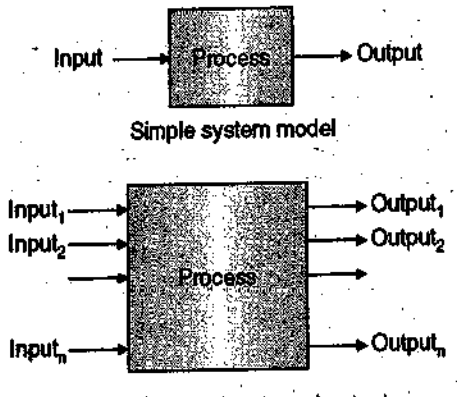

Fig. 1.12.2 : Parts of a System

- A System may have single input and several outputs or several inputs and a single output or several inputs and several outputs. Let us take the case of a business organization now any business organization has several inputs and objectives which are to be achieved. The selection of the inputs and the processing of them will depend on the objectives that are to be achieved.
- Let us consider a manufacturing system which accepts raw materials as input and processes them to produce finished goods as output. Here we have several inputs resulting in a single output or several inputs resulting in several outputs.
- For the System to be more effective two more elements are included to the system and they are feedback and control. A System have both these elements is a self monitoring and regulating system.

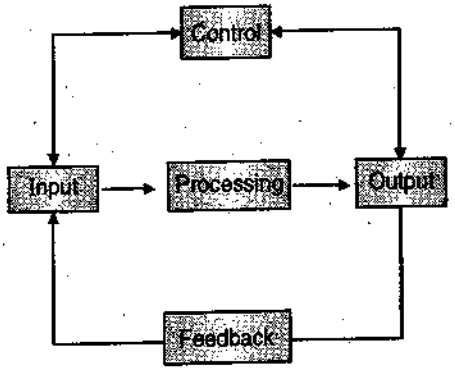

Fig. 1.12.3: Cybernetic System (Self Monitoring and Regulating)

As stated earlier the two additional elements in the system enable the system to self monitor and regulate the system and make changes and improvements as per requirement.

(i) **Feedback :** Feedback is the report card on the performance of the system. Report on the Sales Performance is an example of the feedback. Prior to the designing of the system the designer has certain expectations from the system with respect to its performance and the feedback is the data or the report on the performance of the system.

(ii) **Control :** After receiving feedback the Control Function monitors and evaluates to determine whether the system is performing as per the original plan or design and is successful in achieving its objective. In case the system is experiencing certain problems in achieving its objective then the control function can make the requisite adjustments in the input or the processing function and ensure that the required output is achieved. Continuing with the above example in case the Sales Manager does not get the expected Sales performance then he has to evaluate the feedback that ha receives and take appropriate steps to ensure that performance matches the expectation.

- Every System operates in an environment which plays an important part in its design and performance. While designing of the System, it is very important to first set the objective that the system is to achieve once the objective that the system is to achieve is set it then automatically sets the boundaries for the system.
- While designing of the system, it is important to have a clear understanding of the boundaries as this will enable to decide on the internal components of the system and their arrangement within the system.
- A boundary can be defined as a feature of the system that delineates the system from other systems and the environment. By defining the boundaries clearly it is possible to identify the elements that are a part of the system.

- The system along with its boundaries operates in an environment which influences its choice of inputs, processing method and the outputs that are expected from it. The System is inside the boundary and the environment is outside the boundary but plays an important part in the selection of the elements that go into the making of the system.

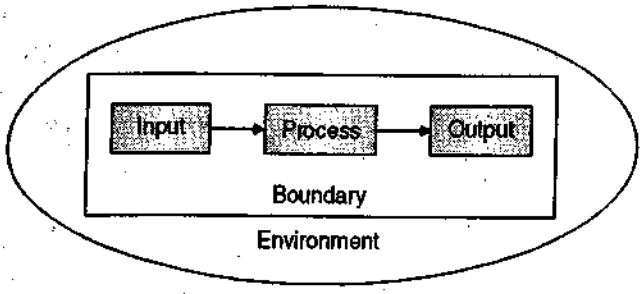

Fig. 1.12.4: Model of a System depicting its boundaries and environment

- Another very important component of the System is the Filter that is provided by the designer of the system. As we are aware that every system is designed to meet a particular objective and the filter just ensures that there are no disturbances from the environment.
- The designer of the system provides a filter around the system to control the influence of the environment on the system. While designing of the system, the designer has to study the environment for the possible impacts it may have on the system and then install appropriate filters to protect the system from these impacts.
- The problem usually lies in the selection of the inputs for the system and therefore filters have to be installed to ensure that the inputs are in accordance with the requirement of the system.
- Every system is made up of sub-systems which are made up of further sub-systems or the system may itself be a part of a larger system. Each of the sub-system is delineated by boundaries.
- The interconnections and the interactions between the sub-systems are termed as interfaces. The interfaces take place at the boundaries and the output of one sub-system acts as the input for the other sub-system.

1.12.2 Characteristics of a System :

From the discussion that we have had about system we will now be pin - pointing certain characteristics of system which will help us in understanding them better.

- **Specific Objectives :** as we have seen that every system has specific objectives that are to be achieved and they have been designed just to do that. The motive behind the designing and implementation of the system is the objective which is to be achieved and the system is just a means to an end.
- **Sub-systems :** every system comprises of sub-systems or the system may itself be part of bigger system. Another important point to be noted here is that every element in the system is a system within itself.
- **Common Elements :** it may be so that the input elements may be common across various sub-systems for example the sales that take place in a business organization act as input to the sales department as well as to the accounts, billing and inventory. The difference lies in the processing that is done on the input and the objective that the system is to achieve.
- **Interrelated and Interdependent Sub-systems :** in any business organization the sub-systems are interrelated as they have a common purpose that is to be achieved and it is not by chance that they are interrelated and interdependent. Though they may have their individual objective to achieve they all work towards attaining the common objective of the business organization. As we have stated earlier that the output of one sub-system acts as the input for the other thus making the sub-systems interrelated as well as interdependent.
- **Responsive to Environment :** we have already seen that systems cannot operate in isolation and have some form of relation with the environment in which they operate. The inputs that the systems have are influenced by the environment while the outputs that these systems generate influence the environment. We have also seen the role that filters play in ensuring that the influence of environment on the inputs is minimal.
- Operate within set boundaries : every system sets for it certain boundaries within which it operates whatever is behind the boundary is the system and whatever is outside is the environment. It is very important to have pre-set boundaries as this enables the smooth working of the system.

1.12.3 Information System as a System :

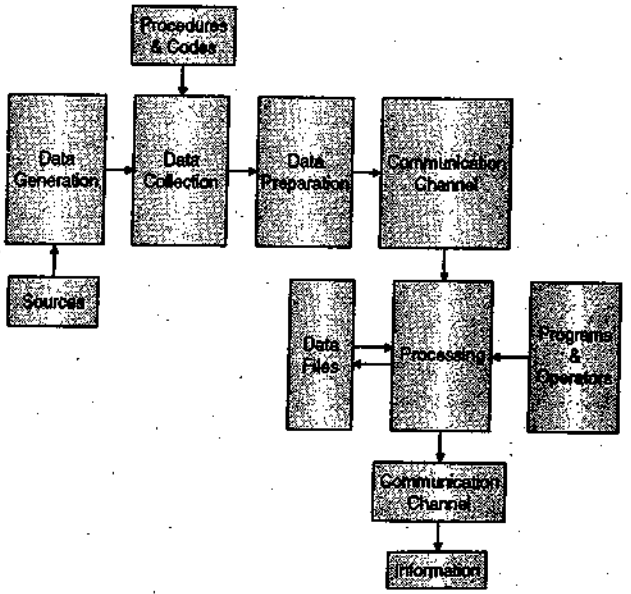

Fig. 1.12.5 : Information system model

- Like any other system, the Information System also receives data inputs, processes the data and then delivers the output to the desired destination. Like other systems, the input, process and output functions are the same the only difference is that the input data could be current as well as that which has been stored over a period to assist the processing function.
- To generate output which in an information system is Information of the processing function, needs data collected, processed and stored of a prior period and therefore the storage and use of data is another function that is added to the Information System. With the addition of data storage in the information processing function. The function now not only undertakes the transformation of the data but also stores the data for further processing which it may undertake at a later stage.

1.12.4 Components and Resources of an Information System :

Q. Describe the components and resources of an information system.

- We are now very well aware that the output of an Information System is Information. Here we will be studying the components and resources that assist it in the task of achieving this transformation of data input into output in the form of information products.
- The Information System Model indicates the components and resources that are needed for the successful implementation of the Information System.
- The model indicates the relationship amongst the components and the resources that form a part of the system

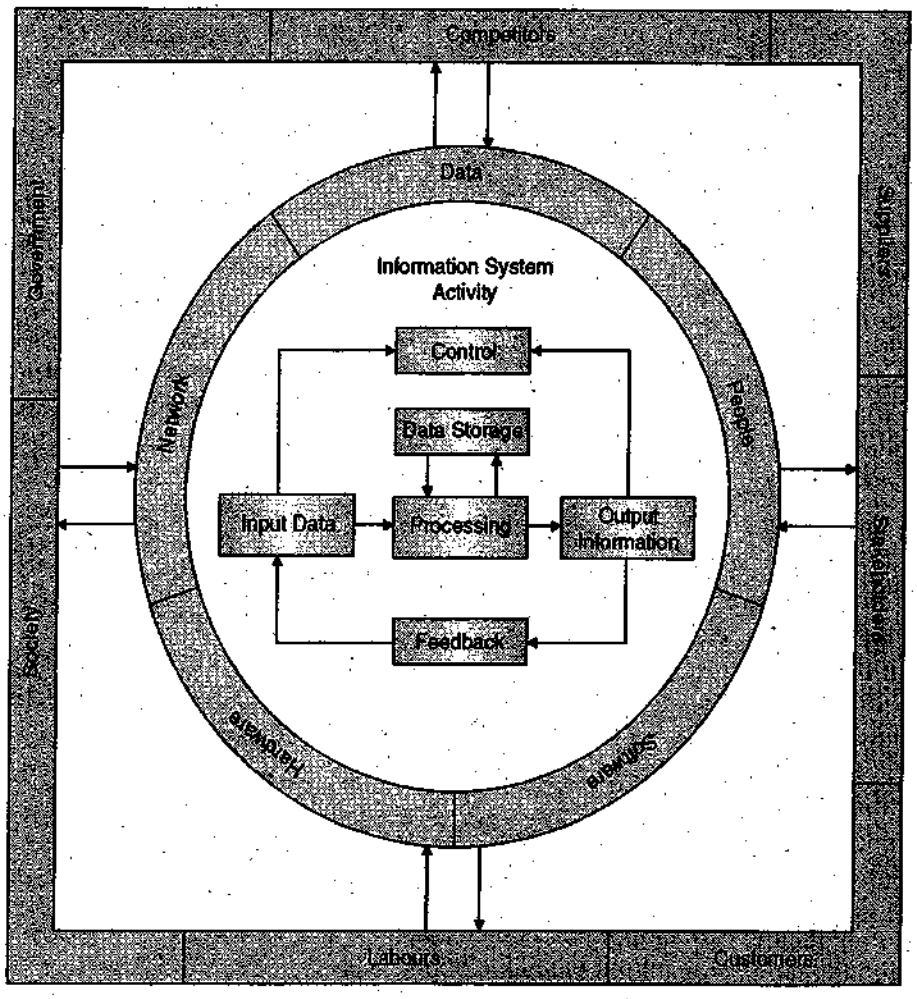

Fig. 1.12.6 : Information systems model indicating its components, resources and activities

In an organization, information systems consist of the following components and resources :

(I) Data :

- In simple words Data is the raw material of the information system. It is the input that the system takes to produce information.
- Data is a valuable organizational resource that should be managed and used effectively to gain maximum benefit from it. Data as an organizational resource has gained momentum after organizations discovered its true potential and the valuable information that it could generate. Data is considered to be the lifeblood of

every organization and is considered very important from the decision making point.

- Various software's that are used to process the data, allow the building up of complex relationship amongst the various elements within the organization. We have already studied Data at great length in the previous section and therefore we won't delve into it in great detail in this section.

(2) Hardware :

- The hardware resource comprises of the physical devices that are used in processing.
- It not only includes machines such as the computer but also its peripheral equipment : input, output, storage devices; includes data communication equipment. As we have already seen that the storage devices are very important in the information system.

(3) Software :

Sets of instructions that tell the computer how to input, process, output and store data i.e. a set of information processing programs which control the hardware that is used in the information system.

(4) Communication Networks :

- There is rampant use of communication technology and networks like the internet, intranet and extranet in modern business especially after the advent of the electronic markets like e-commerce and e-business.
- When we study the modern information systems we find network resources are an inherent part of these systems.

(5) People :

- People resource is a vital component of the information system especially the IS professionals who design, construct, operate and maintain IS and the end-users who use the information system or the output it delivers.
- End-users are found in all levels of the organization they could be the customer, manager or the operator.

(6) Procedures :

- Procedures are set of information processing instructions which are a set of operating instructions for the operators of the system.
- Rules to process data, e.g. priorities in running different applications, security measures, routines for malfunctioning IS, etc.

1.12.5 Information System Activities :

Q. Describe the activities of an information system.

Like any other system, the information system consists of the basic activities namely input, process and output that define a system. The additional activity as we all have seen comprises of the ability to store data which is put to use at a later stage as and when the need is felt. Fig. 1.12.4 and Fig. 1.12.6 illustrate each of the activity of an Information System. Let us study each of these activities in detail.

(1) Input :

- Business transactions and events generate data which must be collected and prepared for processing (Fig. 1.12.5) by the input activity. Input could take either the physical form in which paper entry is made or the data entry form in which the input in made directly into the computer system.
- One should always ensure that the recording of the data is accurate and therefore editing of the data has to be done. Once the data has been ensured then it is transferred on to a magnetic disk for further processing. Input could also take other forms such as the optical scanning of the bar codes which is then directly linked to the computer.

(2) Processing :

- The data which is input for processing could be subjected to various forms of calculations, comparison with other data that has been input into the system, sorting done on various basis and classification also on various basis.
- The processing function analyses the data to obtain the information that is required by the user and also in the form in which he wants it.

(3) Output :

- Outputs are the information products which are as per the requirement of the user and in the form in which he demands it.
- Output could take various forms namely reports either printed or online, messages and graphic images which can also take various forms like video, audio-video and multimedia.

(4) Storage :

- The storage activity is exclusive to information systems. In the storage function data is retained and organized in manner that makes it useful for some later processing. Some data could be retained on a regular basis and is therefore stored and made available as and when required by the system.
- Quality of the data must also be maintained by continuous correction, validating and updating. Stored data is organized into various data elements and data bases so that it could be made available whenever required.

(5) Feedback :

- The feedback activity is an important activity in an information system. The system is so designed that it generates feedback on the input, process, storage and output activities that are undertaken by the system.

- The feedback could range from the quality of the input, its accuracy, the processing done in the process activity and the output generated by the system. Feedback about the system is very useful form the point of view of the designer, user and operator as it helps them in tuning up the system to ensure that the output matches the requirement of the user.

(6) Control :

- We have a feedback on the functioning and the performance of the system and we have found some loopholes which we need to plug to meet the performance standards set.
- The Control function ensures that appropriate action is initiated on the feedback that is received and adjustments are made to ensure that proper information products are produced for the user.

1.12.6 Telecommunication :

- Telecommunications are the means of electronic transmission of information over distances. Today, computer systems are usually interconnected into telecommunications networks.
- Various network configurations are possible, depending upon an organization's need. These include :

Table 1.12.1 : Network classifications according to scale

Inter-processor distance	Processors located in	Examples of network
0.1 m	Same circuit board	Data flow machine
1m	Same system, within square meter	Multicomputer
10 m	Same room	LAN
100 m	Same building	LAN
1km	Same Campus	LAN
10 km	Same City	MAN
100 km	Same Country	WAN
1,000 km	Same continent	WAN
10,000 km	Same planet	Internet

According to above the above classification network is mainly classified into following three categories :

(1) Local Area Network (LAN)
(2) Metropolitan Area Network (MAN)
(3) Wide Area Network (WAN)

This is the primary category of the network.

1. Local Area Network (LAN) :

- The Local Area Network (LAN) is a network which is designed to operate over a small area such as home, office, computer labs, firm, factory or a group of buildings. However, there is a limitation of distance over which can n\be effective.
- It is mostly used to connect the workstation or sharing resources etc.
- LAN's are distinguishable according to following three criteria :
  1) Size of the LAN
  2) Transmission Technology
  3) Topology
- LAN configuration consist of,
  1) **A file server :** It stores all of the software that controls the network, as well as the software that can be shared by the computers attached to the network.
  2) **A workstation :** Computers connected to the file server (Mac or PCs). These are less powerful than the file server.
  3) **Cables :** Cables are generally used to connect the network interface cards in each computer

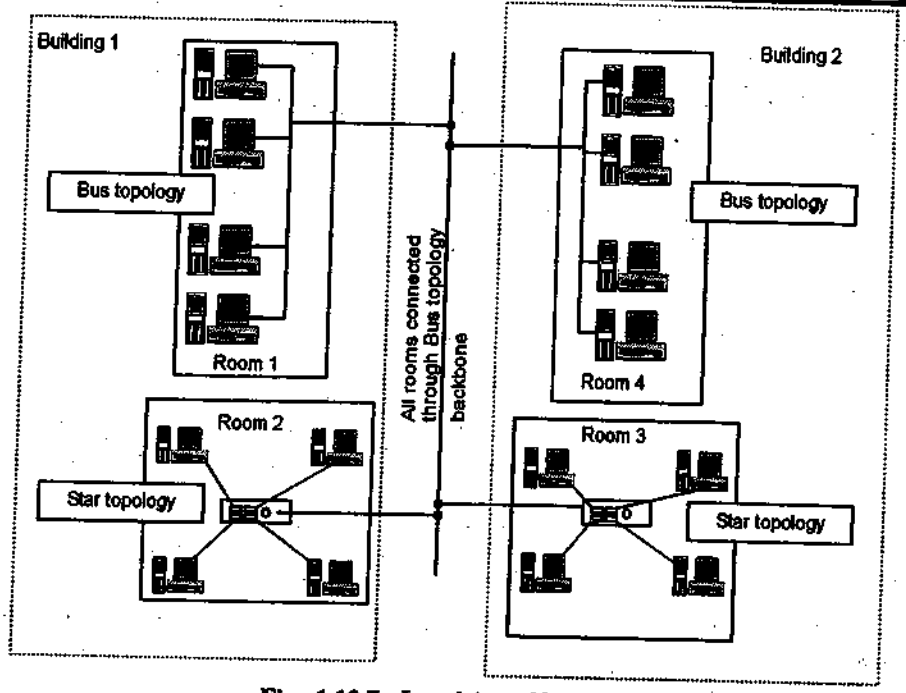

Fig. 1.12.7 : Local Area Network

- LAN is limited by distance and can be used to connect nearby workstations and share different resources like printers, software's or data.
- In this type of LAN, one of the computers acts as specially designed computer which is server for the rest of the client computer machines.
- The speed of the LAN are normally 100 megabits per second (Mbps) to 1000Mbps. Now a days LANs have data rates in the 4 to 16 Mbps range.
- As seen in the figure bus and star topology are used for connection of the LAN. Ring topology is also used for this purpose.

(2) Metropolitan Area Network (MAN) :

- Metropolitan Area Network (MAN) basically covers the entire city or entire town. Means when LAN is restricted to a single room or building for resource sharing then for large distance MAN and WAN are used.
- The general examples of the MAN are cable television network within the city - cable network for city, telephone company network that provide high DSL line to the customer.
- Suppose we want to share the Internet connection in the city for high speed then MAN is used.

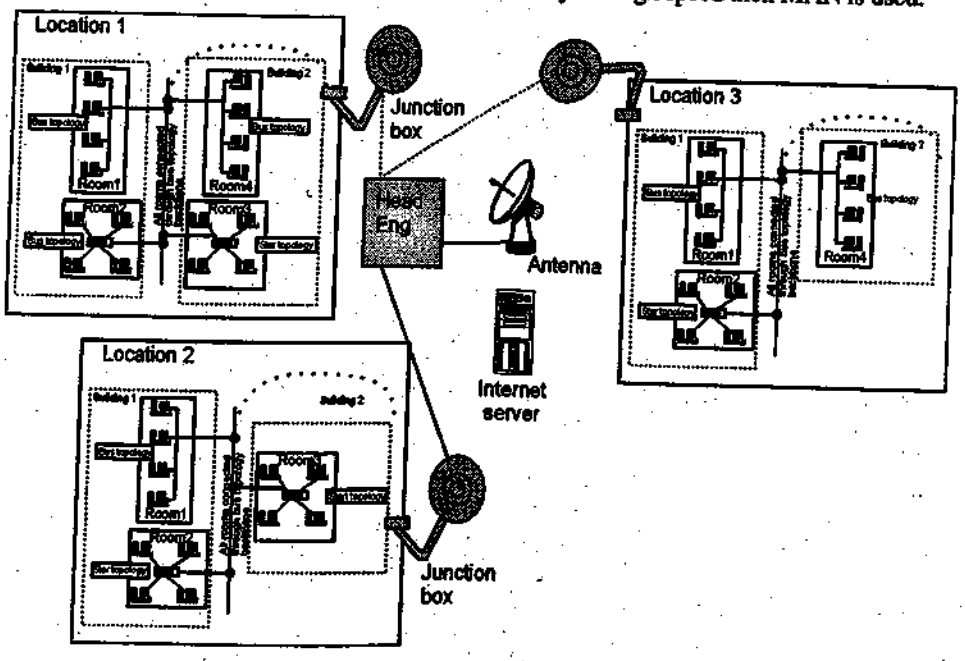

Fig. 1.12.8 : Metropolitan Area Network

(3) Wide Area Network (WAN) :

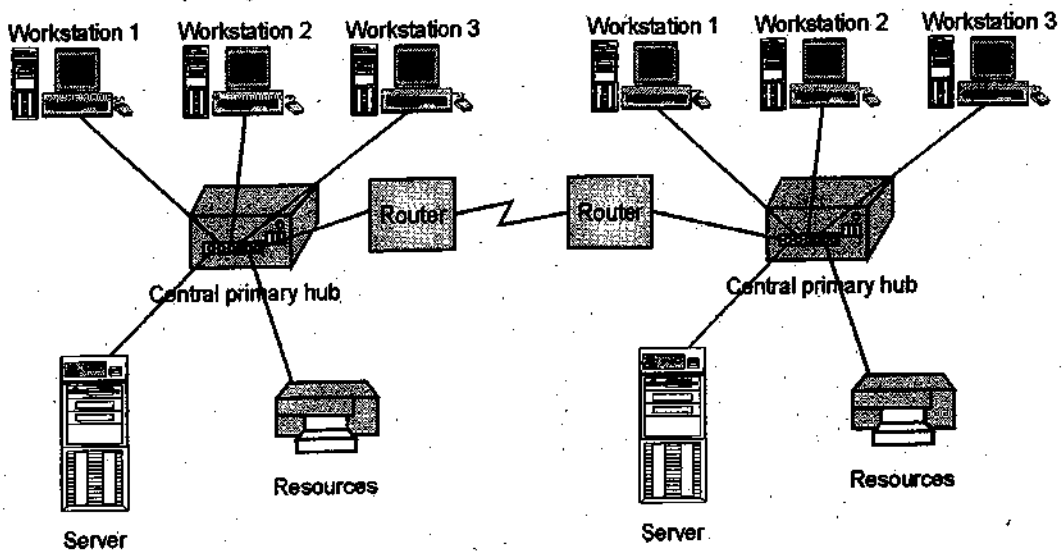

Fig. 1.12.9 : Concept of Wide Area Network

- The **router** is used for the Wide Area Network (WAN) for connection of the interconnected LANs.
- WAN connection is spread over the large geographical area, like one country or continent.
- WAN, consists of two distinct components, one is **transmission lines** and **switching element.**
- Transmission lines are made up of Optic fiber, copper wires or radio frequency links.
- If we use switching element on specially computers that connect three or more transmission lines then data arrives on incoming lines, the switching element must choose an outgoing line on which to forward them. These switching computers are called router.
- It is cheaper and more efficient to use the phone networks for the lines.
- Another example of WAN is an airlines reservation system. Consider the Fig. 1. 12.10. If one aero-plane passes from India to some other country, then intermediate country keep record of which seat is reserved from previous country.

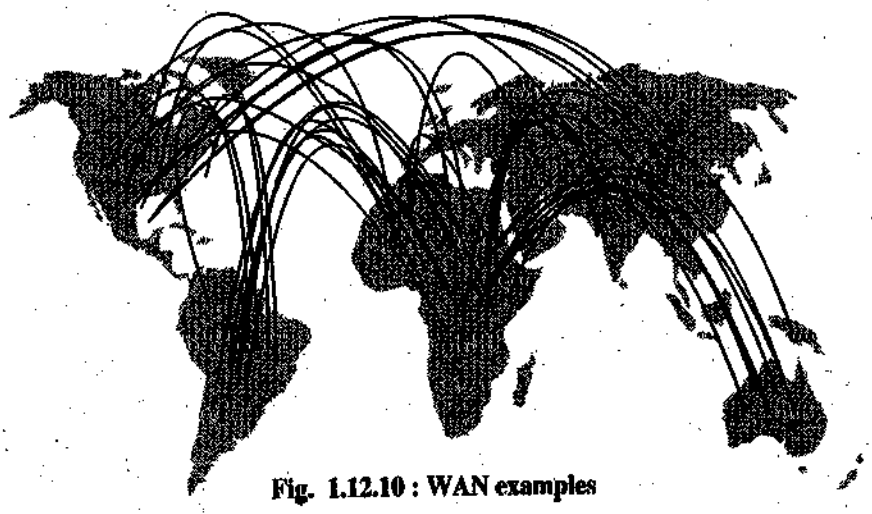

Fig. 1.12.10 : WAN examples

Internet

- **Definition :** When two or more networks are connected, they become an **Internetwork** or **Internet.**
- The Internet came into existence in the 60s.
- Today it is huge hierarchical structure.
- A common form of Internet is a collection of LANs connected by a WAN.
- Now - a - days various users use the Internet Service Providers (ISPs) for Internet connection. According to their limitation for providing these services there are various service providers today like international service providers, national service providers, regional service providers and local service providers.
- Note that Internet service is provided by private companies only and not by the government.

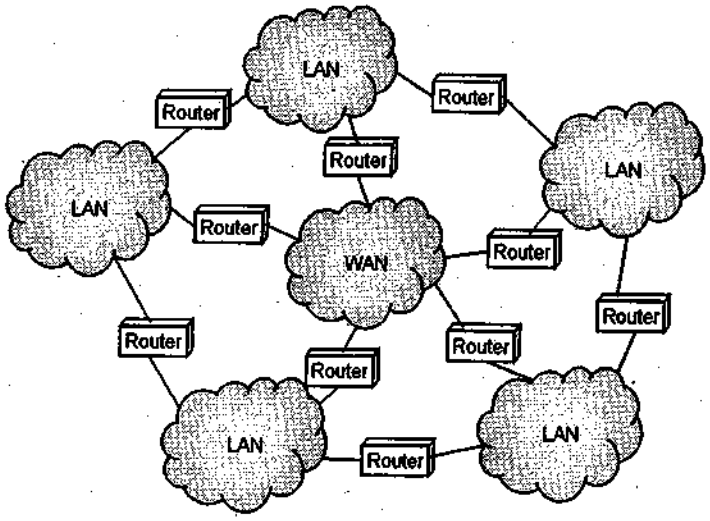

Fig. 1.12.11 : Internet

1.12.7 Types of Information Systems :

Q. Write short notes on :
i. Transaction Processing System ii. Management Information System

The information systems that are used in today's business world can be classified in several ways. We will broadly classify the information system as :

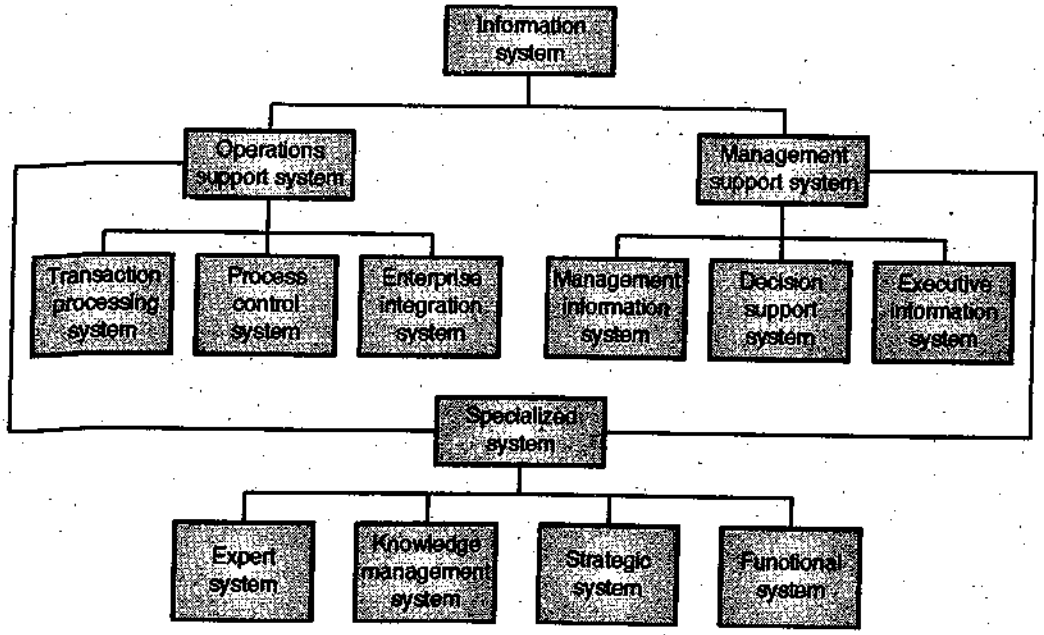

Fig. 1.12.12 : Types of information system

(I) Operation Support System
(II) Management Support System
(III) Specialized Processing System

Information systems are classified as per the roles they play in the operations and management of a business. In this section we will be studying the various types of information system that are used in an organization.

(I) Operation Support System :

- There has always been a need for an information system that processes the data generated by and used in business applications. Operation support system suffices this need by monitoring the day-to-day elementary activities and transaction of the organization.
- Operation Support System produces information products that can be used internally as well as externally by the managers. The information products of the operation support system cannot

be used as it is by the managers further processing by management information system is needed.

- The basic role played by operation support system is to process the business transactions, control the various industrial processes within the organization.
- Operation Support System is also supposed to support the communication and collaboration within the organization. Updating the databases for further use is another role played by the Operation Support System.
- As seen in the classification figure there are basically three types of operation support system namely :

(1) Transaction Processing System.
(2) Process Control System.
(3) Communication and Collaboration System.

This classification is done as per the role played by each of these sub system of the operation support system.

(1) Transaction Processing System :

- The Transaction Processing System is designed to handle transactions between two or more parties. The transaction processing system is a type operation support system that records and processes data that emanates from business transaction.
- The transaction processing system collects stores, modifies and retrieves transaction of an organization. What we mean by a transaction is any event that generates or modifies data stored in the information system.
- Transaction Processing System uses data files, master files, and transaction records. Transaction processing system processes the data in a manner which it has been designed to process the data.
- The output of a transaction processing system is itself a transaction and updating the various records based on the result of output of the transaction processing system is a part of the transaction execution.
- There are two ways of processing transactions.
  - **(a) Batch Processing :** in this data is accumulated over a period and is processed periodically.
  - **(b) Real Time Processing :** in this data is processed as soon as the transaction occurs. This type is also called as online processing.
- In many retail stores the point of sale (POS) system uses electronic cash register system. This system captures and then transmits sales data electronically to regional computers using telecommunication links.
- The sales data is sent to the regional computers for processing which could be done immediately as in real time or online processing or at particular intervals or designated period called as **batch processing**.
- The essence of a transaction program is that it manages data that must be left in a consistent state. E.g. if an electronic payment is made, the amount must be both withdrawn from one account and added to the other; it cannot complete only one of those steps. Either both must occur, or neither.
- In case of a failure preventing transaction completion, the partially executed transaction must be 'rolled back' by the TPS.
- While this type of integrity must be provided also for batch transaction processing, it is particularly important for online processing: if e.g. an airline seat reservation system is accessed by multiple operators, after an empty seat inquiry, the seat reservation data must be locked until the reservation is made, otherwise another user may get the impression, a seat is still free while it is actually being booked at the time. Without proper transaction monitoring, double bookings may occur.
- Other transaction monitor functions include deadlock detection and resolution (deadlocks may be inevitable in certain cases of cross-dependence on data), and transaction logging (in 'journals') for 'forward recovery' in case of massive failures.
- The payroll system is another example of transaction processing system. The payroll system is used to calculate the monthly salary payable to an employee the data that is used is payable days, payment terms and the payment rules. Employee master file and salary computing algorithm is used to compute the salary. The parties to the transaction are the employee and the organization.

(2) Process Control System :

- The process control system is another type of operation support system and is used to monitor and control the physical processes within an organization.
- Computers could be used to monitor the processes and take corrective action in case of any deviation.

(3) Communication and Collaboration System :

- It is also called as the office automation system. This system is used to enhance communication between the various workgroups. This communication and collaboration improves the productivity of an organization.

- Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks and goals. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures.

(II) Management Support System

- The prime focus of the management support system is to provide information and support to the management for effective decision making. The information and support needed for decision making should be provided at all levels within an organization.
- The information needed at different levels is different in its type and format thus making the management support system a complex process. The management support system comprises of :

(1) Management Information System
(2) Decision Support System
(3) Executive Information System
(4) Executive Support System.

(1) Management Information System

- A **Management Information System (MIS)** is a detachment of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing a product, service or a business-wide strategy.
- Management information systems are different from usual information systems in that they are used to scrutinize other information systems applied in operational activities in the association.
- Academically, the term is commonly used to refer to the group of information management methods tied to the computerization or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems. It has been described as, MIS 'lives' in the space that intersects technology and business.
- MIS combines tech with business to get people the information they need to do their jobs better/faster/smarter.
- Information is the lifeblood of all organizations - now more than ever. MIS professionals work as systems analysts, project managers, systems administrators, etc., communicates directly with staff and management across the organization."

(2) Decision Support System

- **Decision Support Systems (DSS)** are a computer-based information system that supports business or organizational decision-making activities. DSS's serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.
- DSS's include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

(3) Executive Information System

- An **Executive Information System (EIS)** is a type of management information system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization. It is commonly considered as a specialized form of a Decision Support System (DSS)
- The emphasis of EIS is on graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities. In general, EIS are enterprise-wide DSS that help top-level executives analyze, compare, and highlight trends in important variables so that they can monitor performance and identify opportunities and problems. EIS and data warehousing technologies are converging in the marketplace.

(4) Executive Support System

- **Executive Support Systems (ESS)** supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as "educated guesses." Executives rely as much, if not more so, on external data than they do on data internal to their organization.
- Decisions must be made in the context of the world outside the organization. The problems and situations senior executives face are very fluid, always changing, so the system must be flexible and easy to manipulate.

(III) Specialized Processing System :

The specialized processing systems support the operation and the management support system. The specialized Processing System comprises of :

(1) **Expert System :** Provides expert advice. Generally the advice of an outside professional is employed. An expert in his area could be in finance, marketing or operations. He assists in the decision making process by providing valuable insight into the area.

(2) **Knowledge Management System :** as the name suggest knowledge management system support creation and dissemination of knowledge to its employees and managers. This knowledge in various areas assists them in their decision making.

(3) **Functional Business System :** This system supports the basic functions of a business. Basic functions like accounting, marketing and distribution are supported by the functional business system.

(4) **Strategic Information System** b This system applies the technique and tools of information technology to the firm's products, processes and services to enable it to gain an advantage over its competitors.

Syllabus Topic : Information Systems and Management Strategy

1.13 Information Systems and Management Strategy :

- The IT strategy of the company specifies the direction of IT investments over the next 5 years. It provides a roadmap, an investment plan that should align with and support the business strategies of the company.
- The business environment is dynamic in nature thereby making it very complex but all the more essential to plan business strategies in advance.
- Environmental factors such as technological changes, competition, market forces are very hard to predict and have a huge bearing on the business prospects. Information systems are designed to assess and monitor these environmental factors, and provide some insights to the management to formulate some strategies to deal with them.
- The information system is designed to keep tap on all the environmental factors that are likely to have an impact on the business entity and provide information to the management for strategy formulation. Strategic planning is a very complex process and management has to take some risks and face the unknown.
- Strategy formulation is based on the strengths and weaknesses of the business entity and its mission and goals that it has set for itself.
- Strategy formulation is the responsibility of the top management which in turn relies on information systems for assistance. The strategic planning process is closely aligned with the IT investments of the company.
- There are various business strategies and the information system is required to provide the relevant information that would assist the management in deciding which type of strategy the company needs. The type of strategy formulated depends on the current status of the company and the goal it wishes to achieve.
- The information system is designed to provide current information on the status of the company in comparison to the goal it has set for itself. So if the company is experiencing slow sales it should adopt a strategy that will enable it to revive sales and meet its targets.
- A close information system – business strategy alignment is facilitated by bringing together various perspectives from the top management, information systems manager and various business groups in the planning stage.
- Once the alignment takes place at the planning stage both the business and information systems strategies are evaluated and adjusted annually to keep pace with the changing industry requirements.
- To ensure that all the resources are being utilised and the highest possible return-on-investment is being achieved the performance is measured and evaluated using balance scorecard methodology.

1.13.1 Balance Score Card :

Q. How have Balance Score Card transformed the traditional approach to strategic management ?

Q. Describe briefly the BSC System Development Process.

- Robert Kaplan and Dr. Davie Norton developed a new approach to strategic management in the early 90s. The new approach was called the Balance Score Card Method (BSC) and was developed to address the weaknesses and ambiguity that was present in the prevailing traditional approach to strategic management which relied on accounting data.
- BSC deals with internal processes of the business and their outcomes and the impact of these outcomes on business performance. The BSC approach busted the traditional approach to strategic management which was based on what had happened in the past and then extrapolating it into the future.
- The traditional approach did not focus on the capabilities of the business, customer relationships and critical success factors that are so critical to information driven organization.
- Kaplan and Norton advocated that information driven organization striving to gain competitive advantage should focus on technology, suppliers, customers, processes and its employees.

- The business environment has undergone a radical change on account of globalization and technology. Traditional management practices and performance indicators such as balance sheets and financial ratios have now been discarded.
- The new cue is "strategic management and planning". In such a changed business scenario the balance score card provides managers with a tool that they can use in this complex environment.
- Balance score card enables businesses to monitor progress in building their capabilities and acquiring intangible assets while they also keep an eye on their financial results.
- BSC takes into account the objectives, measures, targets and initiatives in the four aspects of business. The balance score card translates mission and vision into a comprehensive set of objectives and performance measures that can be quantified and appraised.
- Once the mission and vision of the organization have been translated into clear objectives a clear strategy for action can be formulated. Objectives are the building blocks of strategy and set out what the business is trying to achieve.
- Objectives enable formulation of action oriented statements which help define the course of action the business is to take.

The advantage of having clear objectives is that :

- Objectives are specific and define what is to be achieved.
- Objectives are stated in measurable terms.
- Objectives are achievable as they are realistic and take into account the available resources and conditions.
- Objectives are relevant to the people who are responsible for achieving them.
- Objectives are time bound.

The Balance Score Card Approach takes a balanced comprehensive view of all the four perspectives of business, namely;

- **Finance :** The financial perspective is retained as it is a measure of economic actions already taken. Financial performance indicates the effect of a strategy on the profitability of the company. The financial perspective has to ensure that the needs of its shareholders are taken care of while also taking care of its customers.
- **People :** the people perspective focuses on improving the capabilities of its people and enables them to embrace change and improve.
- **Process** : the business process perspective focuses on identifying the processes that will enable the organization to meet the needs of its customer.
- **Customer** : the customer perspective focuses on understanding the needs of customers which an organization should deliver.
- BSC advocates the use of these perspectives to measure and evaluate every activity of the organization.

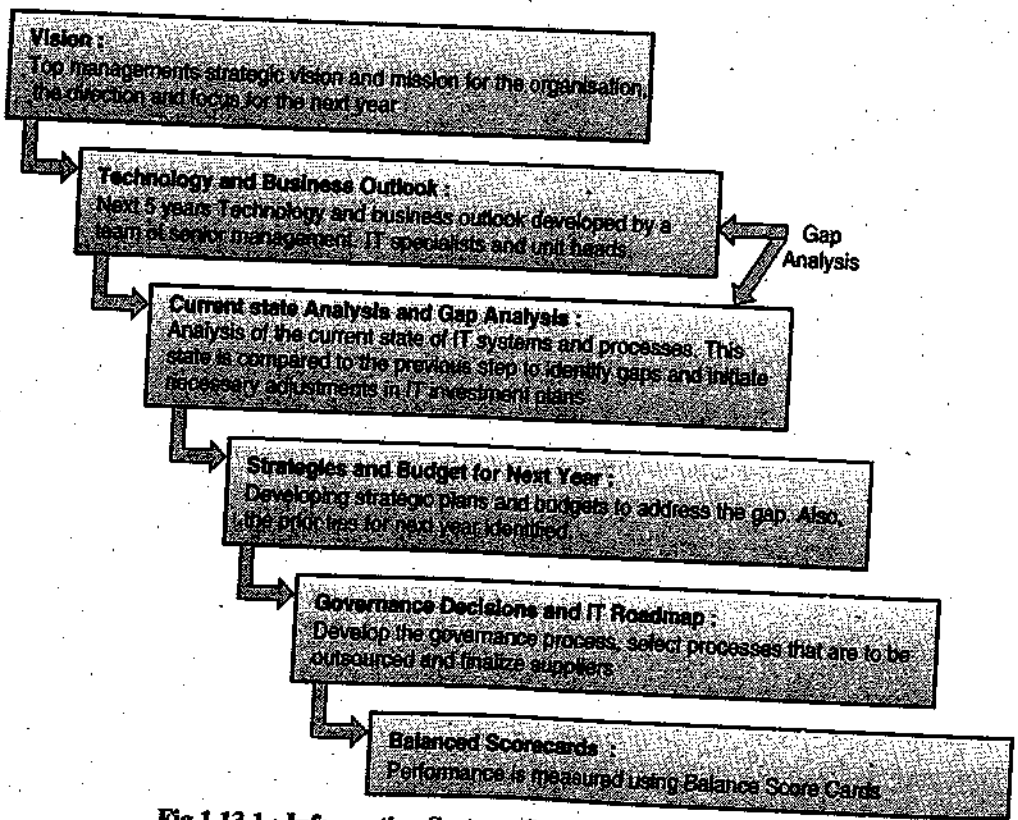

Fig 1.13.1 : Information Systems Strategic Planning Process

The BSC System Development Process :

Step	Process	Explanation of the Step
1	Develop Vision for the organization	Enables the management to understand where the organization is currently and where it aims to be after a certain period.
2	Formulate strategies to achieve vision	Strategies to enable the organization to reach the desired position
3	Develop strategic actions to implement formulated strategies	Actions and decisions which will ensure the success of the strategies
4	Link the four BSC perspectives to the strategies and actions	Determine which critical success factor will be affected by the strategy and action
5	Develop measures to evaluate the four perspectives and critical success factors	Helps measure the effectiveness and impact on critical success factors
6	Implement BSC	Fix responsibility

Organizations are adopting BSC to :

- Update business strategies
- Align strategic objectives to long term targets
- Integrate strategic objectives with resource allocation process
- Disseminate corporate vision and strategy companywide

BSC provides the managers with a fast and comprehensive view of the performance of the key result areas. From the information systems point of view it provides a clear platform to develop information systems. The information system should be designed to capture data and analyse it to evaluate the effectiveness of BSC in attaining business performance.

Case Study

CASE STUDY - I

Information Systems in Indian Railways

Introduction :

Whenever we hear the name Indian Railways the first thing that comes to our mind is the mad mind boggling rush at the railway stations and the long serpentine queues at the ticket counters. Although, we used to hate this wait and rush we used to be patient as we knew the mammoth task that was the Indian Railways. Indian Railways is the second largest rail network under single management in the world and the largest employer in India. Every day the number of passengers using this service is more than 12 million and ferrying more than 500 million tons of freight annually. It has 15 zones and 6853 stations under it thus becoming the largest civilian government department in India. Managing this entity was no mean feat and thus like every other every government entity in India it too was plagued by problems, some of which we are under:

- Increasing number of passengers
- Rising input costs more than 150%
- Inefficient management of resources
- Poor customer service and satisfaction
- Unavailability of easy, correct and timely information

The objective behind developing information systems in Indian Railways was :

- Reduce cost
- Reduce staff burden
- Improve efficiency
- Provide better customer service

Information Systems and Indian Railways - Freight Operating Information System (FOIS)

One may be surprised to learn that Indian Railways tryst with information systems began in the early 1970s. The idea of tracking freight consignments through the use of computerised tracking applications known as TOPS (Total Operating System) gained widespread popularity. Railroads in USA were the first to use such systems and their use spread to UK and Canada as well. In an audacious move, Indian Railways planned the use of a similar system for itself. After years of research, a system known as TRACS prevalent on the Canadian Railways was found to be compatible with IR's needs. The system planned for Indian Railways was called FOIS (Freight Operations Information System).

In 1986, an autonomous organisation known as the Centre for Railway Information Systems (CRIS) was created by the Indian Railways for execution of the FOIS project. This organisation slowly took on the role of the IT arm of the Indian Railways. Recently CRIS celebrated 25 years of its existence.

Salient Features of FOIS :

1. Instant information of current status of goods in transit
2. Helps in managing inventory
3. Helps in asset utilization

Introduction of the Passenger Reservation System (PRS) - An attempt to enhance the ticketing experience :

The ticketing experience of the Indian Railways has always been very exhausting. However, with the turn of the century came a rush of IT project implementations. The first major project launched came in the year 2000; it was the Internet Querying system for PRS (Passenger Reservation System). Passengers could check their PNR number through the internet. The site continues to be extremely popular with railway passengers.

Salient Features of the Passenger Reservation System :

1. The system is web enabled
2. The system provides information on journey planning, fare and availability of reservations
3. It is possible between any pair of stations
4. Upgradation is automatic
5. Uses centralized database
6. PRS has become highly popular as around 90% of people use it.

Unreserved Ticketing System :

In 2002, the Unreserved Ticketing System (UTS) was developed in a record time of 8 months and installed in the Delhi area on 15th August. Prior to the implementation of UTS, unreserved tickets were in the form of small purpose-built cards, specially printed for each origin-destination pair of stations.

Disbursing these tickets was a mammoth exercise, requiring mundane and wasteful effort just to keep the tickets in stock. Passengers faced crowded and chaotic ticket windows, last-minute ticketing glitches, and opaque ticket refund rules. The UTS has eliminated all these bottlenecks by having a centralised database of tickets, which can be bought in advance from any ticket window. The introduction of ATVMs (Automatic Ticket Vending Machines) and smart cards has made ticketing even simpler for Mumbai's suburban passengers. Accounting of the money received from remote rural stations, which used to take months, is carried out by running regular end-of-day routines. UTS now run at more than 5500 stations across the country. It accounts for Mumbai's suburban passengers. It accounts for more than 95% of all unreserved tickets sold. In a related development, in July 2011, CRIS provided automatic flap-type gates for the Kolkata Metro along with in-house ticketing software to take over from the aging turnstiles.

Salient Features of UTS :

(i) Address the issue of unreserved tickets

(ii) Centralized database so that unreserved tickets can be bought from any station

(iii) Brought ease, flexibility and simplicity to the process of procuring unreserved tickets

Managing Train Operations – Integrated Coach Management System (ICMS) and Crew Management System (CMS) :

The FOIS system manages the operations of all freight trains in the Railways. Similarly, the movement and operation of passenger trains is managed by the Integrated Coaching Management System (ICMS). This system collects online information from 220 major yards in the country and provides Railway managers the updated information on passenger train consists, locomotive availability, and maintenance schedules. ICMS was envisaged in 2003 and implementation was completed in 2008. Two systems that have changed the way the Railways function internally are the Control Office Application (COA) and the Crew Management System (CMS). COA assists each train controller (Section Controller in Railway parlance), located in the Divisional Control Offices, to manage short-term train movements. Section Controllers prepare their Control Charts on the COA terminal automatically through the COA program. This frees them up to plan train movements more effectively, leading to more throughputs in each section. The COA provides the controllers with an intuitive interface similar to the manual chart, with which they are fully familiar. Ultimately, the train position will get automatically populated in the chart by transmitting GPS location data from the train locomotive directly into the COA database. COA also provides spin off benefits to the passengers. COA's train movement data and movement forecasts are picked up by the National Train Enquiry System (NTES) to provide train position to passengers through the NTES website and the 139 call-centre.

The Crew Management System, on the other hand, benefits running staff (Train Drivers or Loco Pilots, Assistant Loco Pilots, and Guards) by rationalising their working hours, informing them via SMS about impending duty rosters, and providing them with simple kiosk-based sign-on and sign-off facilities. Mileage allowances to compensate for their movement outside their home station are also automatically calculated by this system. COA was developed in 2005 and remained on trial up to 2007. Thereafter it was implemented in all 70 Divisional Control offices by 2010. CMS also was developed by CRIS during this period and implementation in 340 crew lobbies (all but the smallest ones) was completed by 2011. Scheduling of passenger trains remains an arcane art in railways worldwide. A large number of factors need to be optimised in order to prepare a workable yet efficient train schedule. Apart from passenger trains, freight trains have also to be provided line capacity to maximise freight throughput.

CRIS is in the process of developing the necessary algorithms and programs to enable the design of optimised and stable train schedules, which maximise efficiency in the Railway system. Preliminary work on this system is already over and the first version of the "Sat- sang" (Software aided Train Scheduling and Network Governance) is about to be rolled out.

Material and Asset Management Systems :

Indian Railways buys materials worth well over `15,000 crore annually to maintain its assets consisting of more than 7000 stations, 112,000 track Km of permanent way (30 percent of it with overhead electrification equipment), 9000 locomotives, 2,25,000 freight wagons, and 45,000 passenger coaches. Managing the material is a gigantic task. Material management systems comprising procurement and inventory control functions have been established in all Railway units. However, it is planned to centralise the Material Management systems. This onerous task has been awarded to CRIS for implementation, and is targeted

for completion in the next 3 years. In the meantime, a fully automated and secure e-procurement system had been put in place centrally by CRIS in 2008. This system has already been used for finalisation of more than 3 lakh tenders, and more than 14000 vendors are enrolled in it. The entire application is PKI enabled and completely secure. Railway assets are spread out across the country. It becomes easy to manage them effectively if geo-spatial data about the assets is maintained in a central repository. This aspect has been recently addressed with the initiation of a project for preparation of a geospatial database and GIS map to cover all of the Railways' fixed and moving assets. IT systems in Indian Railway's Production Units have evolved over the years. A landmark was reached in March 2012 when a comprehensive SAP-based ERP system was implemented in the Integral Coach Factory (ICF) after 24 months of design and development effort. The system provides an integrated view of the organisation for all levels of managers and staff.

Conclusion :

Indian Railways has used Information Technology to improve the experience of passengers and freight customers. Increasingly, IT applications are being developed to address internal efficiency and effectiveness. Indian Railways now finds itself in an age in which rapid assimilation of IT in all walks of life opens up greater opportunities. The recent acceleration in development and deployment of IT systems is evidence of Indian Railway's commitment to the common citizen of India.

CASE STUDY - II

Information Systems in an E-Commerce Organization

Introduction

Dell Computer is one of the world's leading computer systems manufacturer and the first one to move its sales onto the internet. More than 50% of its sales revenue is generated through the internet. A brief look at the companies roots have a very interesting story to tell. The promoter of the company Michel Dell at the age of 13 ran a mail-order-stamp-trading business from his home in US. Later on in college he found the time to establish a business selling memory chips and disk drives. Dell bought his products from IBM traders who had excess stock and he would sell them at a price lower than the market price. As sales picked up he decided to quit college and started his own business making clones of IBM computers which he sold directly to end users rather than any retailers and this enabled him to price his computers on the lower side. By eliminating the retail markup, Dell could sell his PCs at about 40 percent of the price of an IBM. Dell's strategy was relatively simple: Beat competition on price and performance by using standard components and software and pull down the profit margins of competition in the process.

Company Overview

In its initial days although the sales were picking there was a drop in the profits of the company. The costs were growing on account of the policy of the company to use proprietary components. Taking stock of the situation the company decided to cut inventory, came out with new products and added new customers and tapped the international market. Today Dell is growing rapidly in the European and Asian market.

Selling Strategy

Unlike other companies Dell has a unique strategy when it comes to selling its products. Customers all over the world can dial toll-free to one of six call centers in Europe and Asia and will be connected to its main centre in France where there order will be taken and processed. Thus it is direct from customer to the company with all the middle men being eliminated.

The e-business design

The Dell's build-to-order business model is one the most successful e-commerce model that is defined by a fine tuned supply chain. The model enables the company to be closer to its customer and yet maintain operational efficiency.

The secret behind Dell's success is that its manufacturing cost is low and the product development cycle is fast. Dell focuses on end-to-end operational excellence. The integration of customer demand from the direct-sales channel with the back-end supply chain is reshaping the PC industry. This integration enables the cost-effective selling of build-to-order computers directly to customers, thus bypassing the resellers and their markups.

Dell has reengineered the computer distribution market which was once controlled by middle men who took a lion's share of the profits. Dell's direct

sales model practically eliminated middle men or reduced their margins.

The Build to Order Model

The Dell's build to Order Model has been highly influenced by Henry Ford's assembly line model. The other reason for its success has been the proximity of Dell's manufacturing units to its key supplier be it Intel, Maxtor or Selectron. Thus it is always in a position to receive its parts just in time thereby reducing inventory and allowing it to be innovative which has been one of the salient features of the computer market. To be competitive in the PC market Dell has to be agile and flexible. Flexibility and agility enables Dell to meet the changing needs of the market in terms of products, quality and delivery schedules.

Dell's Web based Business Model

Dell was the first PC manufacturer to implement a web based business model. Dell integrated all its operations on the internet. Although, the initial model only provided the customer with a product and price list, later improvements in the model enabled the customer to enter his specifications and the customer was provided with prices accordingly.

In the next stage the customer was able to track his order through a courier tracking system and was given customer support online. Dell has also introduced Premier Page service to provide corporate, institutional, and government customers with the ability to readily access company-specific pricing, use a paperless purchase order system, and seek advanced help desk support and asset management information. The objective of the Premier Pages service was to increase Dell's business-to-business (B2B) direct sales significantly and thus turn inventory more quickly.

B2B Direct Business Model

Although, the web based model did work well for Dell it had its drawbacks. Dell on its site maintained customised procurement pages with price list for specific customers. Customers were required to go through these pages and then enter their requirement into the shopping cart. Dell did not allow customers direct access to Dell's applications making the entire process time consuming.

In the next stage of B2B Dell's system will facilitate an exchange of information between applications across corporate boundaries. B2B Direct is creating a business community in which its operational systems are directly integrated for real-time data exchange with the operational systems of its customers. This seamless integration speeds up the business, production, order fulfilment, shipping, and payment cycles.

With B2B Direct, Dell wants to streamline e-procurement for its customers, thus reducing operation costs, shortening transaction and fulfilment cycles, and increasing productivity.

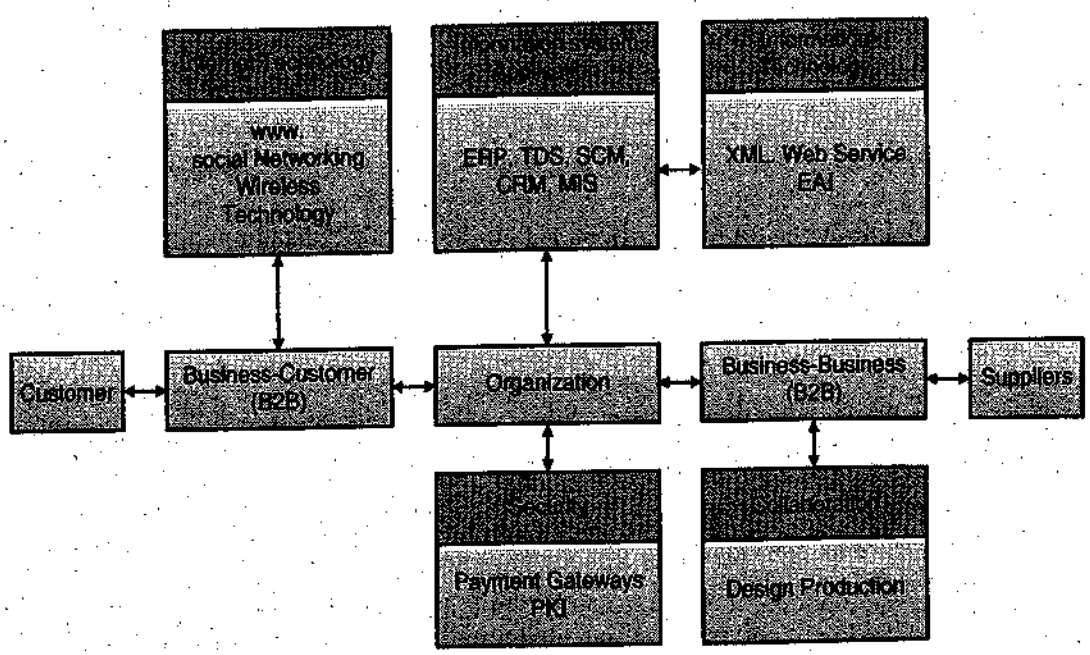

Fig. 1

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UNIT - II

CHAPTER 2

Management Information Systems

Syllabus

Managing information systems, Ethical and social issues, Information technology infrastructure and choices, Information system security and control, Case studies - Information technology infrastructure in a bank. Information technology infrastructure in a manufacturing / process industry.

2.1 Introduction of Management Information Systems :

2.1.1 Concept of MIS :

- A Management Information System (MIS) is a detachment of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing of a product, service or a business-wide strategy.
- Management Information Systems are different from usual information systems in that, they are used to scrutinize other information systems applied in operational activities in the association.
- Academically, the term is commonly used to refer to the group of information management methods tied to the computerization or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive Information Systems.
- It has been described as, MIS 'lives' in the space that intersect technology and business. MIS combines technology with business to get people the information They need to do their jobs better/faster/smarter. Information is the lifeblood of all organizations - now more than ever.
- MIS professionals work as systems analysts, project managers, systems administrators, etc., communicates directly with staff and management across the organization.
- Now a days, People have defined the era we live is an information age. We have a rapacious wish for collecting information.

2.1.2 Evolution of MIS :

Q. Trace the evolution of Management Information System

The concept of MIS has evolved as per the requirement of the organization over a period of time and hence it becomes interesting to study the evolution of MIS.

- The preliminary concept of MIS was to process data from the organization and present it in the form of information at regular intervals. The system was mainly competent of handling data from the collection to processing.
- At the start, in businesses and other organizations, internal reporting was made manually and only periodically, as a by-product of the accounting system and with some additional statistics, and gave limited and delayed information on management performance. Previously, data had to be separated individually by the people as per the requirement and necessity of the organization.
- In the next stage data and information was distinguished and instead of the collection of mass data, important and to the point data that was needed by the organization was stored.
- It was recognized that data could be analyzed in different ways producing information which would probably not suit the requirement of the individual and hence the system's concept should be individually oriented. It was later felt that the system should present information in such a format that it has an impact on the user and induces action from him.

- The impact alone did not suffice and a selective approach was used in reporting. Here, the concept of exception reporting was made a part of MIS. It was necessary that every organization devised its own norms for exception and these norms evolved a period of time.
- The concept of exception reporting could not be effective for top management especially in competitive environment and hence it was felt that the exception reporting should be need based. This made it mandatory for data to be kept together and made available to the individuals or groups in the format that they needed. This gave rise to the Database format of MIS.
- The next step involved the use of multiple databases by the user and this changed the total look of MIS. The system became decentralized and independent of the computer department and the role of the computer department became limited to that of managing the information resource only and the task of processing the information was left to the user. Here, MIS truly became a decision making system.
- Today, the term is used broadly in a number of contexts and includes but is not limited to: decision support systems, resource and people management applications, project management and database retrieval application.
- MIS includes various principles, theories and practices from management, accounts, computers, operations research, psychology and human behavior. A combination of these disciplines make MIS effective decision making tool. The base for MIS is the basic principles of management.
- Management Information Systems encompass a broad and complex topic. To make this topic more manageable, boundaries will be defined. First, because of the vast number of activities relating to Management Information Systems, a total review is not possible. Those discussed here is only a partial sampling of activities, reflecting the more common and interesting developments.
- Likewise where there were multiple effects in a similar area of development, only selected ones will be used to illustrate concepts. This is not to imply one effort is more important than another.
- There are several frameworks that can be used to define and describe management information systems. Because more than one will be used to discuss important concepts. Since more than one is used, it indicates the difficulty in capturing the key concepts of what is a management information system. Indeed, what is viewed as an effective and useful management information system in one environment, may not be of use or value in another.
- Lastly, the historical perspective of Management Information Systems cannot be ignored. This perspective gives a sense of how these systems have evolved, been refined and adapted as new technologies have emerged, and how changing economic conditions and other factors have influenced the use of information systems.
- We have already studied the distinction between data and information and we have also seen that to transform data into information, processing is needed and it must be done while considering the context of a decision.
- We have also studied the concept of inference, wisdom and seen that data that we are flooded with is at the lowest level and wisdom at the highest level. As one move up the hierarchy, the value is increased and volume decreased. Thus, as one acquires knowledge and wisdom the decision making process is refined.
- Management Information Systems attempt to address all levels of hierarchy as well as converting data into information for the decision maker. But one should always remember that by just supplying more data and information we may actually be making the decision making process more difficult and therefore emphasis should be placed on increasing the value of information.
- Another important concept is the value of information which is the value of the change in decision behavior caused by the information, less the cost of the information. This statement implies that information is normally not a free good. Furthermore, if it does not change decisions to the better, it may have no value.
- Many assume that investing in a "better" Management Information System is a sound economic decision. Since it is possible that the better system may not change decisions or the cost of implementing the better system is high to the actual realized benefits, it could be a bad investment.
- Also, since before the investment is made, it is hard to predict the benefits and costs of the better system, the investment should be viewed as one with risk associated with it.
- MIS is effective only if its conceptualized as appropriately designed systems as, then only it can handle complex situations of input and output. For the system to be effective, it should be able to handle data inputs, process these inputs with minimum distortion and deliver output in the form of information to its appropriate destination.
- Therefore MIS uses the principles of management and the systems theory and is an assembly of several subsystems in the organization. The sub-systems

include data collection, processing and validating and then storing the information in databases.

- MIS is subject to continuous modification to meet the changing needs of information of management. Each organization has its own set of requirement and hence the MIS design is also different though the underlying principles remain the same.
- MIS also has to be in tune with the external and internal environment of business and has to make adjustments accordingly to be able to meet the changing needs of information.

2.1.3 Defining Management Information Systems :

- An 'MIS' is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management. In a way it is a documented report of the activities those were planned and executed.
- Management Information Systems (MIS) is the term given to the discipline, focused on the integration of computer systems with the aims and objectives of an Organization.
- The development and management of information technology tools assists executives and the general workforce in performing any task related to the processing of information. MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.
- The terms MIS and information system are often confused. Information systems include systems that are not intended for decision making.
- The area of study called MIS is sometimes referred to, in a restrictive sense, as information technology management. That area of study should not be confused with computer science. IT service management is a practitioner-focused discipline.
- MIS has also some differences with Enterprise Resource Planning (ERP) as ERP incorporates elements that are not necessarily focused on decision support. We will be studying more of this in later chapters. The scope and use is better understood when each part is been explained in detail.

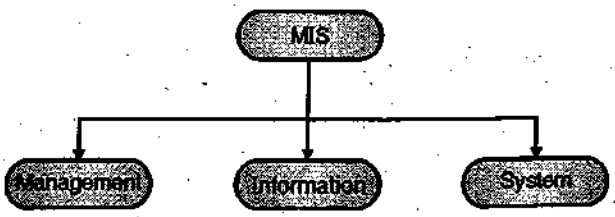


Fig. 2.1.1

1. **Management :**
   - Management has been viewed as a function, a process, a profession and as an elite or a class of people. Management has also been defined as art and science and along with manpower, labour, finance, management is considered as a resource. This segment is considered for the one point that is management as a function.
   - Function refers to the type of work assigned to the managers. The give tasks performed by the managers are scheduling (planning), organizing, directing, leadership and controlling.
   - In fact Management means assigned task to be completed by others, where the organization or company gets benefited by thoughtfully making use of manpower, machines, materials, finance, methods, messages and moments.
2. **Information :**
   - We have also studied information in the previous sections but let us refresh our knowledge about information. Information is been used in our day-to-day work. In MIS, there is different meaning prescribed other than the data.
   - The information has value in decision making while data does not. Information brings simplicity, works, creates human responsibility for minds. MIS gives clear description in being made between Information is the data processed.
   - Information can be defined as the data which is organized and present at the time and place so that the decision maker may take necessary action. In other words information is the result / product of processing data.
   - The conversion process of the data term as an Information system differs from other kinds of system.
   - In that its objective is to monitor /document the operations of some other system, which we can call target system. An information system cannot exist without such a target system.
3. **System :**
   - We use the word system in our day-to-day life to describe something that does something. Thus, we have the Transport System which transports people the Government System which governs us the Administrative System that puts into operation government policies, the judicial System which is responsible for providing justice etc.

- We are always part of a system. A System is a combination of resources working together to transform inputs into usable outputs.
- An information system is an arrangement of people, data, processes, interfaces, networks and technology that interact to support and improve both day-to-day operations (data processing, transaction processing) as well as support the problem solving and decision making needs of management (information services, management (information services, management information system, executives support).

Definition of MIS :

Simply put, MIS is the system, which makes available the right information to the right person, at the right place, at the right time, in the right form and at the right cost.

- According to **Davis** and **Olson,** "MIS is an integrated user-machine system for providing information to support operations, management and decision making functions in an organization.
- The system utilizes computer hardware and software, manual procedures/ models for analysis, planning, control and decision making and a database".
- **Kelly** has defined MIS as "a combination of human and computer based resources which result in collection, storage, retrieval, communication and use of data for the purpose of efficient management of operations and for Business Planning".
- **Lucey** has defined MIS as "a system to convert data from internal and external sources into information to communicate that information in an appropriate form to managers at all levels, in all functions to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible" -
- According to **Henry C. Lucas,** "MIS is a set of organized procedures which when executed provide information to support decision making".
- **Krober** and **Watson** have defined MIS as "an organized set of processes that provide information to managers to support the operation and decision making within an organization".
- From the various definitions quoted above, we can state that the MIS is basically an integrated system which transforms the data (inputs) into reports (outputs) for facilitating decision making through processing using various components of the information system viz. Hardware, Software, Database, Procedures and Personnel. It handles voluminous data and handles complex processing of this data. Data is mass stored and made available to the user in the form of information on time. The system should also cater to the changing needs of information of the user.

2.1.4 Role of Management Information Systems :

Q. Define MIS and state its role in an organization

- Management Information System, or MIS, is a managerial decision-making tool. A company uses it in all of its business operations and processes. As the management is in complete know of everything transpiring in the company, it leverages on this advantageous position. Using it, a company is able to record and document all facts pertaining to its procedures and methodologies. The basic intent is to manage and control all of the company's employees and material through MIS.
- The role of Management Information System is akin to that played by the heart in the human body. As the heart ensures the continuous and smooth supply of blood to all the organs of the body and also undertakes the function of purifying the impure blood, likewise MIS ensures that the data that is received by the system is purified and then supplied to all the departments within the organization.
- MIS is expected to satisfy the needs of all those who are taking part in the decision making process be at any level in the organization, be it a need of an individual, a group or the top management itself. An effective Management Information System will always ensure that information is always passed on to the required party in its required format and that to at the required time.
- So we can safely say that MIS is the life blood of the organization and no organization will be able to function smoothly without the proper implementation of the MIS.

(a) Significance :

Using an MIS, an organization is able to establish its hierarchical structure and work-flow charts. Every employee in the organization knows the employees he has authority over and to whom he is responsible for work. The work then progresses without hitches. The company's operating and procedures are listed by an MIS.

(b) Types :

- Organizations use different types of MIS for different needs and scenarios. At a given point of time an organization might be using several types in isolation and in combination. Organizations essentially use Transaction Processing System

(TPS). The business tabulates all its recurring transactions like inventory and customer orders using TPS.

- The operations information system, or OIS, is used by managers to plan out their production and scheduling activities. The decision support systems or DSS is used by the top management to find feasible solutions and options to different scenarios.

(c) Benefits :

- There are numerous pluses in using an MIS. The organization records and tabulates all its key strategic functions. As and when deviations from the planned course happen, the organization is able to take corrective action at once.
- Communication channels are enforced. As the authority-responsibility diagrams are well established, the superiors delegate work to their subordinates and the subordinates turn to them for guidance and suggestions.
- The MIS mechanism enables the organization to weigh the pros and cons of several methods of accomplishing a task and choosing the most practical one.

(d) Levels :

- MIS caters to the needs of all the people within the organization be it the clerk whose requirement are particular records and documents and will mostly be provided through the Transaction Processing System.
- The junior manager's requirement will be that of operational data which will be useful for him in planning and scheduling activity. The middle level management need of short term planning and setting up of targets is also satisfied by MIS. MIS also assists the top management in goal setting and strategic planning.
- MIS satisfies these diverse needs of people located at diverse locations in the hierarchy using a variety of systems like the Transaction Processing System, Query System, Analysis System and the Decision Support System. We have already studied these systems in the previous chapter and so there is no need to elaborate further.

(e) Considerations :

- With an MIS, company leaders must be mindful of **two** things. **First**, as very often it is consultants who develop the MIS for the company, they must be knowledgeable of all of the company's prevalent policies and practices. **Secondly**, a company must every year allocate funds for maintaining and sustaining the MIS.

2.1.5 Need and Benefits of MIS :

Q. State the primary functions of MIS.
Q. Enumerate the benefits of MIS

- We are living in a time of great change and working in an Information Age. Managers have to assimilate masses of data, convert that data into information, form conclusions about that information and make decisions leading to the achievement of business objectives.
- For an organization, information is as important a resource as money, machinery and manpower. It is essential for the survival of the enterprise.
- Before the widespread use of computers, many organizations found difficulties in gathering, storing, organizing and distributing large amounts of data and information. Developments in computer technology made possible for managers to select the information they required, in the form best suited for their needs and in time they want.
- The information has to be current and in many cases is needed by many people at the same time. So it has to be accurate, concise, timely, complete, well presented and storable. Most firms nowadays depend on IT.
- The term Management Information System (MIS) made its first appearance in U.S. Navy report on the use of computers to construct a single integrated system to manage all navy resources.
- The goal of the MIS organization is to deliver information systems to the various levels of corporate managers. MIS professionals create and support the computer system throughout the company.
- Trained and educated to work with corporate computer systems, these professionals are responsible in some way for nearly all of the computers, from the largest mainframe to the desktop and portable PCs.
- Its purpose is to help managers to solve structured problems. But it should also fulfill a number of other **purposes** :
  (i) It should provide a basis to analyze warning signals that can originate both externally and internally; this is the main function of database.
  (ii) It should automate routine operations thus avoiding human work in the processing tasks.
  (iii) It should assist management in making routine decisions.

(iv) It should provide the information necessary to make non-routine decisions.

(v) It should serve as a strategic weapon to gain competitive advantages.

Computer-based or manual system transforms data into information useful in the support of decision making. MIS can be classified as performing **three functions** :

1. **To generate reports** : For example, financial statements, inventory status reports, or performance reports needed for routine or non-routine purposes.
2. **To answer what-if questions asked by management**. : For example, questions such as "What would happen to cash flow if the company changes its credit term for its customers?" can be answered by MIS. This type of MIS can be called Simulation.
3. **To support decision making** : This type of MIS is appropriately called Decision Support System (DSS). DSS attempts to integrate the decision maker, the data base, and the quantitative models being used.

- Management Information System is an integrated man-machine system that provides information to support the planning and control function of manager in an organization.
- For example, an organization often processes a lot of data which it is required by law to furnish to various government regulatory agencies. Such a system, while it may have interfaces with an MIS, would not be a part of it, instances of such systems is salary disclosures and excise duty statements.
- Generally, MIS deals with information that is systematically and routinely collected in accordance with a well-defined set of rules. Thus, and MIS is a part of the formal information network in an organization.
- Normally, the information provided by an MIS helps the managers to make planning and control decisions. Now, we will see, what is planning and control. Every organization in order to function must perform certain operations. For Example, a car manufacturer has to perform certain manufacturing activities; a wholesaler has to provide water to its area of jurisdiction. All these are operations that need to be done.
- Besides these operations, an organization must make plans for them that it must decide on how many and what type of cars to make next month or what commissions to offer retailers or what pumping stations to install in the next five years.
- Also an organization must control the operations in the light of the plans and targets developed in the planning process. The car manufacturer must know if manufacturing operations are in line with the targets and if not, he must make decisions to correct the deviation or revise his plans. Similarly the wholesaler will want to know the impacts that his commissions have had on sales and make decisions to correct adverse trends.
- Effective Management Information Systems are needed by all business organizations because of the increased complexity and rate of change of today's business environment.
- For Example, Marketing manager need information about sales performance and trends,
- Financial manger returns, production managers needs information analyzing resources requirement and worker productivity and personnel manager require information concerning employee compensation and professional development?
- Thus, effective management information systems must be developed to provide modern managers with the specific marketing, financial, production and personnel information products they required to support their decision making responsibilities.

An MIS provides the following benefits :

1. **It facilitates planning** : MIS improves the quality of plants by providing relevant information for sound decision making. Due to increase in the size and complexity of organizations, managers have lost personal contact with the scene of operations.
2. **In Minimizes information overload** : MIS change the larger amount of data in to summarize form and thereby avoids the confusion which may arise when managers are flooded with detailed facts.
3. **MIS Encourages Decentralization** : Decentralization of authority is possibly when there is a system for monitoring operations at lower levels. MIS is successfully used for measuring performance and making necessary change in the organizational plans and procedures.
4. **It brings Coordination** : MIS facilities integration of specialized activities by keeping each department aware of the problem and requirements of other departments. It connects all decision centers in the organization.
5. **It makes control easier** : MIS serves as a link between managerial planning and control. It improves the ability of management to evaluate and improve performance. The used computers has increased the data processing and storage capabilities and reduced the cost.

- MIS assembles, process, stores, retrieves, evaluates and disseminates the information. To function effectively as an interacting, interrelated, and interdependent feedback tool for management and staff, MIS must be "useable."

- The **five elements** of a useable MIS system are: **timeliness, accuracy, consistency, completeness,** and **relevance.**
- **The usefulness of** MIS is hindered whenever one or more of these elements are compromised.

(1) Timeliness :

To simplify prompt decision making, an institution's MIS should be capable of providing and distributing current information to appropriate users. Information systems should be designed to expedite reporting of information. The system should be able to quickly collect and edit data, summarize results, and be able to adjust and correct errors promptly.

(2) Accuracy :

A sound system of automated and manual internal controls must exist throughout all information systems processing activities. Information should receive appropriate editing, balancing, and internal control checks. A comprehensive internal and external audit program should be employed to ensure the adequacy of internal controls.

(3) Consistency :

To be reliable, data should be processed and compiled consistently and uniformly. Variations in how data is collected and reported can distort information and trend analysis.

In addition, because data collection and reporting processes will change over time, management must establish sound procedures to allow for systems changes. These procedures should be well defined and documented, clearly communicated to appropriate employees, and should include an effective monitoring system.

(4) Completeness :

Decision makers need complete and pertinent information in a summarized form. Reports should be designed to eliminate clutter and voluminous detail, thereby avoiding "information overload."

(5) Relevance :

Information provided to management must be relevant. Information that is inappropriate, unnecessary, or too detailed for effective decision making has no value. MIS must be appropriate to support the management level using it.

The relevance and level of detail provided through MIS systems directly correlate to what is needed by the board of directors, executive management, departmental or area mid-level managers, etc. are in the performance of their jobs.

Syllabus Topic : Managing Information Systems

2.2 Managing Information Systems :

- Managing an information system within an organization necessitates organizational change. The introduction of an information system is much more than the mere introduction of new hardware and software.
- It involves changes in jobs, skills, management and organization. Whenever a new information system is being introduced in an organization the entire organization needs to be redesigned around the information system.
- Hence, it is necessary that the information systems manager understands how the new system will affect specific organizational processes and the organization as a whole.

2.2.1 Information System and Organizational Change :

The introduction of an information system ensue organizational change which may vary from incremental to ones which have far reaching consequences. These changes can be categorized as :

(i) Automation :

- The first and most evident form of organizational change is the process of automation that is an outcome of the introduction of the new information system.
- The new information system assists employees in performing their tasks more efficiently and effectively. Payroll system, computerised stock checking, and rail reservation system as seen in the case are all examples of automation.

(ii) Rationalization of Procedures :

- After automation the next effect of the information system is bound to be on the various procedures that run within the organization.
- Automation automatically induces rationalization of the procedures. Automation brings forth bottlenecks in the production system and makes one question the existing arrangement of procedures and structures.
- One of primary objective of information systems is to simplify the processes and streamline the workflows to take advantage of the system.
- Also, the rationalization of procedures which is imbibed in the programs brings about a series of continuous improvement in the quality of the organizations products and services.

(iii) Business Process Redesign :

- The third and more powerful organizational change is business process redesign in which the existing business processes are analysed, simplified and redesigned. The redesign of business processes warrants the reorganization of workflows, elimination of unnecessary and repetitive steps, restructuring of some jobs made redundant by the new system, etc.
- Thus, it is evident that business process redesign brings about a bigger change in the functioning of the organization. Many organizations had to redesign their processes to make them more effective and efficient.
- A look at any bank in your vicinity is a fine example of the effect that information systems have brought in organizations.

(iv) Paradigm Shift :

- However, the final effect that the information system may have on the organization will overshadow the previous two steps of **rationalization of procedures** and **business process redesign**.
- The new information system may ultimately affect the basic organizational design by transforming how the organization carries out its business and the nature of its business. This step brings about a radical change in the manner in which the organization carries out its business and hence is called as **paradigm shift**. A paradigm shift denotes a basic shift in the very nature of the organization. Such a shift is justified because of its benefits.

Syllabus Topic : Ethical and Social Issues

2.3 Ethical and Social Issues :

Introduction :

- History has time and again shown us that technology change is inevitable. Competitive economics virtually guarantees that the search for new products, new manufacturing techniques, and other ways to gain competitive advantage will continue.
- Changes in technology has a resounding effect, and brings about change in individuals, jobs, education, governments, and social interactions. The current rate of technological development has all the more highlighted this change. As components of society, each group has rights and responsibilities to others, such as a right to privacy and obligations regarding ethics.
- Technology's effect on individuals can be beneficial or detrimental. Often a change in technology helps one set of individuals and harms another group. Typical problems include loss of privacy, de-personalization, and changing incentives or motivations. Advantages include lower prices and better products and services.
- We have to understand one fact that Information Systems become ubiquitous. People as well as organizations have come to depend on them not only for success and survival, but also for the conduct of everyday transactions and activities. Computer systems have invaded nearly every aspect of our daily lives.
- As information technology advances, it creates a continuing stream of new issues pertaining to those parts of our lives that it impacts. In the business arena, information technology has presented ethical issues in **four areas: privacy, property, accuracy** and **access**. In addition, ethical issues surround the impact information technology has on us all.

2.3.1 Ethical Responsibilities for Business Professionals :

- Let us first begin with the word 'ethics'; the word 'ethics' is drawn from the Greek word 'ethos' which means character or custom. It signifies the character or attitude of a particular group of people, example 'the Indian ethos' or 'business ethos'.
- Hence 'Ethics' signifies;
  - Individual character and what it means to be a good person
  - Social rules that govern conduct, which helps in determining what is wrong and right.
- Our primary focus is going to be on ethics as it applies to business and invariably the people or the professionals working there. Business ethics can be defined as the study of what constitutes right and wrong, good or bad, with regards to human conduct in a business context.
- The ethics of a person are put to continuous test in business and hence it is very essential to develop a proper understanding of the subject. The importance of developing an understanding of ethics is all the more felt in today's business environment which demands the business person to build his reputation on integrity and be sensitive to the ramification of his business decision.
- For people to build their reputation on integrity and be sensitive to the ramification of their business decision, they must have high moral standards. Hence moral standards are the base for ethical conduct.

2.3.2 Professional Code of Conduct :

- Codes of conduct were created in part to give the public a sense of trust in a group of professionals. Professionals use the codes to define the limits of their activities and to help guide them in their businesses and organizations.
- These are the rules that govern the conduct of members of a given profession and are agreed to abide upon by all as a pre-condition for their engaging in that particular profession.
- In the event of violation, the person may be rebuked or in some extreme cases may also lose license to practice that particular profession. In some cases the code may even be unwritten and be accepted as a normal practice which has evolved over a period and is part of a common understanding. In other cases they are debated by an authoritative body till a consensus is built, making it easier to enforce them.
- In some cases the written rules are vague and hence proved to be of little value while in other cases they are specific and detailed.
- It is very difficult to generalize about the contents of the professional code of conduct; however they are a mix of moral rules, professional etiquette, and restrictions which benefit the economic interest of the group.
- The codes of conduct do not prove to be complete and reliable guide to one's moral obligation with respect to their chosen profession. The codes may or may not be taken seriously and are left to the discretion of the individual.

2.3.3 Ethical and Social Issues related to Systems :

- It probably goes without saying that the security and ethical issues raised by the Information Age and specifically the Internet are the most explosive to face our society in decades. It will be many years and many court battles before socially acceptable policies and practices will be in place and that too will surely be put to test when the user is introduced to new developments.

  Many a times we are surprised and love it when a particular site that we visit often display products which we like. These sites are very well aware of our likes and dislikes and hence won't bother us with products which we don't like.

Five Moral Dimensions of the Information Age :

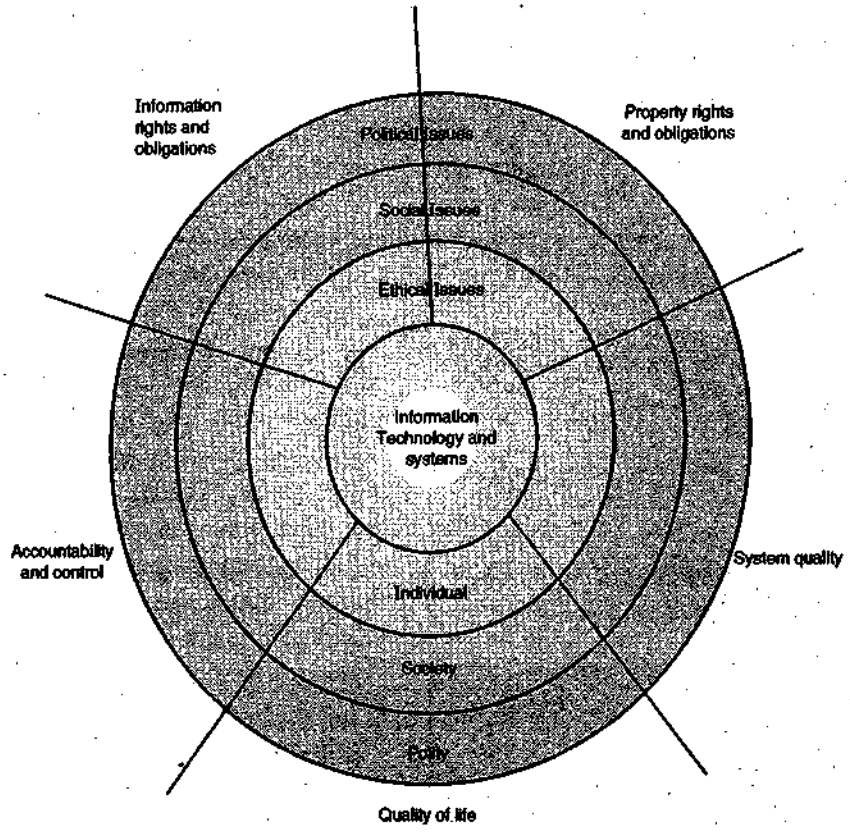


Fig. 2.3.1 : Ethical, Moral, Political issues in an Information Society

- Fig. 2.3.1 shows the relationship between ethical, social, and political issues in an information society. Information technologies pose problems and threats to established societal rules, and new advances pose new situations and possible threats to privacy and ethics.
- There is a normal tendency to think that no one will care what you do on the net, you need to think twice before you do that. Companies are accessing databases from various sources as a part of the screening process to determine the kind of websites the prospective employees has visited and this is all possible because of data mining.
- Ethics is easily managed in small groups because the group itself tends to control the individual's behavior but as the group grows, the harder it is to manage the actions of individuals.

2.3.4 Ethics in an Information Society :

Q. Describe the ethical issues in information society

- While using the internet or just the computer the user should be aware of;
  - (i) **Responsibility:** accepting potential costs, duties, and obligations for your decisions.
  - (ii) **Accountability:** determining who should take responsibility for decisions and actions.
  - (iii) **Liability :** legally placing responsibility with a person or group.
  - (iv) **Due Process :** ensuring the laws are applied fairly and correctly.
- The **responsibility, accountability and liability** are always of the user when it comes to the internet. Using information technology in a socially responsible manner means that the user will be held accountable for the consequences of his actions.
- Just as, we as citizens are subject to rules, whether we like them or not, in public, we are subject to societal rules in cyberspace. Anonymity should not be taken as a license to carry out socially unacceptable acts.
- The user should be aware that every Internet Service Provider has a "usage policy" and this includes even the email service provider who hides your identity. In the event of your actions violating their usage policy they can terminate your services which may prove to be embarrassing.
- In case you are faced with a situation in which your ethics are challenged, how should you handle the situation?
  - o Separate fact from fiction
  - o Remember every coin has two sides, hence you need to examine both the sides
  - o Identify the violator
  - o If possible arrive at a compromise solution
  - o Anticipate the outcome as it helps you in arriving at better solutions

2.3.5 Information Rights : Privacy and Freedom in an Information Society :

- There have been some attempts to regulate the collection and use of information about individuals.

Fair Information Practices Principles :

- There should be no personal record systems whose existence is secret.
- Individuals have rights of access, inspection, review, and amendment to systems that contain information about them.
- There must be no use of personal information for purpose other than those for which it was gathered without prior consent.
- Managers of system are responsible and can be held accountable and liable for the damage done by system for their reliability and security.
- Government has the right to intervene in the information relationship among private parties.
- Many of us take our privacy and freedom for granted. We should be aware of how technology is changing and challenging our basic assumptions about these issues. We all assume our personal privacy and freedom from surveillance.
- If someone set up a video camera inside our room to monitor our every movement, what would you do? In some cases, that's similar to what happens when you access some Web sites. So how do we protect our privacy and freedom from surveillance in a high-tech world? Many sites collect information about their users surfing habits and sell this information to other companies and in no way can we stop them.
- If information is supposedly collected for one purpose, is it ethical for that information to be used for a totally different purpose without you knowing it? Is it fair to require you to provide medical information that is primarily intended to be used to pay your insurance bills and then have that same information used against you when the insurance company deems you too expensive and cancels your policy? Is it fair to have that same information used against you in denying you employment because you're too expensive to hire?

- Spamming (unsolicited emails) has been challenged in the courts by Internet Service Providers (ISP) as an unfair practice. The ISPs say the thousands of emails clog their systems and no one wants them anyway. The spammers argue their right to Freedom of Speech is violated if they can't send emails to anyone they want.

2.3.6 Management Actions : A Corporate Code of Ethics :

- Many firms have not established a Code of Ethics or a policy for employee conduct when computing in today's workplace. Some corporations are confused about what to include and how to approach this new dilemma.
- Following **five moral dimensions** would be a good start that businesses and their managers should recognize :
  1. The information rights to privacy and freedom.
  2. The property rights to individual ideas and efforts.
  3. The accountability, liability and control issues involved in using technology.
  4. The system quality requirements of businesses and individuals.
  5. The quality of life impact of technology.

Companies can no longer ignore the necessity of establishing rules for technology usage. The issue will only continue to grow. If we work for a company that doesn't have a policy, we should encourage it to establish one immediately.

Syllabus Topic : Information Systems Security and Control

2.4 Information Systems Security and Control :

Introduction :

- The term 'cyber/computer crime' is a misnomer. This term has nowhere been defined in any Statute /Act passed or enacted by the Indian Parliament.
- The concept of cyber crime is not radically different from the concept of conventional crime. Both include conduct whether act or omission, which cause breach of rules of law and counterbalanced by the sanction of the state.
- Before evaluating the concept of cyber crime it is obvious that the concept of conventional crime be discussed and the points of similarity and deviance between both these forms may be discussed.

2.4.1 Conventional Crime :

- Crime is a social and economic phenomenon and is as old as the human society. Crime is a legal concept and has the sanction of the law. Crime or an offence is "a legal wrong that can be followed by criminal proceedings which may result into punishment."
- The hallmark of criminality is that, it is breach of the criminal law. Per Lord Atkin "the criminal quality of an act cannot be discovered by reference to any standard but one: is the act prohibited with penal consequences".
- A crime may be said to be any conduct accompanied by act or omission prohibited by law and consequential breach of which is visited by penal consequences.

2.4.2 Cyber Crime :

- Cyber Crime is the latest and perhaps the most complicated problem in the cyber world. "Cyber crime may be said to be those species, of which, genus is the conventional crime, and where either the computer is an object or subject of the conduct constituting crime". "Any criminal activity that uses a computer either as an instrumentality, target or a means for perpetuating further crimes comes within the ambit of cyber crime".
- A generalized definition of cyber crime may be "unlawful acts wherein the computer is either a tool or target or both". The computer may be used as a tool in the following kinds of activity- financial crimes, sale of illegal articles, pornography, online gambling, intellectual property crime, e-mail spoofing, forgery, cyber defamation, cyber stalking. The computer may however be target for unlawful acts in the following cases- unauthorized access to computer/ computer system/ computer networks, theft of information contained in the electronic form, e-mail bombing, data didling, salami attacks, logic bombs, Trojan attacks, internet time thefts, web jacking, theft of computer system, physically damaging the computer system.

2.4.2.1 Reasons for Cyber Crime :

- Hart in his work "The Concept of Law" has said 'human beings are vulnerable so rule of law is required to protect them'. Applying this to the cyberspace we may say that computers are vulnerable so rule of law is required to protect and safeguard them against cyber crime.
- The reasons for the vulnerability of computers may be said to be :

1. **Capacity to store data in comparatively small space :**

The computer has unique characteristic of storing data in a very small space. This affords to remove or derive

information either through physical or virtual medium makes it much more easier.

2. **Easy to access :**

The problem encountered in guarding a computer system from unauthorised access is that there is every possibility of breach not due to human error but due to the complex technology. By secretly implanted logic bomb, key loggers that can steal access codes, advanced voice recorders; retina imagers etc. that can fool biometric systems and bypass firewalls can be utilized to get past many a security system.

3. **Complex :**

The computers work on operating systems and these operating systems in turn are composed of millions of codes. Human mind is fallible and it is not possible that there might not be a lapse at any stage. The cyber criminals take advantage of these lacunas and penetrate into the computer system.

4. **Negligence :**

Negligence is very closely connected with human conduct. It is therefore very probable that while protecting the computer system there might be any negligence, which in turn provides a cyber criminal to gain access and control over the computer system.

5. **Loss of evidence :**

Loss of evidence is a very common & obvious problem as all the data are routinely destroyed. Further collection of data outside the territorial extent also paralyses this system of crime investigation.

2.4.2.2 Cyber Criminals :

- The cyber criminals constitute of various groups/ category. This division may be justified on the basis of the object that they have in their mind.
- The following are the categories of cyber criminals :

1. **Children and adolescents between the age group of 6 - 18 years :**

The simple reason for this type of delinquent behaviour pattern in children is seen mostly due to the inquisitiveness to know and explore the things. Other cognate reason may be to prove themselves to be outstanding amongst other children in their group.

2. **Organised hackers :**

These kinds of hackers are mostly organised together to fulfil certain objective. The reason may be to fulfil their political bias, fundamentalism, etc. The Pakistanis are said to be one of the best quality hackers in the world. They mainly target the Indian government sites with the purpose to fulfil their political objectives.

3. **Professional hackers / crackers :**

Their work is motivated by the color of money. These kinds of hackers are mostly employed to hack the site of the rivals and get credible, reliable and valuable information. Further they are men employed to crack the system of the employer basically as a measure to make it safer by detecting the loopholes.

4. **Discontented employees :**

This group includes those people who have been either sacked by their employer or are dissatisfied with their employer. To avenge they normally hack the system of their employee.

2.4.2.3 Mode and Manner of Committing Cyber Crime :

Q. Enumerate the various modes of committing cyber crime.

1. **Unauthorized access to computer systems or networks/Hacking :**

This kind of offence is normally referred as hacking in the generic sense. However, the framers of the Information Technology Act 2000 have nowhere used this term so to avoid any confusion we would not interchangeably use the word hacking for 'unauthorized access' as the latter has wide connotation.

2. **Theft of information contained in electronic form :**

This includes information stored in computer hard disks, removable storage media etc. Theft may be either by appropriating the data physically or by tampering them through the virtual medium.

3. **Email bombing :**

This kind of activity refers to sending large number of mails to the victim, which may be an individual or a company or even mail servers there by ultimately resulting into crashing.

4. **Data diddling :**

This kind of an attack involves altering raw data just before a computer processes it and then changing it back after the processing is completed. The electricity board faced similar problem of data diddling while the department was being computerised.

5. **Salami attacks :**

This kind of crime is normally prevalent in the financial institutions or for the purpose of committing financial crimes. An important feature of this type of

offence is that the alteration is so small that it would normally go unnoticed.

6. **Denial of Service attack :**

The computer of the victim is flooded with more requests than it can handle which causes it to crash. Distributed Denial of Service (DDoS) attack is also a type of denial of service attack, in which the offenders are wide in number and widespread.

7. **Virus / worm attacks :**

Viruses are programs that attach themselves to a computer or a file and then circulate themselves to other files and to other computers on a network. They usually affect the data on a computer, either by altering or deleting it.

Worms, unlike viruses do not need the host to attach themselves to. They merely make functional copies of themselves and do this repeatedly till they eat up all the available space on a computer's memory. E.g. love bug worm, which affected at least 5 % of the computers of the globe.

8. **Logic bombs :**

These are event dependent programs. This implies that these programs are created to do something only when a certain event (known as a trigger event) occurs. E.g. even some viruses may be termed logic bombs because they lie dormant all through the year and become active only on a particular date.

9. **Trojan attacks :**

This term has its origin in the word 'Trojan horse'. In software field this means an unauthorized programme, which passively gains control over another's system by representing itself as an authorised programme. The most common form of installing a Trojan is through e-mail.

10. **Internet time thefts :**

Normally in these kinds of thefts the Internet surfing hours of the victim are used up by another person. This is done by gaining access to the login ID and the password. E.g. Colonel Bajwa Case.

The internet hours were used up by any other person. This was perhaps one of the first reported cases related to cyber crime in India. However this case made the police infamous as to their lack of understanding of the nature of cyber crime.

11. **Web jacking :**

This term is derived from the term hijacking. In these kinds of offences the hacker gains access and control over the web site of another. He may even mutilate or change the information on the site. This may be done for fulfilling political objectives or for money.

E.g. recently the site of MIT (Ministry of Information Technology) was hacked by the Pakistani hackers and some obscene matter was placed therein. Further the site of Bombay crime branch was also web jacked. Another case of web jacking is that of the 'Gold Fish' case. In this case the site was hacked and the information pertaining to gold fish was changed. Further a ransom of US $ 1 million was demanded as ransom. Thus web jacking is a process whereby control over the site of another is made backed by some consideration for it.

2.4.2.4 Classification of Cyber Crime :

- The subject of cyber crime may be broadly classified under the following three groups.
- They are 4 groups given :

1. **Against Individuals :**
   - i. Harassment via e-mails.
   - ii. Cyber-stalking.
   - iii. Dissemination of obscene material.
   - iv. Defamation.
   - v. Unauthorized control/access over computer system.
   - vi. Indecent exposure
   - vii. Email spoofing
   - viii. Cheating & Fraud

2. **Against Individual Property :**
   - i. Computer vandalism.
   - ii. Transmitting virus.
   - iii. Netrespass
   - iv. Unauthorized control/access over computer system.
   - v. Intellectual Property crimes
   - vi. Internet time thefts

3. **Against Organization :**
   - i. Unauthorized control/access over computer system
   - ii. Possession of unauthorized information.
   - iii. Cyber terrorism against the government organization.
   - iv. Distribution of pirated software etc.

4. **Against Society at large :**
   - i. Pornography (basically child pornography).
   - ii. Polluting the youth through indecent exposure.

iii. Trafficking
iv. Financial crimes
v. Sale of illegal articles
vi. Online gambling
vii. Forgery

2.4.2.5 Statutory Provisions :

- The Indian Parliament considered it necessary to give effect to the resolution by which the General Assembly adopted Model Law on Electronic Commerce adopted by the United Nations Commission on Trade Law. As a consequence of which the Information Technology Act 2000 was passed and enforced on 17th May 2000.
- The preamble of this Act states its objective to legalise e-commerce and further amend the Indian Penal Code 1860, the Indian Evidence Act 1872, the Banker's Book Evidence Act1891 and the Reserve Bank of India Act 1934.
- The basic purpose to incorporate the changes in these Acts is to make them compatible with the Act of 2000. So that they may regulate and control the affairs of the cyber world in an effective manner.
- The Information Technology Act deals with the various cyber crimes in chapters IX & XI. The important sections are Ss. 43,65,66,67. Section 43 in particular deals with the unauthorised access, unauthorised downloading, virus attacks or any contaminant, causes damage, disruption, denial of access, interference with the service availed by a person.
- This section provide for a fine up to Rs. 1 Crore by way of remedy. Section 65 deals with 'tampering with computer source documents' and provides for imprisonment up to 3 years or fine, which may extend up to 2 years or both. Section 66 deals with 'hacking with computer system' and provides for imprisonment up to 3 years or fine, which may extend up to 2 years or both.
- Further section 67 deals with publication of obscene material and provides for imprisonment up to a term of 10 years and also with fine up to Rs. 2 lakhs.

2.4.2.6 Prevention of Cyber Crime :

- Prevention is always better than cure. It is always better to take certain precaution while operating the net. And should make them his part of cyber life.
- Saileshkumar Zarkar, technical advisor and network security consultant to the Mumbai Police Cyber crime Cell, advocates the **5P mantra** for online security: **Precaution, Prevention, Protection, Preservation** and **Perseverance.**

A citizen should keep in mind the following things :

1. To prevent cyber stalking avoid disclosing any information pertaining to oneself. This is as good as disclosing your identity to strangers in public place.
2. Always avoid sending any photograph online particularly to strangers and chat friends as there have been incidents of misuse of the photographs.
3. Always use latest and updated anti- virus software to guard against virus attacks.
4. Always keep back up volumes so that one may not suffer data loss in case of virus contamination
5. Never send your credit card number to any site that is not secured, to guard against frauds.
6. Always keep a watch on the sites that your children are accessing to prevent any kind of harassment or depravation in children.
7. It is better to use a security programme that gives control over the cookies and send information back to the site as leaving the cookies unguarded might prove fatal.
8. Web site owners should watch traffic and check any irregularity on the site. Putting host-based intrusion detection devices on servers may do this.
9. Use of firewalls may be beneficial.
10. Web servers running public sites must be physically separate protected from internal corporate network.

2.4.2.7 Adjudication of a Cyber Crime :

On the directions of the Bombay High Court the Central Government has by a notification dated 25.03.03 has decided that the Secretary to the Information Technology Department in each state by designation would be appointed as the AO for each state.

2.4.2.8 Conclusion :

- Capacity of human mind is unfathomable. It is not possible to eliminate cyber crime from the cyber space. It is quite possible to check them. History is the witness that no legislation has succeeded in totally eliminating crime from the globe.
- The only possible step is to make people aware of their rights and duties and further making the application of the laws more stringent to check crime.

2.5 Hacking :

Q. What is hacking? Describe the different types of hackers.

- Hacking is the process of achieving access to a computer or computer network without legal authorization. A hacker is a person who has a great deal

of knowledge about the working of computer systems and their security.

- Originally, the term hacking or hacker had no negative connotations; on the other hand it indicated that the person had great deal of computer prowess. As times changed so has the connotation, today the term frequently refers to cybercriminals.
- It is the most common activity amongst teenagers and young adults. Many hackers are keen to learn about computers and consider hacking as an art. They want to build programs to display their problem solving skills and not to harm others.
- A hacker first tries their skills on easy targets and then after successful professional attacks on more secured sites. Their goal is to have complete access on any computer so that they can delete, edit or comply any files or directory and also can install any program.
- Computer hackers are employed by many companies to get complete access on the computer so that they can delete, edit, copy any file or install as their technical staff. These hackers use their skills to find faults in company's security system so that it can be repaired quickly. Sometimes hacking also prevents serious identity related crimes.
- It is an offence if hackers steal private information or changes some financial or personal data. All the types of unauthorized access can lead the hacker towards the prison for 20 years.
- One way of hacking is to get a copy of password file which stores all usernames and password in encrypted form or they can also use brute-force attack trying all the possible combinations of letters.
- Hacking is also done by emailing a program to anyone that runs automatically when clicked on some link or attachment. In this way you can install a program on a computer that can give you access of that computer. Another method of hacking is IP spoofing. IP spoofing is the creation of internet protocol packets with the fake IP address in order to conceal the identity of the sender.
- To protect your computer from hacking, you should install firewalls or other antivirus programs on the computer and also check for the updating of the machine at regular intervals.

2.5.1 Types of Hackers :

We have seen what the term 'hacker' means, but it would not be fair to club every hacker as some sort of a criminal and hence it is essential to study the various **types of hackers** and understand their motives and reasons for their behavior.

1. **The White Hat Hacker :**
   - These are the good guys of hacking mostly working as security professionals. These people work within the law and access only those systems which they are permitted to. The objective of their accessing systems is to identify and fix security flaws.
   - White hat hackers closely monitor the net to stay abreast with the latest information on hacking, vulnerabilities, and attacks. As it is their job to ensure that the vital information of the organization is protected from other hackers they are privy to the highest level of access and have an in-depth knowledge of a company's security vulnerabilities.
   - These hackers need to win over the trust of the management which means that they have to maintain the extremely high ethical standards. A new trend has emerged of companies hiring reformed hackers those who have gained their knowledge and expertise through less reputable activities. This is a highly risky practice which may backfire and hence not recommended.
2. **The Ethical or Grey Hat Hacker :**
   - These hackers are not employed by the company but find security lapses in the company's system and report them. As these are ethical hackers they may give the company a chance to fix the problem before they make it public.
   - In some cases they may immediately publicize the lapse in the company's system, providing an opportunity on a platter to other malicious hackers to exploit the lapse. Although their intentions may not be malicious it is still a crime.
   - On their part these hackers feel that they are doing a service to customers by forcing companies to provide better security and products. An attack by an Ethical hacker is obviously better than one by someone with malicious intent.
3. **The Script Kiddy :**
   - As the name itself indicates the script for the hacking is written by someone more experienced and carried out by some unskilled hackers. These are usually teenagers seeking some thrill and fame, hence called Script Kiddies.
   - Howsoever, novice or un-malicious their intent, they may gain access and disrupt systems, or deface web pages. These hackers are easier to detect and catch but their attacks can still be very damaging and embarrassing.

- Surely would not spell well for the company's reputation if its customers learn that the company's system has been hacked by a kid.

4. **The Hacktivist :**
   - These are hackers who hack to spread a social message or awareness. The act is purely to draw attention to a particular cause in which the company may be involved. These hackers use computer knowledge to promote a political or social cause.
   - These hackers may be novices or experienced hackers. It has usually been found that the target company or organization has been involved in some controversial business practices.
5. **The Cracker or Black Hat Hacker :**
   - These are the hacker that everyone should watch out for, they have malicious intent and use their knowledge to commit crimes. These crimes include vandalism, destruction of property, fraud, theft, corporate or government espionage, and terrorism.
   - They are aware that their acts are illegal, and consequently. They are highly professional, and sophisticated, they enter systems undetected and leave behind little evidence. As their intent is to cause harm they do not publicize their conquest which makes them the most challenging hackers to detect or catch.

2.6 Cyber Theft :

- We are currently living in Cyber age, where Internet and computers have major impacts on our way of living, social life and the way we conduct businesses.
- The usage of information technology has posed great security challenges and ethical questions in front of us. Just as everything has positives and negatives, usage of information technology is beneficial as well as insecure.
- With the growth of the internet, network security has become a major concern. Cyber crimes have emerged rapidly in the last few years and have major consequences. Cyber criminals are doing everything from stealing money, hacking into others computer, stealing intellectual property, spreading viruses and worms to damage computers connected on the internet and committing frauds.
- Stoppage of cyber crimes is a major concern today. Cyber criminal makes use of the vulnerabilities in computer software's and networks to their advantage.

Cyber-Theft :

- Cyber-Theft is the use of computers and communication systems to steal information in electronic format. Hackers crack into the systems of banks and transfer money into their own bank accounts. This is a major concern, as larger amounts of money can be stolen and illegally transferred.
- There is a vast increase in the number of computer viruses and they are designed in such a way that they steal the personal information such as bank account numbers, credit cards data.
- There had been attacks by many programs, which includes invisible threats such as worms and Trojan horses and they've jumped over 40 percent in the first half of this year, according to the reports.
- Many of the viruses are designed to mine personal computers for data ranging from the house address to the online banking password. Moreover, others can even access and take over the computer, which hackers use to carry out other attacks, and shield their identification from law-enforcement agencies.
- Personal data can be worth a small fortune in the underground economy; hackers bought and sold US$276 million worth of such data from July last year to June, said a report yesterday by security company Symantec.
- A malicious rise has increased in the hackers profile which moves away from the pimply teenager seeking online fame to organized crime syndicates looking for new revenue streams.
- Microsoft platform strategy manager Matthew Hardman said social networking sites, like Facebook, are among the most commonly targeted because of their huge communities of users concluding by saying the malicious code may be hidden inside Facebook applications or in links under photographs.
- Experts say Internet users can keep safe by being circumspect about sharing personal information, and making sure their computers have up-to-date anti-virus programs.
- Many newsletters on the internet provide the investors with free advice recommending stocks where they should invest. Sometimes these recommendations are totally bogus and cause loss to the investors. Credit card fraud is also very common.
- Cyber-theft is the most common and the most reported of all cyber-crimes. Cyber-theft is a popular cyber-crime because it can quickly bring experienced cyber-criminal large cash resulting from very little effort. Furthermore, there is little chance, a professional cyber-criminal will be apprehended by law enforcement.

Solutions :

An important question arises that how can these crimes be prevented. A number of techniques and solutions have been presented but the problems still exist and are increasing day by day.

Antivirus and Anti Spyware Software :

Antivirus software consists of computer programs that attempts to identify, thwart and eliminate computer viruses and other malicious software. Anti spy wares are used to restrict backdoor program, trojans and other spy wares to be installed on the computer.

Firewalls :

A firewall protects a computer network from unauthorized access. Network firewalls may be hardware devices, software programs, or a combination of the two. A network firewall typically guards an internal computer network against malicious access from outside the network.

Cryptography :

Cryptography is the science of encrypting and decrypting information. Encryption is like sending a postal mail to another party with a lock code on the envelope which is known only to the sender and the recipient. A number of cryptographic methods have been developed and some of them are still not cracked.

Cyber Ethics and Laws :

Cyber ethics and cyber laws are also being formulated to stop cyber crimes. It is a responsibility of every individual to follow cyber ethics and cyber laws so that the increasing cyber crimes shall reduce. Security software's like anti viruses and anti spy wares should be installed on all computers, in order to remain secure from cyber crimes. Internet Service Providers should also provide high level of security at their servers in order to keep their clients secure from all types of viruses and malicious programs.

Syllabus Topic : Information Technology Infrastructure & Choices

2.7 Information Technology Infrastructure & Choices :

Introduction :

- Information Technology infrastructure can be defined as the shared technology resources that provide the platform for the firm's information systems applications. The infrastructure includes hardware, software and people that are shared across the entire organization.
- The infrastructure is developed keeping in mind the customer and provides the foundation for serving customers, interacting with suppliers and managing the internal business processes.

2.7.1 Defining the IT Infrastructure :

- As discussed earlier IT infrastructure consists of physical devices (hardware) and software applications that are required to run the entire organization.
- However, there is another component that is as important as the other two and that component is people. Thus, IT infrastructure can be said to be a set of services comprising of both human and technical capabilities.

IT Infrastructure comprises of the following :

(i) Computing platform that connects the organization with its customers and suppliers and includes mainframes, midrange computers, desktops, laptops and handheld devices such as mobiles.

(ii) Telecommunication devices that provide connectivity to employees, customers and suppliers.

(iii) Data management services that facilitate storing and management of data as well as analysis of stored data.

(iv) Application software that enhance the capabilities of the organization and include enterprise resource planning (ERP), supply chain management (SCM), customer relationship management (CRM), management information system (MIS), knowledge management system, etc. The application software is shared by the entire organization.

(v) Hardware management services that manage all the physical installations required for computing, telecommunication and data management.

(vi) IT management services that are involved in the planning and development of the IT infrastructure. These services have to coordinate with every unit within the organization and manage the entire project of development of the IT infrastructure.

(vii) IT standard services frame the policies that determine the manner in which the information technology will be used.

(viii) IT education service provides identifies the training requirement of the organization and provides training to employees and managers.

2.7.2 Evolution of IT Infrastructure :

I. The Mainframe Era :

- The first step in the commercial adoption of computers was when IBM introduced the IBM 360 series of mainframe computers. The 360 range of mainframes were in the truest sense the first commercial computers as they had a very powerful operating system that enabled time sharing and multi-tasking.
- This range of mainframes enabled connecting thousands of remote terminals to the centralised mainframe using proprietary communication protocols and proprietary data lines.
- However, the era was marked by highly centralised computing under the supervision of professional programmers. Usually the entire IT infrastructure was provided by a single manufacturer.

II. The Era of Minicomputers :

The introduction of minicomputers brought about a sea change in the pattern of computing. Minicomputers were low in price as compared to mainframes thus enabling the organization to decentralise computing and address the specific needs of individual departments.

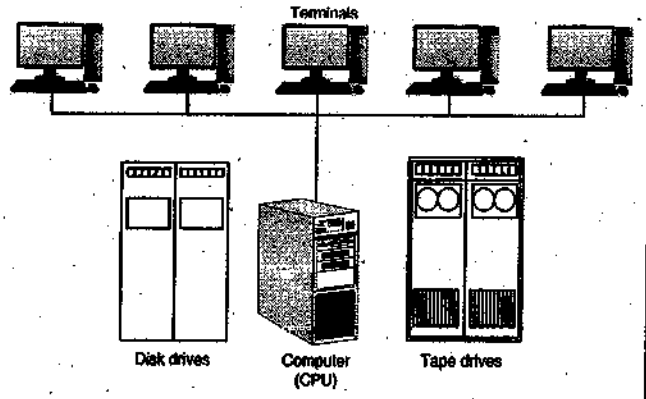


Fig. 2.7.1

III. The Era of Personal Computers :

Although, personal computers were introduced way back in the 70s they in a real sense were able to make a big impact in the 80s, with the introduction of IBM personal computers. These computers used DOS operating system and later on Windows. These systems can work as standalone devices as well as can be connected into networks.

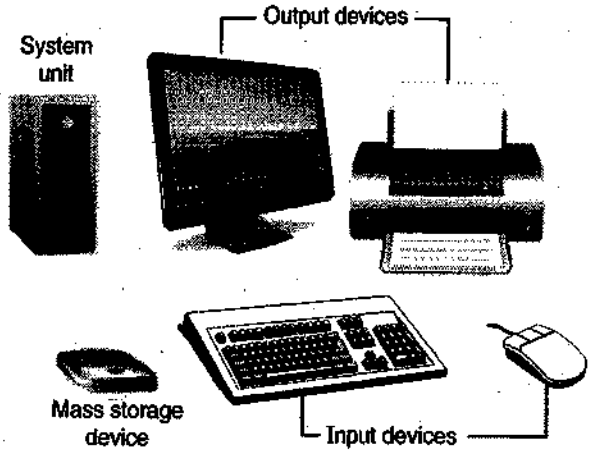


Fig. 2.7.2

IV. The Client-Server Era :

- In the client-server computing the personal computers or laptops (clients) are networked to a powerful computer (server) that provides the client with the required services. The client computer is operated by the user who inputs his requirement and the server processes the request and shares the stored data. The term "server" indicates both the software application as well as the computer on which the software is installed.
- In the initial stage of this era the server was usually the mainframe, however with they have been replaced with more powerful versions of personal computers.

There are primarily two types of client-server networks :

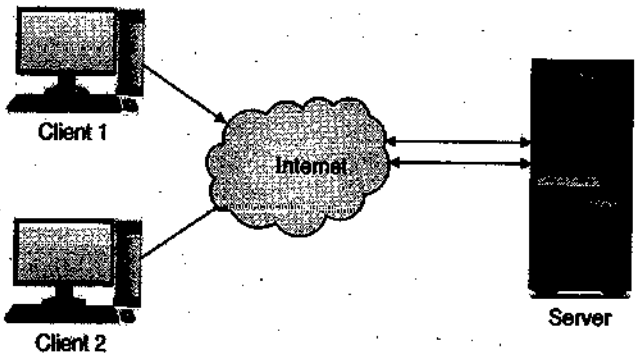


Fig. 2.7.3

(1) Two tiered client-server architecture :

This is the simplest form of client-server network. Here the client computer is networked to a server computer and processing is split between these two machines. This form of network is found in many small businesses.

(2) Multitier client-server architectures

- This is a complex form of client-server architecture wherein the work of the entire network is divided over several different levels of servers depending upon the kind of services being requested.
- At the first level, a web server serves a web page to the user in response to his request for service. The web server upon receiving request from the user will pass it to the application server. The web server is responsible for locating and managing stored web pages.
- The application server handles all application operations between the user and the back end operations of the organization. The application server may be a dedicated computer or may reside on the same computer as the web server.

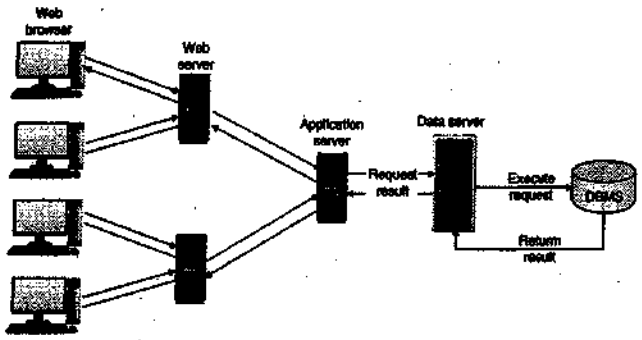


Fig. 2.7.4

V. Enterprise Computing Era :

- The multitier client-server architecture did not suffice the requirements of modern business organization which needed to integrate disparate networks and applications throughout the organization. Therefore, to facilitate such integration, organizations adopted software tools that could enable such an enterprise wide infrastructure.
- The advancement in internet technologies resulted in IT infrastructure that could link different computer hardware and network into an enterprise wide network to enable the free flow of information between the organization.

VI. Cloud and Mobile Computing :

The growing power of the internet has made advancements in the client-server model and pushed it to the cloud computing model. Cloud computing provides the user access to a shared pool of computing resources over the internet. These computing resources include computers, applications, services and storage. These resources can be accessed as an when needed from any location.

2.7.3 Infrastructure Components :

The IT Infrastructure is composed of :

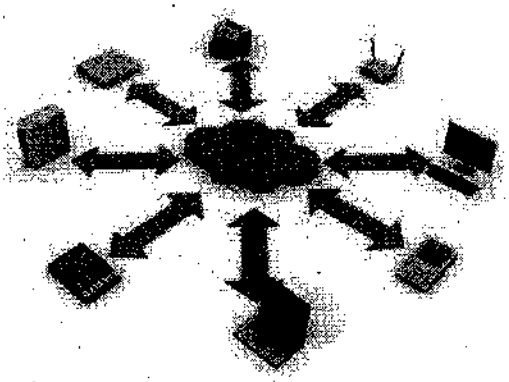


Fig. 2.7.5

- Computer Hardware Platforms
- Operating Systems Platform
- Enterprise Software Application
- Telecommunication
- System Integrators
- Data Management and Storage
- Internet Platforms

Case Study

CASE STUDY - I

Information Technology Infrastructure in a Bank

Introduction :

Advancements in information technology infrastructure have prompted many contemporary firms in India to make investments in it to build strategies, improve profitability and provide extended services. The banking sector is no different and has adopted the inevitability of investing in information technology in a big way. Also, the banking industry has undergone through testing times and has witnessed various expansions and contractions for survival. The number of banks in the country have also risen exponentially bringing along with it a new phase of organizational reforms. The reasons for investing in Information Technology Infrastructure include increased convenience, increase access to information, speed of transactions and new levels of customer segmentation. Information technology in the banking sector can be divided into two areas:

1. Electronic Commerce
2. Electronic Banking

Electronic banking

It can be described as the act of carrying out the business transaction of a bank using electronic devices.

Examples of electronic devices that are used includes :

- Computer Systems,
- Global system for Mobile Communication (GSM) phones,
- Automated Teller Machine (ATM),
- Internet facilities,
- Optical Character Recognition (OCR),
- Smart Cards, funds transfer,
- Electronic mail,
- Bankers Automated clearing Services (BACS),
- Point-of-sales (POS)

E-banking is about using the technology infrastructure of the digital age to create opportunities. E-Banking enables the dramatic lowering of transaction costs, and the creation of new types of banking opportunities that will address the barriers of time and distance.

E-commerce is a system, which includes transaction that centers on buying and selling of goods and services online to directly generate revenue. E-Commerce builds on the advantages of traditional commerce by adding the flexibility offered by electronic networks. E-Commerce provides consumers the ability to bank, invest, purchase, distribute, communicate, explore and research from virtually anywhere an internet connection can be obtained. Again the term Customer Service Delivery(CSD) is not new in the business environment, because every consumer exercises awareness as touching his needs and wants, also service providers being knowledgeable about this awareness ensures that customers receives quality. The key to customer service delivery lies in making the few minutes of a customer convenient, efficient and effective. For instance, a bank introduces welcome kits wherein, a customer comes into open an account with the bank walks out with a fully enabled account debit card, cheque book, net banking account, and phone banking account in a matter of minutes. However, this business not only leads to customer convenience, they also help the banks save on cost, identify customer needs and tailoring products to match these needs. Furthermore, Customer Service Delivery (CSD) practice helps enhance a firm's competitive positioning, enhance reliability, courtesy, and access to good services.

Information Technology Infrastructure in Bank:

Information technology infrastructure can be defined as the physical services, and the management that supports all computing resources in an organization and include operations, documentation, integration, and maintenance. Thus, information technology infrastructure includes both the technical and managerial expertise to provide reliable service.

These resources include :

1. Computer hardware and software (e.g. operating systems);
2. Network and telecommunications technologies;
3. Key Data;
4. Core data - processing applications;
5. Shared Information Technology Services

Information Technology infrastructure include the alignment of information technology plans to business objectives, the information technology architecture, and the skills of information technology personnel. It is the enabling foundation of shared information technology capabilities upon which the entire business depends. This foundation is standardized and shared by business functions within the organization, and typically used by different organizational applications.

From the above discussion we can deduct that information technology infrastructure is composed by two components :

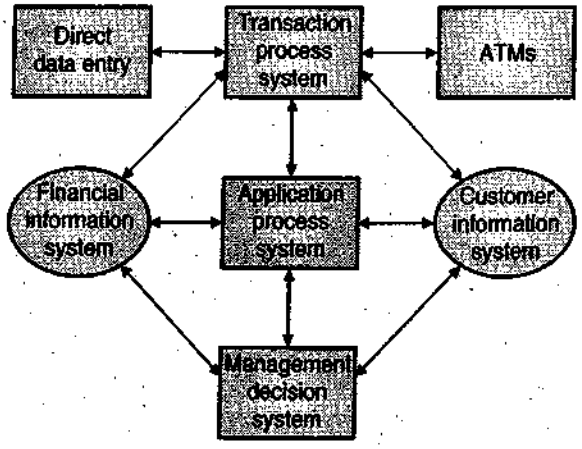


Fig. 1

Technical information technology infrastructure

Human information technology infrastructure

The technical aspect of information technology infrastructure consists of the applications, data and technology while the human aspect of Information Technology Infrastructure consists of the knowledge and capabilities required to handle organizational Information Technology resources. Information Technology Infrastructure capabilities provide the foundation for competitive advantage. A robust IT Infrastructure enables employees to be able to perform their respective jobs, both from having the available technology and the necessary technological skills.

There is direct link between the firm's information technology and its performance. There are three factors that influence performance, namely, the quality of IT management practices, IT management processes should sense, gather, organize and disseminate information in other words IT management is positively related to a firms performance and continual existence. Information technology infrastructure capabilities in firm impacts customer focus and market focus. This in other words means that IT infrastructure capabilities enable firms to position their IT asset so as to capture information about customers as well as disseminate information to customer in other to create satisfaction.

The Challenge :

You have been entrusted with the setting up of information technology infrastructure for a cooperative bank located in Pune that offers a full range of financial products and services, including consumer banking, corporate and investment banking, insurance management and retail banking and had over 20 branches all over the city and the major city of the state. The bank wants to make the entire process of banking very pleasant for its customer and has identified the process of opening an account within any of its branches as the first step in its endeavor to transform its processes.

The account opening process was cumbersome and time consuming, requiring filling of various forms and the submission of different documents. The bank decided to simplify the process and linked the account opening to the Adhar Card which could be scanned and all the information contained in it would be automatically transferred to the account opening form of the bank.

Also, the bank is looking to improve the banking experience for the existing customer by enabling him to know the status of his account, loan assistance for specific needs with a reasonable rate of interest and faster transaction execution. Another issue that the bank plans to address through the infrastructure is that of integration of all its business processes and build a network that will cover all its processes and enable employee communication and transfer of documents.

You, as the information technology expert have been asked to submit your report regarding the technology infrastructure that will be needed to address all the requirements of the bank.

CASE STUDY - II

Information Technology Infrastructure in a Manufacturing/Process Industry

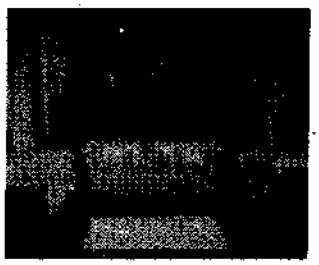
Furniture Manufacturing Industry :

Sofa Sets Manufacturing Company

BACKGROUND :

Company's product range consists of, bed sets, dining sets, sideboards, cabinets, sofa sets, center tables, side tables, corners, consoles, fireplaces and every such thing that can form a part of home or office furniture.

Most furniture manufactures, in India, are not organized or working systematically, barring few large corporate companies. Here is management software that helps small and medium size companies to manage business effectively. ERP for this sector addresses the new, more customer-centric orientation of the furniture industry with an affordable software package that supports end-to-end integration and enhances operational efficiency.



Example of production management

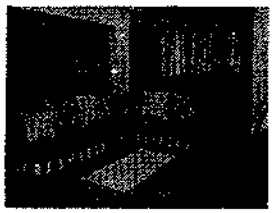
Items pertaining to the Furniture manufacturing company :

- Ply wood
- Clothing
- Dacron cover and fabric cover
- Legs
- Sponge
- Wood
- Springs
- Imported accessory items

Issues & Challenges :

- Today, furniture firms in India face many challenges. Although manufacturers in different line of products may have significantly different operating structures, their business requirements are similar.
- In an economy that's become increasingly competitive, all furniture making firms must efficiently respond to a more demanding customer-base and build long term, profitable relationships.
- Meeting these challenges requires new IT strategies that can boost revenues, improve the productivity, cut costs, and enhance the overall management of your business.
- In addition, you must be innovative, while seeking operational excellence at all levels.
- Real-time organizational control is necessary, for that sophisticated workflow is required.
- Low literacy level of users.

How Business Application (Ba) can address these Issues :



- ERP is also available for the furniture industry that can help users achieve the business goals.
- By implementing following ERP Modules (or procedures) :
  1. Security module
  2. Accounts module - General Ledger Accounts
  3. VAT / Sales Tax module
  4. Excise module
  5. Inventory Management module
  6. Purchase module
  7. MRP - Material Requirement Planning module
  8. BOM - Bill of Materials module
  9. Production module (Assembly Production and Process Production)

10. CRM module (Customer relationship management) and pre-sales module.
11. Order Fulfillment module - Sales Accounting.

Key Benefits : Sophisticated workflow gives real-time reports :

- Customer's order is linked with the Indent and Sales invoice. Chances of mistakes / miscommunication are reduced with this kind of tight integration. The work order (job card) link with material issue from stores ensures high level of material management.

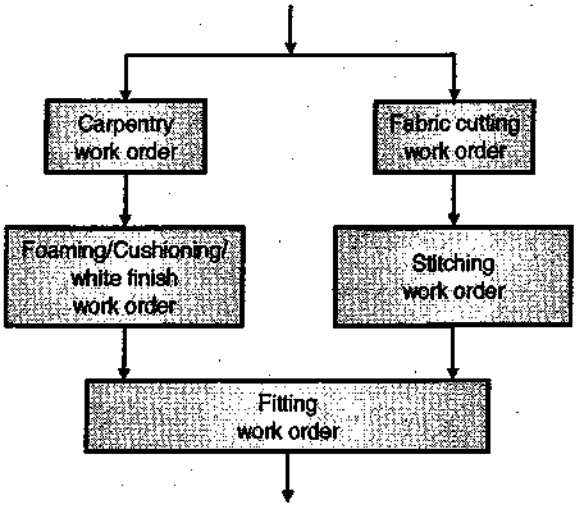
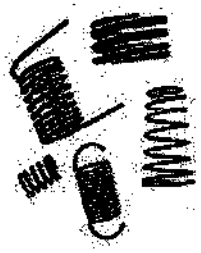


Fig. 1

CASE STUDY - III

OEM (Original Equipment Manufacturer) Supply - Automotive Parts Manufacturing Industry

OEM (Original Equipment Manufacturer) Supply - Automotive Parts Manufacturing Industry



Case study for ERP in an Industrial Spring manufacturing company made to order.

Background :

Original Equipment Manufacturer (OEM) supply or Making as per the customer order.

Unlike FMCG products, here all activities such as production, purchase, sales is linked to the customer's purchase order (sales order). ERP is deployed successfully by this author, in many such electro-mechanical engineering companies. Here is a success story of a company that is a leader in manufacturing high quality springs for 'automobile' sector.

At the same time ERP can take both kinds of automation - standard products as well as customized products manufacturing company.

Example of production management

Items pertaining to the industrial spring manufacturing company :

- Assy Oil Dipstick
- Bearing
- Brass Sheet
- Extension Cam

- Extension Cam HY 605
- Galvanized Wire
- HSS Bit 17 × 17
- OHNS Dia 20 × 500
- Spring Steel Wire Gr-2
- Stainless Steel Wire
- Straighten Wire

Issues & Challenges :

- Smoother and faster process flow
- Efficient distribution of information
- Decentralization of task & decision
- Increased transparency and better control
- Protection/ Security of data
- Wastage, scrap, rejection
- Integration of all departments
- Cost control
- productivity through elimination of duplication
- Inventory of raw materials
- Delivery performance
- Automatic integration of key business processes, such as sales, purchase, production, PPC, MRP-I and MRP II, Quality Check, vendor bill passing, accounts, excise, etc.

How Business Application (BA) can Address these Issues :

ERP pre-sales and sales module helps managing marketing activities by capturing sales enquiry, preparing quotation, sales order, sales schedule, sales invoice, etc.

By using the following ERP modules (or procedures) : above challenges are met :

1. Security module
2. Accounts module - General Ledger Accounts
3. VAT / Sales Tax module
4. Excise module
5. Inventory Management module
6. Purchase & Pre-purchase module and vendor bill passing.
7. MRP - Material Requirement Planning module / Supply Chain Management (SCM)
8. ISO 9000 - Quality check module
9. BOM - Bill of Materials module
10. Production module (Assembly Production and Process Production) CRM module (Customer relationship management) and pre-sales module. Production Planning and control (PPC) module.
11. Automatic email alerts module
12. Payroll and HR module
13. Cost sheet module – preparing estimate
14. Order Fulfilment module - Sales Accounting - (Shipping)

Key Benefits :

- Machine Master and Process Master (tempering, cutting, hooking, etc.) are linked to Work order. The Production Planning module is linked to sales order and Bill of Material master. User is able to track stage-wise production.
- When the work order will be prepared then the user (from production section) will do the daily planning according to machines that are available to him and according to work order quantity and the process that has to be done.
- Select the work order number for which the planning is to be done.
- When you select the work order number, item code and work order quantity gets defaulted automatically.
- Then select machine name for the respective process that has to be done. In the process drop down the process defined in the work order which are required will get defaulted. The user has to select process one by one and then define its plan quantity and shift and click on add button.
- In Production entry, user can enter the time required for manufacturing a given item i.e. start time & end time.

❑❑❑

CHAPTER 3

UNIT - III

Leveraging Information Systems

Syllabus

Information Systems Development and Project Management, Managing Data Resources, Business Process Integration and Enterprise Systems, ICT for Development and E-Governance, Case Studies - in-house or cloud based ERP implementation, UIDAI Unique Identification Authority of India.

3.1 Introduction of Leveraging Information Systems :

In this chapter we shall be discussing in-depth at how today's business organizations use information technologies and systems to achieve corporate objectives and gain competitive advantage. In today's business environment information systems have emerged as one of the major tools available to business managers for achieving operational excellence, developing new products and services, improving decision making and achieving competitive advantage.

We are witnessing a steady transformation in the traditional business world all brought about by a continuous stream of information technology innovations. The continuous change in technology, management and business processes as made this the most dynamic of all fields and business organizations can gain maximum advantage by leveraging these information systems.

Some of these transformational technologies include cloud computing, mobile digital business platforms and use of social networks to achieve business objectives. These technologies can be harnessed to create new products and services, develop new business models and bring about a sea of change in the manner in which business is conducted on a day-to-day basis. We are witnessing the gradual destruction of old business models; the emergence of online music stores has surely destroyed the old business model of distributing music on physical devices, such as records and CDs.

Similarly, e-commerce is changing the manner in which firms design, produce and deliver their products and services. E-commerce has perhaps emerged as the biggest destructive technology that has disrupted the traditional marketing and advertising industry and putting in jeopardy the business of major media establishments.

Information systems and technologies are the backbone of e-commerce and other social networking platforms. The growth of enterprise-wide information systems provide managers with information needed for accurate and timely decisions.

3.2 Leveraging Information Systems :

Q. State the strategic business objectives that can be leveraged by information system.

There are a few questions that one needs to ask to understand the benefits of information systems:

- What makes information systems so essential in today's complex business environment?
- What role do information systems play in creating and sustaining a competitive advantage?
- Why are businesses investing so much in information systems and technologies?

The extent to which information systems have proliferated the business world can be gauged from the dependence of business entities on them to survive and prosper. Information systems are essential for conducting day-to-day business as well as achieving strategic business objectives. There is not a single sector of the economy that is not touched by this technology and business without substantial investments in information systems is practically inconceivable. New business models and entities owe their existence to information technologies and systems. Information technology is the foundation for business in the twenty-first century. There is growing interdependence between the business entity's ability to use information technology and its ability to implement corporate strategies and achieve its objectives. The future prospects of the business and its objectives depend upon the kind and quality of information systems in the organization.

Thus, information systems can be leveraged to achieve the following strategic business objectives :

- **Operational Excellence :** information technologies and systems enable managers to achieve higher levels

of efficiency and productivity which in turn lead to higher profitability.

- **New Products and services :** the ability of the business entity to create new product and services is greatly influenced by its information systems. These systems serve as an enabling tool for these business entities. Many business entities have changed their entire business model on the introduction of information systems.
- **Improved relationship with customers and suppliers :** although the need to know the customer and supplier better had always been recognised, firms had always failed at this. When a firm gets to know its customers better it is able to serve them better and is in turn rewarded by repeat orders and improved goodwill. Similarly, it is always beneficial to get to know the supplier better. Suppliers have very good information about the industry and can provide vital inputs that can help the firm lower its costs or improve its quality. Information systems have provided the right platform to firms to interact with their customers and suppliers and get to know them better. Thus the information stored in large data repository helps them serve them better, know their preferences and their purchasing pattern. A few firms in the hospitality industry have geared their information systems that they now know every need and preference of their customers. Customer data is analysed to identify the best customers and to develop individualised marketing programs based on customer's preferences.
- **Improved Decision Making :** improved decision making has been the primary objective behind the creation of information systems. Traditionally business managers have always operated with minimal information, never the right information and failing to get it at the right time to make informed decision. Traditionally decision making was like a shot in the dark purely based on luck. This meant that there was a direct impact on the fortunes of the firm, loss in customers and rise in costs. However, today's competitive business environment does not permit such luxuries and hence the need for information systems. Information systems have made it possible for managers to use real time data from marketplace when making decisions.
- **Competitive Advantage :** when a firm has been able to achieve one or more of the above stated objectives of information systems, namely, operational excellence, new products and services, improved customer and supplier relationship and improved decision making then there are chances that it has already achieved competitive advantage over its competitors. Information systems enable a firm to respond to its customer and supplier in real time, create products and services as per the requirement of the market and then sell them at a competitive price thereby doing better than their competitors.
- **Survival :** in some cases information systems attract huge investments because it has become a business necessity. These necessities are prompted by industry level changes that are introduced to attract customers through higher level of service or to improve decision making. Whatever the reason be it is simply a requirement driven by the need to survive. However, when the creation of information systems is driven the need to survive there are chances that it is done in a haphazard manner without harnessing the true potential of the system.

Syllabus Topic : Information Systems Development and Project Management

3.3 Information Systems Development and Project Management :

Introduction :

- Managing a Project is akin to being the coach of the Indian Cricket Team, you get to experience some of the same thrills and exhilarating moments as the coach would surely be getting to experience.
- A project is defined as an undertaking of a non-routine, non-repetitive nature having prescribed objectives in terms of scope, time, quality and cost. Within the realm of project planning such projects can be further defined as generally being complex, having a multi-disciplinary involvement and having various phases in their life span. The completion of each of the project phases is usually accompanied by a finished project of some sort.
- Project planning is the comprehensive management and control of any or all aspects of a project throughout all phases of its life to achieve those prescribed objectives defined in terms of scope, time, quality and cost. Through the application of appropriate management techniques, the project manager would direct and co-ordinate the efforts of the multi-disciplinary team to achieve the objectives of a project to meet the client's requirements.
- IT Project Management is different from the management of any other engineering project, there are various factors which influence and keep on changing during the course of the project. To start with, the needs of the client for whom the project is undertaken are likely to change during the course of the project, there are hardware compatibility issues and software glitches, when one has managed to somehow overcome these issues there are security loopholes and bandwidth problems to deal with.

3.3.1 Concept of Project :

Q. What is a Project ?

To study project management it is necessary to first understand the concept of a project.

- A project is defined as an undertaking of a non-routine, non-repetitive nature having prescribed objectives in terms of scope, time, quality and cost.
- A project is an endeavor to accomplish specific objectives through a unique set of interrelated tasks and effective utilization of resources.
- IT projects involve hardware, software and networks to create product, service, or result. A few examples of IT projects are;
- A new feature is added to an existing software application.
- New system is developed to increase sales force productivity, improve customer relationship management and enhance supply chain management.
- A firm decides to implement an integrated ERP project to consolidate its information systems.
- Replacing the company's manual time keeping system with a web based system within a particular time frame.

3.3.2 Attributes of a Project :

Q. State the attributes of a Project.

A few typical project attributes are as follows:

- **Purpose :** A project has a unique purpose and well defined objectives. It begins with rough ideas and an initial plan which is updated as more information emerges. Projects are undertaken to accomplish something of value to the company, maybe, a system or software. The sole purpose of undertaking a project is to produce a tangible product of value to the company.
- **Goal :** a goal drives a project. It is the sole motivating factor and defines each activity, task, work, schedule and budget of the project. It provides direction to the team. Hence, the project goal should be clearly defined, ambiguity in defining the project goal leads to a project with no end.
- **Time frame :** since a project is a temporary endeavour it has to have a definitive start and end. The time frame for achieving the project goal is estimated based on the duration of the various project activities. The completion date of the project is set accordingly. However, for projects where the completion date is fixed, such as the Y2K problem, the starting date has to be set by working backwards.
- **Interrelated tasks and resources :** A project is composed of interrelated tasks and utilizes resources such as people, software, hardware and other assets of the company. The primary asset for an IT project is people who cross departmental and other boundaries to achieve this unique purpose. Most projects demand the service of people outside the organization such as consultants. Resources, however, are expensive and limited hence should be used effectively to meet project objectives. A project is unique and hence it is difficult to estimate the time, budget and resources requirement. Hence, a project involves uncertainty.
- **Ownership :** A project has various stakeholders but only one primary customer known as the project sponsor. The project sponsor is the "go to" entity for funds, direction and approvals regarding all project related matters. For the project manager the project sponsor is the owner of the project.
- The problem with project management, particularly with IT projects, is it doesn't have a particularly good reputation, cases of over-budget, over-schedule and under-performing, if not outright cancelled projects, are rife in both the public and private sectors.

3.3.3 Need for Project Management :

- You may feel that why is such a fuss being made of the management of projects and the need for the adoption of proper project management tools and techniques. With increased competition and globalization a failed project could have more wide ranging implications that could affect the overall prospects of the organization.
- Project managers are expected to deliver results on time, within budget, while adhering to quality parameters and ensuring that the project results cover the entire scope of the project. Hence, a disciplined project management process is important to any project.

Following are a few reasons why an increased need is felt for effective and efficient project management:

(i) **To control scope of project and manage change :** although the project deliverables are defined at the outset of the project, small changes in project deliverables are common. These changes are demanded by customers, stakeholders, management, suppliers or the project team itself.

Individually, these change demands may seem acceptable and manageable, but collectively these change demands can lead to a significant expansion in the project scope and can lead to an overrun in schedule and budget.

However, with project management, if the manager effectively manages the scope of their project, they have a better chance of effectively managing project resources and change.

(ii) **To deliver projects on time and within budget :** the project management process includes cost calculations such as return on investments (ROI). Once ROI is established it is for the project manager to ensure that the project schedule and budget are adhered to else the project will fail to deliver the expected results.

(iii) **To ensure the focus of the project team :** it is common for the project team to drift from the main tasks and spend unnecessary longer time on other tasks. Hence, it is the responsibility of the project manager to

ensure that the project team focuses on the right tasks by using a clear and concise project charter and that there are no interferences.

(iv) **To collect user requirement from disparate sources :** the project manager at the initiation phase should collect user requirement, project constraints and conduct a feasibility study to build a strong business case justification.

The primary advantage of collecting input from various sources is that the project manager is able to avoid future dissent from users and is able to communicate project benefits.

(v) **To define the critical path to optimally complete the project :** every project is made up of connected activities each having their individual constraints. By using the critical path method technique the project manager is able to identify the critical path and thus ensure the successful completion of the project.

(vi) **To provide a process for estimating project resources, time and costs :** solid project management tools and techniques and past experience will enable the project manager to correctly estimate the project resources requirement as well as determine the time required for the completion of the project and the likely expenditure. Such, estimation at the initiation phase will ensure that the project receives adequate commitment from the management and its success is ensured.

(vii) **To communicate project progress, risks and changes :** the stakeholders of the project need to be kept updated on the project progress, hurdles encountered and changes incorporated. Every good project management plan has a communication plan that addresses communication issues, provides formats and lays process for execution of the communication plan.

(viii) **To explore project assumptions :** although ample ground work is done for a project there are bound to be a few assumptions on which the project is based. Hence, a good project manager has to delve deeper into user requirements, project constraints and management expectations to understand the hidden project requirements. A project based on too many assumptions could ruin its chances of success.

(ix) **To prepare for unexpected project issues :** howsoever, one may be prepared there are bound to be a few issues which may suddenly surface. Hence, the project manager should always be prepared with an alternate plan.

(x) **To document the knowledge gained from the project :** the last phase of the project involves the documentation of all that has been learnt at each phase in the project. These documented experiences provide guidance to other project manager in other projects.

3.3.4 Project Goals :

Q. Enumerate the five most important project goals.

- The project manager as a key person is expected to carry out various tasks and lead the project team. The role of a project manager involves handling all aspects of the project such as planning, brainstorming and overseeing the overall completion of the project.
- Therefore, for a project manager the trick for successful project management is to focus on the five most important goals associated with project management. Meeting these five goals of a project will ensure project success. Project goals keep the focus on what is important for the success of the project.

The five most important goals of every project are:

(i) **Ensure that the project is completed within the deadlines set :** every project has a deadline within which it has to be completed and it is the duty and responsibility of the project manager to ensure that the deadline is adhered to.

Although, the project manager and his team may have a role to play in deciding the schedule and at the outset of the project it may have looked feasible but as time passes and requirements change the project may require new strategies and planning making it difficult to complete the project within the stipulated time frame.

However, the project manager should never lose sight of the deadline and keep pushing the team to complete the project within the time frame originally set.

Hence, the project manager before committing to the deadline should take into account all eventualities which he and his team may have to encounter. It is always better to have a buffer period in hand.

(ii) **Ensure that the project is completed within budget :** just as every project has a schedule it also has a budget. A budget is a forecast of the expenditure that will be incurred on the project.

It is essential that the budget is prepared with considerable thought to all the activities and resources that would be utilized in the project. Hence, a budget is prepared after considerable research and after comparison of prices to get the best possible deals.

Like the schedule a budget should leave no stone unturned. However, as requirements change there is every likelihood that the original budget may go astray. It is therefore the responsibility of the project manager to ensure that things stay within budget.

(iii) **Ensure user satisfaction :** although user satisfaction should be the utmost priority for any project manager and is achieved by delivering the project on time it should in no way be achieved by compromising on the quality of the results. Quality of the project output is another project goal of which the project manager should never lose sight of.

(iv) **Ensure that all user requirements are duly met :** another very critical goal for the project manager is to ensure that all the user requirements from the project are duly met. This would mean getting very detailed inputs from the user on his requirements from the project.

(v) **Ensure team management :** along with ensuring that all project goals are met the project manager has to also ensure that his team is happy and contented. It is the responsibility of the project manager to provide encouragement, incentives and rewards for the hard work put in by the team in the project. Remember, no project is complete without a team and hence it is the responsibility of the manager to ensure the well being of all the team members.

- Achievement of these goals is no mean task as it is akin to juggling with five pins at the same time.
- The project manager should ensure that these goals are outlined to the project management team at the very beginning, there in no way for the delivery of the goals to be delayed in any way as everyone will always be aware of what they need to achieve and by when.

3.3.5 Project Feasibility :

Q. What is project feasibility ?

- Information Technology projects are expensive and hence before project initiation a preliminary study called a feasibility study needs to be conducted to determine the validity of the project.
- The primary objective of the feasibility study is to ensure that the organization is on the right track and is focusing on the right problem with respect to the project. A feasibility study is undertaken to determine the information needs of the prospective users and the resource requirements, costs, benefits and the technical viability of the project.
- A feasibility study is a report of the research that the project manager has undertaken. It helps in determining the validity or scope of the entire project or a part of the project. As the title indicates the feasibility study tells the management if a problem is solvable or a business opportunity is realizable.
- Some feasibility studies may also cover the financial implications of undertaking the project. The financial part of the feasibility study will tell the management whether it makes financial sense in undertaking the project. It will indicate the Return on Investment.
- The project manager while preparing the feasibility report should refrain from expressing his opinion about the feasibility of the project. The report should be highly factual and down to the point.
- It should cover all the aspects of the project, its ability to address the problem or realize the business opportunity, financial implications, and the value that it will add to the organization. The project manager should be fair in his assessment and should not be tempted to impose new technology merely for the sake of technology.
- Many a times in IT projects it has been observed that project managers utilize technology merely to display their technical expertise. Technology for the sake of technology is no good; it should add value to the organization. The project manager, in his report, should express how the new technology will benefit the organization.

The feasibility study comprises of the following :

- **Executive Summary :** the purpose of the executive summary is to provide the reader with a brief summary of the findings of the feasibility study.
- **Define the Business Problem or Opportunity :** in this section the business problem that the organization is encountering and its impact on the functioning of the organization is discussed. In case there is an opportunity that the organization wants to utilize that too will have to be defined and how it will benefit the organization has to be stated.
- The business goals or objectives can be utilized to link the project to the opportunity or problem. Also, the benefits of the proposed technology are to be stated in the report. The report should also identify the areas or people who are likely to be affected by the introduction of the new technology.
- **Purpose of the Feasibility Study :** although the primary purpose of any feasibility study is to determine the practicality of an opportunity or the solubility of a problem there are number of other reasons for which a feasibility study can be undertaken.
- To determine whether a particular product should be bought or made in house. It's a typical make-or-buy problem.

Compare various software and hardware solutions :

- Determine capability resource gap with the new technology
- The purpose of this section is to describe the intent of the feasibility study.
- **Assessment of Alternatives :** a feasibility study involves various alternative solutions for the business problem or opportunity. The project manager has to state in the report the alternatives evaluated, basis for selection of the alternatives, and the manner in which the alternatives differ from one another.
- **Impacted Areas :** this section of the feasibility study identifies the impacted people, addresses the issues concerning the users, and determines the capability resource gap. Some of issues addressed are;
  - Probably downtime that the users will experience on account of the implementation of the project.
  - Phased introduction of the new technology within the organization.
  - Assessment of requirement for training, the number of users requiring training, the training period, and the resources that will needed to impart training.

- Learning curve of the new software.
- How will the new software integrate with the organizations existing software
- Does the new software require specific hardware?
- Compatibility of new software with the existing operating system.
- Period before an upgrade to the new software will be available.
- This section will also cover the process of implementation of the new technology.

– **Financial Issues :** this section of the feasibility report will address all the financial issues related to the project. The issues addressed here are;
- Price of the new technology
- License fee and renewal period
- Cost of training
- Additional financial burden arising out of requirement for trained personnel
- Cost of labour to implement the technology
- Technical support from vendor
- Loss incurred for not adopting the new technology
- Return on Investment analysis

– **Project Manager's Recommendation :** this is the final section in the feasibility report and will contain the project manager's personal recommendation for or against the implementation of the proposed technology.

– The project manager should cover the working of the technology, its implementation process, and the resources required. The section should also cover the other alternatives that could be used and a comparison of how they measure up to the proposed technology.

3.3.6 Project Management Lifecycle :

Q. Briefly describe the Project Management Lifecycle.

– Projects do not form the core activity of the organization they are temporary activities with a definitive objective. Today, the project lifecycle approach is used in construction, aerospace, government agencies, research and development, manufacturing, electronics and many other industries; however the term project lifecycle may mean different things to different people depending upon the particular application. The basic project lifecycle principles are applicable to a wide variety of projects such as new applications, major maintenance and repair projects, relocations and re-organizations, creating new web site, or establishing a new data base centre. Irrespective of the type of project the basic framework shared by every project remains the same.

– The project lifecycle describes the various logical phases in the life of a project from its beginning to its end in order to deliver the final product of the project. The idea of breaking the project into phases is to ensure that the project becomes manageable, activities are arranged in a logical sequence, and risk is reduced. The phases are so created that each phase at its end provides one or more deliverables. Deliverables are tangible and verifiable products of work that are produced at the end of each phase and define the resources needed for the completion of each phase.

– The review of the deliverables at the end of each phase enables the project manager to evaluate the performance at the end of each phase and take necessary corrective action if felt necessary.

– Although, it is recommended to undertake the phases in a linear sequence, phases could be overlapped to save time. However, overlapping of resources is risky and should be justified.

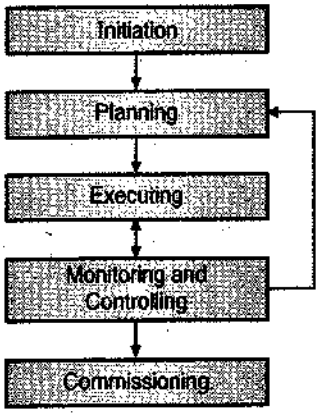


Fig. 3.3.1 : Process Groups of the Product Management Lifecycle

– In this section we shall be studying the generic project lifecycle that comprises of phases common to most projects.

– **Initiation :** Pre launch setting up of the project

– **Planning :** An iterative process communicating the intent of the project

– **Execution :** Undertaking the execution of the project plan by the project team

– **Monitoring and Controlling :** Ensuring that the work is as per the plan

– **Commissioning :** Closure and commencement of the regular operations of the project

3.3.7 Information Technology Project Management :

– As seen earlier in the chapter there are different types of IT projects such as CRM, SCM, ERP, Electronic Commerce, etc, that are undertaken by an organization. Each project has different products to deliver and hence will require different tools, approaches, processes, and knowledge areas.

– However, the idea behind developing a standard IT project management methodology was to provide the project manager with guidelines while undertaking these projects.

– The objective of the Information Technology Project Management Methodology is to develop a standard method and devise guidelines to ensure that IT projects are conducted in a consistent and well managed environment that assures the delivery of quality and ensures that the projects are completed on time and within budget.

– A project management methodology provides a generic strategic level plan for managing and controlling IT projects. The project management methodology is akin

to developing a template for the process groups (initiating, planning, executing, controlling and closing) of an IT project.

- Now, IT projects are different i.e. the products that are attained on the completion of the projects are different, however it is the products which are different and not the process of managing the projects.
- Hence, it is possible to devise a methodology that will provide guidelines to the phases, processes, tools, deliverables and knowledge areas that will support any IT project. The objective of the methodology is to merely provide guidelines as each IT project may require different tools and approaches.

Project Management Methodology :

- After spending considerable amount of time and money on training for developing general project management skills, organizations have discovered that project managers are still not able to tailor their project management skills to the organizations particular needs.
- Therefore, to overcome this problem, organizations have developed their own information technology project management methodology.
- The information technology project management methodology is a standard methodology describing the best organization practices for managing projects and the manner in which project activities should be undertaken.
- IT project management methodologies provide the project manager with guidelines for implementing project lifecycles. Standard project management methodologies provide a common language for all those involved with the project, such as project manager, team members, stakeholders, sponsor, etc, to communicate more effectively.
- The project management methodology also enables comparison between various projects undertaken by the organization as it provides common parameters and language across all the projects.
- The project language, planning and reporting are the same across all the projects thus enabling the management to develop a better understanding which would also lead to better decision making with respect to allocation of resources and funds.
- The project management methodology should be flexible enough to adapt to the changing needs of the project over time. A flexible methodology would enable the project manager to use different modelling approaches during different phases of the development lifecycles.

Methodology Development :

- The project management methodology and all associated activities are independent of the specific project development lifecycle selected. The project management methodology model is not intended as a specific project development lifecycle model (waterfall, spiral, etc).
- The model is a generic methodology for project management that accommodates various development approaches and a variety of detailed execution procedures that are defined by individual organizations.

The foundation for the project management methodology comprises of :

- **Project Management Processes :** Initiating, Planning, Executing, Controlling and Closure.
- **Project Management Objectives :** Schedule, Budget, Scope, and Quality.
- **Project Management Areas :** Time management, Communication Management, HR Management, Scope Management, Risk Management, Integration Management, Quality Management and Procurement Management.
- The development approach depends upon factors such as organizational experience in managing IT projects, the knowledge and experience of the project manager and the project team, and the very nature of the project in terms of size, complexity and the time frame within which it is to be delivered.
- The development approach is also influenced by the infrastructure support to the project provided by the organization and the management's commitment to the project. The development methodology should be a part of the overall project management methodology.
- The project management methodology has a general applicability to the management of all information technology projects. However, the degree to which the organization should apply the methodology depends on project and the risks associated with the project.
- The methodology identifies responsibilities and activities that are assigned and performed on information technology projects. The flexibility of the methodology permits rigorous application of management processes for large and complex projects than for small, well defined projects with readily achievable goals.
- Developing a methodology is not an overnight job it means inculcating all the experience gained from past and current projects in the development methodology to increase the chances of future project success.
- The development methodology over time incorporates all the best project management practices that suit the organization and the kind of projects that it undertakes. Once, the methodology has fully matured the likelihood of project success increases and there is a marked decrease in the wastage of resources.
- Organizations that have adapted and developed the approach observe a higher success rate in project implementation which in turn increases their competitive advantage, efficiency and effectiveness.

Phases in the Project Management Methodology :

The IT project management methodology comprises of five phases which are as follows :

Phase I : Project Conceptualization and Initialization :

- This is the first stage in the project methodology and is responsible for preparing the ground work for further development. In this stage the idea behind the project is hatched and the goal or purpose of the project is defined.
- The primary project goal is very important in project methodology as it provides a basis for future project decisions and aids in defining the project scope. The project goal also serves as a parameter for evaluating the project's success after its completion.
- If the primary goal of the project is achieved the project could be termed as a success, however, there are other factors like the time and cost which also are also to be considered while determining project success.
- Project Initiation is the first official step in the project methodology and marks the commencement of the project. Project Initiation is based on the business needs that justify the allotment of resources and the expenses that will be incurred on it.
- The primary idea behind Project Initiation is to ensure that the business need is properly understood by the project manager and is kept in mind throughout the lifecycle of the project.
- Remember, the business need drives the project hence deviation from it is not acceptable. The business need is the direct outcome of the objectives and goals of the organization.
- The Project Initiation stage enables the creation of the project charter that is the official document authorizing the project manager to undertake the project within the organization. As everyone who is party to the project or who is likely to be affected by it is part of the project initiation stage it is easy for the manager to identify the stakeholders.
- The business need which drives the project could vary from organization to organization. While some organizations may feel the need to increase productivity others may feel the need to reach out to more customers or to increase efficiency.
- The project manager needs to understand the business need that is driving the project and also how the project will help the organization in meeting this business need.
- As stated earlier the organizational objectives, goals and mission are behind the business need hence the project manager should understand the objectives and goals of the organization to understand its business needs better. The project manager also needs to understand how the outcome of the project will be used by its stakeholders.

Phase II : Developing Project Plan and Charter :

- A project is defined as an undertaking of non-routine nature to create a new or unique product, service or result. As the undertaking is new or unique and never been done before in the organization, planning is essential.
- The planning process should complement the size and complexity of the project i.e. the larger and more complex the project the greater the planning effort while small routine project require very less planning effort. Although, planning is an intrinsic part of each phase of the project methodology it is all the more relevant in this phase where the project plan and charter are developed.
- Another very critical feature of planning is that it is never over, planning is an iterative process, and may require constant changes in its budget, scope, schedule or quality, as per the requirement of the client, stakeholder or the management. The project manager will have to depend on his wisdom and experience in developing a good and pragmatic project plan.
- The project manager needs to focus on the project specifics and narrow the project description. It is the time to draft the Project Charter. A project charter is a detailed official document prepared in line with the company's vision and goal describing in detail the finer nuances of the project and chalking out deadlines for the milestones within the project.
- The Project Charter serves as a road map for the project manager and states the goals that are to be achieved from the project.
- A Project Charter gives a clear definition of the project, its attributes, the end results and the project authorities. Project authorities are the people who are responsible for the implementation and success of the project.
- These people are namely the project in charge/project sponsor, project manager and the project team leaders.
- A project charter is the final official authorization for the commencement of the project to the project manager. It is a green signal to the project manager to commence work on the project.

Phase III : Project Execution and Control :

- After having developed the project plan it is time to execute the plan. There are two types of processes, one which result in products and other which form the supporting processes.
- The product oriented process play an important role during the execution phase of the project. Quality assurance, risk management, team development, etc form the core of the supporting processes in the project execution.
- Although, the execution process is a part of every project phase it is more active and prominent during the execution and control phase of the project methodology.

- The second part of this phase is the controlling process. The primary objective of the controlling process is to measure and manage the project activities and ensure that they are on the right track towards the goal and adhere to the scope, budget, schedule, and quality parameters.
- The control process identifies deviation from the plan and makes it possible to take corrective action. Although, controlling process is present in each of the phases it has more emphasis in this phase.

Phase IV : Project Closure :

- The primary objective of the closing process group is to ensure that the project reaches its logical conclusion and to bring the project to an orderly completion. The project closure phase is reached when all the project deliverables have been achieved and accepted by the project sponsor.
- At this phase the project team has to also ensure that the project integrates with the day-to-day operations of the organization and delivers information products as required. The closure of a project is marked by contract and administrative closure.
- Contract closure indicates that all the project deliverables have been successfully completed and all the agreed upon terms and conditions of the contract have been adhered too.
- Contract closure paves the way for the settlement of dues of outside parties, namely, suppliers and consultants. Administrative closure involves the documentation of all project activities and experiences for future references.
- Although, each project process group has closure of its activities, the major project closing process occurs in this phase.

Phase V : Project Evaluation :

- The project evaluation phase focuses on evaluating the previous four project process group. The project review conducted by the project manager and his team should focus on assessing the positive and negative outcome of the project, things that worked in favour of the project and what went against the project.
- The experiences gained from the project should be well documented for future references. The project manager should also identify the best practices from the project that could be incorporated in the project management methodology of the organization. Inculcation of such best practices leads to the evolution of the methodology.
- The second part of the evaluation should take place between the project manager and the project team members and should focus on reviewing individual performance of team members as well as that of the project manager. The review should provide an honest and dispassionate feedback to the individual.
- The third part of the review should be conducted by a neutral party who should review the project, the project manager and the project team.
- The review should focus on the performance of the team in delivering what was promised to the sponsor, the ability of the team in meeting the objectives of the project scope, budget, schedule, and quality, overall client satisfaction, risks and challenges faced by the project team, the performance of the team as a unit, and the professional and ethical manner in which project activities were handled.
- The last part of the evaluation process should determine whether the project succeeded in providing value to the organization. Although, it may take time to gauge the full implications of the project, this part of the evaluation is essential to determine whether the project was an overall success.

3.4 Project Initiation :

- Project Initiation is the first official step in the Project Management Lifecycle and marks the commencement of the project. Project Initiation is based on the business needs that justify the allotment of resources and the expenses that will be incurred on it.
- The primary idea behind Project Initiation is to ensure that the business need is properly understood by the project manager and is kept in mind throughout the lifecycle of the project. Remember, the business need drives the project hence deviation from it is not acceptable. The business need is the direct outcome of the objectives and goals of the organization.
- The Project Initiation stage enables the creation of the project charter that is the official document authorizing the project manager to undertake the project within the organization. As everyone who is party to the project or who is likely to be affected by it is part of the project initiation stage it is easy for the manager to identify the stakeholders.
- The business need which drives the project could vary from organization to organization. While some organizations may feel the need to increase productivity others may feel the need to reach out to more customers or to increase efficiency.
- The project manager needs to understand the business need that is driving the project and also how the project will help the organization in meeting this business need.
- As stated earlier the organizational objectives, goals and mission are behind the business need hence the project manager should understand the objectives and goals of the organization to understand its business needs better. The project manager also needs to understand how the outcome of the project will be used by its stakeholders.

3.4.1 Stake Holders :

- The stakeholders of the project are those people who have some interest in the outcome of the project. Hence, it is imperative that the project manager identifies all the stakeholders and establishes the project requirement with them.

- The stakeholders may a single person, a group, entire department or the entire organization. The stakeholders will be able to provide valuable inputs to the project requirement that will prove useful in ensuring the success of the project.
- However, not all stakeholders influence the projects outcome there are some key stakeholders who have a major influence on the outcome of the project. The project manager should identify these key stakeholder's and get inputs from them on their specific requirements from the project.
- **The stake holders to the project are :**
  - **End users** - are the people who will actually be using the project
  - **Project In charge/ Project Sponsor :** the person in the organization who has the authority to grant the resources and sign the charter.
  - **Project team :** people actually working on the project.
  - **Functional managers :** managers in charge of the various functional departments of the organization.
  - **Project Manager :** the person in charge of the project.
  - **Business Partners :** suppliers, customers, and vendors
- Along with the specific requirements from the key stakeholders the project manager should also gather information on the time frame for the completion of the project, cost criteria and any other technical constraint that may come in way of the success of the project.
- Once all the project requirements have been gathered the project manager can go to the next stage of project planning.

3.4.2 Identifying Project Purpose and Needs :

- As mentioned earlier that it is imperative that the project manager develops a clear understanding of the purpose behind the project. Ambiguity should be avoided as it is likely to cost the organization dear. Clarity of purpose will help the organization save in terms of cost, time and effort and the project will be a success.
- Therefore, the first step in project management is to understand the purpose of the organization behind the project. Once the project manager is aware of what the project should produce he can get around with its planning.
- Requirements analysis is the first stage in software development process and encompasses those tasks that go into determining the needs or taking account of the possibly conflicting requirements of the various stakeholders.
- Requirements analysis is critical to the success of a project. Requirements must be actionable, measurable, testable and related to identified business needs or opportunities. Requirements should be defined to a level of detail sufficient for system design.

Conceptually, requirements analysis includes three types of activity :

- Eliciting requirements: the task of communicating with customers and users to determine what their requirements are. This is sometimes also called requirements gathering.
- Analyzing requirements: determining whether the stated requirements are unclear, incomplete, ambiguous, or contradictory, and then resolving these issues.
- Recording requirements: Requirements must be documented either as language documents or process specifications.
- The easiest and most convenient approach to collecting project requirement is to talk to the key stakeholders. Discussing the requirements of the project will help the project manager understand the requirements better.
- In some cases the project manager is assisted by a business analyst who will complete the requirement collection process for the project manager. The project manager can then discuss the requirement with the business analyst and stakeholder to get a clear idea of all the requirements.

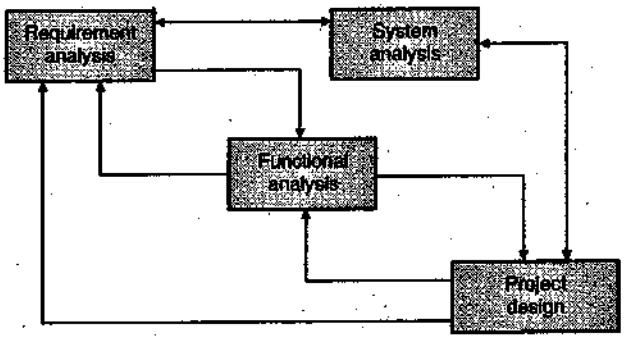


Fig. 3.4.1

- In the absence of a business analyst the project manager has to gather all the requirements on his own. Although the work is cumbersome it helps the project manager in developing an in-depth understanding of the requirements of the clients.
- Once a clear understanding has been developed the project manager will be able to develop the project scope, quality expectations and identify and address any threats to the project and its outputs.
- However, in case the number of stakeholders is large it is not feasible for the project manager to interview or interact with each and every stakeholder on a one-to-one basis. In such a scenario the project manager can resort to web technology and conduct a survey or ask the stakeholders to nominate representatives.
- The project manager can then meet the representatives and discuss the requirements that will affect the large number of stakeholders. Another very effective way of collecting requirement is to passively or maybe

actively observing the stakeholders at work. This gives the project manager an idea of the requirements from the project.

- Whatever, be the approach adopted the project manager should ensure that all the key stakeholders are in agreement with the requirements from the project.
- Once the requirements and purpose behind the project have been defined, the project manager can determine the time frame that will be required for the completion of the project. Although, the management of the organization has set some time frame for the completion of the project the project manager should make his own estimation based on the requirements available with him.
- For estimating the time frame the project manager should be aware of the end result of the project. The end result of the project can be discussed with the project in charge.
- With the end result decided upon the project manager can chalk out the path that the project should take. The project manager is responsible for setting the goals and deciding on the path to get there. However, the project manager should develop the path after thorough discussion with the all the key stake holders.
- IT Project Management is a complex balancing act of technology and external factors such as demand, market conditions and technological changes. Hence, the project manager should ensure the following in the first place;
  - Project has clearly defined objectives
  - Project has well defined end results
  - Project should spell out the exact requirements
  - Project should take into account any industry standard and regulation
  - Project should also take into account any government regulation that it should abide by
  - Project should have reasonable time frame for completion
  - Project in charge has the authority to take decisions
  - Project should have committed resources
- On his part the project manager should have a very inquisitive mind. He should question each concept, technology and the time that will be taken for its implementation. The project manager should not judge everyone with the same yardstick.
- Every person in the organization is bound to have varying knowledge of IT. Hence while deciding on the technology that will be utilized in the project the project manager needs to seek answers to the following questions;
  - Effect of the proposed technology on the users
  - Effect of the proposed technology on other solutions
  - Compatibility of the proposed technology with other operating systems
  - Experience of other companies using the proposed technology
  - Track record of the vendor of the proposed technology

3.4.3 Project Charter :

Q. What is a Project Charter? State the purpose of project charter.

- The first step in the project initiation stage was the determination of the business need and identification of key stakeholders. However, till this time all the project discussions were broadly based and were general descriptions. The project manager needs to focus on the project specifics and narrow the project description. It is the time to draft the Project Charter.
- A project charter is a detailed official document prepared in line with the company's vision and goal describing in detail the finer nuances of the project and chalking out deadlines for the milestones within the project.
- The Project Charter serves as a road map for the project manager and states the goals that are to be achieved from the project.
- A Project Charter gives a clear definition of the project, its attributes, the end results and the project authorities. Project authorities are the people who are responsible for the implementation and success of the project. These people are namely the project in charge/project sponsor, project manager and the project team leaders.
- A project charter is the final official authorization for the commencement of the project to the project manager. It is a green signal to the project manager to commence work on the project.

Purpose of the Project Charter :

- A project charter serves the following purpose;
- Defines the business need
- Identifies the project sponsor
- Authorizes the project
- Identifies the project manager, grants authority and makes him responsible for the management of the project

Elements of the Project Charter :

The project charter contains all the relevant information related to the project and includes;

I. **Official Project Title :** every project has a name by which it is identified. The name is usually based on the kind of work the project is undertaking.

II. **Project Sponsor :** the name, designation and contact details of the person who has authorized the project.

III. **Project Manager :** the name, designation and contact details of the person who is responsible for the implementation of the project. However, it is not always that the project manager is a part of the same organization he may also be a free lance project

consultant who has been hired by the company specifically for the project.

IV. **Purpose of the Project :** every project that is undertaken addresses some problems. Hence, the charter should spell out the need or purpose behind the project. This serves as a constant reminder to the project manager.

V. **Key Deliverables :** the key results expected from the project

VI. **Road Map for Work :** the road map will contain of the approach that the project manager has adapted.

VII. **Project Schedules :** timeline for the completion of the major milestone stages in the project.

VIII. **Project Resources :** specifies the budget for the various stages of the project and other key resources and players of the project.

IX. **Constraints :** specifies the assumptions and constraints of the project.

X. **Risks :** every project has certain risk factor associated with it, hence it is always beneficial for the project manager to identify the risk factors associated with the project and be ready with solutions to tackle them.

3.5 The Business Case :

- The desire to utilize information technology to improve the efficiency and effectiveness of the organization has lead to an increase in the number of IT projects undertaken within organizations.
- However, the utilization of information technology without a thorough understanding of its risk and cost implications has lead to the failure of many IT projects. The haphazard utilization of information technology merely because it is available is not judicious.
- The rampant failure of IT projects on account of the inability of projects to deliver returns as compared to the time and resources invested in them is an indicator of the need to develop some sort of analysis or feasibility study which would indicate the true value of the project for the organization.
- The business case arises out of this need and provides an analysis of the technical feasibility, costs, risks, returns, and organization value of various projects. It provides the basis on which informed decision on the projects can be taken.
- Although, the business case may sound very similar to a project plan or budget it should not be mixed up with one. The business case is a document that provides the top management with all the information needed to select the projects that are to be funded.
- Although creation of the business case document is very much similar to the feasibility report in most of the cases it is a separate document. Like the feasibility study the business case too helps the management in justifying the cost that will be incurred on the project and its return on investment.
- The business case is built on the relevance of the business goals and objectives and the cost of the proposed technology that can get the organization there.
- The business case takes into account the cost of the solution, break-even point, return on investment, and maintenance cost. Along with the quantitative issues the business case may also address qualitative issues such as; working comfort, increased efficiency, improved morale, etc.
- The business case is very similar to an investment proposal. Hence, the developer of the business case has to present compelling facts and figures in favour of the project and base his argument in the most logical manner. However, the business case developer in no way should digress from the facts of the project and the analysis should be as dispassionate as possible. A good business case should;
  - Detail all possible impacts, costs and benefits.
  - Be clear and logical in comparing the cost-benefit impact of each project alternative.
  - Include all pertinent information.
  - Systematically summarize all the findings.

3.5.1 Developing the Business Case :

Q. Describe the steps in developing the business case.

Q. What is Measurable Organizational Value (MOV)?

- Although, IT projects are undertaken for a plethora of reasons such as; improve customer service, reduce costs, improve communication, integrate customers, suppliers and partners, improve decision making, etc, the underlying objective behind each reason is to create organizational value by way of improving efficiency and effectiveness.
- The priority amongst the various reasons for undertaking IT projects differs from organization to organization. It is up to the top management to evaluate the various project proposals and select those which will create maximum organizational value. Therefore, the objective of the business case is to evaluate and advocate how the IT project will create value for the organization and improve its efficiency and effectiveness.

Steps in developing the business case :

Step I : Forming the team :

- Developing the business case should not be a single man's responsibility. On the other hand, a team comprising of stakeholders, managers, users and IT specialists should be formed.
- The team so formed should bring in all the requisite knowledge, experience, information and expertise required to develop the business case. Of the team, the stakeholders are the people who are going to be affected by the project and hence their point of view needs to be presented in the business case document.

- Business managers bring in a higher level of perspective which is so essential for the business case. The users are the ones who understand the requirements that the project has to fulfil. While the IT specialists understand the risks and benefits associated with IT and should present their perspective in the business case.
- According to Schmidt, there are several advantages of having a team develop the business case :
  - **Credibility :** as a team is made up of individuals from various organizational areas they possess expertise, knowledge and experience that may not be readily available outside the realms of their operations. A team also provides different perspectives to the project and provides inputs that an individual developer may tend to overlook.
  - **Alignment with organizational goals :** The managers in the core team can align the business case with the long term strategic goals of the organization. Aligning the project with the strategic goals of the organization further strengthens the business case. The business case should also highlight how the successful completion of the project will help achieve the overall goals and objectives of the organization.
  - **Access to real costs :** The team members selected should have specific expertise and should be privy to information that will assist in building a realistic estimate of the costs.
- The other advantage of forming a team from various areas of the organization is that enables the project manager to manage resistance during project implementation.

Step II : Developing Measurable Organizational Value (MOV) :

- Measurable organizational value (MOV) is the IT projects overall goal and its measure of success.
- For any project the MOV should align with the organization's overall mission, objectives and goals. The term Measurable Organizational Value was coined by Jack Marchewka as an alternative to the more popular return on investment (ROI). According to Jack Marchewka the projects MOV should be :
  - Measurable
  - Provide value to the organization
  - Agreed upon by all the core team members.
  - Verifiable at the end of the project.
  - Guide the project throughout its lifecycle.
  - Align with the organizations strategy and goals.
- A clear MOV will enable the team to know where the project should go, it will be like the road that the whole project lifecycle should take. In case the project deviates from its path, the relevant decisions and adjustments will be based on the MOV which can be vital in achieving the overall goal.

Steps in developing the MOV :

(i) **Identifying the desired area of impact :** The desired area of impact expected from the IT project is the primary reason for undertaking the project. To identify the desired area of impact the project manager should find out from the project sponsor how the idea of the project came about.
Although, the answers could be vague it would provide the project manager with some elementary background as to how decisions are made in the organization.

(ii) **Identifying the desired value of the project :** The value that a project brings to an organization could be in terms of doing something faster, better, cheaper, or on increasing the market share. The project manager should identify and highlight what the project could potentially deliver to the organization.

(iii) **Developing an appropriate metric :** Once the desired value of the project has been identified it is time to quantify the value that would be delivered. So for example a proposed business information system would enable a company to process customer orders faster, the management would be better off in learning the reduced customer order cycle time. Therefore, the value should be quantified and expressed in terms of a metrics i.e. in terms of time, money, percentage or a specific value.

(iv) **Setting a time frame for achieving the MOV :** The time frame for achieving the MOV should also be mentioned. Some MOV's are immediately achievable on the completion of the project, for example the reduction in customer order cycle time, however, some like increase in market share may take time.

(v) **Verifying with stakeholders :** Getting the metric value and time frame verified and approved from the stakeholders adds value to claims made in the business case.

(vi) **Summarize the MOV in a clear and concise statement :** The MOV should be mentioned in a clear and concise statement.

Step III : Identifying Alternatives :

- All the alternative solutions to the problem or opportunity need to be delved upon in the business case. These alternatives should also enable the company to achieve the desired MOV.
- The alternative of maintaining status quo i.e. not doing anything and continuing with the present situation

could also be a solution that needs to be looked into. However, the business case should put forth compelling reasons to bring about change and the cost that would be incurred in continuing with the existing process, systems or product. The cost incurred could be in terms of downtime, maintenance cost and systems failure.

Step IV : Defining Feasibility and Assess Risk :

- The feasibility and risk associated with each alternative solution should be analysed. Feasibility is the probability of successfully implementing an alternative while risk focuses on what can go wrong and what must go right.
- Feasibility and risk analysis will enable the project manager to identify alternatives that are not worth pursuing. Feasibility is viewed in terms of economic feasibility, technical feasibility, and organizational feasibility. Risk analysis focuses on its identification, assessment, and response.

Step V : Defining Total Cost of Ownership :

- The total cost of ownership of the application needs to be accounted for before any decision on implementing it is to be taken. Total cost of ownership is over and above the cost of purchasing or developing the application and as such includes cost of purchasing/developing, training, maintaining and supporting the application over its entire lifetime.
- Thus, total cost of ownership calculation is complex and hence the project manager has to authenticate his calculation with data sources, assumptions and methods for arriving at the cost.

Step VI : Defining Total Benefits of Ownership :

- The total benefits of ownership includes direct and indirect benefits associated with each alternative. Benefits could be in terms of increased efficiency, improved productivity, improved customer service, improved accuracy and efficiency, or improved decision making.
- However, not all benefits all easy to identify and quantify. Every alternative has certain tangible and intangible benefits. Tangible benefits are easy to identify and quantify as they lead to cost savings. On the other hand, though intangible benefits are identifiable they are difficult to quantify. The project manager should try and quantify intangible benefits by linking them to tangible benefits.

Step VII : Analysing alternatives :

- Once costs and benefits have been identified it is time to compare all the alternatives and arrive at one that best meets the requirement of the organization. Financial models such as ROI, Payback and Net Present Value and Scoring Models are used to analyse the alternatives.

Step VIII : Recommend Solution :

- After analysing each alternative the one that best suits the company should be recommended for approval.

3.6 Project Management Processes :

- Project management is the application of knowledge, skill, tools and techniques to project activities to meet project requirements.
- Project management is accomplished through processes, which support all the activities necessary to implement the project, using project management skills, tools and techniques that receive inputs and deliver outputs. In order for the project to be successful the project manager should select appropriate processes within the process groups that are required to meet the project objectives.
- The project manager has to adapt the product specifications and plans to meet the requirements of the project and product. A process is a set of interrelated actions and activities that are performed to achieve a pre-specified set of products. The project management processes are undertaken by the project team and fall under one of the following category.
  (i) The project management processes are common to most of the projects and are associated with each other by their performance for a common purpose. The common purpose is to initiate, plan, execute, monitor, control, and close a project.
  (ii) Product oriented processes specify and create the project's products. Product oriented processes are defined by the project lifecycle and vary by application areas. Project management processes and product management processes interact throughout the project.
- Project management processes focus on defining, coordinating and controlling the activities needed to manage the project while product management processes focus on the final product i.e. the tangible output of the project, namely, the information system. Unlike, project management processes product management processes necessitate specific domain knowledge to complete the work.
- Thus, every project will require a subject matter expert who has the requisite knowledge, tools and techniques to handle the product processes. However, there must be a balance between project management processes and product management processes.
- For successful project management the project management and product management need to be properly aligned and connected with each other's processes to facilitate coordination.
- Balance is the key, a solo focus on project management processes will not enable the project team to define the project scope or develop a quality system and on the other hand a solo focus on product management processes will not ensure the completion of work as required.

3.6.1 Project Management Process Groups :

Q. Describe the Project Management Process groups.

- Project management process groups have been termed according to the nature of integration between the processes, the interactions within them and the purposes they serve.
- These processes have been grouped into five groups, defined as the project management process group.
- These process groups overlap between the different phases of the project lifecycle since the output of one process group becomes the input for the next or another process group.
- These five process groups are dependent and are performed in the same sequence on each project independent of the industry. A process group constitutes project management processes that are linked by their respective inputs and outputs i.e. the output of one process group becomes the input for the other.
- However, the process groups should not be mixed up with project phases. Large or complex projects may be divided into distinct phases or sub-projects and therefore all process group processes should be repeated for each phase or sub-project.

The five process groups are as follows :

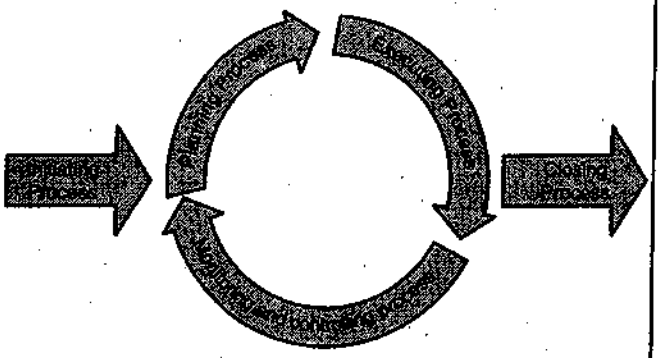


Fig: 3.6.1 : Project Management Processes

(i) Initiating Process Group :

- The initiating process group signals the formal authorization to start a new project or project phase. Initiating process group processes are done external to the project's scope of control by the organization. Even before beginning the initiating process group activities the organizations business needs are identified and documented.
- The business case is developed to establish the feasibility of the new project through a process of evaluating alternatives to pick the best one that can support the organizations strategy and goals. Along with the documentation of the objectives of the organization, the reason why this project best meets the objectives is also documented.
- Developing the business case needs time and money commitment from the organization i.e. there is a cost attached to it. This means that the organization has to make a commitment to the project even before its actual implementation. Once the business case receives the green signal from the management it becomes a project and requires greater commitment from the organization.

(ii) Planning Process Group :

- The planning process group's processes and activities are used by the project team to successfully plan and manage the project. The planning process is the most critical part of the project management process. The planning process group gathers information from various sources and develops the project management plan.
- The efforts expended on planning should be proportional to the size and complexity of the project i.e. larger and complex projects demand more planning efforts while smaller and simpler projects could do away with less efforts.
- Although, the efforts on planning may vary from project to project, planning is required at each phase of the project more so during the development of project charter and project plan. The planning processes also identify, define, and mature the project scope, project cost and project schedule.
- The planning process is iterative in nature and is subject to constant change and revision. Project planning changes as more information emerges, additional dependencies are discovered, new requirements evolve, and new risks, opportunities, assumptions are identified.
- Hence, significant changes occur throughout the project lifecycle making it mandatory to revisit the planning process and in some cases the initiating process again and again. However, experience and good judgement enable the project team to overcome most of the difficulties during the planning process.
- Supporting processes include a basic description of the project scope, the deliverables, project duration, resource planning, activity planning, cost estimating, schedule estimating, organizational planning and procurement planning.

(iii) Executing Process Group :

- The developed and approved project plan needs to be executed in order to bring the project to realty. The executing process group consists of the processes used to complete the work defined in the project plan.
- The project team should determine which of the processes are required for the implementation of

the plan. The product oriented processes play an important role in the completion of the project plan activities.

- The executing process group involves coordinating people and resources as well as integrating and performing activities in accordance with the project plan. This process group also addresses the scope defined in the project scope statement and implements changes approved by the project team. The supporting processes in this process group include perform quality assurance, acquire and develop project team, risk management, and implementation plan.

(iv) Monitoring and Controlling Process Groups :

- The monitoring and controlling process group consists of those processes that observe and control project execution so that potential problems can be identified in a timely manner and corrective action can be initiated. This process group also measures the progress made in the direction of the project's MOV as well as the scope, cost, schedule and quality objectives.
- The key benefit of this process group is that project performance is observed and measured regularly to identify variances from the project plan. This group also includes proposing controlling changes and preventive action in anticipation of problems. Supporting processes include scope control, schedule control, quality control, budget control and communications plan.

(v) Closing Process Group :

- The closing process group includes all the processes used to formally terminate all the activities of a project or a project phase. In case the project has been successfully completed the project team should ensure that all deliverables have been completed to the satisfaction stakeholders and that the project sponsor accepts the project's products.
- The project team should also ensure that the final product has been successfully integrated into the day-to-day operations of the organizations. In case the project has failed the project team has to document all the relevant information with the project sponsor and then close the cancelled project.
- This process group when completed indicates that all the processes within all other process groups have been completed and the project or project phase is ready to be closed. There are primarily two types of closures; contract closure and administrative closure.
- Contract closure indicates that all agreed upon project deliverables and agreed upon terms have been completed and that the project can now officially end. It also paves the way for all the specifically assigned resources to be reassigned to new projects and dues under the contract to be paid.
- On the other hand, administrative closure involves documenting of all project related information that would prove valuable for future projects. Although each phase has a closing process, the major emphasis is during the final project closure process.

Syllabus Topic : Managing Data Resources

3.7 Data Resources :

Introduction of Data Resources

- The rapid growth in industrialization and computerisation has created information management challenges. Also, the transformation from legacy information systems to a singular enterprise-wide information system presents its own set of challenges for the information system manager. Each functional department has its own systems and its own set of customer, vendor and product data. As the data is coming from different sources it is more than often inconsistent, duplicated or incomplete.
- Thus, the challenge is to reconcile the data from multiple systems and present a clear single set of data that is accurate and consistent for the entire enterprise. The enterprise has to ensure that it does not use multiple versions of the same piece of data in different parts of its operations by merging disparate records into a single authenticated master file.
- Although, this method is in sharp contrast to the adage "to never place all eggs in one basket" that is exactly what is recommended when it comes to the management of data. Once the master file is in place employees and applications access a single consolidated view of the enterprise's data.
- However, this is easier said than done as this is a multi-step process that includes business process analysis, data cleansing, data consolidation and reconciliation and data migration into a master file of all the enterprise's data.
- This becomes all the more difficult when the enterprise is involved in mergers and acquisitions. In such cases, the enterprise must identify what group has what data and is responsible for resolving inconsistent definitions of data and other discrepancies. In the first stage the enterprise may let the data continue to reside in the system where they originate but are also registered in a master file and cross referenced so that applications can find the data. The data in the source system are not touched. After a certain period of consolidation the data from numerous systems are integrated into a master data store. Data that are outdated, incomplete or incorrectly formatted are rectified or eliminated. Also, a registry is maintained which points to where the

source data are stored. Thus, by having a single consistent enterprise-wide set of data with similar definitions and standards, user is able to easily find out the information he is seeking.

- The success of any business entity depends on what it can or cannot do with the immense data it has. The organizational effectiveness hinges on the ability of the business enterprise to store, organize and manage their data. Manual paper processes are no longer viable as it become difficult to manage information from an enterprise-wide perspective. A better solution would be to identify, consolidate, cleanse and standardise data in a single master data management registry. The data has to be reorganised into a standard format and rules, responsibilities and procedures for updating and using the data have to be established. Data stored in a master data management system helps boost profitability, improves operational efficiency and decision making by having more accurate and complete data available.

3.7.1 Traditional Organization of Data :

Q. State the characteristics of good information.

The objective on any information system should be to provide its users with good information. When we say good information we mean the action that the information induces in the user and its contribution in effective decision making. The value of the information is determined by the value of the change in the decision making behaviour.

Now, let us discuss some of the characteristics of good information

– Timeliness	– Appropriateness	– Accuracy
– Relevant	– Conciseness	– Complete
– Frequency	– Current	– Economical
– Understand ability		

- **Timeliness :** Information must reach the user in a timely manner, just when it is needed; not too early, because by the time it is used it would be out-of-date; not too late because the user will not be able to incorporate it into his/her decision-making.
- **Appropriateness :** Information must be relevant to the person who is using it. It must be within the sphere of his/her activities so that it can be used to reduce uncertainty in his/her decision-making.
- **Accuracy :** Accuracy costs. We don't always need 100% accurate information so long as we know the degree of accuracy it represents (e.g.: ± 5%).
- **Conciseness :** Information should always contain the minimum amount of detail that is appropriate for the user. Too much detail causes information overload.
- **Frequency :** Frequency is related to timeliness. Too often the information presented is linked to the calendar (end of the week, beginning of the month); its frequency should be synchronized with the timing of the decision making of the user.
- **Understand ability :** The format and presentation of information are very important. Some people prefer tabular information, whereas others may need it in a graphical form. Also the use of colors enhances the understandability of what is presented.
- **Relevant:** It pertains to the particular problem. What data is relevant depends on the decision-making model used. E.g. University admissions officials may choose to consider the results of some high-school test irrelevant, if they believe that it does not improve the chances of some applicant later becoming a successful student.
- **Complete :** All the relevant parts are included. E.g. Marketing data about household incomes may lead to bad decisions, if not accompanied by consumption habits of the target population.
- **Current :** Decisions are often based on the latest information available
- **Economical :** The costs of gathering information should be justified by the overall benefits
- **Errors and Bias:** The decision maker will always prefer information which has quality and not the quantity of information that he is receiving. The quality of the information is bound to get affected due to the bias of the presenter and the errors that may occur due to various reasons. Now if the presenter is known to the decision maker then he anticipates the degree of bias and can make the necessary adjustments in his decision making. But the same is not possible with errors as errors pose a more serious problem as errors can creep in at various stages and it is not possible to make the adjustments in the decision making.

However, there are many business enterprises that do not have timely, accurate or relevant information because the data in their information systems has been poorly organised and maintained. This makes management of data all the more essential. To understand the problem we will need to study how information systems arrange data in computer files and the traditional methods of file management.

3.7.2 Concept of File Organization :

Data in a computer system is organized in a hierarchical manner starting with bits and bytes and progressing to fields, records, files and databases.

- **Bit** – a bit is the smallest unit of data that a computer can handle. A bit is used to denote the basic and physical unit of information.
- **Byte** – byte is a unit of information and consists of 8 bits. A byte represents a single character, which can be a letter, number or another symbol.
- **Field** – a field is a grouping of characters into a word, a group of words or a complete number.
- **Records** – a grouping of such related fields comprises a record. Data is usually stored in the form of records. Each record consists of collection of related data values or items where each item corresponds to

particular field of the record. Collection of field names and corresponding data types constitutes of record format. Data type is associated with each field. Field uses standard data type in programming having numeric (integer, long integer float), string (Array of character), Boolean (0 or 1, TRUE or FALSE), Date (YYYY-MM-DD) and time.

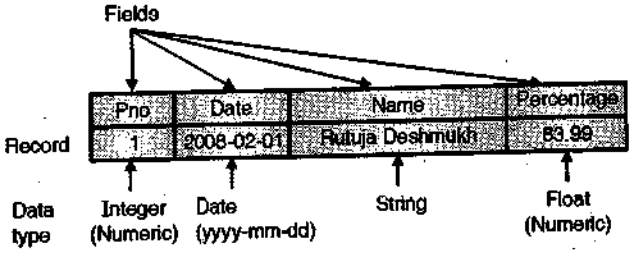


Fig. 3.7.1 : Data types in File

- **File** – a file is a group of records of the same type. The records the Fig. 3.4 constitute a student's percentage.
- **Database** – a group of related files makes up a database. The above shown file can be grouped with files of other students to create a student's percentage database.

3.7.3 Problems with Traditional File System :

Q. What are the problems of traditional file system?

The traditional file system, which still exists in many organizations, is plagued with many problems. The system is developed without taking an enterprise-wide plan and each system applicable to each functional unit is developed independently. Thus, we have accounts, production, human resources and every functional department within the organization developing their own system and maintaining their own data files. Each application required its own files and its own software to operate. This lead to the creation of multiple master files which were operated by separate functional departments. Now, imagine an organization which is operating in a similar manner for a number of years. It is bound to be saddled with number of programs and applications that are difficult to maintain and manage. This leads to problems of data redundancy, data inconsistency, poor data security, inflexibility, and inability to share data among applications.

- **Data Redundancy :** data redundancy is the outcome of multiple systems operating within the enterprise. Multiple systems give rise to the duplication of data as the same data is stored in multiple locations. Data redundancy takes place when different groups within the organization collect and store the same data independently. As the same data is collected and stored by multiple departments of the same enterprise it leads to wastage of storage resources and also gives rise to data inconsistency.
- **Program-Data Dependence :** as each department has its own program that updates and maintains the data files a change in program will automatically lead to changes in data. So data worked upon by one program would be of no use to other programs as they would be making changes in the data that would make them useless for other programs. Such changes could prove to be costly to the organization.
- **Lack of Flexibility :** the traditional file systems lack the ability to cater to ad hoc information requirements in a timely manner. These systems have been developed to deliver routine scheduled reports only and although the information requested is there in the system it would be prove to be costly to retrieve.
- **Lack of Security :** as there is no central control over the data being collected, accessed and disseminated there is a likelihood of the information being tampered with or being accessed by unauthorised people. All this is not promising from the point of view of the organization.
- **Lack of Data Sharing :** the sharing of data and information in a timely manner is virtually not possible. Also, as each piece of information has different values it is not possible to trust the accuracy of the information being shared and this hampers the flow of information.

3.8 Database Approach to Data Management :

Q. Describe briefly the database approach to data management.

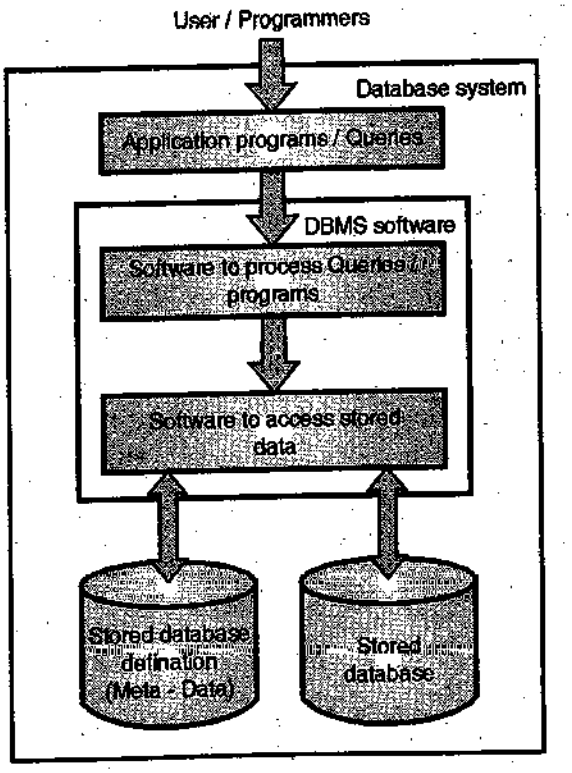


Fig. 3.8.1 : A simplified database system environment

Database :

- Data base system is a term that is typical used to encapsulate the construct of a data model, database management system (DBMS) and data base.

- A data base is an organizer pool of logical - related data. Data is stored within Data structure of the data base.
- A DBMS is suite of computer software providing the interface between users and a database or database A DBMS is a shell which surrounds Database or series of database through all interaction takes place with the data base.

Functions :

- Defining new data structure for a database, removing data structures from the database, modifying the structure of existing data.
- Data Maintenance inserting new data into existing data structures, updating data in existing data structures, deleting data from existing data structure.
- Data retrieval querying existing data by end-users and extracting data for use by application programs.
- Data control creating and monitoring users of the database restricting access to data in the database and monitoring the performance of the database.
- Both a database and its DBMS confirms to the principal of a particular data models data models include the hierarchical model data model, the network data model ,the Relational Data model an then object-oriented data model.
- A database management system (DBMS) is a computer software designed for the purpose of managing data base.
- DBMS may use any of variety of data model, such as network model or relational model. The role of a DBMS in a larger system is to allow other software, or users, to store under retrieve data in a structured way.
- A set of computer programs that controls the creation, maintained and utilization of the database of an organization.
- A "Database Management system" is software that defines a database, stores the data, supports a query language produces report and creates data entity.
- The database approach evolved/emerged out of the need, indeed urgency, to eliminate the data management problems. Hence, the name Database Management System.
- Database is pivotal to IS. The database implies a particular structuring of data, both conceptual/logical and physical. But what is meant by the term Database really?
- A database could be defined as, "A mechanical/automated, formally defined, centrally controlled collection of data in an organization". Database can also be defined as, "A collection of data organized to service many users/applications at the same time and managing data so that they appear to be in one location".
- Instead of storing the information individually in dissimilar location/records, for different application, the data proceedings are actually organized and store, so as to promote distribute aptitude, availability, resolvability and integrity, which are the major objectives of the database approach.
- The aforesaid objectives of the database approach are detailed in the following diagram as they provide a guide to the database requirements process and data modeling.

Database Management System

- DBMS is basically a software system which performs the functions of defining, creating, revising and controlling the database.
- DBMS is especially devise/deliberate software to create and maintain a database and enable individual business applications to remove the data they need without having to fashion separate files or data definitions in their computer programmer.

DBMS - The Conceptual Model

The conceptual model of the DBMS could be illustrated as follows:

The DBMS Components :

The components of database management system are classified in three parts:

1. Data Definition Language (DDL)
2. Data Manipulation Language (DML)
3. Data Dictionary

The DBMS components have been illustrated hereunder:

1. **Data Definition Language (DDL) :**
   - DDL, the first component of the DBMS, is the formal language used by the computer professionals to specify the content and structure of the database.
   - It defines each data element as it appears in the database. The data element is then translated into the format desired/required by the applications programmed.
2. **Data Manipulation Language (DML) :**
   - The DML is the second component of the DBMS. It is a specialized language, which is used by the end-users and programmers to manipulate data in the database.
   - The DML consists of commands, which enable end users and programmers to extract data from the database to satisfy information requests and develop applications.
   - The DML is usually used in combination with some 3rd Generation or 4th Generation Programming Languages. The SQL or Structured Query Language, is presently, the most important and established data manipulation language used.
3. **Data Dictionary :**
   - Data Dictionary, which is considered to be the core or the hub of the DBMS, is the third component of the DBMS.

- The Data Dictionary is the storehouse of in sequence about data. In fact, defines each data constituent (which represent a field) and provides it a given name and identifier for simple right to use.
- The data dictionary is a mechanized or physical, lively or inactive file which stores the definition of data elements and data individuality.
- The information restricted in the data dictionary could be stated as follows :
  - The name of the data item
  - The narrative of the data item (The description may be a language description or data processing description. It may also specify permissible values, edit and validation criteria, security, calculations for determining value, classification aliases, owners and number of occurrences).

The sources of the data (input sources) :

- The impact analysis (data users, screens, reports, programmers and organizational position that entrance and use the data item).
- Keywords used for categorizing and searching for data item descriptions.

The Data Dictionary Functions :

- The Data Dictionary is useful in carrying out the following functions :
  1. It defines the data component.
  2. It helps in preparation and manages.
  3. It permit users know which data is available and how can it be obtained.
  4. It helps to identify directorial data irregularity, if any.
  5. It provides a equivalence instrument and acts as a corporate glossary of the ever-growing information resource.
  6. It serves as an important data management device.
  7. It provides the statement Facility; manage Facility and the Excerpt Facility. The Report Facility enables the users to have complete Reports, irritable Reference information and rundown Reports. While comprehensive Reports provide details about data items and their uses, Cross Reference Reports indicate relationships and précis Reports provide various précis data.
- The Control Facility detects violations of standards for user authority documentation etc.
- The Excerpt Facility facilitates the performance of specific tasks such as preparation of test data, copying code from existing programmes, inserting of code in programmer under development and copying documentation into source code.

Database Models :

There are three types of database models commonly in use in business organizations. These models are used for keeping track of entities, attributes and relationships. The three database models are:

1. Hierarchical Database Model (HDBM)
2. Network Database Model (NDBM)
3. Relational Database Model (RDBM)

1. Hierarchical Database Model (HDBM)

The Hierarchical Database Model is one of earliest DBMS, when the computer applications focused on processing huge data like the sales order processing, check processing, inventory updating etc.

- This model follows a structured organizational mode. It represents data in a pyramidal or tree-like structure.
- Each record appears to be like an organizational chart with one top level segment, called the root, spreading downwards into branches and leaves as illustrated.
- Under this Model there is a record. Within each record, data elements are organised into pieces of record called segments.
- An upper segment is connected logically to a Lower segment in a parent-child relationship.
- A parent segment can have more than one child, but a child can have only one parent, indicating a one-to-many relationship.
- The hierarchical model is, thus, highly structured and requires a controlled, finite and rule-based approach, where record and its segments are connected to each other in one-to-many parent-child relationships.
- The most common hierarchical DBMS has been the Information Management System (IMS) released by the IBM in 1968.

2. Network Database Model (NDBM) :

The NDBM is a variation of the earlier.

3. Relational Database Model (RDBM) :

The Network Database Model features data logically as many-to-many relationship. To put it more succinctly, just as 'parents can have multiple children', a 'child' too can have more than one 'parent'. The many-to-many relationship under this model is illustrated here under :

- It would be observed that the data regarding the sales person could be made use
- Understanding / analyzing 'Sales Zone' performance.
- Analyzing Sales/ Recovery position.
- Analyzing product-wise sales performance.

The network model was used by the US giant business corporation General Electric during the mid-sixties and their model was known as the Integrated Data Store (IDS) The model was developed by the GE under the leadership of

Charles Bach man The model used blocks, area and arrows to represent the organization's database. This process is popularly known as "Bachman's Diagram".

IDS, it may be noted, emerged to be the standard of the CODASYL Group, an organization of major hardware and software vendors.

Relational Database Model (RDBM) :

The Relational Database Model is the most recent of the three database models and was proposed by Dr. E. F. Codd in 1970. The model represents all data in the database as simple two-dimensional tables called 'Relations'. The table has rows and columns, the rows representing individual records and the columns representing attributes of each record. Although the tables appear to be similar to flat files, the information in more than one file can be easily extracted and combined to suit the user's specific requirements, thereby providing ad-hoc request flexibility/facility.

The key is the separation of the data on logical and physical levels, which is made possible by use of sophisticated mathematical algorithms and notations, which are used in the relational model.

Basic Operations Used in RDBMS :

The relational database makes use of three basic operations to develop useful sets of data.

The three basic operations are :

1. Select 2. Project 3. Join

1. **Select :** The 'Select' operation is used for create a subset consisting of all records in the files, which satisfy the stated criteria. To put it differently, 'Select' operation is used for creating a subset of rows that meet certain stated criteria.
2. **Project :** The 'Project' operation helps create a subset consisting of columns in a table and permits the user to create new tables which contain the acquired information only.
3. **Join :** The 'Join' operation combines relational tables to provide the user with more information than is available in individual tables.

Some of the leading relational database management systems are DB2 from IBM, Oracle from Oracle Corporation, Microsoft Access, dBase IV and Paradox.

Database Models : A Comparison :

- We have, so far, discussed the three database models viz., the Hierarchical Database Model (HDBM), Network Database Model (NDBM) and the Relational Database Model (RDBM)
- Let us now make an attempt to compare the three database models.

Features / Aspect	HDBM	NDBM	RDBM
Data storage	"Tree Structure" (Parent to Child)	Sets and records in Y structure	Two dimension al table structure
Processing Efficiency	High	High/Medium	Improving
Flexibility	Low	Low/Medium	Improving
Deletion	Roots and nodes are deleted along with	After deletion of one type set, other record, information may get deleted, causing deletion of another set type	Possible
Insertion of Entity	Not Possible	Easily Possible	Possible
Request for Information	Procedural, in accord with the Tree structure	Complex and procedural	Non-procedural as no positional dependenc y between 'Relations '
End user orientation and friendliness	Low	Low/Moderate	High
Simplicity for user	Has to know database tree structure	Not so simple	Most simple to use
Degree of data independence	Low	Low	High
Programming Complexity	High	High	Low

DBMS : Advantages :

Following can be said to be the major advantages of the DBMS :

1. The DBMS helps reduce the difficulty in the systems surroundings due to the central control/management of data, access, utilization and security.
2. As same data elements are not frequent in all the files, DBMS helps reduce/eliminate data redundancy and inconsistency and promote data integrity throughout the system/organization.

3. The DBMS provides for central control of data creation and definition, thereby reducing/eliminating data confusion.
4. DBMS helps to bring about substantial reduction in the costs related with programmed development and maintenance.
5. DBMS helps separate logical view and physical arrangement, thereby, reducing programmer-data dependence.
6. DBMS, particularly the RDBMS, permits ad-hoc queries, here by ensuring flexibility of information systems. DBMS helps increase access and availability of/to information. It may be mentioned that among the DBMS, Oracle, Ingress, Sybase, Informix and Unify are some of the products on the Server Class machine and dBase, FoxBASE Access and Paradox are some of the products on the client class machines.

3.9 Advantages of DBMS over File System

Q. State the advantages of DBMS over File system.

Following points covers the advantages of DBMS on the points which are posses drawbacks of the file system;

(1) Data redundancy :

- This is the major problem with file system.
- If similar information is stored in more than one place, afterwards the updatation or minute changes may happen only with one file. It is not possible always to update each and every file, because it is time consuming process. In future this mismatch of data (information) causes inconsistency.

(2) Security :

- File processing system can not assure any kind of security mechanism with it's data.
- Database system can hide the stored information from the unauthorised person.
- Database system has various security mechanism. For example username, password etc.

(3) Data isolation :

- The data is stored in the file according to different purpose in different manner (different format).
- This formatting of data is dependant on the programmer.
- Since data isolation is not possible as data will be in different format in file system.
- Database system record (or store) each and every data in similar way and hence data isolation is possible in database system.

(4) Accessing data :

- File system contain huge amount of data. To access such huge data file system uses special application programs.
- Because of huge data, the access is in maximum time.
- Manually searching and then access is quite difficult task with file system.
- In database system we can access the data with the help of query language for example structure query language (SQL) (that we will discuss in chapter number 7)

(5) Concurrency control :

- If one user of file is engaged with its file operation other user cannot access same file for using data from respective file.
- Another user can access that file, when the current user leaves that file.
- In general, sharing of file is not possible with the file system.
- In database system such current access problems are removed by concurrency control method.

3.9.1 Capabilities of Database Management Systems :

A Database Management System has capabilities and tools for organizing, managing and accessing the data in the database. These tools and capabilities are as follows:

1. Data Definition Language :

1. As we know the overall design of the database is nothing but **schema** of that database.
2. If we specify the database schema by a set of definitions expressed by a specific language called a Data- Definition Language. (DDL)
3. This is very important because with the help of DDL we can create the database.
4. The SQL-DDL provides commands for defining relational schemas, deleting relations and modifying relation schema.

2. Data manipulation Language :

1. A **query** is a statement requesting the retrieval of information. This is used for accessing and manipulating the data.
2. Data manipulation language is used to add, change, delete, and retrieve data from the database.
3. The portion of the DML that involves information retrieval is called a **query language.**
4. The SQL-DML includes the query language based on the both relational algebra and tuple relational calculus.
5. It includes the commands like insert tuple into, delete tuple from and modify tuple in the database.

3. Data Dictionary :

1. A data dictionary is an automated or manual file that stores definitions of data elements and their characteristics.

2. Data dictionary displays information about the name, description, size, type, format, and other properties of each field in a table.
3. Data dictionaries for large corporate databases may capture additional information, such as usage, ownership, authorization, and the individuals, business functions, programs, and reports thatuse each data element.

3.10 Distributed Data Management :

- Data is a vital resource and hence its management is very crucial for the survival and success of any organization. The emergence of the mainframe, programming languages and business productivity applications allowed organizations to capture and store more data than previously imaginable and to begin automating and accelerating basic business processes.
- Data Management, though was still largely a matter of capture, store, access and report. Distributing data widely beyond the immediate scope of the application that created the data was not a priority. Well, those were simpler times. Today, the distribution of data is of utmost importance, because the data is needed by a broad audience and the response times have become much tighter by order of magnitude. The methods for distributing data in today's up-to-the-nanosecond business environment require a very different technology strategy than those of the past.
- Data storage and management functions have strategic importance in the information age and hence managers need to practice Data Resource Management.
- Data Resource Management incorporates activities like database management, data warehousing and other activities which assist in managing the data resource of the organization and meeting its information need.
- In this section we will be studying the management of distributed data of an organization and how it can be used to meet the information needs of the organization.

3.10.1 Distributed Databases :

Q. What are distributed databases? State the advantages and disadvantages of distributed databases.

- A distributed database is a database in which storage devices are not all attached to a common CPU. It may be stored in multiple computers located in the same physical location, or may be dispersed over a network of interconnected computers.
- Collections of data (e.g. in a database) can be distributed across multiple physical locations. A distributed database can reside on network servers on the Internet, on corporate intranets or extranets, or on other company networks. The replication and distribution of databases improves database performance at end-user worksites. The distributed databases may contain operational, analytical or discussion databases.
- To ensure that the distributive databases are up to date and current, there are two processes: replication and duplication. Replication involves using specialized software that looks for changes in the distributive database. Once the changes have been identified, the replication process makes all the databases look the same. The replication process can be very complex and time consuming depending on the size and number of the distributive databases. This process can also require a lot of time and computer resources.
- Duplication on the other hand is not as complicated. It basically identifies one database as a master and then duplicates that database. The duplication process is normally done at a set time after hours. This is to ensure that each distributed location has the same data. In the duplication process, changes to the master database only are allowed. This is to ensure that local data will not be overwritten. Both of the processes can keep the data current in all distributive locations.
- Besides distributed database replication and fragmentation, there are many other distributed database design technologies. For example, local autonomy, synchronous and asynchronous distributed database technologies. These technologies' implementation can and does depend on the needs of the business and the sensitivity/confidentiality of the data to be stored in the database, and hence the price the business is willing to spend on ensuring data security, consistency and integrity.

Distributed data management enables information to flow freely from the data center to the point of action and back. Distributed data management is a requirement for any organization that needs to :

- Process extreme transactions that are driven by Internet-enabled business models and highly distributed, global, always-on applications.
- Fuel analytic applications with comprehensive, timely data in order to drive revenue growth, identify risks and trends, improve products and services, grow market share and enhance customer loyalty.
- Empower and support remote offices and mobile employees so they can out-think and out-perform competitors.

Optimizing Performance and ROI :

- Decoupling databases from applications and integrating enterprise-wide data can enable any person using any device to access the information he/she needs. Sophisticated data movement technology can automatically deliver and refresh that data so it is always available when and where it is needed and to facilitate collaboration regardless of location. Leveraging the power of cluster and virtualization technology will improve performance, reliability, productivity and ROI.
- All of these actions and others fall under the umbrella of distributed data management. As competition inevitably increases, organizations need to shift their focus and efforts to ensure that decision-ready

information is readily available to employees, customers and business partners who need it, when and where they need it on the computing device of their choice.

3.10.2 Advantages and Disadvantages of Distributed Data :

Advantages :

Management of distributed data with different levels of transparency like fragmentation transparency, replication transparency.. etc..

- Increase reliability and availability.
- Easier expansion.
- Reflects organizational structure - database fragments are located in the departments they relate to.
- Local autonomy or site autonomy - a department can control the data about them (as they are the ones familiar with it,)
- Protection of valuable data - if there were ever a catastrophic event such as a fire, all of the data would not be in one place, but distributed in multiple locations.
- Improved performance - data is located near the site of greatest demand, and the database systems themselves are parallelized, allowing load on the databases to be balanced among servers. (A high load on one module of the database won't affect other modules of the database in a distributed database.)
- Economics - it costs less to create a network of smaller computers with the power of a single large computer.
- Modularity - systems can be modified, added and removed from the distributed database without affecting other modules (systems).
- Reliable transactions - Due to replication of database.
- Hardware, Operating System, Network, Fragmentation, DBMS, Replication and Location Independence.
- Continuous operation.
- Distributed Query processing.
- Distributed Transaction management.
- Single site failure does not affect performance of system. All transactions follow a-atomicity, the transaction takes place as whole or not at all; c-consistency, maps one consistent DB state to another; i-isolation, each transaction sees a consistent DB; d-durability, the results of a transaction must survive system failures. The Merge Replication Method used to consolidate the data between databases.

Disadvantages :

- Complexity - extra work must be done to ensure that the distributed nature of the system is transparent. Extra work must also be done to maintain multiple disparate systems, instead of one big one. Extra database design work must also be done to account for the disconnected nature of the database - for example, joins become prohibitively expensive when performed across multiple systems.
- Economics - increased complexity and a more extensive infrastructure means extra labour costs.
- Security - remote database fragments must be secured, and they are not centralized so the remote sites must be secured as well. The infrastructure must also be secured (e.g., by encrypting the network links between remote sites).
- Difficult to maintain integrity - but in a distributed database, enforcing integrity over a network may require too much of the network's resources to be feasible.,
- Inexperience - distributed databases are difficult to work with, and as a young field there is not much readily available experience on proper practice.
- Lack of standards - there are no tools or methodologies yet to help users convert a centralized DBMS into a distributed DBMS.
- Database design more complex - besides of the normal difficulties, the design of a distributed database has to consider fragmentation of data, allocation of fragments to specific sites and data replication.
- Additional software is required.
- Operating System should support distributed environment.
- Concurrency control: it is a major issue. It is solved by locking and time-stamping.

3.11 Use of Databases to Improve Business Performance and Decision Making :

Q. Describe the use of databases to improve business performance and decision making.

- The primary purpose of databases is to keep track of business transactions which includes, processing customer orders, keeping track of dispatches, employee salaries and other benefits, payment to suppliers and their orders, etc. In addition to this databases are also used to provide information that will help the management run the organization more effectively and efficiently, and provide assistance in the decision making process. Vital information regarding customer purchase patterns can help the management in taking decisions regarding the product line and production pattern. The database capabilities that help in analysing vast quantities of data contained in large database are data warehousing, data mining and tools for accessing internal databases through the web.

3.11.1 Data Warehousing :

Introduction :

- The company organizations produce huge amount of data from their day-to today behavior/operation.
- On-Line Transaction Processing (OLTPJ, Point-of-Service (POS) Systems, ATMs and Webs have now become the new sources of data generations.

- These huge, routinely generated data are unfortunately, equally routinely collected and confined to the archives of many corporate organizations.
- Such data, in today's Information Era, constitute one of the potentially most powerful assets of the corporate organizations.
- However, as the data are routinely collected and stored away in the archives, these organizations typically face the dilemma of being "DATA-RICH" but "INFORMATION-POOR".
- This dilemma leads to the challenge viz. How to extract valuable information from huge data and make it available to the right person, at the right place, at the right time, at the right cost and in the desired/ appropriate form to support the decision making process/function?"
- It is in the context of this impasse that the question arises as to whether the huge data that is generated and stored away in the records can be used for further civilizing the efficiency and effectiveness of the commercial/ production organizations.
- It is here where Data Warehousing and Data Mining play a vital role. It would indeed, be in the robustness of things to state that the corporate future, in today's increasing and intensifying globalization, hinge on Data Warehousing and Data Mining.
- No wonder then that Data Warehousing and Data Mining are more and more popular among both the IT Professionals and the Corporate World.

Definition :

- Data Warehousing is a new technology that provides the users with the tools to store the summarized information from multiple, heterogeneous databases in a single repository.
- Data Warehouse is also seen as a Data Arrangement and Analysis Technology, adopting an "up-date" approach.
- What has been mentioned earlier can perhaps be considered as generic perceptions about Data Warehousing.
- However, Data Warehouse has also been specifically defined. Before moving further, therefore, let us note a few definitions of Data Warehouse.
- According to Vidette Poe, "Data Warehouse is a read only analytical database that is used as the foundation of a Decision Support System".
- Amy Helen Johnson defines a Data Warehouse as, "a database that collects business information from many sources in the enterprise covering all aspects of the company's processes, products and customers".
- W. H. Xnmon, who is considered to be the "Father of Data Warehousing", has given the following definition : "A Data Warehouse is a subject-oriented, integrated, time-varying, non-volatile collection of data in support of the management's decision making process".

Subject-Driven :

- A data warehouse is organized around major subjects and contain only the in sequence necessary for the decision support processing.
- It is not organized according to application (e.g. a data warehousing for Bank would be organized by customer, deposit/ advances, interest rate and not by different products).

Non-Volatile :

- A data warehouse is always a physically separate data store. The relative data is transformed from the application data.
- As such, Data Warehousing does not require dispensation of transactions, recovery etc.
- The data are not updated or changed after the data enters the Data Warehouse. Data are only loaded, refreshed and accessed for queries.

Time-Varying :

- Data in the data-warehouse is collected from the corporate data archives and could be 3 to 10 years old, or even older.
- The data provide historical perspective and are used for comparisons, trends and forecasting.

Integrated :

- While constructing the 'data warehouse, multiple, heterogeneous sources such as relational databases, flat files and OLTP files are utilized and data collected from them is integrated.
- Data cleaning and data integration techniques are applied to maintain constancy in naming conventions, measures of variables, encoding structures and physical attributes.

Data Warehouse Structure/Architecture

- We have, so far, discussed the definition of data warehouse. Before we proceed further, let us note. A typical data warehouse structure.
- The structure of data inside the data warehouse.

The flow of data inside the data warehouse.

(a) Data Warehouse Structure

It must, however, be noted that the data warehouse structure could vary from I business to another depending upon the business activity.

(b) Structure of data inside the data warehouse

(c) Flow of data inside the data warehouse

The major functions/utilities of Data Warehouse could be stated as follows :

- It helps integrate data from a number of diverse, heterogeneous sources.
- It consolidates such data and stores it in a step-by-step fashion. Such data can then be used for "Informative Analytical Processing" over a long historical time perspective.
- It allows the management mostly at the senior level using the Decision Support System (DSS) and the

Executive Information System/Executive Support System (EIS/ESS) for semi/unstructured decisions - to consider issues in context, by providing a consistent view of the enterprise.

- It helps create an enterprise-wise integrated database of summarized historical information and supports business analysis and decision making.
- It improves the optimization efforts through consolidation, conversion transformation and integration of operational data.
- In addition to the utilities/functions stated above, there are some other benefits of data warehousing. Such benefits, as stated by H. J. Watson and B. J. Haley (Managerial Considerations Communication of the ACM 42 (9) 1998) are illustrated hereafter.

Benefits from Data Warehousing :

- A Data Warehouse typically starts out as Very Large Database (VLDBs) containing huge data records - numbering millions or even hundreds of millions ! Data Warehouse, as a process, evolved increasingly within an endeavor. The longer that a Data Warehouse has been in use, the more it-would evolve.
- Initially, the Data Warehouse was mainly used for generating reports and answering pre-defined queries. Eventually, it was used to analyze the summarized and complete data.
- In the next phase, the Data storehouse was/can be used for strategic purposes, performing arts multi-dimensional analysis and sophisticated "slice and dice operations".
- Finally, the Data Warehouse may be used for knowledge discovery and strategic decision making using Data-Mining tools. In this context, the Data Warehousing tools can be categorized into:

1. Access Tools
2. Retrieval Tools
3. Database Reporting Tools
4. Data Analysis Tools
5. Data Mining Tools

Data Warehousing : Successful Implementation :

- Drury Jenkins, an expert on Business Intelligence, has written a lot about Data Warehouse and how it supports Business Intelligence.
- According to Drury Jenkins, certain mistakes must be avoided while implementing Data Warehousing.
- Some of the Data Warehousing mistakes which need to be avoided are :
  (a) Not implementing a comprehensive meta data strategy.
  (b) Not deploying a central warehouse administration tool.
  (c) Not cleaning or integrating transactional data.
  (d) Expecting the warehouse to stay static.
  (e) Under-estimating the refresh and update cycles.
  (f) Using a poor definition and approach.
  (g) Poor design and data modeling,
  (h) Using inexperienced personnel.

3.11.2 Data Mining :

Q. What is data mining? How does data mining work.

- As stated earlier, a lot of data gets collected by the company in the course of their daily operation.
- The data so collected is normally store/accumulate in a Data Warehouse and Data public sale for analysis.
- The analysis is conducted, using the stored data, to help managers in the decision making process.
- 'The analysis becomes more meaningful using Data-Mining, as it enables managers to establish relationship between business elements and find out aspects and facts about their business that may not be evident otherwise.
- Data Mining, thus, is an information analysis tool that involves the automated discovery of patterns and relationships in a data warehouse.
- Data mining is a new, but powerful concept that has started to gain popularity in the Business Intelligence World.
- Data Mining aims at extracting patterns, trends and rules from Data Warehouse to evaluate, either predict or scour proposed business strategies, which in turn, will improve competitiveness, improve profits and transform business processes.

Definitions :

- Data Mining has been defined in various ways. Let us note a few of these definitions "Data Mining, or Knowledge Discovery Databases (KDD), as it is also known is the non-trivial removal of understood, beforehand unknown and potentially useful information from the data.
- This encompasses a number of technical approaches, such as clustering, data summarization, classification, finding dependency networks, analyzing changes and detecting anomalies".
- **KDD :** Knowledge Discovery in Database is the process of identifying a valid, potentially useful and ultimately understandable structure of data.
- The process involves selecting or sampling data, from a data warehouse, cleaning or pre-processing it, hand forming or reducing it (if needed), applying a data mining component to produce a structure and then evaluating the derived structure.
- "Data Mining is the search for the relationships and global patterns that exist in large database but are hidden among vast amounts of data, such as the relationship between patient data and their medical diagnosis.
- This relationship represents valuable knowledge about the database, and the objects in the database, if the database is a faithful mirror of the real world registered by the database".

- Data Mining refers to "using a variety of techniques to identify nuggets of information or decision making knowledge in the database and extracting these in such a way that they can be put to use in areas such as decision support, prediction, forecasting and estimation.
- The data is often voluminous, but it has low value and no direct use can be made of it. It is the hidden information in the data that is useful".
- Data mining is "the process of discovering meaningful, new correlation patterns and trends by sifting through large amount of data stored in repositories, using pattern recognition techniques as well as statistical and mathematical techniques".

Objectives of Data Mining :

As could be observed from the definitions quoted earlier, data mining is expected to lead to the following results :

(a) Discovering unknown associations. Such associations can be found when one event can be co-related to another event that seems completely unrelated.

(b) Sequences, where one event leads to another later event.

(c) Recognizing patterns that lead to classification or new organization of data.

(d) Finding out facts previously not known (event clustering).

(e) Forecasting or simply discovering patterns in the data that can lead to predictions in/about the future.

Working of Data Mining :

- Data Mining, as is clear by now, is more empirical and hence application-oriented and applications facilitator. As such, Data Mining has to be of real value for an organization.
- The outcome of Data Mining must be measurable and actionable. Hence, Data Mining should not only enable the analysis to be undertaken/performed but it must enable learning from this activity.
- This learning, in turn, are applied in practice for ensuring qualitative/predictive decision making.
- The typical cyclical functioning of Data Mining would therefore consist of the following :
  1. Understanding the situation.
  2. Building/Developing (suitable) model/s.
  3. Undertaking analysis based on the model/s.
  4. Initiating appropriate action.
  5. Measuring the results.
  6. Iterations.

Data Mining Applications

- As stated earlier, "data mining takes the evolutionary process beyond retrospective data access and investigation to prospective and pro-active delivery of information".
- The fundamental impact on Data Mining.

A brief discussion about the trends is as follows :

1. Data trends
2. Hardware trends
3. Network trends
4. Scientific computing trends
5. Business trends

1. Data trends :

- Digitization of data has caused data explosion over the past two decades. The data availability is going to increase further.
- As such, Data mining is going to play a critical role in ensuring that the huge data is not dumped in archive files without any extraction and practical use.

2. Hardware trends :

- The memory size and processing speed/capabilities of workstations are going to improve significantly.
- This would enable intensive numerical/statistical computation, further facilitating Data Mining applications.

3. Network trends :

- The improvements in Internet connectivity and availability of bandwidth are going to make network connectivity and distributed database use easier.
- This is going to further facilitate Data Mining applications.

4. Scientific computing trends :

Data Mining and Knowledge Discovery play an important role in linking theory experiment and simulation, especially for those cases in which the experiment or simulation results in large datasets.

5. Business trends :

- Today's business operations are highly competitive.
- To survive, succeed and prosper in this fiercely competitive world, the business organisations have to be more profitable respond quickly and offer better quality of products/services at prices lower than before and all this has to be achieved with fewer people and lesser wastage/rejection to be cost, price, quality and technology competitive.
- Under these circumstances of growing constraints and expectations, Data Mining can become a fundamental technology in enabling business organisations to predict opportunities and risks generated by their customers and their transactions more accurately.

- To Summaries Data mining, therefore, is likely to emerge as an important managerial decision making tool.
- In fact, it is now being increasingly accepted that Data Mining represent the next step in the evolution of Decision Support Systems.
- In this connection, it deserves to be mentioned that the great potential of Data Mining has already been realized by the major players in the software industry.
- It is because of the realization of the great potential of Data Mining that some of the leading DBMS/RDBMS software companies like Oracle, Informix Software, Sybase, Tandem and Real Price Systems have all started incorporating Data Mining functionality into their products.

3.12 Managing Data Resources :

In the sections so far we have discussed the setting up of the database however that is only the means to an end. Once, the database has been set the management has to decide policies and procedures for data management. Setting up of policies and procedures is essential to ensure that the data for your business remains accurate, reliable and readily available to all those who need it.

3.12.1 Establishing an Information Policy :

The firm's data is not only an important resource but also one that needs to be protected from people who are not authorized to have access or make changes in it. For this the management needs to set rules on how the data is to be organized and maintained and also clearly name the people who are authorized to access and make changes in the data.

Large organizations have a separate group within the information systems division to manage the database design and are responsible for defining and organizing the structure and contents of the database and maintaining the database. This group is called the data administration group and is responsible for establishing the databases, defining the logical relations among elements and for framing the access rules and security procedures. The responsibility for framing the specific policies and procedures through which data can be managed rests with data administration. Data administration is responsible for framing the information policy, developing the databases, planning for data, developing the data dictionary and monitoring the use of data by end users.

The information policy of the organization should specify the rules for sharing, disseminating, acquiring, standardizing and classifying information. The policy specifies the procedures and people who shall be accountable for its security and those who are authorized to make changes in it, users who are to share information and where information can be distributed. In a big organization it is all the more essential to specify who is authorized to view and change what information; for example, only a select few have access to the accounts of the organization and are authorized to make changes in them. In a small organization it is usually the owner or the manager who has the right to frame the information policy of the organization.

3.12.2 Ensuring Data Quality :

In addition to a well-designed database and information policy the management will have to ensure that the data in the databases are accurate, consistent and reliable. Accuracy, consistency and reliability are the attributes of information integrity. Information Integrity in the modern business context is the dependability and the ability of the recipient of the information to trust the information and use and control it to gain strategic and competitive business advantage. Accuracy, consistency and reliability are the attributes of integrity of the information and the information system from which the information emanates.

Integrity Attributes :

- **Accuracy (A) :** accuracy is the degree of agreement between a particular value and the value of an identified source. Acceptable tolerance limits need to also be set. The identified source needs to be identified as the standard and should provide with the correct value which should correspond to the optimum integrity.
- **Consistency (C) :** Consistency can be defined as the ability of data and information to be consistent with respect to a set of constraints and data and information are said to be consistent if they satisfy all the constraints of the data and information model. Constraints can apply to same attribute in different entity or different attribute in the same entity. The degree to which multiple instances of a value satisfy the set constraint is consistency. The multiple values must exist from place to place and also over time.
- **Reliability (R) :** Reliability is the most difficult of all the attributes to define as it is related to issues which play a major part in the designing of the system. Reliability can be defined as the accuracy with which the information that is obtained after processing of the data represents the data. Let us assume an information system that has proven low random error component in such a system the volume of error in the processed should always be the same which will reflect on the high reliability of the information. Reliability is also associated with completeness which has two aspects one of exactness (outcome of noise in the system) of information and the other of observability (outcome of distortion in the system). So we can say that when the Reliability Factor with the requirement of correctness of information faces the incompleteness issue which is due to noise and distortion. Whether inexactness is due to noise or incorrectness is due to distortion does not matter as the result is the same as it results in errors in the information and loss of information integrity. And therefore the Reliability attribute of correctness of information while considering the completeness must account for both noise and distortion. We can therefore

conclude this discussion by saying that reliability refers to complete, current and auditable data/ information. Information can be said to be complete when all its components are present and the twin effects of noise and distortion are accounted for. For the aspect of information being current we can say that information is current when it represents the most recent value. And for information being auditable it refers to the ability to trace from where the information has been derived and its source.

- Thus the information that lacks integrity i.e. information lacking accuracy, reliability and consistency may lead to incorrect decision making which in turn may cause financial losses, low sales, etc. We have ourselves experienced the outcome of faulty databases when we receive letters and parcels which are either not intended for us or have our name spelt incorrectly. This all may not happen if the database is properly designed and enterprise-wide data standards established.
- So before an organization designs a new database it needs to identify and correct their faulty data and establish better methods for editing data once the database is operational. Thus, to ensure the quality of data the organization should undertake a data quality audit which is a structured survey of information integrity. These audits are carried out by surveying either the entire data files or samples from data files or surveying end users for their perceptions of data quality.

3.12.3 Data Cleansing :

Data cleansing or data scrubbing is undertaken to detect incorrect, incomplete or improperly formatted data and correct the data in the database. In addition to correcting errors in the database, data cleansing also enforces consistency among different sets of data that have originated in separate information systems.

Separate specialized data cleansing software surveys and corrects the errors in the data files. The software also integrates the data from disparate systems into a consistent company-wide format.

Syllabus Topic : Business Process Integration and Enterprise System

3.13 Business Process Integration and Enterprise System :

Since, the industrial revolution, the complexities of business have grown and to manage this complex nature of business various functional departments such as manufacturing, marketing, finance etc were automated using computers. The random computerization of the functional departments within an organization gave rise to the creation of various databases and use of various hardware and operating systems. This also gave rise to the duplication of activities such as data entry, mismatch of data and to the creation of islands of information.

In addition to the above mentioned problems created by the random computerization of business functions, global competition as well as the expectations of customers was on the rise. Customers demanded reduced prices, better quality, faster delivery and better after sales service. Global competition also meant that the businesses needed to have more products which in turn had shorter life cycles, cater to demanding customers in global markets. This business scenario forced many business organizations to decentralize their operations. A decentralized business meant that the organization could tap local low cost labor, raw material, and supply in local markets. Though decentralization meant lower costs it added to the complexities of managing business as it lead to greater need for coordination among the various units. Global enterprises operate in multiple locations which increases problems of cooperation and coordination.

These enterprises not only had to deal with the lack of integration in the independent functional departments but also masses of data which were created and located at various sites. This meant that the real issue was the management and coordination of huge masses of data available at different locations and stored in different computer hardware using different operating systems. Organizations recognized that their success depended on the efficient and effective coordination and use of this data.

During this time various internet and intranet technologies started taking shape. The concept of ERP came into existence with the prime aim of integrating all the data located at various sites and make it available to management in real time. ERP attempted to develop a system which would integrate the computerized planning and execution with shared databases and single entry of the data. ERP proved to be a boon for planning of the major resources (men, material, money and machines) of the organization. ERP ensured the effective overall integration of the enterprise for the efficient utilization of the resources of the organization irrespective of their location. ERP also assists in improving the business processes within the organization.

3.13.1 Transition from Business Functions to Business Processes :

Every organization comprises of various functional areas like marketing, finance, production etc and these functional areas comprises of various functions and activities. As we have earlier seen that these functional areas operated in isolation and had bare minimum exchange of information with other functional areas.

The management saw that this style of operation of the functional areas hampered the overall working of the organization and lead to conflicts. To overcome this problem management felt that it would be better to think in terms of business processes rather than business functions. A business process is a collection of activities which have some inputs that create an output of value to the customer.

The customer may be another business process or a realistic customer. The business process approach views the organization from the point of view of the customer and the satisfaction of his needs. The customer is in no way interested in the internal dynamics of the organization, its policies, formalities and procedures all that he expects is a fast solution to his need. The requirements of the customer are simple, a quality product, competitive price, and quick service with minimum hassles.

A business process has a much wider coverage than the business function and is spread across various business functions. For example a person buys a TV set and finds out that it has been damaged during transit, now it is a business function on the part of the organization's customer service department to accept the TV and either repair or replace it. Now the actual process of repairing or replacing the TV is a business process as it will cut across various functional areas. The management is now looking at business activities from the point of view of customer satisfaction and hence business functions need to be integrated. Once the integration of business functions is in place information starts to flow smoothly and the customer is provided with up-to-date information.

Hence business processes is nothing but the integration of all business functions with the organization. The information system should be designed in a manner that ensures smooth, accurate and timely sharing of data and information between the functional areas. The integration of the information system is hence very critical from the point of view of the organization and the satisfaction of its customers.

3.13.2 Integration of Information Systems :

- The traditional information system comprised of three elements namely; people, data and procedures. People applied the set procedures on data to produce information. The modern computerized information systems are different from the traditional systems as they comprise of hardware, software, people, data and networking resources.
- A majority of these modern information systems produce information products that support the daily decision making needs of the management. These information products (reports, graphs etc) are specified by the manager in advance and satisfy the needs of the manager as they are based on structured decision that the manager has to make on a daily basis. As these information systems operate at the departmental level and produce pre-defined information they have limited scope. Such forms of information systems are designed as per the requirement of each department and have their own database and produce pre-defined information products. Hence the production department will have its own production planning system, accounts department its own accounting system and so on.
- The disadvantages of this form of information system are that minimal information is shared between departments which mean that one department is not aware as to what is happening in the other department. Though a summary form of departmental report is sent to the management periodically it fails to capture the true picture. Another major drawback is that the system provides information it was designed to produce and not what the manager may want at a particular instance. This meant that the decision maker had to base his decision on isolated data from various departments. The decision was arrived at after collecting, combining and co-relating the data which meant that valuable time was lost in the process.
- To overcome the above mentioned drawbacks integrated information systems were designed. In the integrated form of information system the departmental information functioning in isolation are integrated into a single system. This provided the much needed impetus as each department was now aware as to what was happening in the other departments. This integration enabled the organization to work as one cohesive unit and not as one operating in bits and pieces. This meant that the production department was now aware of what material had been ordered by the purchase department and likewise the purchase department was not aware of the production schedule.
- The Sales department could now take orders and make delivery commitments after studying the production schedule.
- The finance department could now plan the cash flows after studying the purchase schedule. This kind of integration is very much essential for a business to survive in today's competitive atmosphere. The success of the organization hinges on the availability of timely and correct information for the decision maker and this is ensured by the integrated system.

3.13.3 Enterprise System to Integrate Business Processes :

- The current business environment is a rapidly changing one and the pace of change is continuously accelerating making it inevitable for organizations to reinvent themselves to succeed. Organizations need to respond to changing customer needs and grab market opportunities as and when they arise.
- In the current competitive global market scenario organizations need to adapt to continuous changing customer demands.
- In addition to changing customer demands organizations have to constantly be on their toes to adapt to changing technological developments which shorten many product life cycles. Competition has also diminished the margins and costs are being reduced making it necessary to improve production efficiency.
- To adapt to the rapidly changing business environment and to increase competitive advantage organizations need flexible information systems. The key to success

for an organization in this rapidly changing business environment is to coordinate the supply chain. Organizations need to fine tune themselves in the response time taken to meet customer requirement, quality of the product or service, customer satisfaction and performance. Improvement in all these areas means that organizations need real time information which would enable them to act instantly.

3.13.3.1 Enterprise Resource Planning (ERP) :

The ERP software enables organizations to meet this need and attain their objective.

- Enterprise Resource Planning (ERP) is the technique of integrating the various processes within the organization with the aim of better and effective utilization of management resources for the improvement of the efficiency of the organization.
- ERP is a powerful planning and execution tool to support and provide seamless dissemination of information across all the business units of an enterprise irrespective of their location.
- The American Production and Inventory Control Society has defined ERP as "an accounting oriented information system for identifying and planning the enterprise wide resources (men, material, machine and money) to take, make, ship for customers orders".
- Deloitte Consulting has defined ERP as follows: An ERP system is a packaged business software system that allows a company to:
  - Automate and Integrate majority of its business processes
  - Share common data and practices across the entire enterprise
  - Produce and access information in real time environment
- ERP has been defined by Jyotindra Zaveri a renowned ERP specialist as: "Complete integrated business management software which captures data in chronological order, links businesses processes automatically and gives real time information to authorized users".
  - An ERP system has a very wide coverage as it is multi-user, multi-location (web based) and multi-company.
  - Though modern ERP system covers all business functions across all forms of industries, initially they were targeted to service the manufacturing industry and catered to functions like sales, production, and finance etc. Current ERP systems are designed to cover all basic processes in a company and their prime objective is to integrate information across the length and breadth of the organization.
  - The ERP system should reflect the major business processes of the organization and its success depends on its ability to connect and integrate the various functions within the organization seamlessly.
- ERP utilizes client - server technology to integrate basic resource planning (men, material, money, machine and methods) of the enterprise according to the requirement of the market. Though it initially utilized client-server technology it now utilizes web based technology.
- ERP is a standard software product which consists of ready to implement seamlessly integrated business application that enables effective and efficient execution of business processes across various functional departments irrespective of their geographic location.

ERP from an IT perspective :

- ERP is a standard software product that can be configured and customized to suit the specific requirements of the enterprise.
- ERP has large number of functionalities spread across various modules of the enterprise. The enterprise can select those modules which it feels are relevant to its requirement and get them configured to meet their needs.
- When the ERP package is implemented it optimizes the enterprises business processes and provides for their management.
- ERP package incorporates the best practices from various organizations in the solution though the enterprise has the option of accepting the modules as they are or getting them configured to suit its requirement.
- ERP uses the standard client-server technology which is now web enabled.
- ERP uses shared databases that can be accessed online by various authorized users.

Characteristics of ERP

- ERP is a packaged software solution and not custom built for a particular client though some degree of customization can be carried out to meet the requirements of the client.
- ERP uses the best available practices in business processes, provides for their management, and enables cross functional integration.
- ERP provides for data sharing possibilities and making it available to the user on real time basis.
- ERP does not provide strategic solutions it is only an enabler and acts as the transactional backbone of the enterprise.
- ERP packages are evolving at a rapid pace, most of the solutions use the client –server technology while some have progressed to object-oriented design making it totally web based.
- ERP provides for the technology and technique to manage the workflow. It expedites and smoothen the flow of work across the length and breadth of the organization.

- ERP computerizes the business procedures during which documents and information is passed from one computer to another as per the procedure that has been designed.

Evolution of ERP :

As we have stated earlier that ERP has its base in the manufacturing and has evolved from there to serve practically every type of industry. ERP has developed from methods of Material Requirement Planning (MRP) and Manufacturing Resource Planning (MRPII).

- **Inventory Management & Control / Statistical Inventory Control (1960) :** It all began in the 60's when manufacturing organizations felt the need to control their inventories as they constituted nearly 80% of the total cost and this lead to Inventory Management & Control or Statistical Inventory Control. It also marked the entry of computers in the field of business management. The prime objective of Inventory Management & Control is to ensure that an optimum level of stock is maintained in warehouse. Activities that were in the ambit of Inventory Management & Control were setting targets, indentifying material requirements, monitoring material usage, setting control techniques, reconciling inventory balances and preparing reports. Inventory Management and Control worked on the concept of reorder level and economic order quantity and this suited the limited computing capacity of the computers available then.
- **Material Requirement Planning - MRP (1970) :** production planning people felt that the techniques of Inventory Management & Control were not efficient and sufficient methods of ordering material. Procuring a single material in isolation did not serve the purpose as their planning cannot be done independent of each other. For example, a shirt cannot be sold to a customer even if a small button is not available. Hence when ordering every part required for the production needs to ordered. In Inventory Management and Control planning takes place independently without considering the dependency amongst material and hence Material Requirement Planning (MRP) was developed. MRP was based on Bill of Material (BOM) which utilized parts list management and parts development. MRP through the Master Production Schedule and Inventory Records provides information on the products that are to be manufactured, the material needed for manufacturing, material in the stock, and material that needs to be purchased. MRP takes into account the relationship between various assemblies, sub assemblies, raw material, purchased material and manufactured material. MRP uses software applications for production planning and the purchase of material needed for this production is scheduled accordingly.
- **Manufacturing Resource Planning - MRP II (1980) :** though MRP served its purpose very well a need was felt to get more functions in its ambit as it was realized that material was not the only resource important to the organization. The importance and contribution of other resources namely men, machine and money was recognized and this lead to evolution of Manufacturing Resource Planning (MRPII). MRPII used basic MRP logic regarding the ordering of material as well as used the information to plan for machine capacity required, manpower needed and the cash flow required. As the title itself suggests MRP II is a method for planning of the resources of the organization and includes operational planning, sales planning, financial interfaces and simulation capabilities. MRPII also had simulation capabilities which permitted testing of possible scenario to assist the decision making process. MRP II is an integration of various functions like business planning, sales and operations planning, production planning, material requirement planning, capacity planning and demand management. The output of MRP II is integrated with the business plan and other financial reports of the organization. MRPII used mainframe computers to perform huge computations and as they were slow these runs were made once or twice in a month. Thus MRPII brought about the integration of all the four M's namely men, machine, material and money and also provided for 'what if' capabilities to plan before taking the actual plunge. The mainframe computers were connected to terminals placed at various locations using local area network.
- **Enterprise Resource Planning – ERP (80-90's) :** the new client-server technology that was developed during the late 80's offered many advantages over the mainframe technology. The client-server technology allowed simultaneous access to various users at faster speeds. This technology also integrated the various islands of information that was created within the organization and lead to the birth of ERP. ERP was based on the same fundamental as that of MRP II the only difference being that ERP had a much broader scope.

ERP includes all the capabilities of MRP and MRP II as it is a natural extension of them. ERP provided enterprise wide tools for planning, forecasting and scheduling. ERP provided guidelines and processes for decision making. ERP coordinated the total working of all the functions of the enterprise and ensured that the company functions as one cohesive unit. ERP improved the overall functioning of the organization it improved the overall productivity, customer service and inventory management. An effective and efficient ERP system helped in reducing production costs which enabled the company to be more competitive in the market.

On the technology side ERP integrated disparate hardware systems using different operating systems (Unix, Windows, Mac), it also had friendly user interfaces. The technology permitted the enterprise to work as one cohesive unit despite operating in various locations, and irrespective of the hardware and software that they employed. The technology not only integrated but also brought speed in the

organizations processes. Unlike MRPII which was run once or twice in a month due to the lack of speed on the part of the mainframe computers, ERP could be run as frequently as required. Despite the claim of higher speeds by the ERP vendors the software solution still processed in batches due to server speed and limitations in memory. The technology employed permitted the linking of several users of the same organization located across the globe using intranet, LAN and WAN.

Generic Model of ERP :

We have seen that ERP involves the effective and efficient planning of material and resources of the company. This planning of material and resources is carried out at the Strategic and Operational Level.

- **Strategic Planning :** Strategic planning is an organization's process of defining its strategy, or direction, and making decisions on allocating its resources and material to pursue this strategy. In order to determine the direction of the organization, it is necessary to understand its current position and the possible avenues through which it can pursue a particular course of action.
- **Operational Planning :** operational planning describes short-term ways of achieving milestones and explains how, or what portion of, a strategic plan will be put into operation during a given operational period, in the case of commercial application, a fiscal year or another given budgetary term.

Modern ERP models need to be designed and managed with a more global and tightly integrated perspective.

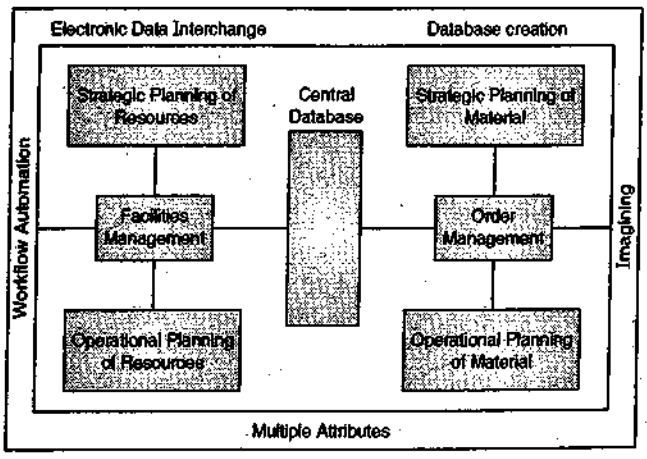


Fig. 3.13.1 : Generic Model of Enterprise Resource Planning

The generic model of ERP comprises of five major quadrants namely;

- **Central Database :** the Central Database is at the centre of all the activities as it comprises of entities that are shared by all the functions of the enterprise. Entities which form the Central Database in a generic ERP model are Accounts Information (Receivable & Payable), General Ledger, Employee Database (Skills, Payroll), Fixed Assets, Inventory, Logistics Management, Budgeting etc.
- **Strategic Planning of Resources :** modern business enterprises are a complex web of various manufacturing and distribution sites and to derive optimum results these sites need to be networked to enable intelligent planning of resources. Intelligent Resource Planning permits the enterprise to identify the demand supply chain, it enables inter site order processing by checking of availability at other sites when the resource is not available at the site where it is needed. Strategic planning of resources plans the optimal utilization of two of the enterprises major resource namely human resource and equipment. Management of human resource will include maintaining of employee database, job profile and description, application tracking, performance review, career planning and identifying training needs. The other important resource which needs to be managed and planned for effectively is equipment. An up-to-date record of the status of equipment and its location needs to be made available online. A proper record of the operating and maintenance cost of the equipment needs to be maintained. The enterprise needs to simulate equipment scheduling, set up cost of machines, machines run cost and the overheads under various forecasted scenarios. Another area of concern for every enterprise that needs to be addressed under Strategic Planning of Resources is Quality Management.
- The strategic planning application is connected to facilities management application. This application caters to the management and maintenance of facilities.
- **Operational Planning of Resources :** the operational planning of resources comprises of activities like the Management Information System of Resources. The management works out the requirement for resources for a particular period based on forecasts for that particular period. Management Information of Resources should ensure that no resource lies unused or is over committed. The Quality Control resource enables the monitoring of the specifications of the product and/or process. Time and Attendance is another resource which is covered here and is linked to payroll, performance appraisal and job evaluation. The tracking and analysis of costs that are directly related to the production process is enabled through Cost Accounting of Manufacturing. The operational planning of resources should support the various activities (insurance, depreciation, taxes etc) that are associated with the management of fixed assets of the enterprise.
- **Strategic Planning of Material :** the most important activity in this quadrant is the management of engineering change, be it by way of introduction of new product or changes to existing product. The engineering change management needs to be fully integrated in the system. Another important application in this quadrant is the Bill of Materials which depicts the structure of products. The material database should take the form of a single repository and should enable

the sharing of data by various functions (Sales, Purchase, Costing, Warehousing, Material Planning etc) and in the measure and form that they require. The costing of material from the point of product pricing should cover every aspect of cost of material (direct material cost, overhead cost). This quadrant is integrated by the Order Management Quadrant.

- **Operational Planning of Material :** this quadrant involves the actual execution of the materials function as it is more convenient to do forecasting at various levels. The other applications related to material like its distribution, routing etc are carried out in this quadrant. The integration of these applications should provide for free flow of information.
- The entities that lie outside the inner boundary represent the cross enterprise functionality and need to be shared by all the functions within the enterprise.
- **Electronic Data Interchange (EDI) :** modern enterprises need to be more flexible in their approach and hence need information on the move this is made possible by EDI. Electronic Data Interchange is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention hence customer information, orders, invoices can now be shared in real time.
- **Imaging :** imaging is another tool which enhances the integration process within the enterprise. It enables the sharing and storing of images, pictures, structures, sales orders, invoices, drawings etc.
- **Electronic Approval Process :** the electronic approval process enables the speedy approval of documents needing the consent of higher authorities. This is made possible by integrating Email for effective workflow automation.
- **Database Creation :** possibly the most important cross enterprise functionality. It enables the creation of various forms and types of data needed throughout the enterprise.
- **Multiple Capabilities :** another important aspect of the cross enterprise functionality is the multiple capabilities needed by the system. To operate on a global level the software solution has to be multilingual and multicurrency. In addition to these capabilities modern enterprises have to incorporate multiple manufacturing strategies. Modern enterprises operating in global markets have multiple divisions and hence the software solution should support multiple facilities.

Advantages of ERP :

An ERP system has many advantages and can be grouped as direct and indirect advantages. The direct advantages are better integration which permits sharing of information for decision making, improved response time to queries, flexibility which enables quick adaption to change, use of open system technology. Indirect advantages are improved corporate image and goodwill, better inter-corporate relations, customer satisfaction, societal acceptance etc.

Let us discuss a few of these direct advantages in detail.

- **Integration :** as we have seen in the previous section that ERP evolved from legacy information systems that catered to the individual functions within the enterprise. The weak communication that the legacy systems permitted made it necessary to design such a system that would integrate and transcend every business function. Hence integration of every business function within the enterprise is the most important advantage that ERP has to offer. ERP enables the automatic updation of data within the enterprise proves to be very advantageous to the enterprise as it permits faster decision making. The integration that ERP system enables proves to be more advantageous for larger firms and to those having multiple products.
- **Flexibility :** as discussed earlier modern business organizations have gone global and hence have to deal with multiple currencies, languages and accounting standards which has been made possible by ERP. ERP also permits multiple locations to be integrated as one system. This 'multi' variety that ERP offers makes the enterprise flexible to conduct business in multiple locations, languages, currencies and adapt multiple accounting standards.
- **Improved Planning and Decision Making :** as real time data is shared by all it enables the enterprise to utilize a variety of decision support systems. As information is available to the decision in real time it enables them to make better decisions.
- **Latest Technology :** modern ERP systems are technological far superior than the legacy information systems. The ERP systems embrace the latest in IT technology (open systems, e-commerce, client/server technology etc) to enable the enterprise to adapt to the rapidly changing business environment.
- Apart from the above mentioned advantages there are some tangible and intangible benefits that ERP affords.
- **Tangible Benefits :** tangible benefits are those benefits that can be quantified monetarily. These benefits are;
  - Reduces cycle time and improves delivery performance
  - Improved productivity of the entire enterprise
  - Reduced inventory, procurement, manufacturing and distribution lead time
  - Lower cost of production
  - Flexibility in production in terms of volume, product mix, product configuration which leads to increases the competitiveness of the enterprise
  - Inventory turnover is faster thereby increasing the availability of working capital for the business. This is possible as inventory levels are reduced
  - Simplifies inventory and production planning

- Paperless transactions with no duplication of entries
- Reduced inventory means reduced obsolescence
- Automated ordering ensures saving in ordering time and money
- Business grows as there is faster adaptation to of new products, customers, and locations

– **Intangible Benefits :** intangible benefits are those that cannot be quantified monetarily. These benefits are;

- Transparency within the enterprise
- Accuracy of information leads to improved decision making
- Decision making is in real time thereby improving the responsiveness of the enterprise
- Saving of time and efforts as duplication of data entry is avoided which also improves the accuracy and transparency of the data. Data is shared across the enterprise.
- Improved performance by increasing agility
- Faster customer response
- Improved customer and vendor satisfaction and coordination
- Improves the morale of the employees
- Provides the groundwork for the reengineering of business processes

Limitations of ERP :

As is true with every software solution ERP also has its share of limitations which are;

– ERP solutions are primarily designed for the manufacturing sector and project industry. These solutions are not suitable for the service industry and though developments have been, they have still not been so widely accepted. For the service industry better IT solutions are available.

– The success of ERP hinges on the selection of the right package. More than often it has been found that the package has not served its purpose as it did not meet the requirements of the enterprise and hence selecting the right package is extremely important; it should fit the business and should be implemented efficiently and effectively. For example an enterprise whose prime function is manufacturing should focus more on the manufacturing module of the package and ensure that it meets its requirements.

– The prime reason for the failure of ERP is when enterprises try to over customize the package. This in no way means that enterprises should not customize the package with the fear of failure, as in that case it would defeat the very purpose of implementing. Optimum customization of the package should be carried out.

– The existing business processes needs to match the software requirement and vice versa and hence exhaustive detailing is required.

– ERP caters only to the operational side of the business and totally overlooks the creative side of it. So unless and until there is a transaction the system doesn't come into play. But a business has more to it than mere transactions and this aspect of business is not recognized by ERP. The creative side i.e. the product conceptualizing, designing, customer's opinion for product development, R&D, and all product promotion activities are overlooked or not addressed to.

– ERP requires the enterprise to be transparent and fair about its dealings and any enterprise which is not may find this as a limitation. The enterprise may find it difficult to match the requirements of business and software with the legal requirements of the land in which it operates.

– The data that is used is internally generated, has no external intelligence and hence fails to portray a clear picture.

– ERP deals with only current data and past data is not taken into consideration. This does not go well with the decision makers who like to study past trends while making decisions.

– The ERP system proves to be unfeasible from the viewpoint of finite and bottleneck scheduling while considering machine capacity issues.

– ERP is purely driven by data which some of the employees may find cumbersome.

– ERP makes the whole process mechanical thus reducing the creativity of employees.

– ERP is very time consuming and capital intensive. Time consuming as the implementation process may take more than a year or two and not all implementations are successful. The costs are high as they involve licensing of software package, hardware, networking, training, mapping, aligning processes to software requirement, and consultant's fees.

– ERP is not a total solution to the requirements of the enterprise and add on software solutions are needed to make it complete. This not only increases the cost of implementation but also the complexities of the system.

3.13.4 Supply Chain Management and CRM :

The two other Enterprise Systems that play a vital role in the integration of business processes are Supply Chain Management (SCM) and Customer Relationship Management (CRM). We shall be studying both these enterprise systems in brief here.

3.13.4.1 Customer Relationship Management :

Customer Relationship Management (CRM) is an implemented strategy for managing a company's relations with customers, clients and sales prospects. It involves using technology to organize, automate, and synchronize business processes-principally sales activities, but also those for marketing, customer service, and technical support. The overall goals are to find, attract, and win new clients, nurture

and retain those the company already has, entice former clients back into the fold, and reduce the costs of marketing and client service. Customer Relationship Management describes a company-wide business strategy including customer-interface departments as well as other departments.

It is a process or methodology used to learn more about customers' needs and behaviors in order to develop stronger relationships with them. There are many technological components to CRM, but thinking about CRM in primarily technological terms is a mistake. The more useful way to think about CRM is as a process that will help bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness and market trends. **CRM** helps businesses use technology and human resources to gain insight into the behavior of customers and the value of those customers...continue reading the

Customer Relationship Management (CRM) is set of processes and technologies for managing the relationship with potential and current customers across the business functions. The role of the CRM is the satisfaction of the customer and revenue through relationships built with potential and current customers across the business functions. The Goal of the CRM is to deal with customer so that customer is full of relief, contentment and delight

Loyal customers can not only give operational companies sustained revenue but also advertise for new marketers. To reinforce the reliance of customers and create additional customer sources, firms utilize CRM to maintain the relationship as the general two categories B2B (Business-to-Business) and B2C(Business-to-Customer or Business-to Consumer). Because of the needs and behaviours are different between B2B and B2C, so that the implementation of CRM should come from respective viewpoints

From the business and international catastrophes of the past two years, a new information technology initiative has arisen. It is called Customer Relationship Management (CRM) and it is dedicated to improving through automated, especially Internet-driven, means the entire arena of customer service and interaction. If the amount of print space, conference literature and position advertisements devoted to a topic is a criterion for importance, CRM is a hot button for the IT industry as well as the entire business world. In reality, customer-driven applications have been in existence for years. Successful sales and marketing organizations have always used the principles which CRM now formalizes. So it is important that the CRM starts with an organization vision and mission, which should become part of the mind-set of employees. The objective of CRM is to give customers satisfactory and pleasant experiences in doing business with an organization. Such experiences will result in more profitable business. CRM technology enables the organization to apply sound relationship development and maintenance principles on a larger scale within the organization. In the application of CRM technology, techniques used by successful sales and marketing people become available to all employees. However, the employees must be trained and incentivized to take advantage of this powerful tool.

Customer Relationship Management (CRM) helps businesses to gain an insight into the behaviour of their customers and modify their business operations to ensure that customers are served in the best possible way. In essence, CRM helps a business to recognize the value of its customers and to capitalize on improved customer relations. The better you understand your customers, the more responsive you can be to their needs.

CRM can be achieved by:

- Finding out about your customers' purchasing habits, opinions and preferences
- Profiling individuals and groups to market more effectively and increase sales
- Changing the way you operate to improve customer service and marketing

The advent of the Internet, personal computers, sophisticated database management systems capable of handling very large volumes of data efficiently, hand-held technologies, GUI-based workstations, data distribution and access facilities have made the CRM concept workable and have significantly raised management's expectations.

Enabling technologies and the thrust toward a customer-centric business focus have brought CRM applications to the forefront as a viable approach for increased competitiveness and profitability. Unfortunately, the success rate in realizing potential benefits from CRM projects is still lower than expected and, in fact, many projects fail even before a first phase is completed.

Benefiting from CRM is not just a question of buying the right software. You must also adapt your business to the needs of your customers.

Three Phases of CRM :

For any relationship to flourish there needs to be certain level of understanding likewise the relationship with the customer will flourish only if the understanding improves. In today's competitive world the customer has many options from which he can make a choice as to whom he wants to go with.

The three phases in which CRM support the relationship between a business and its customers are to. The phases have been so developed that they develop the understanding between the company and the customer. Each phase has an impact on the relationship and the bond becomes stronger. Remember that this is more the requirement of the company then the customer as the customer always has more options with him so the efforts to improve the relations have to be more form the company. The three phases are as follows:

- **Acquire:** it is always the endeavour of the company to acquire new customers by promoting the products and the services of the company. CRM can help a business acquire new customers through contact management, selling, and fulfilment.

- **Enhance :** in the phase of enhancement of the relationship with the customer that you have just acquired by encouraging excellence in selling. Web-enabled CRM combined with customer service tools offers customers service from a team of sales and service specialists, which offers customers the convenience of one-stop shopping.
- **Retain :** in this phase it is important form the point of view of the company to retain the customer for life means that should be the idea behind this exercise. Care should be taken to deliver value to the customer. Today more importance is given to retaining a customer than acquiring new ones though that phase should not be overlooked also. CRM software and databases enable a business to identify and reward its loyal customers and further develop its targeted marketing and relationship marketing initiatives.

All these phases are interrelated and form the core of CRM. Let us now study these phases in detail.

Phase I : Acquiring New Customer :

Whenever a new customer approaches a new company or vice versa there is certain degree of anxiety, apprehension and insecurity on the part of both the parties. Now here it is up to the company to act in a very determined manner and deliver a rich and innovative purchasing experience to the customer. A great deal of planning needs to be put into the designing the strategy for new customer because well began is half done so the first experience has to be novel in its concept and should be very pleasant for the customer. The response should be prompt as surveys have proved that a prompt response always helps in forging a relationship. For example you visit the website of an online shop and while you are browsing through their website looking at their various offering you get a call from them thanking you for the interest shown and your requirement are you not impressed. That is what a quick response does to you so the first step in acquiring a customer is a prompt response. A well thought sales and service strategy helps in converting a prospective customer into a customer.

Phase II : Enhancing the Relationship:

In any relation it is necessary to take care of the problems at the start itself like that in Customer Relationship also it is very important to take of any grievances at the start itself. Time should be dedicated to take care of the problems of the customer this not only helps in solving the problem but also enhances the relation giving the customer a rich experience.

Lately I had given my car for servicing in the company showroom after getting it back the next day I noticed that the vipers were not working, I lodged a complaint with the company and within no time did I have someone coming down and repairing it and to add to that I also got a call from the company apologising for the problem and enquiring if everything else was in order. Now with a experience so rich even if I had any ill feelings they are sure to be swept away. So the whole point is that to enhance any relationship the problems need to be taken care of before they escalate and spoil the relationship.

The basic job of the call center is to ensure that the problems have been taken care of and the customer is satisfied. To add to ensuring customer satisfaction CRM also promotes cross and up selling. Cross selling means to suggest a complimentary product when someone enquires for a product and up selling means suggesting a better product then the one the enquiry has been made for.

Phase III : Retaining the Customer :

It is not easy to maintain a relationship and it takes quite an effort and commitment to maintain but at the end of the day it is all worth it for a relationship that has gone through the test of fire is sure to last and bear good fruits.

In this phase a complete understanding of the needs of the customer are developed. Like said previously that it is very important to retain your customers than hunt or acquire new customers and most off the companies pay more attention to retaining then acquiring new customers. Most of the banks, Cellular operators are more interested in retaining their existing customers through various attractive schemes, products and offerings.

Benefits of CRM :

The past few years have witnessed an upsurge in companies as more and more companies are recognizing that the benefits of CRM are huge and that CRM has potential gains for them. Companies now have renewed faith in the system and are slowly opting for it. On the other hand CRM vendors themselves are realizing that this sector is hugely advantageous and needs to be focused on.

The Benefits that CRM has to Offer :

Positive ROI results :

CRM caters specifically to the requirements of companies. Most companies want to know what is in store for them in the future in terms of ROI. CRM contributes to a positive ROI even though it may take some time. It is a means by which supply chain management communication can be increased thereby contributing to ROI increase. Enterprise knowledge management as well is far more easily achieved as businesses can build a single view of the customer and create a profile that contains information pertaining to all previous communication, purchases and interactions and use this in its customer interactions, to boost sales thus resulting in positive return on investment.

Companies Sales Soars :

CRM for the Companies provides for sales functionality. It makes possible automated sales processes. It facilitates easy quotations. CRM for companies caters to increased sales success. It shortens the sales cycle and improves leads opportunity management. The loss in sales leads due to improper sales lead management is obliterated completely. Careless employees, strewn valuable information become a thing of the past. Information pertaining to the company's customer dealings is packed away securely waiting to be analyzed and studied and then implemented in customer dealings.

The benefits of CRM for companies include easy forecasting of sales and the measurement of business performance. CRM helps companies handle inbound calls with maximum efficiency thus ensuring that the sale is completed.

It provides for better opportunities for cross-selling. It provides the organization with a chance to evaluate sales success, and enables it to identify new trends existing problems, and possible opportunities as well. CRM for companies offers them excellent opportunities for cross-selling and up-selling which indirectly boosts profits.

Customer Knowledge :

It makes possible a shared knowledgebase that is easily assessable to all employees within the organization. It enables a company to basically look into the stored data and provide accurate information to employees about customers. It helps the organization to make informed and correct decisions. It also helps the organization to stay close to the customer, so that it can anticipate upcoming needs and cater to those needs.

Employees are able to view share and update information across the various departments with ease. With an accurate customer database and customer service history businesses are able to achieve a better understanding of their customers. With CRM for the business will be able to able to deliver superior products and services because it has been able to study customer preferences.

Boosting Revenue :

CRM helps a company know which channels will help to drive revenue and helps it understand how to connect all aspects of the business. It helps it understand how its business is connecting with the various facilities, markets, technologies and applications. Sales Force Automation is focused on as it is one of the key functional components of CRM boosting revenue indirectly. CRM boosts customer revenue through excellent computerized book keeping. It enables the business to increase the revenue through more purchases or extended purchasing.

With better customer satisfaction on the plate, companies can now be assured that their customers will start turning their way and not towards competitors. It helps companies with their e-Commerce, advertised campaigns and direct mail. It manages to achieve customer profile analyses that enhance market campaigns.

CRM in companies coordinates the various activities like orders, customer care and sales, payment processing, warehousing, inventory management, packing, and returns processing. It assists in a reduction of capital outlay. It does this by providing lower-cost options to low-margin customers and vice versa. This results in a considerable saving of time and resources

Customization :

CRM deliver customized solutions that are specifically built for the small and medium industry market and that are not complex. Ease of integration with other business processes is the key word of companies CRM. CRM for companies provide for customization and the ability to change in accordance with business needs .Verticalization and customization are what draw the companies to CRM. Configuration with ease using interfaces and workflow processes becomes possible contributing to increased ease in customization.

Excellent Customer Service :

Companies CRM manages to drive customer interaction forward. CRM is an approach to customers that looks at basically strengthening the relationship. Customer loyalty is a natural byproduct as CRM for companies provides for better allegiance with customers. It helps them to create and retain loyal customers. A COMPANY CRM gives the consumer incentive to remain loyal and increase his purchases over his lifetime. It helps customers ensure a rewarding relationship and provides for opportunities to deliver customer service with better efficiency.

3.13.4.2 Supply Chain Management :

In every business there is a stream of processes of moving goods from the customer order through the raw materials stage, supply, production, and distribution of products to the customer. All organizations have supply chains of varying degrees, depending upon the size of the organization and the type of product manufactured. These networks obtain supplies and components, change these materials into finished products and then distribute them to the customer.

Managing the chain of events in this process is what is known as supply chain management. Effective management must take into account coordinating all the different pieces of this chain as quickly as possible without losing any of the quality or customer satisfaction, while still keeping costs down.

The first step is obtaining a customer order, followed by production, storage and distribution of products and supplies to the customer site. Customer satisfaction is paramount. Included in this supply chain process are customer orders, order processing, inventory, scheduling, transportation, storage, and customer service. A necessity in coordinating all these activities is the information service network.

In addition, key to the success of a supply chain is the speed in which these activities can be accomplished and the realization that customer needs and customer satisfaction are the very reasons for the network. Reduced inventories, lower operating costs, product availability and customer satisfaction are all benefits which grow out of effective supply chain management.

The decisions associated with supply chain management cover both the long-term and short-term. Strategic decisions deal with corporate policies, and look at overall design and supply chain structure.

Operational decisions are those dealing with every day activities and problems of an organization. These decisions

must take into account the strategic decisions already in place. Therefore, an organization must structure the supply chain through long-term analysis and at the same time focus on the day-to-day activities.

Furthermore, market demands, customer service, transport considerations, and pricing constraints all must be understood in order to structure the supply chain effectively. These are all factors, which change constantly and sometimes unexpectedly, and an organization must realize this fact and be prepared to structure the supply chain accordingly.

Structuring the supply chain requires an understanding of the demand patterns, service level requirements, distance considerations, cost elements and other related factors.

It is easy to see that these factors are highly variable in nature and this variability needs to be considered during the supply chain analysis process. Moreover, the interplay of these complex considerations could have a significant bearing on the outcome of the supply chain analysis process.

There are six key elements to a supply chain :

(i)	Production	(ii)	Supply
(iii)	Inventory	(iv)	Location
(v)	Transportation, and	(vi)	Information

The following describes each of the elements:

(i) Production :

Strategic decisions regarding production focus on what customers want and the market demands. This first stage in developing supply chain agility takes into consideration what and how many products to produce, and what, if any, parts or components should be produced at which plants or outsourced to capable suppliers.

These strategic decisions regarding production must also focus on capacity, quality and volume of goods, keeping in mind that customer demand and satisfaction must be met. Operational decisions, on the other hand, focus on scheduling workloads, maintenance of equipment and meeting immediate client/market demands. Quality control and workload balancing are issues which need to be considered when making these decisions.

(ii) Supply :

Next, an organization must determine what their facility or facilities are able to produce, both economically and efficiently, while keeping the quality high. But most companies cannot provide excellent performance with the manufacture of all components. Outsourcing is an excellent alternative to be considered for those products and components that cannot be produced effectively by an organization's facilities. Companies must carefully select suppliers for raw materials. When choosing a supplier, focus should be on developing velocity, quality and flexibility while at the same time reducing costs or maintaining low cost levels. In short, strategic decisions should be made to determine the core capabilities of a facility and outsourcing partnerships should grow from these decisions.

(iii) Inventory :

Further strategic decisions focus on inventory and how much product should be in-house. A delicate balance exists between too much inventory, which can cost anywhere between 20 and 40 percent of their value, and not enough inventory to meet market demands. This is a critical issue in effective supply chain management. Operational inventory decisions revolved around optimal levels of stock at each location to ensure customer satisfaction as the market demands fluctuate. Control policies must be looked at to determine correct levels of supplies at order and reorder points. These levels are critical to the day to day operation of organizations and to keep customer satisfaction levels high.

(iv) Location :

Location decisions depend on market demands and determination of customer satisfaction. Strategic decisions must focus on the placement of production plants, distribution and stocking facilities, and placing them in prime locations to the market served. Once customer markets are determined, long-term commitment must be made to locate production and stocking facilities as close to the consumer as is practical. In industries where components are lightweight and market driven, facilities should be located close to the end-user. In heavier industries, careful consideration must be made to determine where plants should be located so as to be close to the raw material source. Decisions concerning location should also take into consideration tax and tariff issues, especially in inter-state and worldwide distribution.

(v) Transportation :

Strategic transportation decisions are closely related to inventory decisions as well as meeting customer demands. Using air transport obviously gets the product out quicker and to the customer expediently; but the costs are high as opposed to shipping by boat or rail. Yet using sea or rail often times means having higher levels of inventory in-house to meet quick demands by the customer. It is wise to keep in mind that since 30% of the cost of a product is encompassed by transportation, using the correct transport mode is a critical strategic decision. Above all, customer service levels must be met, and this often times determines the mode of transport used. Often times this may be an operational decision, but strategically, an organization must have transport modes in place to ensure a smooth distribution of goods.

(vi) Information :

Effective supply chain management requires obtaining information from the point of end-use, and linking

information resources throughout the chain for speed of exchange. Overwhelming paper flow and disparate computer systems are unacceptable in today's competitive world. Fostering innovation requires good organization of information. Linking computers through networks and the internet, and streamlining the information flow, consolidates knowledge and facilitates velocity of products. Account management software, product configurations, enterprise resource planning systems, and global communications are key components of effective supply chain management strategy.

Value Chain :

The supply chain has also been called the value chain and the service chain, depending on the "fad of the moment". Just like anything else, supply chain management is no magic it is just another strategy.

It is an operational strategy that, if implemented properly, will provide a new dimension to competing: quickly introducing new customized high quality products and delivering them with unprecedented lead times, swift decisions, and manufacturing products with high velocity.

Applications :

Fast delivery is critical in most markets today. Many companies address this market demand by carrying higher inventories. Inventory is a hedge against lead time. Higher levels of inventory are often maintained because a company is unable to produce the material within the time demanded by the market. Analyzing the processes in the supply chain can identify the causes and facilitate solutions to reduce overall throughput time.

Compressing time in the chain of events from the time a customer places an order until the order is satisfied can provide a competitive edge without the burden of carrying excessive inventory.

As discussed earlier Supply Chain Management is the design, planning, execution, control and monitoring of supply chain activities from the raw material to final product to the end consumer .Supply chain management ensures the movement of right product with a smarter ,faster and efficient way to the right customer and the right time ,place and price.

The main objective of supply chain management is to create net value, building a competitive environment and synchronizing supply with demand .Under the supply chain management, one has to focus on distribution network, distribution strategy, information and inventory management. Distribution of newspaper , milk , post or courier , the lunch box that the famous Dabawallas of Mumbai deliver at the door step at right time and place are very simple and good example of efficient Supply Chain Management.

Every small ,medium and large companies have their supply chain team of size according to the size of their companies. Large organization like Big Bazaar, LG, Samsung, Mother Dairy, Tanishq etc require very large and organized Supply Chain Management team.

Supply chain technology plays a huge role in keeping an eye on production, cost, and delivery. These software systems create a network of collected data, organizing scattered parts into a cohesive whole. Once your various vendors and internal departments connect, your customers and your bottom line will reap the benefits.

It is important to organize your software solutions so that you are collecting data from all areas of your chain. Warehouse management systems help keep an eye on inventory, communication software will help you stay up to date on important milestones, and business intelligence software can help with the organization of data. However, the most important factor in SCM is how all these informational layers are linked so the results are readable, accessible, and actionable as soon as they are compiled.

Not only does supply chain management help increase your overall efficiency, it helps you identify gaps and issues within your supply chain. Without data collection at all levels, your decision-makers won't know where problems lie and opportunities exist. This will eventually lead to a mismanagement of resources that your company cannot afford.

Today's technology has made organizing scattered information simpler than ever. Connecting your business across a network, constantly collecting the info and reducing that info into actionable reporting should be equal parts of your 21st century chain. Only then can you move at the speed of today's business leaders.

Benefits of Supply Chain Management :

As we have seen earlier a Supply Chain Management (SCM) system is one in which there is a network of businesses that are interconnected to provide services and products required by a customer. A SCM system controls the planning, execution, design, monitoring and control of these activities to create value and improve global performance. Supply Chain Management (SCM) creates value by enabling you to reduce costs, increase revenue and improve service to your customers.

A supply chain software can offer tremendous value to any company that relies on the smooth planning and execution of related operations to achieve long-term profitability and maintain a solid competitive edge. That's why more and more organizations are purchasing and implementing supply chain applications.

There are multiple benefits to adding this system to a business, though, like any system, supply chain management takes time and money to implement.

Improve Your Supply Chain Network :

Supply chain software's provide complete, 360 degree visibility across the entire supply chain network – something that cannot be easily achieved with disjointed manual processes. With supply chain, users can monitor the status of all activities across all suppliers, production plants, storage facilities, and distribution centers.

This enables more effective tracking and management of all related processes, from the ordering and acquisition of raw materials, through manufacturing and shipping of finished goods to customers or retail outlets. So the status of mission-critical activities can be tracked at all times, and potential inefficiencies or problems can be identified and corrected immediately, before they become unmanageable.

Lower Costs :

By adding an effective SCM system to a business, the added global efficiency can lead to lower costs of raw materials. This system efficiently plans for materials to be brought to your company from the lowest cost provider possible and at just the right time to ensure there is no excess or deficiency in the material. An SCM system can improve your company's relationship with vendors so that there are opportunities to cut costs like through a volume discount.

Improved Collaboration :

An SCM system wired in to the latest software allows you to know the position your raw materials and your finished products are in by tracking both your suppliers and your distributors. These companies can also track where you are at in receiving or sending those materials. This knowledge can keep relationships between these businesses strong. This system often includes the development of reports on how the chain of goods progresses from supplier through distributor. These reports help your businesses to determine potential areas of improvement.

Cycle Times :

The cycle time can be defined as the time it takes your business to turn over a product from raw materials, give it to your distributor to sell and then make enough money to purchase new raw products to start the cycle over. If at any point it takes too long to obtain these raw materials, production may have to stop which will slow down your organization. An SCM system improves cycle times and ensures that raw materials are provided when your business needs them so that you never have to stop production.

Response to Conflict :

Unfortunately, a business cannot always run smoothly and there are a number of factors that can lead to problems in the production of a product. If an issue occurs with the suppliers of your company, you may have to change how you produce your product. If the distributor goes out of business, you will have to find another way to sell the product. An SCM system lets your company better cope with problems at either side of the production spectrum. You can quickly and easily figure out a response to the problem instead of being surprised by it at a later time.

Increase Revenue :

Higher utilization of capacity helps you increase revenues. Collaborate with partners and optimize supply planning and execution across enterprise boundaries. Achieve faster responsiveness to unanticipated demand. Reduce order cycle times, enhancing the conversion of materials to revenue. Improve asset use and reduce unnecessary capital expenditures. Introduce new products and promotions with efficiency and accuracy.

Retain Customers :

Accurate planning improves customer service and in turn customer retention. Detailed order-status information results in higher customer satisfaction. Provide quality products and services at competitive prices. Have the ability to respond to unanticipated demand so you can commit to more orders. Respond to changing customer requirements quickly and efficiently. Share performance information and common goals among partners

Minimized Delays :

Many supply chains - particularly those that haven't been enhanced with a supply chain application - are plagued by delays that can result in poor relationships and lost business. Late shipments from vendors, slow downs on production lines, and logistical errors in distribution channels are all common issues that can negatively impact a company's ability to satisfy customer demand for its products. With supply chain software, all activities can be seamlessly coordinated and executed from start to finish, ensuring much higher levels of on-time delivery across the board.

With the increased visibility into the supply chain and adaptive supply chain network, you can be more responsive. You can sense and respond quickly to changes and quickly capitalize on new opportunities.

By offering a common information framework that supports communication and collaboration, SCM enables you to better adapt to and meet customer demands. You can track and monitor compliance in areas as environment, health and safety. Information transparency and real-time business intelligence can lead to shorter cash-to-cash cycle times. Reduced inventory levels and increased inventory turns across the network can lower overall costs.

With SCM, you can lower operational expenses with timelier planning for procurement, manufacturing and transportation. Better order, product and execution tracking can lead to improvements in performance and quality - and lower costs.

You can also improve margins through better coordination with business partners. Tight connection with trading partners keep your supply chain aligned with current business strategies and priorities, improving your organization's overall performance and achievement of goals.

3.13.5 Overview of Enterprise Systems

In today's age of information and technology the way business is being operated has changed drastically. The business needs of today have changed and the response that

is expected from the business enterprise by the customer is instant. Technology tools such as computers and other communication tools have altered the style of working making the enterprises more competitive by improving on the speed and time of response. Today's business enterprises thrive on information, they are information hungry and in such a scenario the system that is developed and implemented by the enterprise should consider the complete enterprise and the effects a event would have on the enterprise.

We have already know the meaning of an event in business but to refresh, a event is a transaction that is triggered and an appropriate response is expected from the total enterprise as any transaction would trigger a multiple transactions within the enterprise. Today's business is full of challenges and in such an environment to survive and compete an enterprise has to have some additional tools which would assist it in this effort.

Let us study a simple event in an enterprise, a customer approaches the business enterprise with an enquiry for certain products, the enterprise checks its inventory for the product if it finds that the product is available then it can confirm the acceptance of the order else it will have to check up with the production department as to their schedule and then issue works order for the manufacturing of the products.

If all this is possible in the schedule the customer wants the product in then the enterprise is in a position to accept the order else it will have to decline the order. On accepting the order the enterprise issues work order to its production department who in turn issue order to their vendors for the supply of material for production. The marketing department needs to be informed about the order too.

This whole process requires management of the system as you can see that the complete process in interlinked and therefore needs to be properly integrated. EDI (Electronic Data Interchange) is needed to interlink the customers and vendors so that information can be exchanged immediately. Other interfacing modules such as MRP (Material Requirement Planning), Machine Requirement Planning, CAD, CAM need to also be managed.

As is evident from the above example that communication and the transfer of data are needed to improve in matters of speed and transparency. The process needs to be automated, integrated and coordinated. While designing the system the requirements of the business enterprise need to studied and catered to. Systems for the processing of information and communication are also needed.

The systems need to be automated in accordance with the needs of the business enterprise, interfacing with other systems need to also be done. What we need is an enterprise wide system that caters to the need which is an integrated system using the modern technologies of communication and information processing as support and such a system is the E- Enterprise Management System.

E-Enterprise Management System is made up systems which when implemented in an integrated manner with an aim to coordinate and bring about cooperation within the functions of an enterprise. E-Enterprise Management System (EMS) is made up of integrated Enterprise Resource Planning (ERP), Supply Chain Management (SCM) and Customer Relationship Management (CRM). The crucial component of EMS is the ERP which controls the support systems like;

- **EDI :** Electronic Data Interchange
- **AMS :** Attendance Management System
- **DMS :** Document Management System
- **CAD/CAM :** Computer Aided Design and Manufacturing
- **CMS :** Communication Management System
- **SMS :** Security Management System

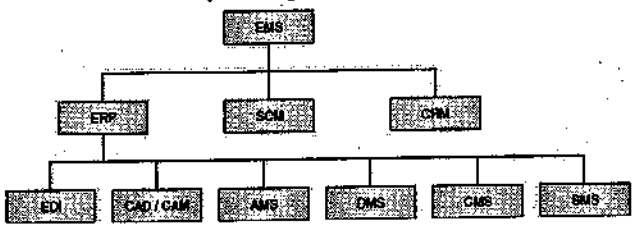


Fig. 3.13.2

The ERP plays the pivotal role of taking the major decisions and execution of these decisions the enterprise revolves around the ERP. The EMS manages the functions of the enterprise with support of the ERP. E-EMS provides the vital information needed by the middle as well as the top management to aid their decision making.

As the figure indicates and as we have stated the ERP is amply supported by other support systems which provide the specific inputs that are needed by the ERP in the decision making process.

Let us study these systems for the role played by them in the E-EMS.

1. **Electronic Data Interchange** is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention. It is more than mere e-mail; for instance, organizations might replace bills of lading and even cheques with appropriate EDI messages. It also refers specifically to a family of standards.
2. **Attendance Management System** is the system of managing attendance or presence in a work setting, which maximizes and motivates employee attendance thereby minimizing loss. If you are on loss due to employee downtime, then it is time to opt for a good time attendance managing system.

A few reasons to implement an Attendance Management System:

- **Saves you lots of time and money :**

  Managing attendance manually is a very tedious and time-consuming process. As the numbers of employees grow the task becomes quiet more exhausting. Similarly, the entire operation can also prove to be very costly in case you decide to hire a professional agency for this purpose. By using attendance management software, all this can be automated.

- **Promotes optimal and consistent attendance at work :**

  Once you start using time attendance management software, you have each employees work record for every minute. That is you have the exact performance record for each employee. This in turn ensures the employees maintain consistent performance i.e. attendance.

- **Ensures proper utilization of the human resource capital :**

  Manual employee scheduling is another hassle in attendance management. Proper allocation of manpower to different departments and fields of work is really important for a good outcome. This can be made possible by using employee scheduling or work planning incorporated with a good attendance management software.

- **Ensures maximum productivity :**

  Ensuring that every single minute of constructive work is recorded and rewarded properly will act as a motivation for the employees who will then strive to put in greater efforts and hence enhance the overall productivity of your business.

A good system can automate the following for you:

1. Accumulate the attendance data for each employee from the time attendance device.
2. Automatically mark in-time, out-time, overtime, late entries, early outs, absence, leaves etc.
3. Overtime, work time and leave management.
4. Load attendance data into payroll software for payroll processing
5. Generate reports on attendance, leave, overtime, holiday and so on.
6. Efficient work planning/scheduling for employees.

An automated system will not only make the entire process simple, it will also provide a well-structured and analyzed report of the pattern of employee attendance and time management, which can further help you in allocating and using the human resources in your organization to the maximum possible benefit.

3. **A document management system (DMS)** is a computer system (or set of computer programs) used to track and store electronic documents and/or images of paper documents. The term has some overlap with the concepts of content management system. DMS is designed to keep important documents in the database and making them available for viewing as and when demanded for document support in the transactions. In ERP DMS is used for checking the information that will be needed for confirming the data in the transactions.
4. **CAD/CAM** is a broad term describing the use of computer technology to aid in the design, analysis, and manufacture of products. They will provide the designs and drawings to the ERP this will help the ERP in the manufacturing and planning of inventory and the inspection of the manufactured with the design that is provided. The designs and drawings are also stored in a database that acts as a backup to the ERP.
5. **Communication Management System** is the systematic planning, implementing, monitoring, and revision of all the channels of communication within an organization, and between organizations; it also includes the organization and dissemination of new communication directives connected with an organization, network, or communication technology. Aspects of communications management include developing corporate communication strategies, designing internal and external communications directives, and managing the flow of information, including online communication. New technology forces constant innovation on the part of communications managers. For the ERP the CMS plays the role of providing for the communication needs of it and for the recording of the transactions.
6. **Security Management System** is a broad field of management related to asset management, physical security and human resource safety functions. It entails the identification of an organization's information assets and the development, documentation and implementation of policies, standards, procedures and guidelines. In network management it is the set of functions that protects telecommunications networks and systems from unauthorized access by persons, acts, or influences and that includes many sub-functions, such as creating, deleting, and controlling security services and mechanisms; distributing security-relevant information; reporting security-relevant events; controlling the distribution of cryptographic keying material; and authorizing subscriber access, rights, and privileges. SMS supports the ERP by monitoring the situation and clearing it for further action by the ERP. Information generated through the SMS is sent to the ERP for further processing and therefore SMS is an important tool for ERP.

These systems support the ERP and each of them has a specific role to play and the role that they play is very useful to the ERP.

Syllabus Topic : ICT for Development and E-Governance

3.14 ICT for Development and E-Governance :

Introduction :

- Information and Communication Technologies (ICT) play a key role in the economic development and rural growth of developing countries such as India and China. ICTs can play a critical role in sustainable human development and poverty eradication. Till date the ability of the government has always been hampered by its inability to access, gather, analyse and utilize information through which it could undertake socio-economic development. Even the noblest of intentions of the government would be let down due to non availability of information and inability to reach to the masses. However, things are changing as ICTs have emerged as a powerful enabler of developmental goals because of the manner in which it improves communication and exchange of information and knowledge necessary for socio-economic development. ICTs are all pervasive and have the ability to impact every human activity and hence will become one of the main enablers in the pursuit of poverty alleviation and wealth creation especially in developing countries and also in developed countries.
- ICTs serve as conduit that transmits information and knowledge to the citizens of the country to widen their choices for economic and social empowerment. Governments in developing countries have ambitious plans of transforming citizen-government interaction through these ICTs. ICTs are slated to transform the way in which government and citizens interact. The challenge for each country, according to United Nations Development Programme (UNDP), is to create, develop and sustain a system of governance that promotes, supports, and sustains human development. India is no different and has made huge investments in ICTs aimed at improving governance processes.

3.14.1 ICTs and E-Governance

- The ability of ICTs to integrate people, processes, information and technology in the service of governance is perhaps one of the biggest achievements of ICTs from the point of view of countries. ICTs pave the road for good governance. In developing countries the government had always fallen short in reaching out to its people and as such ICTs have brought about an increase in the efficiency of government operations, enhancing transparency, and providing better service to its people and business establishments. Developing countries have always been marred by wide scale corruption and this has hampered all round development especially of the rural community. Thus, successful application of ICTs in e-Governance is the need of the hour for giving one-stop solutions for rural community.
- India lives in the villages and therefore to improve and sustain the overall prosperity, growth and development of the country it is necessary to bring in everyone in the fold of a National E-Governance Plan (NEGP). In India, NEGP lays the foundation of e-Governance with various projects starting from the grass root and provide impetus for long term e-Governance within the country.

The term e-governance focuses on the use of new ICTs by governments as applied to the full range of government functions. Thus e-governance is the application of information and communication technology for delivering government services, exchange of information, communication, transactions, integration, various stand-alone systems, and services between government and citizens, government and business as well as back office processes and interactions within the entire government frame work. The government being the service provider it is important to motivate the employees for delivering the services through ICT. E-governance seeks to achieve Efficiency, Transparency, and Citizen's Participation. Enabling E-governance through ICT contributes to Good Governance, Trust and Accountability, Citizen's Awareness, and empowerment, Citizen's Welfare, Democracy, Nation's Economic growth. ICT is the biggest enabler of change and process reforms fade in face of what ICT has achieved in few years.

- A few of the e-governance schemes introduced in India are:
- Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)
- Online Income Tax, Excise, and VAT
- Unique ID: Adhar Cards
- SETU and Warana Project in Maharashtra

These projects have been successfully implemented and are providing excellent service to the people. These services enable people to save time and money and also ushered in an era of greater transparency. The growing dependency on ICTs means that the infrastructure and the design have to be robust. The government on its part has to ensure that:

- The service delivery mechanism is dependable
- Appropriate technology is selected for connectivity and information processing
- Availability of centres where this servce can be availed
- Ensure transparency and efficiency that will instill confidence in the people and will make them trust the service being provided. Confidence building measures are essential in the early part of introduction of the service.

ICTs speed up the flow of information and knowledge between the government and the citizens and bring about a transformation in the manner in which the two interact. Gone are the days when you had to stand in a line for hours to get your grievance or query addressed to be the government. Now all this is possible at the click of a button. ICTs have brought about a positive impact in the process of public service delivery and socio-economic structure of communities.

ICTs minimize the cost of processing, increase transparency, and ensure that all government schemes reach its rightful beneficiary thereby supporting economic development and income generation. Every government launches a slew of measures which fail to reach its rightful beneficiary due to the lack of communication channels that disseminate information. ICTs provide the channels through which information about each government scheme can be provided to the citizens. This will lead to socio-economic development and improved agriculture productivity.

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Case Study

CASE STUDY - I

In-House or Cloud based ERP implementation

In-House or Cloud based ERP implementation :

As the Information system manager of a mid size manufacturing company you have been asked to select between an in-house ERP and a Cloud based ERP system and make a case before the management before the management of the company.

As you go through the requirements of the company with respects to its information needs and the kind of the infrastructure and capabilities available you realize that it will be difficult to manage an in-house ERP system and the cloud ERP system would serve the purpose considering all the factors.

The basic difference between on-premise ERP and cloud ERP is clear: On-premise ERP solutions are installed locally on your company's hardware and servers and then managed by your IT staff while cloud ERP - also called SaaS, or Software-as-a-Service - is provided as a service. With this type of deployment, a company's ERP software and its associated data are managed centrally (in the Internet "cloud") by the ERP vendor and are accessed by customers using a web browser.

What may not be so clear is that the type of ERP deployment model you choose can have a significant impact across your business. Here are some key factors that you need to consider when weighing whether to use on-premise or cloud-based ERP software.

Ownership Costs :

On-premise ERP systems usually require large upfront and ongoing investments to purchase and manage the software and the related hardware, servers, and facilities necessary to run it. If your company doesn't have a large or experienced IT staff, you may also have to also invest more time and money in additional personnel and train them. Even more importantly, on-premise systems require that your IT team spend a significant amount of their time and budgets ensuring your system is up-and-running when you need it, including maintenance of hardware, server rooms, and more. When its time for your ERP system to be upgraded, IT must then redeploy the system across the various users' computers and re-implement various customizations and integrations that your business installed on your previous software.

For cloud-based ERP, initial costs are typically much lower because you simply implement the software to your requirements and then access it through your computer's internet connection. The cloud ERP provider hosts and maintains all of the IT infrastructure for you, ensures the system is always running, that the data is secure, and that product enhancements are rolled out painlessly to your solution without breaking your previously implemented customizations. Ultimately, this all allows your IT resources to focus on innovating and helping grow the business more effectively, rather than spending a disproportionate amount of their time on maintaining and managing your on-premise systems. Cloud ERP also offers a predictable, pay-as-you-go subscription model that can make cash flow management and planning much easier.

Over time, those IT savings add up. When comparing the total cost of ownership of on-premise ERP solutions relative to cloud systems, one industry analyst study found that cloud-based ERP can cost 50 percent less than on-site ERP for a 100-employee company over a four-year period.

System Upgrades and Enhancements :

On-site ERP software can be customized, but those customizations are tied to your current software deployment and are not easy to re-implement with future versions. As your ERP provider releases new product updates and enhancements, your previously implemented customizations will be wiped out when you upgrade and your IT team will have to start customizing from scratch again. That's the main reason many companies simply avoid upgrading their on-site ERP software and just settle for running their business on out-of-date technology. In fact, two-thirds of mid-size businesses are running outdated versions of their ERP software.

In contrast, cloud ERP solutions are continually upgraded by the provider so you can be sure you're always using the latest, most advanced version of your ERP software. Because of the cloud platform today's leading cloud applications are built upon, your previously implemented customizations and integrations automatically carry forward when the solution is updated without additional investment.

Improved System Performance and Accessibility :

Cloud ERP often delivers better performance than on-premise solutions. Cloud software architecture is designed from the ground up for maximum network performance, which can mean better application availability than traditional on-site ERP systems. Cloud-based ERP also offers optimized performance that can adapt to your needs. If there is a spike in your business, cloud ERP automatically adjusts and dynamically provisions additional resources to handle the surge.

A local IT department is unlikely to be able to achieve these results, and may not even be able to regularly report their system uptime results to management.

It's also important to note that a cloud-based ERP solution provides real-time data that can be accessed via the Internet anywhere at any time. That means that staff at your company can see accurate information on laptops, smartphones, and tablet devices while they travel or telecommute - all without extra setup fees or ongoing costs. Not only can cloud-based ERP provide better performance and greater accessibility, but better security as well.

Deployment Speed :

Every ERP deployment takes time and requires careful planning, but cloud ERP offers clear advantages when you consider speed of deployment. Since cloud ERP requires no additional hardware, your business doesn't have to waste time procuring and installing IT infrastructure. With cloud ERP, you can easily roll it out across multiple regions, subsidiaries, and divisions, avoiding the cost associated with those rollouts. If you chose a cloud-based ERP system, these differences can add up to a significant time savings: Cloud ERP deployments usually take 3-6 months compared to the 12 months that it typically takes to implement an on-premise solution. Cloud-based ERP systems are also easier to scale, giving you the flexibility to add more users as your business grows. On-site ERP solutions don't offer the same freedom - to give more employees access to an on-site system, it's often necessary to provision additional hardware.

CASE STUDY - II

UIDAI - Unique Identification Authority of India

Unique Identification Authority of India (UIDAI):

The developments in data capture technologies have redefined the role of data and information. Low cost auto-identification technology of bar codes has totally done away with large scale data entry that was necessary to process large transactions. Bar codes have reduced data processing and such have also changed the design of information systems. One such system is the UID or Aadhar that has been launched by the Government of India. This initiative by the government is likely to fundamentally transform the information capture, verification and delivery of information services.

Increasing Indian population, migration from neighbouring countries as well as numerous variants of identity cards like ration card, voter ID card forced Government of India to form 'Unique Identification Authority of India (UIDAI)'.

The primary responsibility of the UIDAI is to issue Unique Identification Number (UID) or Aadhaar number to Indian residents which can be used for all the government transactions/benefits schemes like gas subsidy, Mahatma Gandhi National Rural Employment Gurantee Act (MGNREGA). This scheme is expected to enhance the expectation to move towards national e-governance and enables an entire 'digital ecosystem' that includes state and market initiatives such as direct transfers of state subsidies, employment guarantee schemes, banking, insurance and financial sectors. UID-enabled bank accounts will act as a catalyst in financial inclusion of poor. The centralized database will help in data surveillance and Government surveillance also to prevent antisocial activities of terrorism and theft. It is planned to link Aadhaar Card information with other identity systems like banks and voting cards.

The Challenge :

The UIDAI is a government body mandated with the task of assigning every single one of India's 1.2 billion citizens a Unique Identity (UID) number. To do that, the Authority will photograph a staggering 1.2 billion Indians, scan 2.4 billion irises, collect twelve billion fingerprints and record 1.2 billion addresses.

The other challenges facing UIDAI are :

- Challenge of making the card secure
- Overcoming errors in biometrics
- Fingerprinting errors

There are major issues of sensor noise and poor image quality in large scale deployment of Automatic Fingerprints Identification System. Thus, critical techniques during enrolment should be consistently followed for good quality capturing of fingerprint images. Further, in India, where a large population belongs to rural areas, presence of scars, warts and deteriorating patterns in the fingerprints will lead to change in biometrics over time. Absence of birth records and address proof with a large number of people add to the problem. There is also a high likelihood for data recording errors. As per directions of UIDAI, it can alert the authority for erroneous information in database but has no right to correct it.

There is also a fear among experts that comprehensive information data of an individual might be misused by its possessor. Furthermore, GoI lacks to some extent public trust and confidence, where the residents have a fear of coming into radar of government with UID. Scaling needs of UID project are unprecedented.

The benefits :

Central government has also decided to incorporate the biometric-based attendance which will be linked to Aadhaar number. Government has also proposed Pradhan Mantri Jan Dhan Yojana to provide government benefit to the beneficiaries with Aadhaar linked bank accounts. It is also planning for digital India program in which all the government documents and records of all citizens will be available online on real time basis to avail government services. UIDAI is also considering hiring an advertising agency to look after media campaign to increase awareness for Aadhaar.

Schematic Diagram and Mechanism of Aadhaar

When a person enrols for Aadhaar, all ten fingerprints and images of both the iris are captured, along with a photograph and his or her basic demographic data. Before the person is given a new Aadhaar number, the biometric features of this person are compared with the biometrics of all the persons who have been allocated Aadhaar numbers earlier.

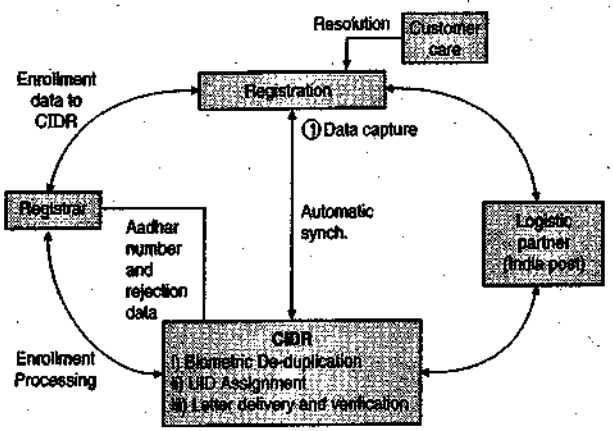

Fig. 1

If the biometrics of the person match with biometrics already present in the gallery (the database of all the people already enroled), it means that that person has already been enroled, and that he or she is trying to enrol again. The system rejects this attempt. This prevents issue of two Aadhaar numbers to the same person. If the biometrics do not match any other person's biometrics, then the person is issued an Aadhaar number. He can now use this number to authenticate his identity. However, testing for uniqueness or for authentication both involve checking for matches between biometrics, and these checks are not infallible. Algorithms to determine whether two biometrics are the same do not look for an exact match, because multiple captures of the very same biometric might vary. Instead, they use a threshold: if the match between the biometrics exceeds the threshold, they are considered identical, and else, they are considered different. Setting the threshold to any particular value forces a trade-off; if the value is too high, two captures of the same biometric may be considered different, and if the value is too low, then different biometrics may be considered identical. Correspondingly, there are two possible errors that can arise at the time of initial deduplication (UIDAI 2010b). A person who is new to the database might be mistaken for another person who already exists in the database, and he might thus be denied an Aadhaar number. The likelihood of this is called the False Positive Identification Rate (FPIR). This will prevent the person from getting an Aadhaar number, even if he has not got one earlier.

The second error is that a person who already has an Aadhaar number enrols again, and he is not detected to be already present in the gallery. The likelihood of this happening is called False Negative Identification Rate (FNIR). This would enable the same person to have two (or even more) Aadhaar numbers. The principle of ensuring the uniqueness of identities would be violated, and such a person would be able to receive more benefits or services than he is entitled to, using his multiple avatars. Once

enrolled, UIDAI enables a person to authenticate himself. Here, a person claims to have a certain Aadhaar number, and provides his biometrics. UIDAI compares the biometrics associated with that Aadhaar number with the submitted biometrics, and provides a Yes or a No, confirming or denying that the person is who he claims to be. Again, two kinds of errors are possible here. The biometrics of a person who falsely claims a different identity might be erroneously found to match that identity, and UIDAI would thus confirm him in his false claim; this likelihood is called the False Acceptance Rate (FAR). The person would be able to impersonate others and avail services and benefits meant for them. Another possibility is that a person might make a true claim about his identity, but his biometrics may not match his previously captured biometrics, and his claim might be rejected. This likelihood is called the False Rejection Rate (FRR), and such an event would prevent the person from availing services that he is entitled to.

Ideally, there should be no false rejects and no false accepts. Generally, both cannot be made zero: there is an inverse relationship between these two parameters. Tightening the system so as to reduce the false accepts may result in more false rejects, and vice-versa. However, it is possible to ensure that both have very low values - thus effectively eliminating false acceptance and false rejection.

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UNIT - IV

CHAPTER

4

Money and Economic Value

Syllabus

Engineering Economic Decisions, Time Value of Money, Understanding Money Management, Case Studies- Economic decisions done in Multi-national companies.

4.1 Introduction :

Contrary to the belief that economics or economic activities are purely the purview of the policy and decision makers, we find people from all walks of life performing some form of economic activity. The economic activities vary from production to consumption. When in production the objective is to earn maximum income and while consuming the objective is to earn maximum satisfaction. It has always been our desire to have more for less, i.e. more goods and services for less money. The strife to meet unlimited needs within the limited means is economics. Primarily economics as a science is concerned with this economic problem.

There are two basic definitions of economics – one attributed to Adam Smith, Karl Marx and others which states "Economics is a social science which deals with human behavior pertaining to production, exchange and consumption of goods and services (wealth)" and the other inspired by the 'marginal revolution' of the 1870's. Lionel Robbins in his book, "Essay on the Nature and Significance of Economic Science" in 1932 advocated, "Economics is the analysis of universal type of problems of the allocation of resources, which are given and versatile among ends, which are many and varied in significance". This explains Economics as 'a science of choice'.

4.2 Basic Economic Study Pattern :

- Of all the problems a business might face, those linked to economic issues are among the most important it will have to consider.
- Business is an economic activity. An economic activity involves the task of adjusting means to the ends or ends to the means. An economic activity assumes the form of production, consumption, distribution and exchange.
- Each business firm has a goal to achieve for which it has resources at its disposal. Sometimes the goals have to be achieved with the given resources and sometimes the resources have to be matched with the given goals. Essentially, the function of a business firm is to achieve optimum result of economic activities.
- A business faces different levels of a problem. Hence we can identify four levels of economic analysis that a business might need to consider.

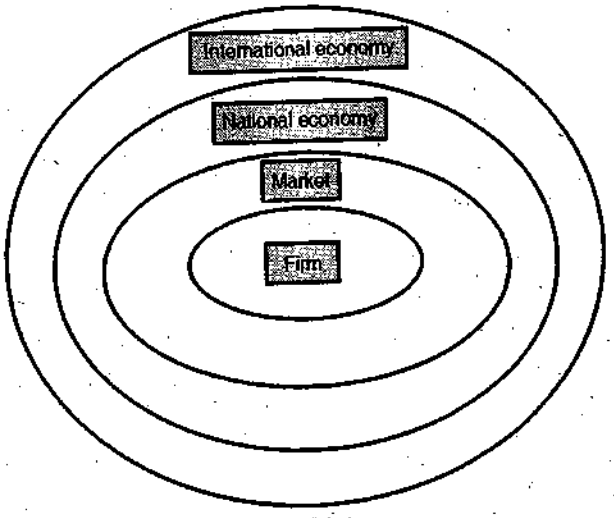

Fig. 4.2.1

- **The Firm :** Economic issues facing the business at this level of analysis is primarily concerned with problems of production; price setting, costs, revenues and organisational structure.
- **The Market and Industry :** Economic issues facing the business at this level of analysis tends to focus upon the implications of the market structure for business performance; the number and size of firms and the limitations on market expansion.
- **The National Economy :** Economic issues facing the business at this level of analysis are concerned with the problems of overall national economic performance; for example, the level of interest rates, the rate of economic growth, rates of taxation.
- **The International Economy :** Economic issues facing the business at this level of analysis is concerned with problems of international trade; rates of exchange, access to overseas markets, the implications of overseas investment.

4.3 Business Economics :

Q. What is Business Economics? State its scope.

Introduction :

- A business firm is an economic unit. It transforms input into output. It is a value-added process - the value of output is in excess of the value of input.
- The goal of this activity is to maximize profits in the long run.
- Business decision-making is an economic process. Rational choice is at the root of all economic problems.
- This is because resources are limited whereas the ends to be achieved may be unlimited. For example if we produce 'more butter, we cannot produce more cheese'.
- Hence we can define business economics as the application of economic theory, principles and methodology to decision-making problems faced by the business firms.
- Business economics is an attempt to apply economic analysis in the formulation of business policies.
- Economic theory with appropriate modifications can be used by the business firms to the realization of targets set out by them. The principles and methodology of economic theory enable the business firms to allocate the resources most efficiently.
- In fact the principles of economic theory can be applied not only by the business firms but by any entity which seeks to achieve optimization of decision-making, given the situation of limited resources and unlimited ends.
- Business economics is an integration of economic principles with business management practices.
- The subject matter of business economics apparently pertains to economic analysis that can be helpful in solving business problems, policy and planning.
- Business economics has evolved by establishing links between economic theory and decision sciences (tools and methods of analysis) for the optimal solution to business decision problems.
- The tools of decision sciences include mathematical economics, statistics and econometrics as applied to business problems.
- Business economics is confined only to a part of business management. It primarily addresses the analysis of economizing aspects of business problems and decision making by a business firm or an organization.
- It is not directly concerned with the managerial problems and actions involving implementation, control, conflict resolution and other management strategies in day to day operations of the business.
- Business economics is the application of knowledge of economic concepts, methods and tools of analysis to the business decision making process within the firm or organization in conducting the business activity. It seeks to establish rules and principles to facilitate the attainment of the chosen economic goals of business management, such as minimization of costs, maximization of revenues and profits and so on.
- Finally business economics involves an application of economic theory - especially, micro-economic analysis to practical problem solving in real business life. It is essentially applied microeconomics. It explores and enhances economic mindfulness and awareness of business problems and managerial decisions.

4.3.1 Scope of Business Economics :

Q. State Business Economics scope.

Business economics is closely connected with the following areas of study.

- **Microeconomics** : Microeconomics deals with individual consuming units or individual producing units. For business economics the main source of concepts and analytical tools is microeconomics. The microeconomic environment deals with the operation of the firm in its immediate market, involving the determination of prices, revenue, costs, employment levels and so on. The areas of microeconomics dealing with demand theory and with the theory of production and cost enable a businessman who is generally interested in estimating demand and cost relationships. This would enable him to take decisions regarding the price to be charged for a product and the quantity of output to be produced.
- **Macroeconomics :** The macroeconomic environment comprises the general social and economic conditions of the larger system of which each firm forms a part. Therefore, a businessman is not only interested in studying his price and output structure alone. He is also interested in knowing the shape of the present and future economic system, which would in turn determine the business atmosphere. Hence the businessman has to consider the trends in gross national product, changes in consumption and investment patterns etc.
- **Theory of Decision Making** : Most of economic theory is based on the assumption of a single goal maximization- maximization of utility in the case of a consumer and maximization of profits in the case of a producer. It also assumes certainty and perfect knowledge. However, in the real world there is a multiplicity of goals, existence of uncertainty and perfect knowledge does not exist. The theory of decision-making is concerned with the processes by which expectations under conditions of uncertainty are formed. Therefore when business economics is concerned with real world phenomena it has to take the help of the theory of decision-making.
- **Operations Research** : Business economics is closely associated with operations research which deals with the construction of models and the problem of optimization. An extensively used tool in business economics is linear programming which is a best known method in operation research. Inventory models developed by operation research analysts are used by businessmen to indicate optimum quantities to order and optimum ordering times.

- **Statistics** : for the empirical testing of theory, business economics has to depend on statistics. The demand and cost functions required by the business firms are built up with statistical techniques. For example, firms produce in the current period for the satisfaction of consumer demand at some future date. Demand forecasting makes use of various statistical devices for dealing with uncertainty of future events.

4.3.2 Nature of Business Economics :

There are a number of basic concepts which lie at the heart of business economics. These concepts are significant for business decision-making. The most important of these are :

1. Resource Allocation
2. The Production Decision
3. Opportunity Cost
4. Diminishing Marginal Returns
5. Marginal Analysis
6. Business Objectives
7. Time Dimension
8. Externalities
9. Discounting

1. Resource Allocation :

Decisions regarding resource allocation need to be made at three levels :

- **What** goods and services to produce with the available resources;
- **How** to combine the available resources to produce different types of goods and services, and
- **For whom** the different goods and services are to be supplied.

The following figure illustrates the interrelationship between the production decision and decisions regarding these three factors.

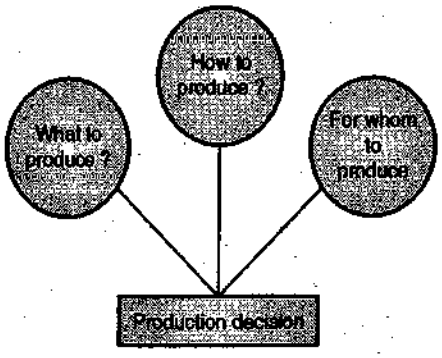

Fig. 4.3.1

2. The Production Decision :

- The above decisions are sometimes described as the allocative, productive and distributive choices respectively, which face society in general.
- In business economics we examine how the price mechanism relates to making these choices. Traditionally, the price mechanism has been seen as the major determinant of the what, how and for whom decisions, especially in market economies, though less so in the formerly centrally planned or command economies of Eastern Europe.
- However, over time, in all economies firms have grown in size and importance. Resources within firms are allocated by both command and price. For example, a decision on where to locate plant could be based upon detailed costing of alternative sites (price).
- Alternatively, the decision might be made by management on the basis of non-price factors, which may in fact be purely subjective. The market represents a network of unconscious co-operation between a multitude of buyers and sellers.
- At the same time, the boundary between the firm and the market is constantly evolving through mergers, takeovers, divestment, management buyouts, etc. Firms are constantly reassessing their structures and strategies.
- Firms have to constantly monitor what activities are to be directed by the 'conscious power' of management and what should the prerogative of the 'unconscious co-operation' which is the hallmark of the market. Sometimes it may pay to buy in the market while sometimes it may be more efficient to undertake an activity in-house. In economic terms, the deciding factor will be relative costs.
- The businessman, therefore, needs to be aware of not only the current costs of production but also the costs of the alternative method of supply.

3. Opportunity Cost :

- The underlying business decision is the fact that resources are scarce.
- This scarcity can be reflected in many ways, such as shortages of capital, physical and human resources, and time. The existence of scarcity means that whenever a decision or choice is made, a cost is incurred. In economists' jargon, such costs include opportunity costs.
- The opportunity cost of any activity is the loss of the opportunity to pursue the most attractive alternative given the same time and resources.
- Any firm with its available factors of production such as land, labor and capital has a choice as to the products it may produce.

4. Diminishing Marginal Returns :

The concept of diminishing marginal returns refers to the situation whereby as we apply more of one input (e.g. labor) to another input (e.g. capital or land), then after some point the resulting increase in output becomes smaller and smaller.

5. Marginal Analysis :

- The idea of opportunity cost highlights that choices have to be made regarding what to produce. The concept of margin points out that most of these choices involve relatively small (incremental) increases or decreases in production.
- The concept of margin is central to most economic decisions. Hence it is referred to both in terms of consumer behavior when buying products and the behavior of firms when deciding whether to alter production.
- Consumers, through their purchasing decisions, must decide whether or not buying a particular product will add more to their well-being than spending the same amount on some alternative.
- Similarly, for a producer, the question is whether or not the increase in output will provide enough extra revenue to compensate for the extra cost of production.
- The aim of the producer is to find the optimal level of production.

6. Business Objectives :

- Traditionally, the study of business decision-making has focused on the single objective of profit-maximization.
- This stems from the fact that owners of businesses were considered to be simply interested in making profit. However, the development of modern capitalism has led to a divorce of ownership and control in modern companies.
- In large companies, a 'managerial class' controls the company's operations, while ownership of the company is spread among a multitude of shareholders. This development has led to a reassessment of the view that the pursuit of maximum profit is always the firm's primary objective, even in the longer term.
- In reality, management in large companies may pursue a wide range of objectives, which may not always be wholly consistent (e.g. maximizing output as against minimizing environmental damage).
- Other possible objectives of business firms include the following :
  - The achievement of personal goals, involving personal security and reward, status, degree of discretionary power, etc.
  - Growth targets for the company in terms of scale of output, market share, geographical market, annual extension of physical capacity, size of departments or size of the labour force etc.
  - Maximization of sales revenue (as opposed to sales volume).

7. Time Dimension :

- Business decisions and objectives are to be considered within a time framework - profit maximization in the short term may not be consistent with the long term success of business.
- In certain circumstances it may even lead to the downfall of the business in the long-run. For example, short-term profit maximization might mean that workers are pushed so hard to increase production for relatively low wages that they eventually go on strike, or that goods are made which are less reliable and sold at such high prices that new competitors eventually emerge to take over the market.
- This suggests that profit-maximization can only be usefully discussed in relation to a given time dimension.
- Time is a continuum, but for convenience, economists distinguish between two broad time periods-short run and long run :
  - The short run represents the operating period of the business in which at least one factor of production is fixed in supply.
  - The long run represents the planning horizon for the firm. This is the period in which all factors may be varied.

8. Externalities :

- It may arise that short run and long run objectives are not compatible with the interests of society in general.
- The annual accounts of firms do not reflect social costs or social benefits (referred to by economists as externalities). For example, the expansion of industrial output may increase the firm's profits but damage the environment through pollution (an external cost).
- Alternatively, the development of a new reservoir may enhance the quality of life for the public in general by increasing the provision of water sports (an external benefit), while at the same time benefiting the water company.
- However, it is becoming increasingly important to businesses in today's society to pay greater attention to social and environmental issues as public awareness on these issues have increased.
- Business decisions have therefore to reflect both the internal costs and benefits of a project to the firm (the costs and benefits they directly control) and those external costs and benefits which affect society in general. For public sector managers concerned with pursuing social welfare, externalities are of central concern.

9. Discounting :

- In considering all of the costs and benefits of an investment project it is important to appreciate not only externalities but the fact that, because internal and external benefits accrue over the life of the project, they must be discounted.
- The concept of discounting is concerned with the fact that costs and benefits arising in future years are worth less than costs and benefits arising today.
- The fact that interest can be earned over time means that, even with zero inflation, all future costs and revenues must be discounted at an appropriate rate of interest (discount rate) before we are able to make proper comparisons with costs and revenues expressed in current values.

4.3.3 Significance of Business Economics :

1. In recent decades, many concepts and tools of microeconomics have been extensively used by businessmen in the decision-making processes. Business economics as a new branch of Economics has developed at a fast rate.
2. Through demand analysis and forecasting, cost analysis, analysis of different market structures etc., business economics has contributed significantly to improved decision-making in business.
3. Further, the development of the theory of linear programming has provided a powerful new analytical tool to analyse business problems. It helps in finding actual numerical solutions to problems calling for optimum choices where the problems have to be solved within definite bounds.
4. In modern times, business economists have assumed a prominent place in business enterprises. They act as advisers. They have to be both conceptual and practical. They must not only possess a good knowledge of the working of the individual firm as well as the industry as a whole and the behaviour of the market and the business conditions, but also about the likely changes that may take place in the economy. Only then can they be effective advisers.
5. Business economists have to be in touch with the technological developments. An economic decision is taken within the framework of technological developments. Changing technology and innovation of new products may adversely affect the business of the firm if it fails to keep pace with modern times. Business economists suggest ways and means of economizing, thereby minimizing the cost of production.
6. Business economists advise the businessman or management on financial matters such as the financial needs and the alternative arrangements of business finance. They are responsible for guiding the management in ensuring that business operations bring a fair return on the capital employed.
7. By assessing returns on different forms of investment, through cost-benefit analysis, business economists help in making a right choice of investment. They also suggest appropriate and economically suitable location of industry.

Syllabus Topic : Engineering Economic Decisions

4.4 Engineering Economic Decisions :

Introduction :

As young budding engineers you may think that economic decisions are the sole prerogative of the economists or the top management and as engineers your sole responsibility would be to handle production related issues. However, engineers are required to play multiple roles within a firm. Engineers are called upon to participate in a variety of decisions, ranging from manufacturing, through marketing, to financing decisions. The primary objective behind each decision is to improve the firm's profits.

Behind all these decisions lie various economic decisions related to engineering projects which are referred to as engineering economic decisions.

The role of an engineer in an engineering project starts from the conceptual design of the product to its production and finally till its shipping and after sales service. As a matter of fact, engineering decisions account for majority of products cost. Engineers must consider the effective use of capital assets such as building and machinery. As part of long range planning process decision needs to be taken on the various projects the company can undertake and the appropriate resources that need to be allocated to each project over the next few years. Engineers have to plan for the acquisition of equipment that will enable them to design and produce products economically. This will involve capital investment and the allocation of resources that are limited.

Whenever the purchase of a new machinery is being planned the first thing that needs to be estimated is the profits or in financial terms the cash flows that this new fixed asset would generate for the firm during its period of service. Evaluation of capital investment proposals is difficult since the benefits from investment are received in some future period. Hence there is a substantial risk involved in estimation of the future benefits. Add to this, the possibility of shift in consumer preferences, the action of competitors, technological developments and changes in the economic and political environment. Even to quantify the future benefits in monetary terms is not an easy task. This underlines the need for thoughtful and correct investment decisions.

An inaccurate estimate of the need of the asset could have serious implications on the cash flows of the firm and could detriment its financial health. On the other hand, spending too little on fixed assets could also prove harmful

for the firm's existing machinery may be too obsolete to produce products competitively and without an adequate capacity the firm may lose its market share to its competitors.

Also investment in new machinery may improve the productivity of the firm and enable it to lower its cost of production and offer its products to its customer at a lower price. However, if the firm delays this decision it may lose some of its customers and regaining lost customers involves heavy marketing expenses and may necessitate price reduction and/or product improvement.

4.4.1 The Complexity of Engineering Economic Decisions :

Q. Discuss the complexity of Engineering Economic Decisions.

- The development of any product depends upon the ability of an engineer or a technocrat to translate his idea into an innovative product.
- Innovation is the use of knowledge to produce product and services with a commercial angle. The development of a firm depends upon its ability to constantly launch innovative products and services. Innovation could be in launching new products or offering existing products with improved quality or at a reduced cost of production. This means that the firm has to keep on reinventing itself to stay in the competition and maintain a healthy growth rate. Now, for all this the role of the engineer in the economic decision making of the firm is paramount.
- To better understand the role of engineers in economic decisions of firm let us trace the success story of one of the major innovator of our times, Honda which has consistently innovated with its products.

Year	Event	Significance
1946	Founded as Honda Technical Research Institute	Began their journey by developing engines for bicycles
1949	Introduced its first motorcycle	Introduced its first motorcycle Dream in Japan which proved to be a huge success in the market and helped build the image of Honda as a quality motorcycle manufacturer.
1959	Entered the US market	Honda entered the US automobile and motorcycle market by founding the American Honda Motor Company.
1963	Released first car	Released its first sports car the S500 in Japan and then on grew rapidly to become one of the largest manufacturers of cars and motorcycles in the world.
1972 -74	Civic Car	Introduced the Civic in the US market which immediately became a success and was ranked first in fuel efficiency. This car catapulted Japanese cars and car makers in the US market and there on people's perception towards cars changed.
1980-90	Environmental Friendly Cars	Introduced various environmental friendly cars and also used solvent free paint into mass production. The period also marked the introduction of solar and electric cars. These cars have not yet attained commercial success.
1997 -99	Hybrid Car	Introduced a two door hybrid car the Insight in Japan. This car had high fuel efficiency and was not required to be plugged for electric charging. The car was later introduced in the US where it caught the fancy of everyone.
2000-2002	Awards	Received various awards at the international level for its innovative and path breaking work. Honda focused on developing environmentally friendly vehicles and cleaner transportation alternatives.

Year	Event	Significance
2002-2005	Development in Hybrid Cars	Manufactured the first fuel cell vehicle which was certified by the US authorities. Honda FCX became the world's first fuel cell vehicle which was commercial launched.

- It is evident from above that continuous innovation has enabled Honda to grow as one of the largest automobile manufacturers and a respected global brand. Honda is committed to technological and the environment. Team Honda is dedicated to in-house Research and Development and does not believe in collaboration with outside sources and prefers going alone. As stated earlier collaboration enables the sharing of cost and risk and hence industry observers were perplexed by Honda's strategy of going at it alone.
- This strategy is risky but potentially profitable. This strategy has come in for flak as Honda's competitor in Hybrid cars, Toyota has pursued joint venture and collaboration strategies, which seems to have paid rich dividends as its hybrid cars are outselling Honda's hybrid cars. Despite this Honda still does not believe in collaborating and ensures that its knowledge and learning remains in-house.
- Every economic decision that an engineer has to make has to be based on sound logic. Let us assume that a firm has a printing machine that it has been using for the past ten years however since the past one year the machine has been persistently requiring maintenance and the down time is taking a toll on the production.
- The demand for material being printed in the machine is constant and you as an engineer estimate it to be the same over the next few years. Now, as an engineer you are required to take a decision to either replace the aging printing machine and replace it with a new one which will involve high capital investment or keep on repairing the machine till the demand lasts. You will also have to consider the probability of competition which may arise once your firm fails to deliver to your clients on time and on the other hand the overall decline in demand. You may have to conduct an economic analysis to determine whether declining profits from the machine offset the cost of a new lathe.
- Although, the attractiveness of any investment decision is simple the information required for such evaluation involves forecasting the demand, price and other factors for the product in the future period. However, forecasting the future is never completely accurate and may vary from a far distance when compared with the actual values realised in the future.
- This may want us to go back to the economic decisions and change them. Therefore, economic decisions have to be based on the best possible information available at the time of decision, a thorough understanding of the uncertainties in the future and the financial implications of the decision.

4.4.2 Typical Engineering Economic Decisions :

Q. Describe briefly the typical Engineering Economic Decisions

- They are many engineering economic decisions that need to be made in a firm and given the level of competition in business today the implications of these decisions could end up being disastrous for the firm. However, one cannot put these decisions off for the future as decisions not made at the right time could also affect the fortunes of the firm. Hence, these decisions need to be made judiciously taken into consideration all the factors that come into play.
- As we are aware the future prospects of any firm depend on its ability to innovate and design innovative products or ideas. This is especially all the more relevant in the Information Technology where innovative products and ideas are the norm of the day. We have many examples of new products and ideas being launched in the IT sector by entrepreneurs and intrapreneurs.
- In an engineering firm project ideas can originate from all corners of the organization. Now some of them may be worth a further look while others may not be. The firm needs to establish procedures for screening projects and recognising the importance of these projects many companies have set up a specialised project analysis division that analysis these proposals of projects and ideas. Once a project passes the first stage it is classified under the following categories :

1. Service or quality improvement
2. New product or product expansion
3. Equipment and process expansion
4. Cost reduction
5. Equipment replacement

Such a classification enables the management to analyse the feasibility of the project and seek answers to the following questions :

- Does the firm have the technical expertise to manage such a project or will it require new recruitment?
- Can the existing facility of the firm be utilised to implement the new project?
- Does the firm have the spare capacity to implement the new project or will it require new investment?
- Do the returns justify the investment?

Every firm big or small is required to face these investment decisions at some time. Larger investment decisions will naturally require detailed analysis of the expenditure and the likely returns. Of the five economic decisions the one that will require a detailed analysis will be that of new product or product expansion. These decisions

are made at a higher level in hierarchy of the organization. A closer look at these engineering economic decisions will enable us to understand them better.

Engineering Economic Decision I - Equipment Replacement :

- In our daily lives we regularly take decisions as to which new car or mobile to purchase? However, it is not always that a choice between new alternatives is to be made. Sometimes, a choice needs to be made between the existing and the new; should we replace a consumer product or repair it. Electronic products and automobiles are two areas in which the replace/repair decision is very difficult to make.
- Likewise, engineering economists too have a classical dilemma; should a firm trade its existing machinery on a cyclical basis or wait till their productive age is over. From an economic point of view it could be proved that replacing machines on a cyclical basis would be beneficial even though they need not be replaced.
- Another trend that exists within firms is to adopt new technologies despite the existing technologies working and delivering good results. With the advent of computer control systems we are experiencing rapid conversion from existing manual systems to system wherein the computer controls the processes. The mass movement to computerization could be attributed to the various advantages and economic edge that they provide.

Replacement Studies :

- Replacement, as the title itself suggests, is replacing some existing commodity/asset with something similar, but better equipped to serve the purpose. Replacement Studies is a broad concept in engineering economics and embraces the selection of an asset which is new but similar to an existing asset which it is to replace. The new asset is not only to replace the existing one but also outdo its performance.
- For instance, old printing machines are replaced with new models, which perform similar functions of the earlier machines, but also have advanced functions which not only improve output but also the quality of the final output. The new machines could have a pneumatic system, computer program controlled, or a continuous feeder, these added features help in improving the output as well as the quality of the printing.
- However, replacement decisions are critical from the point of view of the firm, hence should not be taken in haste. Remember, we are merely replacing an existing machine with a new improved one, so we have to justify the replacement.
- A hasty decision to replace a temporarily malfunctioning machine or merely for the sake of buying the latest, is not prudent as it has serious capital implications. On the other hand, a firm which is hard pressed for capital could postpone its replacement decisions until one day its total production comes to a standstill. Postponement of replacement decision could make the firm non-competitive. Machines with heavy downtime and breakdown prone lead to higher operating costs or lower quality, making the firm lose out on customers and eventually its profits. It is for the engineers to determine the efficiency of an existing machine and the replacement that should be considered.
- Replacement Study is an economic analysis involving the comparison of an existing facility and a proposed replacement facility.
- Replacement study is the selection between the existing asset called the defender, and the asset set to replace it called the challenger. It is not always that the defender is at the end of its life, it may merely be because it may not be able to meet the current requirements of the firm and hence the decision to replace it. The defender may not be totally scraped; it may be sold off to another firm where it may be the challenger.

Reasons for Replacement :

Industrial assets may be replaced because of their deteriorating performance, obsolescence, and depletion. As is evident all the above reasons make it impossible for the asset to deliver the desired output in terms of quantity and quality. In all the above cases it would be prudent to replace the asset with a new one.

- **Obsolescence :** Is the state of being which occurs when an asset, service, or practice is no longer wanted even though it may still be in good working order. Obsolescence frequently occurs because a replacement has become available that has, in sum, more advantages than the inconvenience related to repurchasing the replacement. Typically, obsolescence is preceded by a gradual decline in popularity. Changes in technology cause a major change in the market demand for older assets. Example; with the advent of LCD and LED Television sets the demand for flat screen sets has diminished. Thus, technologically obsolete assets may need to be replaced with technologically advanced assets. Obsolete refers to assets which are disused or discarded.
- **Depletion :** Refers to the gradual loss in the market value of an asset due to its consumption or exhaustion. The term depletion is mostly used in mining, oil extraction and timber. Unlike other asset the owner of the asset uses the asset till he exhausts it totally. On complete he finds a replacement and moves on.
- **Deterioration :** Is the loss in the value of an asset due to its aging. Machinery which was once new deteriorates with the passage of time. The machine looses it ability to function as per the new machine and this makes it financially unviable. Also, the expenditure incurred on its maintenance and upkeep increases. The down time of the machine is also a matter of concern for the management. Hence, to maintain its position in the market the firm has to replace the machine with a new one. The new machine may be technologically similar but on account of it being new is able to meet the requirements of the market better.

Whatever the reason for replacement the firm has to provide money for it in its capital budget. Replacement of existing machinery is an expensive proposition and hence may take time.

Factors to be considered in Replacement Studies :

The following factors need to be taken into consideration while undertaking replacement studies;

1. **Past Estimation Errors :** Estimation errors with respect to the defender asset made in the past have no bearing on the replacement unless and until they have some income tax implications. As we have seen, the economic implication of replacement study is in the future hence, any errors with respect to estimation committed in the past will have no direct bearing. Usually an error is made with regards to the value of the asset, so when the book value of an asset is greater than its market value, the difference is attributed to incorrect estimation. Errors are usually made while estimating the capacity of the asset as well as its maintenance cost. These differences may not always be estimation errors but could be attributed to the inability of the management to foresee the future while estimating. For a brighter future the management should do away with any estimation errors committed in the past. Living with the past errors will not enable the firm to be competitive in the market, where the likelihood of other firms having committed similar errors is less. The psyche of the management is to not accept the loss in the value of the asset in case replacement is made. The management has got to remember that the loss has already been incurred irrespective of its replacement decision.
2. **Sunk Cost :** For replacement decision, the present and future cash flows should only be taken into consideration. Any unamortized value (unallocated) of the defender asset is the outcome of past decisions. Decisions taken to invest in that particular asset and the number of years depreciation is to be charged. The difference between the book value of the asset and its market value represents sunk cost. Sunk cost should in no way be part of the replacement decision and should be included in the engineering economy study if they have income tax implications.
3. **Investment Value of Existing Asset and the Outsider Viewpoint :** The realization of the non-relevance of the book value and the sunk cost lead to a fresh viewpoint on the value of the defender asset for replacement study. The outsider viewpoint could be employed to approximate the investment worth of the defender asset. An impartial third party is asked to establish the fair market value of the defender. This is a simple but effective way to ensure that the sunk cost and the opportunity cost of the salvage value are properly addressed in the replacement study. The opportunity cost is the opportunity foregone by deciding to persist with an asset. The outsider viewpoint assumes that you own neither the defender nor the challenger, and as an outsider you have the option of buying either the defender at its salvage value or the challenger. As the outsider pays only the salvage value he properly allocates the opportunity cost to the defender. If an upgrade of the defender is required to have a competitive service level with the challenger this should be added to present realizable market value.
4. **Economic Life of the Challenger :** The economic data regarding challengers should be periodically updated and replacement studies should be done using the most updated data. The economic life of the challenger minimizes the Economic Uniform Annual Cost (EUAC).
5. **Economic Life of Defender :** Often the life of defender and challenger are different. The defender should be kept longer than economic life, if its marginal cost is less than the minimum EUAC of the challenger over its economic life.
6. **Income Taxes :** As is obvious, replacement results in gains or losses from the sale of depreciable assets. Hence, studies should be made on an after tax basis for an accurate economic analysis. Taxes have a considerable effect on the decisions of a firm.

Engineering Economic Decision II - New Product or Product Expansion :

The designing and developing of new products is quite different than the well defined analytical problems that we have studied in the other engineering subjects throughout this course of engineering. The most glaring difference that is encountered while designing and developing new products is the lack of information which forces one to depend on his judgment and assumptions which is in sharp contrast to the abundance of information in other engineering areas. The other difference is that there is no one correct solution/design/method of development. The designer or the developer cannot be assured that this is the only and the best way of doing. The problems encountered need more time and effort to understand.

The underlying motive behind the development of a new product is profit. Every investment that is done in a new product is to gain profit and to produce the goods and to sell them profitably. But where a new product is being developed it is not easy to quantify the profit so early in the life cycle of the product and hence we have to identify other dimensions which can be used to assess the performance of the product development effort and then relate that to the profit that is generated from the product. The dimensions which are related to profit are;

- **Product Quality:** The quality of the product depends or is directly proportional to the effort that is taken in developing the product. The quality should satisfy the requirements and needs of the customer. Ultimately it is the satisfaction of the customer which is important as this satisfaction will reflect in sale, a healthy market share and profits for the company. Quality also helps in procuring a good price for the product which is also going to add to the profits. Reliability is also an indicator of the quality of the product as reliability and quality go hand in hand.

- **Product Cost :** Product cost means the cost of manufacturing of the product. Manufacturing cost includes fixed cost which is the plant and machinery and variable cost which is the cost that is incurred on the men and material that is used in the manufacturing of the product. Product cost is very important as it will determine the profit that accrues to the company. The selling price is also dependent on the product cost.
- **Development Time :** Development time is the time taken by the development team to develop the product. The development time indicates the general preparedness of the company to competition and technology. Competition and technology are two of the most important factors that induce a company to develop new products. The time taken for development also determines the speed with which the returns of the product development are received by the company.
- **Development Cost :** Development cost is the cost incurred in developing the product and though it is a fraction of the investment made to attain the desired profit it needs to be monitored. Developing new products is a well planned gamble and though it made sound cruel the success of the product in the market cannot be taken for granted. In a survey of 700 consumer and industrial companies, Booz Allen Hamilton reported an average new product success rate (after launch) of 65 percent; although it had to be noted that only 10 percent of these were totally new products and only 20 per cent new product lines - but these two, highest risk, categories also dominated the `most successful' new product list (accounting for 60 percent).
- **Development Capabilities :** The ability of the development team to develop new products will determine the future of the company. A company with better capabilities to develop products is bound to have a bright future and assist in charting the future course of the company.
- If the company scores well on all these dimensions then it is bound to succeed with its product. Each member in the company will be having different aspirations from the product like;
- **Stakeholders :** Growth and profit.
- **Community :** Number of jobs that the new product creates, less waste and damage to the ecology and judicious use of resources.
- **Employees :** Skills that are developed to meet the requirement of the product and the safety measures that are employed.
- **Product development team :** An exciting and challenging product.

Engineering Economic Decision III – Equipment or Manufacturing Process Selection

This engineering economic decision selects the best equipment or manufacturing process out of the several that meet the project requirements. The choice of equipment or manufacturing process depends on various factors that we shall be discussing later on here, but whatever be the choice, it must meet two basic objectives:

(i) It should be able to meet the specifications of the final product.

(ii) It should be cost effective.

The final product specification can be met by choosing the right equipment, manufacturing process or the right technology but that is not always an easy task. Since, stricter final product specification lead to an increase in the cost of the product, there is always a trade off between the desired specifications and the cost to be incurred to achieve those specifications. Also, the choice of raw material will influence the choice of equipment and vice versa. Engineers are to consider all major cost elements such as the cost of equipment, labour, material, etc. For example, sophisticated injection moulding machine and high quality plastic can produce quality plastic products however the cost of production is high if the volume demanded is low and may fail to compete with local production. In such cases the engineer has to take into account all these factors before deciding on the equipment that would be employed into production.

Factors that determine the choice of manufacturing process :

1. **Volume/Variety Demanded :** One of the major considerations in the selection of process is the volume/variety of the product that would be produced. High product variety (many products) would require highly skilled labour, general purpose machines and good production planning and control system. On the other hand, a low product variety but high volumes would require mow skilled labour, highly automated production processes, specialised machines and a simple production planning and control system.
2. **Capacity of the Plant :** The projected sales volume also has a major influence on the selection of the manufacturing process. The firm can resort to intermittent process of production if the volumes are going to be low or to continuous process if the volumes are going to be high.
3. **Flexibility :** Flexibility is the ability of the process to meet the varied requirements of different customers. Flexibility and variety are inter-related. If more variety is to be added the engineer will have to identify the commonalities in terms of specifications in the products. Where the commonalities are high the firm will have to resort to intermittent process which is associated with higher inventories, greater lead time and demands elaborate planning.
4. **Lead Time :** Lead time is the time taken to deliver the product to the customer on receiving an order and has a major impact on the selection process.

Engineering Economic Decision IV - Service or Quality Improvement :

The impact of quality upon the profit of the company is highly significant. Quality is a route to higher profits, by bringing down the cost in terms of wastes, rework, and

rejects and doing continuous improvement. However, there is a cost attached to the improvements in service or quality which have to be taken into consideration by the engineer before implementing the improvement program. The cost incurred on the improvement program has to justify the benefits of the program.

Engineering Economic Decision V - Cost Reduction :

When it becomes difficult for a firm to increase the price of its products or services to maintain or improve its bottom line the only option that remains with the firm is to implement a cost reduction project that attempts to reduce operating costs. Value analysis is one of the major techniques of cost reduction. Value analysis ensures cost reduction without affecting the quality, reliability, performance and appearance of the product. The objective of value analysis is not to degrade the product but to improve its value by reducing cost. The elimination of unnecessary costs causes no adverse effect on quality, reliability, maintainability or saleability of the product. Value analysis as a cost reduction tool analysis the manufacturing methods and eliminates unnecessary costs incurred on account of traditional ways of working or limitations. In addition to cost reduction, value analysis maximises value of the product by considering both cost and function.

Syllabus Topic : Time Value of Money

4.5 Time Value of Money :

Q. What is Time Value of Money? How is it calculated

- This part is concerned with interest rates and their effects on the value of money. Interest rates have widespread influence over decisions made by businesses and by us in personal lives. Corporations pay lakhs of Rupees in interest each year for the use of money they have borrowed.
- We earn money on sums we have invested in savings accounts, certificate of deposit, and money market funds. We also pay for the use of money which we have borrowed for school loans, mortgages, or credit card purchases. We will first examine the nature of interest and its computation. Then we will discuss several investment solutions and computations related to each.
- Time Value of Money (TVM) is an important concept in financial management. It can be used to compare investment alternatives and to solve problems involving loans, mortgages, leases, savings, and annuities.
- TVM is based on the concept that a rupee that you have today is worth more than the promise or expectation that you will receive a rupee in the future. Money that you hold today is worth more because you can invest it and earn interest.
- After all, you should receive some compensation for foregoing spending. For instance, you can invest your rupee for one year at a 6% annual interest rate and accumulate 1.06 at the end of the year. You can say that the future value of the rupee is 1.06 given a 6% interest rate and a one-year period. It follows that the present value of the 1.06 you expect to receive in one year is only 1.
- A key concept of TVM is that a single sum of money or a series of equal, evenly-spaced payments or receipts promised in the future can be converted to an equivalent value today. Conversely, you can determine the value to which a single sum or a series of future payments will grow to at some future date.

4.5.1 Time Lines and Notations :

- When we are dealing with cash flows that are at different points in time then it is made easier using a time line that shows both the timing and the amount of each cash flow in a stream. Thus a cash flow stream of Rs 1000 at the end of each of the next five years can be depicted on a time line as shown in Fig. 4.5.1

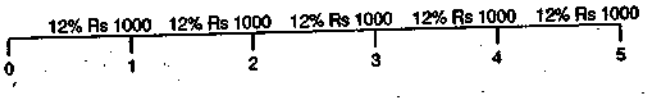

Fig. 4.5.1

- In the Fig. 4.5.1 refers to present period and therefore a cash flow that occurs at time 0 is therefore already in present value terms and does not need to be adjusted for time value. It is important here to understand the distinction between a period of time and a point in time.
- The portion of the time between 0 and 1 refers to period 1, which here is assumed to be the first year. The cash flow that occurs at the point in time 1 refers to the cash flow that occurs at the end of period 1.
- The discount rate which is 12 percent in this example, is specified for each period on the time line and may be different for each period. Had the cash flows been at the beginning of each year instead of at the end of each year, the time line would have been as shown in Fig. 4.5.1.

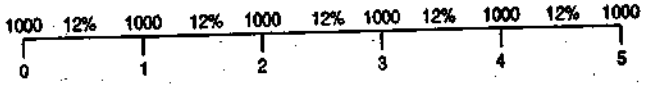

Fig. 4.5.2

- Here it is worth noting that a cash flow that occurs at the beginning of the second year is the same as that which occurs at the end of year one.
- Cash flows can be positive and in that case are called inflows and when negative are called as outflows.

4.5.2 Interest :

- Money available at present is more valuable than money value in future. The compensation for waiting is the time value of money, called interest.
- **Interest** is a fee which is paid for having the use of money e.g. interest on mortgages for having the use of bank's money. Similarly the bank pays us interest on

money invested in savings accounts or certificates of deposit because it has temporary access to our money. The amount of money that is lent or invested is called **principal**. Interest is usually paid in proportion and the period of time over which the money is used. The interest rate is typically stated as a percentage of the principal per period of time, for example: 18 percent per year or 1.5 percent per month.

- Interest that is paid solely on the amount of the principal is called **simple interest**. Simple interest is usually associated with loans or investments which are short-term in nature. The computation of simple interest is based on the following formula:

$$\text{Simple interest} = \text{Principal} \times \frac{\text{Interest rate}}{\text{per time period}} \times \frac{\text{Number of}}{\text{time period}}$$

Prob. 4.5.1 : A person lends Rs.10,000 to a corporation by purchasing a bond from the corporation. Simple interest is computed quarterly at the rate of 3 percent per quarter, and a cheque for the interest is mailed each quarter to all bondholders. The bonds expire at the end of 5 years and the final cheque includes the original principal plus interest earned during the last quarter. Compute the interest earned each quarter and the total interest which will be earned over the 5-year life of the bonds.

Soln. :

In this problem, principal = Rs.10,000, interest = 3 percent per quarter and the period of loan is 5 years. Since the time period for interest is a quarter of a year, we must consider 5 years as 20 quarters. And since we are interested in the amount of interest earned over one quarter, the period is 1 quarter. Therefore, quarterly interest equals Rs. $10,000 \times 0.03 \times 1$ = Rs. 300

To compute total interest over the 5-year period, we multiply the per-quarter interest of Rs.300 by the number of quarters 20, to obtain

Total interest = Rs. 300×20 = Rs.6,000

4.5.2.1 Compound Interest :

Compound Interest occurs when interest earned during the previous period itself earns interest in the next and subsequent periods. If Rs. 1000 is placed into savings account paying 6% interest per year, interest accumulates as follows :

Principal invested in the first year	Rs. 1000.00
Interest for first year (Rs. $1000 \times 0.06 \times 1$)	60.00
Amount available at end of first year	**1060.00**
Interest for second year (Rs. $1060 \times 0.06 \times 1$)	63.60
Amount available at end of second year	**Rs. 1123.60**

The interest earned in the second year is greater than Rs. 60 because it is earned on the principal **plus** the first year's interest. If the savings account pays 6% interest compounded quarterly, 1.5% interest is added to the account each quarter, as follows :

Principal invested in the first year	Rs. 1000.00
Interest for first quarter (Rs. $1000 \times 0.06 \times 1 \times 1/4$)	15.00
Amount available at end of first quarter	**1015.00**
Interest for second quarter (Rs. $1015 \times 0.06 \times 1 \times 1/4$)	15.23
Amount available at end of second quarter	**Rs. 1030.23**
Interest for third quarter (Rs. $1030.23 \times 0.06 \times 1 \times 1/4$)	15.45
Amount available at end of third quarter	**1045.68**
Interest for fourth quarter (Rs. $1045.68 \times 0.06 \times 1 \times 1/4$)	15.69
Amount available at end of first year	**1061.37**

With quarterly compounding, the initial investment of Rs. 1000 earned

Rs. 1.37 more interest in the first year than with annual compounding. Compound interest is defined with the following terms:

P = Principal sum earns

i = Interest rate per period

n = Number of period during which compounding takes place a period can be any length in time

Future Value of Rs. 1 :

A sum of money invested today at compound interest accumulates to a larger sum called the **amount** or **future value.** The future value of Rs. 1000 invested at 6% compounded annually for 2 years is Rs. 1123.60. The future value includes the original principal and the accumulated interest.

The future value varies with the interest rate, the compounding frequency and the number of periods. If the future value of Rs. 1 principal investment is known, we can use it to calculate the future value of any amount invested. For example, at 8% interest per period, Rs. 1 accumulates as follows :

- Future value of Rs. 1 at 8% for 1 period
  = Rs. 1.00000×1.08 = Rs. 1.08000
- Future value of Rs. 1 at 8% for 2 periods
  = Rs. 1.08000×1.08 = Rs. 1.16640
- Future value of Rs. 1 at 8% for 3 periods
  = Rs. 1.16640×1.08 = Rs. 1.25971

- The above table can be diagrammed as follows :
  Interest is added to principal at the end of each period

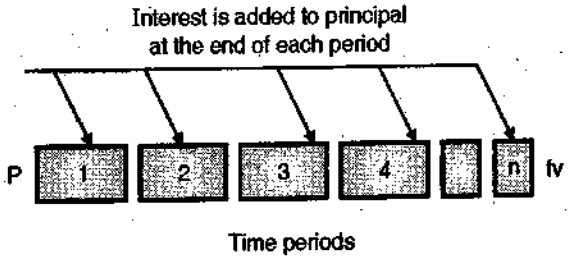

Fig. 4.5.3

The end of each period is designated by a grey cylinder like Fig. 4.5.3. The arrows pointing to the end of each period indicate that payments are made into the investment. The general formula for the future value of Rs. 1, with n representing the number of compounding period is,

$$fv = (1+i)^n$$

Using this formula, future values can be calculated for any interest rate and any number of time periods. To obtain the future value of any principal other than Rs. 1, we multiply the principal by the factor for the future value of Rs. 1,

$$fv = (1+i)^n$$

or $fv = Pf$

where f is the factor in the future value of Rs. 1, with interest rate i and number of periods n.

Prob. 4.5.2 : XYZ Company invests Rs. 40,00,000 in certificates of deposit that earn 16% interest per year, compounded semiannually. What will be the future value of this investment at the end of 5 years when the company plans to use it to build a new plant ?

Soln. :

Compounding is semiannual and there are 5 years, so the number of half- year periods is 10. The semiannual interest rate is half the 16% annual rate or 8%. With $i = 8\%$ and $n = 10$, the factor in the table is 2.15892. Multiplying this factor by the principal invcstment, we get:

$$fv = P \times f(n = 10, i = 8\%)$$
$$= \text{Rs. } 40,00,000 \times 2.15892 = 86,35,680.$$

4.5.3 Compound Discount :

- If Rs. 1 can be invested at 8% today to become Rs. 1.08 in the future, then Rs. 1 is the **present value** of the future amount of Rs. 1.08. The present value of future receipts of money is important in business decision making. It is necessary to decide how much future receipts are worth today in order to determine whether an investment should be made or how much should be invested.
- Finding the present value of future receipts involves discounting the future value to the present. **Discounting** is the opposite of compounding. It involves finding the present value of some future amount of money that is assumed to include interest accumulations.

Present Value of Rs. 1 :

Knowing the present value of Rs. 1 is useful because it enables us to find the present value of any future payment. Assuming 8% interest per period, a table of present values of Rs. 1 can be constructed as follows:

- Present value of Rs.1 discounted for 1 period at 8%
  = Rs. 1.0/1.08 = Rs. 0.92593
- Present value of Rs.1 discounted for 2 periods at 8%
  = Rs. 0.92593/1.08 = Rs. 0.85734
- Present value of Rs.1 discounted for 3 periods at 8%
  = Rs. 0.85734/1.08 = Rs. 0.79383
- The general formula for the present value of Rs.1 is

$$pv = 1/(1+i)^n$$

The present value on the tables can be constructed from this formula. To find out the present value of any future amount, the appropriate factor from the table is multiplied by the amount.

Prob. 4.5.3 : Alpha company can invest at 16 percent compounded annually .Beta company can invest at 16 percent compounded semi-annually. Each company will need Rs.2,00,000 four years from now. How much must each invest today?

Soln. :

With annual compounding n = 4 and I = 16 per cent. With semiannual compounding n = 8 and i = 8 per cent. Using the above formula we find the present value $= 1/(1.16)^4 = 0.55229 \times 2,00,000 = \text{Rs. } 110,458.$

For Beta Company present value $= 2,00,000 \times 1/(1.08)^4$
$= 200,000 \times 0.54027 = \text{Rs.}108,054$

The more frequent the compounding the smaller the present value. Beta company needs to invest less than Alpha Company because its investment grows faster due to more frequent compounding.

4.5.4 Annuities :

- An **annuity** is a serious of equal payments made at equal time intervals, with compounding or discounting taking place at the time of each payment. Each annuity payment is called a **rent.**
- There are several types of annuities, out of which in an ordinary annuity each rent is paid or received at the **end** of each period. There are as many rents as there are periods. Instalment purchases, long-term bonds, pension plans, and capital budgeting all involve annuities.

Future Value of Annuity of Rs. 1 :

- If you open a savings account that compounds interest each month, and at the end of each month you deposit Rs. 100 in the savings account, your deposits are the rents of an annuity.

- After 1 year, you will have 12 deposits of Rs.100 each, to a total of Rs. 1200, but the account will have more than Rs.1200 in it because each deposit earns interest. If the interest rate is 6 per cent a year, compounded monthly, your balance is Rs.1233.56.
- The future value of an annuity or amount of annuity is the sum accumulated in the future from all the rents paid and the interest earned by the rents. The abbreviation fv is used for the future value of an annuity to differentiate it from the lower case fv used for the future value of Rs.1.
- To obtain a table of future values of annuities, we assume payments of Rs.1 each period made into a fund that earns 8 percent interest compounded each period. The Fig. 4.5.4 illustrates an annuity of four payments of Rs. 1, each paid at the end of each period, with interest of 8 percent compounded each period.

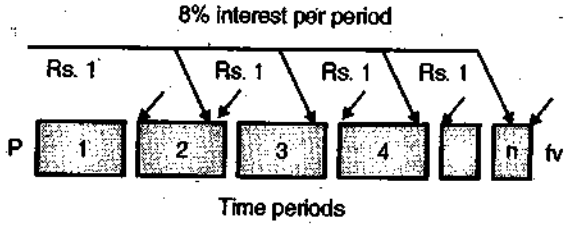

Fig. 4.5.4

- Notice that there are four rents and four periods, each rent is paid at the end of each period. At the end of the first period, Rs.1 is deposited and earns interest for three periods. The next rent earns interest for two periods, and so on The amount at the end of the fourth period can be determined by calculating the future value of each individual Rs.1 deposit as follows :

Future value of Rs.1 at 8% for 3 periods	=	Rs.1.25971
Future value of Rs.1 at 8% for 2 periods	=	Rs.1.16640
Future value of Rs.1 at 8% for 1 period	=	Rs.1.08000
The fourth rent of Rs.1 earns no interest	=	Rs.1.0000
Total for 4 rents	=	**Rs.4.50611**

The formula for the future value of an annuity of Rs.1 can be used to produce tables for a variety of periods and interest rates.

$$fv = \frac{((1+i)^n - 1)}{i}$$

Prob. 4.5.4 : In the beginning of 2006,the directors of Molloy Corporation decided that plant facilities will have to be expanded in a few years. The company plans to invest Rs.50,000 every year, starting on June 30,2006, into a trust fund that earns 11 percent interest compounded annually. How much money will be in the fund on June 30, 2010, after the last deposit has been made ?

Soln. :

The first deposit is made at the end of the first 1-year period, and there is a total of 5 periods. The last deposit, made on June 30, 2010 earns no interest. The investment is an ordinary annuity with n = 5 and i = 11 percent. From Table Future Value of Annuity Rs. 1 we find that the amount of an ordinary annuity of Rs.1 is 6.22780.

$$fv = Rent \times f(n = 5, i = 11\%)$$
$$= Rs.\ 50,000 \times 6.22780$$
$$= Rs.\ 311,390$$

If the company needs a total of Rs.3,00,000 on June 30, 2010, how much would it have to deposit every year? Here we have to solve for the rent, given the future value, as follows :

$$fv = Rent \times f(n = 5, i = 11\%)$$
$$Rs.\ 3,00,000 = Rent \times 6.22780$$
$$Rent = Rs.\ 3,00,000 / 6.22780$$
$$= Rs.\ 48,171.10$$

The company has to deposit Rs. 48,171 each time in order to accumulate the necessary Rs. 3,00,0000 by June 30,2010.

Present value of Annuity of Rs. 1 :

The present value of an annuity is the sum that must be invested today at compound interest in order to obtain periodic rents over some future time.

Notice that we use the abbreviation **PV** for the present value of an annuity, as differentiated from the lower case pv for the present value of Rs.1.By using the present value of Rs. 1, we can obtain a table for the present value of an ordinary annuity of Rs.1. The present value of an ordinary annuity of Rs.1 can be illustrated as follows :

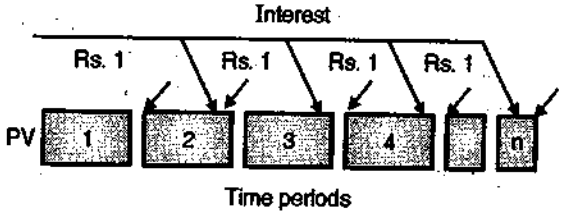

Fig. 4.5.5

With each rent available at the end of each period, when compounding takes place, the number of rents is the same as the number of periods. By discounting each future event to the present, we find the present value of the entire annuity.

Present value of Rs.1 discounted for 1 period at 8%	=	Rs. 0.92593
Present value of Rs.1 discounted for 2 periods at 8%	=	0.85734
Present value of Rs.1 discounted for 3 periods at 8%	=	0.79383
Present value of Rs.1 discounted for 4 periods at 8%	=	0.73503
Present value of annuity of 4 rents at 8%	=	**Rs. 3.31213**

The first rent is worth more than others because it is received earlier. Table on present value of annuities may be used to solve problems in this regard. The formula used to construct Table is :

$$PV = \frac{(1+i)^n}{i}$$

Prob. 4.5.5 : Mr. F, the owner of F Corporation is retiring and wants to use the money from the sale of his company to establish a retirement plan for himself. The plan is to provide an income of Rs. 5,00,000 per year for the rest of his life. An insurance company calculates that his life expectancy is 32 more years and offers an annuity that yields 9 per cent compounded annually. How much the insurance company wants now in exchange for the future annuity payments?

Soln. :

The investment today is the present value of an annuity of Rs. 5,00,000 per year, with n = 32 and i = 9 percent compounded annually. From the cumulative present value table we find the factor 10.40624 which is the present value if the rents were Rs.1.

PV = Rent × f (n = 32, i = 9%)

= Rs. 5,00,000 × 10.40624

= Rs. 52,03,120

Present value of an Infinite Life Annuity (Perpetuities) :

An annuity that goes on forever is called a perpetuity. The present value of a perpetuity of Rs .C amount is given by the simple formula: C / I where I is the rate of interest.

This is because as the length of time for which the annuity is received increases, the annuity discount factor increases but as length gets very long, this increase in the annuity factor slows down. In fact, as annuity life becomes infinitely long the annuity discount factor approaches an upper limit. Such a limit is 1/I.

Example :

Mr. X wishes to find out the present value of investments which yield Rs.500 in perpetuity, discounted at 5%.The appropriate factor can be calculated by dividing 1 by 0.05.The resulting factor is 20. This is to be multiplied by the annual cash inflow of Rs.500 to get the present value of the perpetuity i.e. Rs.10,000.

Solution of Managerial Problems :

Many business problems are solved by use of compound interest and present value tables.

For example, B Corporation is investigating two possible investments. Project A is the purchase of a mine for Rs.20,00,000 which will give an expected income from sale of ore of Rs.480,000 per year for 10 years, after which the property will be sold at an estimated price of Rs. 600,000.Project B is the purchase of an office building that is leased for 15 years. The lease provides annual receipts of Rs. 4,00,000 at the end of the each of the next 4 years, and annual receipts of Rs. 4,50,000 for the remaining life of the lease. The purchase price is Rs. 20,00,000.B Corporation requires a 20 per cent return on its investments. Which investment is preferable?

Soln. :

To evaluate Project A we need to find the present value of the future income stream of Rs.4,80,000 per year for 10 years plus the present value of the future sales price of Rs.6,00,000, both discounted to the present at the company's required rate of return of 20 percent.

PV of annuity of Rs. 4,80,000 (n = 10, i =20%) = 480,000 × 4.19247	=	Rs. 20,12,386
PV of Rs.6,00,000 at the end of 10 years = 600,000 × 0.16151	=	96,906
Total present value of Project A cash inflows	=	**21,09,292**

The problem can be broken down into two separate annuities, one with receipts of Rs.4,50,000 per year for 15 years and the other with payments of Rs.50,000 for 4 years. The present value of the two annuities can be found by computing the present value of Rs.4,50,000 for 15 years at 20 percent minus an annuity of Rs.50,000 for 4 years at 20 percent.

PV of annuity of Rs.4,50,000 (n=15, i=20 percent) = 450,000 × 4.67547	=	21,03,961
PV of annuity of Rs.50,000 (n = 4,i = 20 percent) = 50,000 × 2.58873	=	(1,29,437)
Total present value of project B cash inflows	=	**19,74,524**

By discounting each project at the company's required rate of return, we find the Project A cash inflows have a present value of Rs.12,09,292 and Project B cash inflows have a present value of Rs.19,74,524 Since the asking price of each project is Rs.20,00,000, project B should not be accepted. The value of project A is greater than the asking price, therefore the company should acquire Project A.

Syllabus Topic : Understanding Money Management

4.6 Understanding Money Management :

Introduction :

- Money is what money does. Money occupies a pivotal position in the modern world. All economic transactions are expressed in money terms. Money is an asset which facilitates exchange of any kind, either of goods or services. It overcomes the problems of barter

especially the problem of double coincidence of wants. Money is a measuring rod in terms of which we can affix values to the things, we buy or sell.

- Very often the words 'income', 'credit' and 'wealth' are used as synonyms for money. However, in Economics the word 'money' is differentiated from income, wealth and credit. Money is generally defined as 'any good that is widely accepted for purposes of exchange and in the repayment of debt'. Money has attracted the attention of very prominent thinkers and economists because of its amazing independence and decisive power.
- Similar, to the role of an engineer in economic decisions of a firm, we all too should be responsible for managing our money more prudently. A crash course in money management should help in understanding its finer nuances.
- Money management is the process of managing money which includes expense tracking, investment, budgeting, banking and taxes. Money management is also called as investment management.
- Money management is a strategic technique employed to make money yield the highest interest yielding value for any amount spent. It is human nature to spend money to satisfy personal cravings. The objective behind this section is to enable the reader to understand interest and its implications, maximising the returns from investments and risks that come along with investments. Selecting an investment is difficult given the wide range of options that are available ranging from saving accounts, stocks, bonds, mutual funds, etc.
- A person can carry out an analysis of each investment alternative similar to the process used for engineering economic decisions. However, the person should choose wisely, wrong selection can be disastrous as we get to read and hear from many people around. Although, the return on investment is important it is not the only factor that should be taken into consideration while making an investment.
- The investor should also analyse the risk factor that is associated with the investment and then make a decision. We have many examples of people who have been lured by high returns to later find out that they have been duped and all their savings wiped out.
- A wise investment strategy is one in which the investor diversifies his investment. It is merely following the age old adage of not placing all your eggs in one basket. When one adopts such an approach he gets to invest in different investments ranging from high risk ones to low risk and spread across different business sectors.
- Also, the chances of losing all your money is minimised as your investments are spread across different sectors. In the first part of this section we shall be discussing interest rates and later on shift our attention to debt management.

4.6.1 Market Interest Rate :

- Interest rate is the amount of interest due per period as a proportion of the amount invested or borrowed which is also called the principal amount. The total interest on an amount invested or borrowed depends on the principal amount, the interest rate, the compounding frequency and the length of time over which it is borrowed or invested.

Market rates have been defined as :

- The prevailing rate of interest offered on cash deposits, determined by demand and supply of deposits and based on the duration (the longer the duration, the higher the rate) and amount (the higher the amount, the higher the rate) of deposits.
- The prevailing rate of interest on loans determined by the demand and supply of credit and based on the duration (the longer the duration, the higher the rate) of loan and type of security offered (the higher the quality of security, the lower the rate).

Market interest is also referred to as the current interest rate, the yield-to-maturity and the effective interest rate. The market interest rate is always changing whereas the stated interest rate does not change.

4.6.2 Nominal and Effective Interest Rate :

- An interest rate takes two forms: nominal interest rate and effective interest rate. The nominal interest rate does not take into account the compounding period. The effective interest rate does take the compounding period into account and thus is a more accurate measure of interest charges.
- A statement that the "interest rate is 10%" means that interest is 10% per year, compounded annually. In this case, the nominal annual interest rate is 10%, and the effective annual interest rate is also 10%. However, if compounding is more frequent than once per year, then the effective interest rate will be greater than 10%. The more often compounding occurs, the higher the effective interest rate.
- The relationship between nominal annual and effective annual interest rates is,

$$i_a = [1 + (r/m)]^m - 1$$

where "i_a" is the effective annual interest rate, "r" is the nominal annual interest rate, and "m" is the number of compounding periods per year.

Prob. 4.6.1 : A credit card company charges 21% interest per year, compounded monthly. What effective annual interest rate does the company charge?

Soln. :

$r = 0.21$ per year

$m = 12$ months per year

$$i_a = [1 + (.21/12)]^{12} - 1$$
$$= [1 + 0.0175]^{12} - 1$$
$$= (1.0175)^{12} - 1 = 1.2314 - 1$$
$$= 0.2314 = 23.14\%$$

It may be desired to find the effective interest rate for a period other than annual. In this case, adjust the period for "r" and "m" as needed. For example, if the effective interest rate per semi-annual period (every 6 months) is desired, then

r = nominal interest rate per 6 months

m = number of compounding periods per 6 months and the effective interest rate, i_{sa}, per semi-annual period, is:

$$i_{sa} = [1 + (r/m)]^m - 1$$

Let us understand what 20% compounded monthly means:

Interest rate per month (i) = 20%/12 = 1.67%

This means that if you borrowed 100 Rs for a month you will have to pay an interest of 1.67 Rs for the month along with the principal amount of 100 Rs.

Now suppose the interest is compounded on a monthly basis then the interest paid at the end of the year would be:

Adjusted-discount method : Performs deflation and discounting in one step

Step 1 : $$A_n' = \frac{A_n}{(1+\bar{f})^n}$$

Step 2 : $$P_n = \frac{A_n'}{(1+i')^n}$$

Combine $$P_n = \frac{\frac{A_n}{(1+\bar{f})^n}}{(1+i')^n}$$

Rearrange

$$P_n = \frac{A_n}{[(1+\bar{f})(1+i')]^n}$$

Since market interest rate reflects both earning power and purchasing power, it is also true that :

$$P_n = \frac{A_n}{(1+i)^n}$$

Equate :

$$\frac{A_n}{(1+i)^n} = \frac{A_n}{[(1+\bar{f})(1+i')]^n}$$

Simplify : $$(1+i) = (1+\bar{f})(1+i')$$

Simplify : $$1 + i = 1 + i' + \bar{f} + \bar{f}i'$$

With the result that : $$i = i' + \bar{f} + \bar{f}i'$$

Thus, 20% compounded monthly amounts to 1.67% but on an annual basis it amounts to 21.98%.

Prob. 4.6.2 : A credit card company charges interest at 15% annual percentage rate (APR). Calculate their monthly interest rate and annual effective interest rate respectively. Also, a customer of the credit card company has an outstanding balance of Rs 10,000/- at the end of March and fails to make any payment for the next two months. What would his total balance be at the end of May?

Soln. :

$$F = (1+i)^{12}$$
$$= (1+0.016)^{12} = (1.0167)^{12}$$
$$= 21.98\%$$

Monthly interest rate

$$i = \frac{15}{12} = 1.25\ \%$$

Annual effective interest rate

$$i_a = (1+0.0125)^{12} - 1$$
$$= (1.0125)^{12} - 1$$
$$= 1.0160 - 1 = 16\ \%$$

Total outstanding balance

Interest the end of 1st month = 10,000 × 1.25 %

= 125

Interest at the end of 2nd month = 10.125 × 1.25 = 126.56

Total outstanding at the end of May = 10,000 + 12.5

= 10,251.56

Practice Problems on Compound Interest :

In case of compound interest, (denoted by CI), interest is periodically calculated. It is added into the principal amount to calculate the interest for next period. Thus for each period the principal and the interest go on increasing for every next period. For illustration of this procedure, consider principal amount is Rs. 100 and rate of interest is 10% p.a. Then first year interest is Rs. 10. For second year principal is Rs. 110 and interest is Rs. 11. For third, principal is Rs. 121 and interest is Rs. 12.10 and so on. The total compound interest paid on the sum of Rs. 100 for 3 years at the rate of 10% is

10 + 11 + 12.10 = 33.10

Note that simple interest on the sum of Rs. 100/- for 3 years with the same rate is Rs. 30/-.

Following are the formulae for calculation of compound interest.

$$CI = P \times \left[\left(1 + \frac{i}{100}\right)^n - 1\right]$$

Where,

CI = Compound interest at the end of n periods

P = Present worth (Principal amount)

n = Number of periods. It may be in months, quarter year, half year or years.

i = Rate of interest per period.

Note the following points :

1. i = rate of interest per period. If mode of period change CI also change for the given term. Hence it is very necessary to state the period for which interest is calculated and added into the previous principal. For example, if rate of interest is 12% p.a. and interest is to be accrued monthly, i = 1%, if interest is quarterly accrued i = 3%, for half years i = 6% and lastly if interest is accrued yearly i = 12%.
2. In CI calculation we concern with number of periods, and not just year.
3. SI and CI are same in the first year, if compounded yearly.

Amount due :

Let P be the present worth or principal amount and r be the rate of interest p.c.p.a. The amount due at the end of n periods is given by

$$A = P\left(1+\frac{i}{100}\right)^n$$

In case of deposits, A is called maturity value.

Compare this formula with simple interest formula.

$$A = P\left(1+\frac{nr}{100}\right)$$

Difference between simple interest and compound internist

1. In compound interest formula i = rate of interest per period is used.
   In simple interest formula r = rate of interest p.c.p.a. is used.
2. In compound interest n = number of periods.
   In simple interest n = number of years.
3. In compound interest position of n is changed. It is the power of the bracket.
4. Period of compounding the interest is to be stated for calculating CI. If this period is not given, we consider interest is compounded yearly.
5. CI = A – P,

where A = Amount due at the end of n periods

P = Present worth or principal amount.

In calculation of CI we require powers of the abstract or odd numbers; for which we use calculator. The answers are taken with 2 to 4 decimal only.

6. CI in the n^{th} year is given by $A_n - A_{n-1}$

Where A_n is the amount at the end of n^{th} year and A_{n-1} is the amount at the end of previous year.

For example,

CI in 4^{th} year = $A_4 - A_3$

CI in 3^{rd} year = $A_3 - A_2$

CI in 2^{nd} year = $A_2 - A_1$, etc.

Prob. 4.6.3 : Find CI on Rs. 2000 at 14% p.a. for 3 years compounded half yearly.

Soln. :

We have

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

Identify the values of the terms

CI = ?

P = 2000

n = Number of periods (half yearly in 3 years) = 6

i = Rate of interest for half year = 7 %

On substitution in the formula, we have

$$CI = 2000\left[\left(1+\frac{7}{100}\right)^6 - 1\right]$$

$$= 2000\left[(1+0.7)^6 - 1\right]$$

$$= 2000\left[(1.7)^6 - 1\right]$$

$$= 2000\,[1.418519 - 1]$$

$$= 2000\,[0.418519]$$

$$= 837.03822$$

$$= 837.04$$

Prob. 4.6.4 : In how many years the amount Rs. 3600 becomes Rs. 7702 at 9% rate of CI.

Soln. :

We have

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

Identify,

$$P = 3600;\quad A = 7702$$

$$n = ?\quad i = 9$$

$$\therefore\ 7702 = 3600\left[\left(1+\frac{9}{100}\right)^n\right]$$

$$= \frac{7702}{3600} = (1+0.09)^n$$

$$= 2.1394 = (1.09)^n$$

To calculate n, we use logarithm [or take the powers of 1.09 until 2.1394 (approximately) results.] Taking log on both sides.

$$0.33029 = n \log (1.09)$$

$$0.33029 = n \times 0.03742$$

$$\therefore\ n = 8.82 \approx 9 \text{ years}$$

Prob. 4.6.5 : Find the rate of CI if Rs. 3150 becomes Rs. 4781.90 in 4 years.

Soln. :

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

Identify,

$A = 4781.90$ $p = 3150$

$n = 4$ years i = rate of interest per year

$$\therefore 4781.90 = 3150\left[1+\frac{i}{100}\right]^4$$

$$\therefore \left(1+\frac{i}{100}\right)^4 = 1.518$$

$$1+\frac{i}{100} = 1.11$$

$$\frac{i}{100} = 0.11$$

$$i = 11.0$$

$\therefore$ Rate of interest is 11% p.a.

Prob. 4.6.6 : Calculate the CI in the third year on Rs. 7000 at a rate of 12% p.a.

Soln. :

Interest in the third year will be calculated on the basis of amount at the end of 2nd and 3rd years.

Hence first calculate amount at the end of 2nd year.

$$A_2 = P\left(1+\frac{1}{100}\right)^2$$

$$= 7000\left(1+\frac{12}{100}\right)^2$$

$$= 7000\,(1.12)^2$$

$$= 7000 \times 1.2544$$

$$= 8780.80$$

Amount at the end of 3rd year.

$$A_3 = P\left(1+\frac{1}{100}\right)^3$$

$$= 7000\left(1+\frac{12}{100}\right)^3$$

$$= 7000 \times (1.12)^3$$

$$= 700 \times 1.40492$$

$$= 9834.50$$

CI in 3rd year is given by

$$A_3 - A_2 = 9834.50 - 8780.80$$

$$= 1053.70$$

$\therefore$ CI in 3rd year $= 1053.70$

Prob. 4.6.7 : Find approximate period for tripling the amount at the rate of 12% p.a. CI.

Soln. :

We know that

$$A = P\left[\left(1+\frac{i}{100}\right)^n\right]$$

A = 3 times principal $i = 12\%$

$\therefore$ We have

$$3P = P\left(1+\frac{12}{100}^n\right)$$

$$\therefore 3 = (1.12)^n$$

Now take the powers of 1.12 until the value reaches approximates at 3.

Observe that

$(1.12)^{10} = 3.1058$ $(1.12)^9 = 2.7730$

$(1.12)^{10}$ is close to 3.

Thus $n = 10$, approximately, is the required answer.

Hence, approximately at 10 years the amount will be tripled.

Prob. 4.6.8 : CI on a sum of Rs. 60,000/- is Rs.. 9337.50 in 2 years. Calculate rate of CI.

Soln. :

We have,

$$A = P\left(1+\frac{i}{100}\right)^n$$

Identify,

$A = 69337.5$, $P = 60{,}000$

$i = ?$, $n = 2$

$$\therefore 69337.5 = 60000\left(1+\frac{i}{100}\right)^2$$

$$\therefore 1.155625 = \left(1+\frac{i}{100}\right)^2$$

Taking square root on both sides.

$$1.075 = 1+\frac{i}{100}$$

$$\therefore \frac{i}{100} = 0.075$$

$$\therefore i = 7.5$$

Since period is given in years

$$i = 7.5$$

$\therefore$ Rate of CI is 7.5% p.a.

Prob. 4.6.9 : Difference of SI and CI on the sum of Rs. 5000 for the period of two years is Rs. 72. What is the common rate of interest.

Soln. :

$$SI = \frac{Pnr}{100}$$

$$= \frac{5000 \times 2 \times r}{100}$$

$$= 100r$$

$$CI = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$$

$$= 5000\left[\left(1+\frac{r}{100}\right)^2 - 1\right]$$

$$= 5000\left[1+\frac{2r}{100}+\frac{r^2}{1000}-1\right]$$

$$= 5000\left[\frac{2r}{100}+\frac{r^2}{1000}\right]$$

$$= 100r+\frac{r^2}{2}$$

Given difference of SI and CI is Rs. 72

$$\therefore \left(\frac{r^2}{2}+100r\right)-100r = 72$$

$$\therefore \frac{r^2}{2} = 72$$

$$\therefore r^2 = 144$$

$$\therefore r = 12\% \text{ p.a.}$$

Prob. 4.6.10 : For a certain sum the difference between CI and SI is Rs. 310 for 3 years at 10% p.a. Find the sum.

Soln. :

$$SI = \frac{Pnr}{100} = \frac{P \times 3 \times 10}{100} = 0.3\,P$$

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

$$= P\left[\left(1+\frac{10}{100}\right)^3 - 1\right]$$

$$= P\left[(1.1)^3 - 1\right]$$

$$= P = (0.331)$$

Given CI – SI = 310

We have,

$$(0.331)\,P - (0.3)\,P = 310$$

i.e. $$0.031\,P = 310$$

$$P = 10{,}000$$

$\therefore$ Required sum is Rs. 10,000

Prob. 4.6.11 : On a certain sum at a certain rate of interest CI and SI for 2 years are 2553.10 and 2420 respectively. Find the sum and rate of interest.

Soln. :

We have

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

$$SI = \frac{Pnr}{100}$$

CI compounded annually, $\therefore$ I = 4

Given CI = 2553.10, SI = 2420, n = 2

We have,

$$2553.10 = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]$$

$$= P\left[1+\frac{2r}{100}+\left(\frac{2}{100}\right)^2 - 1\right]$$

$$= P\left[\frac{2r}{100}+\frac{r^2}{(100)^2}\right] \quad \ldots(I)$$

Similarly for SI

$$2420 = \frac{P \times 2 \times r}{100}$$

$$\therefore 2420 = \frac{2Pr}{100} \quad \ldots(II)$$

Divide I by II

$$\frac{2553.10}{2420} = \frac{P\left[\frac{2r}{100}+\frac{r^2}{(100)^2}\right]}{\frac{2Pr}{100}}$$

On cancelling P

$$1.055 = \left[\frac{2r}{100}+\frac{r^2}{(100)^2}\right] \times \frac{100}{r^2}$$

$$1.055 = 1+\frac{r}{200}$$

$$0.055 = \frac{r}{200}$$

$$\therefore r = 11$$

$\therefore$ Rate of interest is 11%. Substitute r = 11 in I or II. (II) equation is more simple

$$2420 = \frac{2P \times 11}{100}$$

$$\therefore P = 11{,}000$$

Hence sum = 11,000, rate of interest = 11%.

Prob. 4.6.12 : The amount by CI at the end of 5 years on a certain sum is Rs. 10574. With the same rate of interest the amount at the end of 7 years is 13264. Find the sum and rate of interest.

Soln. :

We have amount at the end of n periods by CI, as

$$CI = P\left[\left(1+\frac{i}{100}\right)^n - 1\right]$$

(Note i = r)

We have in I case

$$10574 = P\left(1+\frac{r}{100}\right)^5 \quad \ldots(I)$$

and in II case

$$13264 = P\left(1+\frac{r}{100}\right)^7 \quad \ldots(II)$$

Divide II by I

$$\frac{13264}{10574} = \frac{P\left(1+\frac{r}{100}\right)^7}{P\left(1+\frac{r}{100}\right)^5}$$

$$1.2544 = \left(1+\frac{r}{100}\right)^2$$

$$1.12 = 1+\frac{r}{100}$$

By taking square root

$$\frac{r}{100} = 0.12$$

$$\therefore r = 12\%$$

Substitute in I, we have

$$P = \frac{10574}{1.76234}$$

$$= 5999.97$$

$$\approx 6000$$

Prob. 4.6.13 : A sum invested at CI amounts to Rs. 21148.10 in 5 years and 26528.18 in 7 years. Find the sum and rate of interest.

Soln. :

We have

$$A = P\left(1+\frac{i}{100}\right)^n$$

In case I, identify that

A = 21148.10, P = ?, I = ?, r = ?, n = 5 years

$$\therefore\ 21148.10 = P\left[1+\frac{i}{100}\right]^5 \quad \ldots(I)$$

In case II, identify that

A = 26528.18, P = ?, I = ?, r = ?, n = 7 years

$$\therefore\ 26528.18 = P\left[1+\frac{i}{100}\right]^7 \quad \ldots(II)$$

Divide II by I

We have

$$\frac{26528.18}{21148.10} = \frac{P\left(1+\frac{r}{100}\right)^7}{P\left(1+\frac{r}{100}\right)^5}$$

$$1.2544 = \left(1+\frac{r}{100}\right)^2$$

Taking square root on both sides.

$$\therefore\ 1+\frac{r}{100} = 1.12$$

$$\frac{r}{100} = 0.12$$

$$r = 12\%\ \text{p.a.}$$

Prob. 4.6.14 : You wish to deposit Rs 1,00,000 in a bank and are faced with two options. The first option is of a bank that is offering 8% per year compounded quarterly while the other bank is offering 9% per year compounded half yearly. Where should you deposit your money to get maximum returns?

Soln. :

Bank A

Interest – 8%, Compounded Quarterly

$i = 8/4 = 2\%$

Annual Effective Interest Rate

$i_a = (1+0.02)^4 - 1 = 8.24\%$ annual effective interest rate

Balance at the end of the year with a initial deposit of Rs 1,00,000/-

$F = 1,00,000\ (F|P, 2\%, 4)$

$= 1,00,000\ (F|P, 8.24\%, 1)$

= 1,08,240 will be your balance at the end of the year

Bank B

Interest – 9% Compounded Half Yearly

$i = 9/2 = 4.5\%$

Annual Effective Interest Rate

$i_a = (1+0.045)^2 - 1 = 9.20\%$

Balance at the end of the year with a initial deposit of Rs 1,00,000/-

$F = 1,00,000\ (F|P, 4.5\%, 2)$

$= 1,00,000\ (F|P, 9.2\%, 1)$

= 1,09,200 will be your balance at the end of the year and hence you should deposit your money in Bank B

Effective Annual Interest Rates (8% Compounded Quarterly)

Initial Amount	First Quarter = Initial Amount + Interest (2%)	Second Quarter = New Initial Amount + Interest (2%)	Third Quarter = New Initial Amount + Interest (2%)	Fourth Quarter = New Initial Amount + Interest (2%)
1,00,000	1,00,000 + 2,000 = 1,02,000	1,02,000 + 2040 = 1,04,040	1,04,040 + 2080 = 1,06,120	1,06,120 + 2120 = 1,08,240

4.6.3 Table of Nominal and Effective Interest Rates with different Compounding Periods :

Nominal Interest Rates	Compounded Annually	Compounded Semi-annually	Compounded Quarterly	Compounded Monthly
5%	5%	5.06%	5.09%	5.12%
7%	7%	7.12%	7.19%	7.23%
10%	10%	10.25%	10.38%	10.47%
12%	12%	12.36%	12.55%	12.68%

Effective Interest Rate per payment period :

$$i = [1 + r/CK]^C - 1$$

where

i is the effective interest rate per payment period

K is the number of payment periods per year

C is the number of interest periods per payment period

M is the number of interest periods per year and is = CK

Prob. 4.6.15 : Calculate the effective interest rate for a quarterly payment period and monthly compounding period when the nominal interest rate is 10%

Soln. :

Effective Interest Rate per Quarter

$$i = [1 + r/CK]^C - 1$$
$$= [1 + 0.0083]^3 - 1$$
$$= 2.51\% \text{ per quarter}$$

Effective Annual Interest Rate

$$i_a = [1+0.0251]^4 - 1 = 10.42\%$$

The effective interest rate will be 10.42%

Prob. 4.6.16 : The monthly interest offered by a bank is 2% and the compounding is monthly. What will the effective rate of interest be?

Soln. :

$$i_a = [1+0.02]^{12} - 1 = 26.82\%$$

The effective interest rate will be 26.82%

Effective Interest Rate per Payment Period with Continuous Compounding :

We have previously seen that the formula for effective interest rate per payment period is :

$$i = [1 + r/CK]^C - 1$$

However, when the compounding is continuous then CK which is the number of compounding periods per year tends to ∞

Continuous Compounding (CK) → ∞

$$i = \lim \{[1 + r/CK]^C - 1\} = (e^r)^{1/k} - 1$$

Prob. 4.6.17 : A bank offers an interest rate of 10% compounded quarterly. The payment period and interest period is quarterly.

Soln. :

$$i = [1 + r/CK]^C - 1$$

where

r = rate of interest which in this case is 10%

C = the number of interest periods per payment period which in this case is 1 per quarter

K = the number of payment periods per year which in this case is 4

M = the number of interest periods per year which in this case is 4

Thus we get :

$$i = [1 + 0.10/4]^1 - 1 = 2.5\% \text{ per quarter}$$

Prob. 4.6.18 : A bank offers an interest rate of 10% compounded monthly. The payment period is quarterly and the interest period is monthly.

Soln. :

$$i = [1 + r/CK]^C - 1$$

where

r = rate of interest which in this case is 10%

C = the number of interest periods per payment period which in this case is 3 per quarter

K = the number of payment periods per year which in this case is 4

M = the number of interest periods per year which in this case is 12

Thus we get :

$$i = [1 + 0.10/12]^3 - 1 = 2.519\% \text{ per quarter}$$

Prob. 4.6.19 : A bank offers an interest rate of 10% compounded weekly. The payment period is quarterly and the interest period in weekly.

Soln. :

$$i = [1 + r/CK]^C - 1$$

where

r = rate of interest which in this case is 10%

C = the number of interest periods per payment period which in this case is 13 per quarter

K = the number of payment periods per year which in this case is 4

M = the number of interest periods per year which in this case is 52

Thus we get:

$$i = [1 + 0.10/52]^{13} - 1$$
$$= 2.524\% \text{ per quarter}$$

Prob. 4.6.20 : A bank offers an interest rate of 10% compounded continuously. The payment period is quarterly and the interest period is continuously.

Soln. :

As the compounding is continuous the formula is:

$$(e^r)^{1/k} - 1$$

where

r = rate of interest which in this case is 10%

K = the number of payment periods per year which in this case is 4

Thus we get:

$$i = (e^r)^{1/k} - 1$$
$$= e^{r/k} - 1$$
$$= e^{0.025} - 1 = 2.531\%$$

Prob. 4.6.21 : If the nominal interest rate offered by one bank is 9% and is compounded quarterly while that of other bank is 8.5% but is compounded continuously. Which bank is offering a better deal?

Soln. :

Bank A :

r = 9% compounded quarterly. Here we are assuming that number of payment periods to be 1.

$$i = \left[1 + \frac{r}{CK}\right]^C - 1$$

$$= \left[1 + \frac{0.09}{4}\right]^4 - 1$$

$$= 9.3\%$$

The effective annual rate of interest offered by the bank is 9.3%

Bank B :

r = 8.5% compounded continuously.

$$i = (e^r)^{1/k} - 1$$

$$= e^{0.085} - 1 = 8.871\%$$

The effective interest rate offered by the bank is 8.871% which is lower than that offered by the first bank and hence it is economically beneficial to invest with the first bank.

Prob. 4.6.22 : A person has deposited Rs 1,00,000 in a bank offering nominal interest rate of 9% which is compounded on a weekly basis. What will the balance be at the of 5 years?

Soln. :

Step 1 : We will have to convert the nominal interest rate to effective annual interest rate. For which the formula is:

$$i = [1 + r/CK]^C - 1$$

$$= [1 + 0.09/52]^{52} - 1$$

$$= 9.234\% \text{ per year}$$

Step 2 : Balance at the end of five years

$$F = 1{,}00{,}000(1+0.09234)^5 = 1{,}55{,}521$$

Prob. 4.6.23 : A person has deposited Rs 1,00,00 in a bank offering nominal interest rate of 9% which is compounded on a daily basis. What will the balance be at the end of 5 years.

Soln. :

Step 1 : We will have to convert the nominal interest rate to effective annual interest rate. For which the formula is :

$$i = \left[1 + \frac{r}{CK}\right]^C - 1$$

$$= \left[1 + \frac{0.09}{365}\right]^{365} - 1 = 9.393\%$$

Step 2 : Balance at the end of five years

$$F = 1{,}00{,}000(1 + 0.09393)^5 = 1{,}56{,}656$$

Prob. 4.6.24 : A person has deposited Rs 1,00,000 in a bank offering nominal interest of 9% which is compounded continuously. What will the balance be at the end of 5 years?

Soln. :

Step 1 : We will have to convert the nominal interest rate to effective annual interest rate

$$i = (e^r)^{1/k} - 1$$

$$= e^{r/k} - 1$$

$$= e^{0.09} - 1$$

$$= 9.417\%$$

Step 2 : Balance at the end of five years

$$F = 1{,}00{,}000(1 + 0.09417)^5$$

$$= 1{,}56{,}828$$

Prob. 4.6.25 : A person has borrowed a sum of Rs 2,00,000 from a bank for five years at nominal interest rate of 12% compounded monthly. How much will he have to return at the end of five years?

Soln. :

Interest rate per month = 0.12/12 = 1%

$$F = 2{,}00{,}000(F|P, 1\%, 60)$$

$$= 2{,}00{,}000(1.817)$$

$$= 3{,}63{,}400/-$$

Let us do the same calculation by another method

Effective annual interest rate = $[1 + 0.12/12]^{12} - 1$

$$= 12.683\%$$

$$F = 2{,}00{,}000(F|P, 12.683\%, 5)$$

$$= 3{,}63{,}347/-$$

4.6.4 Equivalence Analysis using Effective Interest Rate :

- Equivalence is a fundamental concept that forms the basis of personal finance. Equivalence concept is a must to explain financial products that involve a series of payments over a period of time. Equivalence indicates that different amount of money at different time periods are equivalent by considering the time value of money.
- A payment received in lump sum today has to be equated with a series of payments received over time using interest rate. The following example will explain the meaning of equivalence.
- The following simple example will explain the meaning of equivalence.

Prob. 4.6.26 : What are the equivalent amounts of Rs.1,00,000 (today) at an interest rate of 12% per year one year from now and one year before?

Soln. :

a) At interest rate of 12% per year, Rs.100,000 (now) will be equivalent to Rs.1,12,000 one year from now.

Amount accumulated at the end of one year = Rs. (100,000 × 1.12) = Rs. 1,12,000/-

b) Similarly Rs. 1,00,000 now was equivalent to Rs. 89,285/- one year ago at interest rate of 12% per year.

Thus due to the effect of time value of money, these amounts Rs.89,285 (one year before), Rs.1,00,000 (today) and Rs.1,12,000 (one year from now) are equivalent at the interest rate of 12% per year.

Steps in equivalence analysis using effective interest rate are :

Step I : Identify the payment period

Step II : Identify the interest period

Step III : Find the effective interest rate that covers the payment period

Case I : When compounding period and payment period coincide

Case II : When Compounding is more frequent than payments'

Case III : When compounding is continuous and deposits are quarterly

Case IV : When Compounding is less than payments

Case (I) : When compounding period and payment period coincide

Step 1 : Identify the number of compounding periods in an year

Step 2 : Calculate the effective interest rate per payment period

Step 3 : Determine the total number of payment periods

Step 4 : Calculate interest

Prob. 4.6.27 : A person has borrowed a sum of Rs 1,00,000 for a period of 5 years at a rate of 12% compounded monthly. What will his monthly payment be?

Soln. :

Here $M = 12, r = 12\%$

$i = 12\%/12 = 1\%$ per month

$N = 12 \text{ months} \times 5 \text{ years} = 60 \text{ months}$

$A = 1,00,000(A|P, 1\%, 60)$

To calculate A we will need to calculate the Capital Recovery Factor (CRF)

$$CRF = i(1+i)^n / (1+i)^n - 1$$

Where i is the decimal interest rate and n is the period of the loan.

$$= 0.01(1+0.01)^{60} / (1+0.01)^{60} - 1$$
$$= 0.0222$$

Thus,

$A = 1,00,000(0.0222)$

$= 2220/-$ per month

Case (II) : When Compounding is more frequent than payments

Prob. 4.6.28 : A person deposits a sum of Rs 1,00,000/- in a bank which offers monthly compounding and quarterly payments. If the nominal rate of interest is 10% what will the amount be at the end of the year.

Soln. :

Here A = 1,00,000, M = 12 compounding periods,

K = 4 payment periods in an year, 3 interest per quarter.

Let us first calculate the effective rate of interest

$i = [1 + 0.10/12]^3 - 1 = 2.521\%$

$F = 1,00,000(F|A, 2.521\%, 4) = 110470/-$

Case (III) : When compounding is continuous and deposits are quarterly

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Prob. 4.6.29 : A person makes quarterly payments of 25,000/- into a bank account that pays interest at a rate of 10% compounded continuously. Find the balance at the end of the year.

Soln. :

Here K = 4 payments in the year, C ∞ interest periods in a quarter

$$i = (e^r)^{1/k} - 1$$
$$= 2.531\% \text{ per quarter}$$
$$N = 4$$
$$F = 25,000(F|A, 2.531\%, 4)$$

Calculating F|A Uniform Series Compound Amount Factor

$$\frac{(1+i)^N - 1}{i}$$

$$= (1 + .02531)^4 - 1 / 0.02531 = 4.1544$$
$$F = 25,000(4.1544) = 1,03,861/-$$

Case (IV) - When Compounding is less than payments

Prob. 4.6.30 : A person makes a monthly deposit of 10,000/- in a bank that pays interest at a rate of 10% compounded quarterly. Compute the balance at the end of the year.

Soln. :

$$i = (1 + 0.10/4)^{1/3} - 1$$
$$= 0.826\%$$
$$F = 10,000(F|A, 0.826, 12)$$
$$= 1,25,604/-$$

4.6.5 Commercial Loans :

- A **commercial loan** is a debt-based funding arrangement that a business can set up with a financial institution. The proceeds of commercial loans may be used to fund large capital expenditures and/or operations that a business may otherwise be unable to afford.
- This type of loan is usually short-term in nature and is almost always backed with some sort of collateral. Commercial loans usually charge flexible rates of interest that are tied to the bank prime rate.
- The effective interest rate is specified and the loan is paid off in equal periodic amounts known as installments. Although, the interest rate may help decide the bank from which the loan is to be taken the borrower needs to also look at the length of time required to repay along with the fees charged by the bank.

Prob. 4.6.31 : Mr. A has purchased a car for 7,00,000 for an effective annual interest rate of 12% payable over a period of 5 years. What will his instalment be ?

Soln. : $A = 7,00,000(A|P, 12\%/12,60)$

$= 7,00,000(.0222) = 15,540/-$ per month

Suppose Mr A decides to sell the car after paying 30 instalments how much should he pay the bank.

$$A = 15,540(P|A, 12\%/12, 30)$$

For this we will have to calculate the Uniform Series Present worth Factor the formula for which is :

$$\frac{(1+i)^N - 1}{i(i+1)^N} = (1+.01)^{30} - 1 / .01(.01+1)^{30}$$

$$= 25.81$$

$$A = 15,540(25.81) = 4,01,181/-$$

Mr. A finds this difficult as after half the time period his loan amount stands at more than half. So he wants to find out the interest payment and principal payment for the 31st installment.

We have calculated the remaining balance after the 30th installment to be 4,01,181

The interest component for the 31st installment shall be $4,01,181(0.01) = 4011.81$

Principal Payment component for the 31st installment shall be $15,540 - 4011.81 = 11,528.19/-$

4.6.6 Buying Vs Lease :

- Paying cash or taking out a car loan isn't the only way to get into a new car. Leasing was once reserved for corporate customers and luxury car buyers, but now it's found in every segment of the car industry. As vehicle prices continue to climb, so does the number of people who lease. Leasing now accounts for nearly one-third of vehicle sales.
- While many people take out a car loan to finance a car, leasing offers another way to have a new car in your driveway. Leasing can allow buyers to acquire a more expensive vehicle than they might otherwise be able to afford. However, it isn't without its drawbacks. Buying could be the better choice in the long run, depending on your financial situation and how you use your car.

Benefits of Leasing a Car

- Leasing a car is similar to financing in many ways, but there are some key differences. When you are purchasing a car, the loan value is based on the entire cost of the vehicle, minus your down payment and trade-in value. When leasing, however, you're only financing the depreciation that occurs during the lease term (most commonly three years), plus fees. At the end of the lease term, you simply return the car to the dealership.
- So, unless you pay a tremendous amount of money down, or your trade-in had a high value, a monthly lease payment will be lower than a monthly loan payment. With the car lease, you only pay the difference between the car's price and what it's expected to be worth at the end of the lease, which is known as its residual value.
- Say your dream car is a new SUV that costs 30,00,000, you're able to put 10 percent down (3,00,000), and don't have a trade-in. You'll need to finance 27,00,000.
- With any lease, there will be a predetermined residual value. Let's say, for our example, that it's 55 percent, or 16,00,000. That means you'll only make payments on the $14,00,500 worth of use that you're expected to get from the vehicle. That's half the price of the outright purchase. It's not quite that simple – both types of deals generally come with fees that need to be included in the math - but that gives you an idea of why lease payments are generally lower than financing payments.

Benefits of Buying a Car

- If you tend to keep your vehicle for a long time, buying is probably a better option for you than leasing. When you buy, you own the car outright when the loan is paid off (though until then, the lender owns the vehicle). Throughout the length of the loan, you gain equity in the car as long as your payments outpace the depreciation of the vehicle.
- At the end of the loan, the car belongs to you, and your lender will transfer its title to you. Other than the basic costs of ownership - gas, insurance, repairs, etc. - you won't have to figure any car payments into your budget.

4.7 Factor Formulas

The table 4.6.1 summarizes the equivalency factors . The *Name* column shows the traditional names for the factors. Each factor has a formula that depends on *i*, the interest rate per compounding period, and *N*, the number of compounding periods in the interval. The factors are valid for *i* strictly greater than zero and *N* integer.

Table 4.7.1

Name	Formula	Purpose
Single payment compound amount factor (F/P, *i*, *N*)	$(1+i)^N$	Moves a single payment to *N* periods later in time
Single payment present worth factor (P/F, *i*, *N*)	$\frac{1}{(1+i)^N}$	Moves a single payment to *N* periods earlier in time
Sinking Fund factor (A/F, *i*, *N*)	$\frac{i}{(1+i)^N-1}$	Takes a single payment and spreads into a uniform series over *N* earlier periods. The last payment in the series occurs at the same time as *F*.
Uniform Series Compound Amount factor(F/A, *i*, *N*)	$\frac{(1+i)^N-1}{i}$	Takes a uniform series and moves it to a single value at the time of the last payment in the series.
Capital Recovery Factor (A/P, *i*, *N*)	$\frac{i(i+1)^N}{(1+i)^N-1}$	Takes a single payment and spreads it into a uniform series over *N* later periods. The first payment in the series occurs one period later than *P*.
Uniform Series Present Worth Factor (P/A, *i*, *N*)	$\frac{(1+i)^N-1}{i(i+1)^N}$	Takes a uniform series and moves it to a single payment one period earlier than the first payment of the series.
Arithmetic Gradient Present Worth Factor (P/G, *i*, *N*)	$\frac{(1+i)^N-iN-1}{i^2(1+i)^N}$	Takes a arithmetic gradient series and moves it to a single payment two periods earlier than the first nonzero payment of the series.
Arithmetic Gradient to Uniform Series Factor (A/G, *i*, *N*)	$\frac{(1+i)^N-iN-1}{i(1+i)^N-i}$	Takes a arithmetic gradient series and converts it to a uniform series. The two series cover the same interval, but the first payment of the gradient series is 0.

Case Study

Economic Decisions in Multinational Companies

With globalization and the progressive removal of barriers to trade, an increasing number of companies have developed international activities. To access foreign markets, firms face a choice between producing goods at home for exports and producing abroad. Those companies which decide to shift their manufacturing base to other countries or establish additional manufacturing capacities in other countries and have presence in more than one country are known as multinational companies. Multinational companies arise because capital is more mobile than labor and raw material and facilitates the tapping of newer markets. A multinational corporation (MNC) is usually a large corporation incorporated in one country which produces or sells goods or services in various countries. The two main characteristics of MNCs are their large size and the fact that their worldwide activities are centrally controlled by the parent companies.

According to Franklin Root (1994), an MNC is a parent company that

(i) Engages in foreign production through its affiliates located in several countries,

(ii) Exercises direct control over the policies of its affiliates, and

(III) Implements transnational business strategies in production, marketing, finance and staffing in a way that transcend national boundaries.

In other words, MNCs exhibit no loyalty to the country in which they are incorporated.

Given this background of multinational companies it would be very interesting to study the kind of economic factors that play a role in the decisions of the firm.

If you were in the management of a multinational company where would you locate your activities and investments? A host of tax and non-tax factors affect the decision whether to relocate production abroad. The first non tax factor behind a company going to other countries is that it has reached a plateau satisfying local demand which is not growing and the company's hunger is not subsiding. The other factors are, company finds better growth prospects in other countries, the wage and productivity levels abroad are attractive, by basing its manufacturing activity in that country the company is able to circumvent the countries import policy, the foreign regulatory and legal environment and transportation cost.

In addition to the non tax factor the biggest economic influencer is the tax implication of the decision to go multinational. Tax plays a critical role in where multinational firms locate their economic activity. The individual countries corporate tax rate affect multinational firm's decision to invest. Multinational firms focus on statutory tax rate which in some cases may be misleading and it would be more meaningful to follow the average effective tax rate. Although, many multinationals base their decision on statutory tax rate because of its simplicity yet it portrays an incomplete picture. The average effective tax rate is perhaps the biggest influence of firm's decision from the tax perspective. The firms base their decision on the average effective tax rate of the country where they plan to invest.

The other economic factor that influences the decision is the transportation cost. Transportation costs are like tariffs that raise consumer prices. Where the market is large and the transportation costs are high the company wants to build their production plant close to the market or in some cases close to the source of raw material.

As a part of the management of a software company that is planning to go multinational you have been asked to list the economic factors that would be having a major impact on their decision.

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CHAPTER 5

UNIT - V

Economics and Management

Syllabus

Equivalence Calculations under Inflation, Present-Worth Analysis, Annual-Equivalence Analysis. Case Studies - comparative analysis of software enterprises from similar domains.

5.1 Introduction of Economics and Management :

The science and the art of economics and management are like two sides of the same coins. Economic studies have a major role to play in the manner in which consumers and businesses make decisions that determine the allocation of resources. As an engineer economics will enable you to understand management policies, the conduct of business and the changes in economic systems which are occurring all around us. Management is concerned with the effective use and coordination of materials and labour to attain organizational objectives. Management is concerned with the interrelationship and interaction between the distinct parts of the organization and the organization and its environment. As students you will need to understand both economic and management theories and models to develop a better understanding of the decision making process.

Syllabus Topic : Equivalence Calculations under Inflation

5.2 Equivalence Calculations Under Inflation :

We are all used to hearing our elders complain or sometimes we ourselves complain as to how much less can now be bought with 100 Rs. "In the past, money had a lot of 'value'. With Rs.100/- families could manage their entire monthly expenditure.

Today, salaries have practically multiplied ten times; we earn more than ten times the salary of our elders, and yet we are in a dilemma as to whether we are better off economically then our elders. Despite the six digits salaries that people earn today, they are still worried about meeting ends. So where exactly is the problem. To understand the problem we got to understand the concept of inflation.

5.2.1 Inflation :

Q. Define Inflation

Different economists have offered different definition of inflation. In fact, there is a plethora of definitions on the subject. The common person relates the term 'inflation' to a sizeable and a rapid increase in the general price level. Inflation is generally associated with rapidly rising prices, which cause a decline in the purchasing power of money. Various economists have given defined inflation, according to their interpretation and understanding of the concept.

- **Edward Shapiro** has defined inflation as "a persistent and appreciable rise in the general level of prices".
- **Crowther** has defined the concept as "a state in which the value of money is falling".
- **Prof. Samuelson** says that "Inflation occurs when the general level of prices and costs is rising".
- **Dernberg and McDougall** define Inflation, "the term usually refers to a continuing rise in prices as measured by an index".
- **Milton Friedman**, "Inflation is always and everywhere a monetary phenomenon and can be produced only by a more rapid increase in the quantity of money than output".
- **Prof. Edwin Walter Kemmer,** "inflation is too much money and deposit currency, i.e. to currency in relation to the physical volume of business being done."
- **Prof. Pigou,** "Inflation occurs, when money income is expanding relatively to the output of work done by the productive agents for which it is the payment."
- **Sir R.G. Hawtrey,** "Inflation is the issue of too much currency".
- **Dr. T. E. Gregory,** "Inflation is the state of abnormal increase in the quantity of purchasing power."
- **Prof. Coulbourn** "Inflation as a situation where there is "too much money chasing too few goods."

5.2.1.1 Characteristics of Inflation :

Q. State characteristics of inflation.

From the various definitions given above, we can ascertain the following characteristics of inflation :

- **A continuous and persistent rise in the General Price Level :** For a price rise to be labelled as inflation, the rise in the price level has to be sustained. A temporary rise in the price level cannot be termed as inflation.
- **A continuous process of rising prices :** Mere high prices does not qualify as inflation. Inflation is a process of rising prices. Inflation is a continuous and persistent rise in the price level. Inflation is a state of disequilibrium and hence needs to be analyzed dynamically.
- **A fall in the value of money :** Rising inflation signifies a fall in the value of money or money losing its purchasing power. When the General Price Level increases, goods and services are sold at higher prices. This implies that few goods and services can be purchased with the same amount of money. This signifies a fall in the value of money or falling purchasing power.
- **Aggregate Demand exceeds Aggregate Supply :** During periods of inflation there is a rise in the aggregate demand with no corresponding increase in aggregate supply. As the aggregate demand is high it indicates that more money is chasing too few goods, causing the price of available goods to rise.
- **Inflation is a Monetary Phenomenon :** Inflation is attributed to excess money supply. When money supply increases, demand for goods and services rise thus causing an increase in the General Price Level.
- **Inflation is persistent and Irreversible :** Inflation price rise is persistent and is irreversible within a short time it should be distinguished from a price rise which may occur temporarily, due to short - term scarcity or during a cyclical upswing.
- A cyclical movement is not inflation. Inflation is a rising trend in the price level.
- Inflation is endogenous to the economic system.
- Inflation is fostered by the interaction of a multitude of economic factors.
- Inflation, in a real sense, is a post-full employment phenomenon.

5.2.1.2 Types of Inflation :

Q. Enumerate the types of inflation.

I. Types of Inflation on the basis of Rate of Inflation :

- **Creeping Inflation :** When the rise in prices is very slow, it is called creeping inflation. In terms of speed, a sustained rise in prices of annual increase of less than 3 per cent per annum is characterized as creeping inflation.
- Such an increase in prices is regarded safe and essential for economic growth.
- **Walking Inflation :** When prices rise moderately and the annual inflation rate is a single digit. In other words, the rate of rise in price is the intermediate range of 3 to 7% per annum. Inflation at this rate is a warning signal for the govt. to control it before it turns into running inflation.
- **Running Inflation :** When price rise rapidly at a rate of 10 to 20 per cent per annum, it is called running inflation. Such inflation affects the poor and middle classes adversely. Its control requires strong monetary and fiscal measures, otherwise it leads to hyperinflation.
- **Hyperinflation :** When price rise very fast, more than 20 to 100 percent per annum or more it is usually called Galloping or Hyperinflation inflation. In reality, hyperinflation is a situation when the rate of inflation becomes immeasurable and absolutely uncontrollable Prices rise many times every day. Such a situation brings a total collapse of the monetary system because of the continuous fall in the purchasing power of money.

II. Inflation on the Time Period of its Occurrence :

- **War time Inflation :** It is on account of increased government expenditure on defences which is of an unproductive nature. By such public expenditure the government apportions a substantial production of goods and services out of total availability for war which causes a down ward shift in the supply, as a result, an inflationary gap may develop.
- **Post - war Inflation :** In the immediate post - war period the disposable income of the community increases when war - time taxation is withdrawn, or public debt is repaid in the post - war period.
- **Peace time Inflation :** is the rise in prices during the normal period of peace. Peace time inflation is often a result of increased government outlay on capital projects having a long gestation period, so a gap between money income and real wage goods develops. In a planning era thus, when government expenditure increase prices may rise.

5.2.1.3 Causes of Inflation :

Q. Briefly describe the causes of inflation.

Inflation in an economy may develop on account of number of factors. These factors relate mainly either to the demand or to the supply side. By 'demand' we mean the demand for money income for goods and services and by 'supply' we imply the available output for which the money income can be spent. Expectations also play an important role in causing inflationary pressure in the country.

Therefore, the factors that cause inflation may be divided also three groups :

(1) Factors on the demand side
(2) Factors on the supply side
(3) Role of expectations

(1) Factors on Demand Side :

According to **Kenneth K. Kurihara**, the major factors on the demand side causing inflation are :

(i) **Increase in Money Supply :** Inflation is caused by an increase in the supply of money which leads to increase in aggregate demand. The higher the growth rate of the nominal money supply, The higher is rate of inflation. Modern quantity theorists do not believe that true inflation starts after the full employment level. This view is realistic because all advanced countries are faced with high level of unemployment and high rate of inflation.

(ii) **Increase in Public Expenditure :** Government activities have been expanding much with the result that government expenditure has also been increase at a phenomenal rate, thereby raising aggregate demand for goods and services. Government of both developed and developing countries are providing more facilities under public utilities and social services and also nationalizing industries and starting public enterprises with the result that they help in increasing aggregate demand.

(iii) **Increase in Disposable Income :** when this disposable income of the people increase. It raises their demand for goods and services. Disposable income may increase with the rise in national income or reduction in taxes or reduction in the saving of the people.

(iv) **Increase in Consumer Spending :** The demand for goods and services increase when consumer expenditure increases. Consumers may spend more due to conspicuous consumption or demonstration effect. They may also spend more when they are given credit facilities to buy goods on hire - purchase and installment basis.

(v) **Deficit Financing :** In order to meet its mounting expenses, the government resorts to deficit financing by borrowing from the public and even by printing more notes. This raises aggregate demand in relation to aggregate supply thereby leading to inflationary rise in prices. This is also known as 'deficit - induced' inflation.

(vi) **Cheap Monetary Policy :** Cheap monetary policy or the policy of credit expansion also leads to increase in the money supply which raises the demand for goods and services in the economy. When credit expands, it raises the money income of the borrowers which, in turn raises aggregate demand relative to supply there by leading to inflation. This is also known as credit induced inflation.

(vii) **Expansion of the Private Sector :** The expansion of the private sector also tends to raise the aggregate demand. For huge investment increase employment and incomes there by creating more demand for goods and services. But it takes time for the output to enter the market.

(viii) **Black Money :** The existence of black money in all countries due to corruption tax evasion etc. increases the aggregate demand. People spend such unearned money extravagantly, thereby creating unnecessary demand for commodities. This tends to raise the price level farther.

(ix) **Repayment of Public Debt :** Whenever the govt. repays its past internal debt to the public, it leads to increase in the money supply with the public. This tends to raise the aggregate demand for goods and services.

(x) **Increase in Exports :** When the demand for domestically produced goods increases in foreign countries, this raise the earning of industries producing export commodities. These in turn, create more demand for goods and services within the economy.

(2) Factors on the Supply Side :

There are also certain factors, which operate on the opposite side and tend to reduce the aggregate supply. Some of the factors are as follows :

(i) **Shortage of Factors of Production :** One of the important causes affecting the supplies of goods is the shortage of such factors as labor raw materials, power supply, capital etc. They lead to excess capacity and reduction in industrial production.

(ii) **Industrial Disputes :** In countries where trade unions are powerful, they also help in curtailing production. Trade unions resort to strikes and if they happen to be unreasonable from the employer viewpoint and are prolonged, they force the employers to dealer lockouts. In both cases, industrial production fall thereby reducing supplies of goods. In the unions succeed in raising money wages of their members to a very high level than the productivity of labor, this also tends to reduce production and supplies of goods.

(iii) **Natural Calamities :** Drought or floods is a factor which adversely affects the supplies of agricultural product. The latter in turn, create shortages of food products and raw material. There by helping inflationary pressures.

(iv) **Artificial Scarcities :** Artificial scarcities are created by hoarders and speculators who domestic consumption.

This creates shortages of goods in the domestic market. This leads to inflation in the economy.

(v) **Increase in Exports :** When the country produces more goods for export than for domestic consumption. This creates shortages to goods in the domestic market. This leads to inflation in the economy.

(vi) **Lop-Sided Production :** If the stress is on the production of comfort luxuries, or basic product to the neglect of essential consumer goods in the country this, creates shortages of consumer goods. This again causes inflation.

(vii) **Law of Diminishing Returns :** If industries in the country are using old machines and outdated methods of production the law of diminishing retunes operate. This raises cost per unit of production, thereby raising the prices of products.

(viii) **International Factors :** In modern times, inflation is a worldwide phenomenon, when prices in major industrial countries, their effects spread to almost relations of often the rise in the price of a basic material like petrol in the international market leads to rise in the price of all related commodities in a country.

(3) Role of Expectation :

Inflation cannot be explained only in terms of excessive spending relative to available output. Expectations play an important role in the speed of inflation. Expectations regarding future movement of prices and wages result in the inflationary pressure in the economy. When prices are expected to increase consumers will purchase more goods. This will leads to an increase in the price level. Similarly, a rise in the expected income induces people to spend more. Expected wage increase also brings about inflation in the country. Expectations thus play a vital role in causing inflation in an economy.

Measures to Control Inflation :

There are various measures suggested by the experts on the subject to control inflation. The measures are as follows.

(1) Monetary measures
(2) Fiscal measures
(3) Social and economic measure or non-monitory measures

(1) Monetary Measures :

Monetary measures have direct affect on the inflation process. It includes the measures which are to be taken by the Central Bank of the country i.e. in case of India it is the Reserve Bank of India. The aim of these measures is to control and reduce the money from circulation. Following steps are taken by the Central Bank to check inflation.

(a) **Bank Rate Policy :** Bank Rate, announced by the Central Bank, is the rate at which it will accept and lend money to commercial banks. On the basis of this rate the Central Bank can reduce the credit by increasing the bank rate. The interest will become costly and money becomes dearer. People will borrow less and save more to get high rate of interest. This will help reduce the supply of credit and money in the economy.

(b) **Open Market Operation :** It is a direct step to be taken by the government bank central bank may issue credit papers in the market openly inviting investors. These credit papers contain higher rate of interests than those offered by commercial banks, people will buy more and more and consequently money will go in the deposits of the central bank.

(c) **Raising the level of Reserve :** The central bank in order to reduce the money supply may raise the reserve value to be kept by the commercial bank with the Reserve Bank. This will result in the transfer of that money to the reserve, and will no longer be available for lending. This will result in a credit squeeze in the economy.

(2) Fiscal Measures :

The fiscal policy of the government can be adopted with two motives : (a) Reduction in public expenditure and public works. (b) Withdrawal of public money from the market. Modern government adopts following fiscal measures.

(a) **Reduction in Public Expenditure :** To curb inflation the government should reduce expenditure on public works since it involves more circulation of money. If possible public works programs should be postponed for certain period of time to curb inflation.

(b) **High Taxation :** Fiscal policy must adopt scheme to raise the direct taxes to curtail the spending power of the community. But taxation should not be increased to such a level that it would distort capital formation. De-valuation of money is one of the products to reduce the purchasing power of money at the internal level.

(3) Social and Economical Measures or Non - Monetary Measures :

Following are the measure to check the inflation in this category.

(a) **Increasing Production :** Government should provide enough incentive to increase production in economy. This is positive step to fight inflation. This will increase the supply of commodities in the market, which will check the rising prices.

(b) **Voluntary Savings :** Lord. J. M. Keynes suggested this formula to check inflation. According to Lord Keynes, "it is a method of compulsorily converting the appropriate part of the earning of the worker which he does not save voluntarily in to the voluntary saving of the entrepreneur". He suggested a "Deferred Pay Scheme" Which envisaged for the reduction of the part of the salary of the worker and keeping it as a deposit with the government. This will raise the saving potential by reducing the expenditure on consumption.

(c) **Marketing and Rationing :** The prices of the essential commodities can be checked by rationing system. Controlled marketing through co-operative stores can be also of help in this field. Government can also create some procurement schemes and construct buffer stocks. Fixation of prices can also be taken into help in this context.

5.2.2 Consumer Price Index

Q. What is Consumer Price Index ?

- CPI is a statistical time-series measure of a weighted average of prices of a specified set of goods and services purchased by consumers. It is a price index that tracks the prices of a specified basket of consumer goods and services, providing a measure of inflation.
- CPI is a fixed quantity price index and considered by some as a *Cost* of living index. Under CPI, an index is scaled so that it is equal to 100 at a chosen point in time, so that all other values of the index are a percentage relative to this one. The CPI is a commonly used measure of the level of prices.
- CPI turns the prices of many goods and services into a single index measuring the overall level of prices. Since the CPI is a measure of the overall cost of the goods and services bought by the typical consumer, to construct this index, data on the prices of innumerable goods and services have to be considered.
- While calculation one cannot simply calculate an average of all prices because that would imply that all goods and services are equally important. People attach different degrees of importance to different commodities. Most people give more importance to buying vegetables than fruits then vegetables should have a greater 'weight' in the CPI than fruits.

Q. Briefly describe the steps in computing consumer price index.

Steps in Computing Consumer Price Index :

1. Fix the Basket
2. Find the Prices
3. Compute the Cost of the Basket
4. Choose a Base Year
5. Compute the Index
6. Compute the Inflation Rate

There are six steps in computing Consumer Price Index.

1. Fix the Basket

The first step would be to fix the basket of commodities for which a survey is conducted amongst consumers. If the consumer buys more vegetables than fruits, then the price of is vegetables is more important that the price of fruits. In that case vegetables are given more weight in measuring the cost of living index.

2. Find the Prices

The second step is to find the prices of each of these commodities and services in the basket for each year.

3. Compute the Cost of the Basket

The next step would be to compute the cost of the basket for which the quantities purchased in the basket during each year are kept the same. So, if the basket contains 5 kgs of onions then the quantity of onions for each year should be 5 only. The basket therefore, remains the same in terms of quantity, only the prices of the commodity change.

4. Choose a Base Year

To calculate the CPI, one year has to be chosen as the 'Base Year'. All other years are compared with the Base Year. This Base Year has to be a normal year with no sudden fluctuations or shocks to the economy.

5. Compute the Index

To compute the index the price of the basket of commodities and services in each year is divided by the price of the basket in the Base Year and then multiplied by 100 resulting in the CPI.

6. Compute the Inflation Rate

The final step would be to use the CPI to calculate the rate of inflation. The rate of inflation is the percentage change in the price index from the previous year.

To calculate the rate of inflation between two consecutive years, 2016 and 2017, the following formula is used :

$$\text{Inflation Rate in 2017} = \frac{\text{CPI in 2017} - \text{CPI in 2016}}{\text{CPI in 2016}} \times 100$$

So, if the CPI in 2016 is 160 and the CPI in 2017 is 175 then the inflation rate is,

$$\text{Inflation Rate in 2017} = \frac{175 - 160}{160} \times 100$$

$$= \frac{15}{160} \times 100 = 9.3\%$$

5.2.3 Average Inflation Rate :

Q. What is average inflation rate?

The average inflation rate accounts for the varying inflation rate over a given period of time. Here year's inflation rate is based on the previous year's rate. The process of compounding is used to calculate.

Example:

The inflation rate in the 2016 was 5% while the inflation rate in the year 2017 is 6% with a base price of 100 Rs. Find the price at the end of second year and the average inflation rate.

For calculating the price at the end of the second year we shall be using the compounding method.

$100(1+0.05\%)(1+0.06\%) = 111.30$

For finding the inflation rate we use the following equivalence equation,

$100\,(1+f)^2 = 111.30 = 5.45\%$

5.2.4 General and Specific Inflation Rate :

Q. Differentiate between general and specific inflation rate.

The general inflation rate is the average inflation rate that is based on Consumer Price Index for all items in the basket. Specific inflation rate is based on an index specific to a segment of the economy.

Mathematically it can be expressed as :

$$CPI_n = CPI_0\,(1+\bar{f})^n$$

Where,

CPI_n is the consumer price index at the end of period n

CPI_0 is the consumer price index for the base period

$\bar{f}$ is the general inflation rate

Example :

Calculate the general inflation rate for the year 2017 when CPI for the year 2016 is 160 and CPI for 2017 is 175.

$$\text{General inflation rate} = \frac{175-160}{160} \times 100 = 9.3\%$$

Prob. 5.2.1 : The costs of a fixed amount of consumable of a printing press are given in the table. Calculate the inflation for each period and the average inflation rate over two years. The year 2000 is the base year.

Table P. 5.2.1

Year	Cost
2000	1,00,000
2001	1,10,000
2002	1,25,000

Soln. :

The average inflation rate is 12.8%.

5.2.5 Actual and Constant Value of Money :

Q. What is actual and constant value of a currency? How is constant currency value calculated?

Q. Briefly explain the process of converting constant currency to actual currency and vice versa.

Constant value of a currency (Rs, $, etc) is an adjusted value currency used to compare currency values from one period to another period. As we are all experiencing, the purchasing power of every currency changes over time. It is not possible to buy the same commodity for the same amount as the purchasing power of that currency has changed over a period. However, is one wishes to compare values from one year to another they need to be converted from actual values to constant values. Constant currency values may also be referred to as real currency values.

Constant Currency calculation :

Second year currency value =

$$\frac{\text{First year currency value} \times \text{CPI for second year}}{\text{CPI for first year}}$$

This concept is used by companies to compare their recent performance with the past performance. Consumer price index can be used to convert any financial data into constant currency terms.

For Example :

Constant currency can be used to calculate what Rs. 1,00,000 earned in 1995 would be equal to in 2005.

The CPIs for the two years are 152.4 and 195.3, respectively. The value of 1,00,000 in 1995 would be equal to 1,28,149/- in 2005.

This is calculated as $1,00,000 \times \left(\frac{195.3}{152.4}\right)$.

Conversion from Constant to Actual :

Cash flows with inflationary effects can be converted to constant currency using the general inflation rate.

$$A_n = A_n'(1+\bar{f})^n$$

Where,

A_n' is the constant currency expression for the cash flow with year ending n

A_n is the actual currency expression for the cash flow with year ending n.

Example :

If the general inflation rate is 6% what will the actual value of Rs 1,00,000/- be ?

Using the above given formula we get:

$$A_n = 1,00,000\,(1+0.06) = 1,06,000/-$$

Conversion from Actual to Constant

Similarly actual currency can be converted to constant.

$$A_n' = A_n\,(1+\bar{f})^{-n}$$

Where,

A_n' is the constant currency expression for the cash flow with year ending n

A_n is the actual currency expression for the cash flow with year ending n.

Example :

If the general inflation rate is 6% what will the constant value of Rs 1,00,000/- be.

$$A_n' = A_n (1 + \bar{f})^{-n} = 94,300/-$$

Where:

A_n' is the constant currency expression for the cash flow with year ending n

A_n is the actual currency expression for the cash flow with year ending n.

5.2.6 Equivalence Calculations under Inflation :

There are two approaches to equivalence calculations under inflation.

- **Approach 1 :** Estimate all cash flows in constant currency using inflation free interest rate (i'). Inflation free interest rate gives an estimate of the true earning power of the currency when the effects of inflation have been removed. Real interest rates can be computed from the market rate and the inflation rate. However, in the absence of inflation the market rate is the same as the inflation free interest rate.
- **Approach 2 :** Estimate all future cash flows in actual currency using market interest rates (i). The market interest rate takes into account the combined effect of the earning power of the currency and any anticipated inflation or deflation in the purchasing power of the currency. The interest rates stated by financial institutions for loans and saving accounts are market interest rates.

Constant Currency Analysis

In this approach all future cash flows are estimated in constant currency using inflation free interest. Inflation free interest indicates the absence of inflation so we will be using only 'i'' to account for the earning power of money. The constant currency approach is commonly used in the analysis of government projects as the government does not have to pay any taxes. However, while estimating the future cash flows of the private sector we have to use actual currency analysis as income tax is levied on the private sector based on the taxable income in actual currency.

Actual Currency Analysis

There are two approaches to estimating the present worth equivalent :

1. **Deflation Method :** Deflation is the reverse of inflation and proves useful in the estimation of present worth analysis. Steps in the deflation method are:

   Step 1 : Bring all cash flows to a common purchasing power

   Step 2 : Consider the earning power
2. **Adjusted Discount Method :** In this method both the above mentioned steps are combined into one single step.

Example : The cash flows of a company for five years are given if the inflation rate is 6%. Calculate the cash flows in constant currency terms. The discounting factor or the inflation free interest rate is 8%.

Step 1 : Converting actual currency to constant currency

n	Cash Flows in Actual Currency	Multiplied by Deflation Factor	Cash Flow in Constant Currency
0	-55,000	1	-55,000
1	20,000	$(1 + 0.06)^{-1}$	18,868
2	25,000	$(1 + 0.06)^{-2}$	22,249
3	30000	$(1 + 0.06)^{-3}$	25,189
4	20000	$(1 + 0.06)^{-4}$	15,842
5	35,000	$(1+ 0.06)^{-5}$	26,154

Formula :

$$A_n' = \frac{A_n}{(1 + \bar{f})^n}$$

Where,

A_n' is the cash flow in constant currency terms

Step 2 : Converting Constant Currency to equivalent present worth

n	Cash Flow in Constant Currency	Multiplied by Discounting Factor	Equivalent Present Worth
0	(-) 55,000	1	(-) 55,000
1	18,868	$(1+0.08)^{-1}$	17, 470
2	22,249	$(1+0.08)^{-2}$	19,074
3	25,189	$(1+0.08)^{-3}$	19,995
4	15,842	$(1+0.08)^{-4}$	11,644
5	26,154	$(1+0.08)^{-5}$	17,799
			Total = 85,982

Formula :

$$P_n = \frac{A_n'}{(1 + i')^n}$$

where,

A_n' is the cash flow in constant currency terms

i' is inflation free interest rate

P_n present worth of constant currency

Deflation Method :

Converting Actual Currency to Constant Currency and then to Equivalent Present Worth.

n	Cash Flows in Actual Currency	Multiplied by Deflation Factor	Cash Flow in Constant Currency	Multiplied by Discounting Factor	Equivalent Present Worth
0	-55,000	1	-55,000	1	(-)55,000
1	20,000	$(1 + 0.06)^{-1}$	18,868	$(1+0.08)^{-1}$	17,470
2	25,000	$(1 + 0.06)^{-2}$	22,249	$(1+0.08)^{-2}$	19.074
3	30000	$(1 + 0.06)^{-3}$	25,189	$(1+0.08)^{-3}$	19,995
4	20000	$(1 + 0.06)^{-4}$	15,842	$(1+0.08)^{-4}$	11,644
5	35,000	$(1+ 0.06)^{-5}$	26,154	$(1 +0.08)^{-5}$	17,799
					Total = 85,982

Adjusted-discount method performs deflation and discounting in one step

Step 1 : $$A_n' = \frac{A_n}{(1+\bar{f})^n}$$

Step 2 : $$P_n = \frac{A_n'}{(1+i')^n}$$

Combine $$P_n = \frac{\frac{A_n}{(1+\bar{f})^n}}{(1+i')^n}$$

Rearrange

$$P_n = \frac{A_n}{[(1+\bar{f})(1+i')]^n}$$

Since market interest rate reflects both earning power and purchasing power, it is also true that :

$$P_n = \frac{A_n}{(1+i)^n}$$

Equate :

$$\frac{A_n}{(1+i)^n} = \frac{A_n}{[(1+\bar{f})(1+i')]^n}$$

Simplify : $$(1+i) = (1+\bar{f})(1+i')$$

Simplify : $$1 + i = 1 + i' + \bar{f} + \bar{f}\,i'$$

With the result that : $$i = i' + \bar{f} + \bar{f}\,i'$$

Example :

Continuing with the above example the adjusted discount method table will be as follows :

N	Cash Flows in Actual Currency	Multiplied by Deflation Factor	Equivalent Present Worth
0	-55,000	1	-55,000
1	20,000	$(1 + 0.1448)^{-1}$	17,470
2	25,000	$(1 + 0.1448)^{-2}$	19074
3	30000	$(1 + 0.1448)^{-3}$	19,995
4	20000	$(1 + 0.1448)^{-4}$	11644
5	35,000	$(1+ 0.1448)^{-5}$	17799
			Total = 85,982

Formula:

$$i = i' + \bar{f} + \bar{f}\,i'$$

$$i = i' + \bar{f} + \bar{f}\,i' = 0.08 + 0.06 + (0.08)(0.06)$$

$$= 0.1448 = 14.48\%$$

Equivalent Present Worth

$$P_n = \frac{A_n'}{(1+i')^n}$$

Syllabus Topic : Present Worth Analysis

5.3 Present Worth Analysis :

Q. What is MARR?
Q. Briefly describe Present Worth Method of evaluating project alternatives.
Q. Differentiate between Reserve Cash Flow and Cost Cash Flow.

- The decision making process requires that the outcome of various investment alternatives be so arranged they could be judged for economic efficiency in terms of selection criteria. The Present Worth method (PW) is one such tool along with Present Value (PV) and Net Present Value (NPV) that enable the comparison of investment alternatives.
- In the present worth method a future amount of money is converted to its equivalent value. The present worth is always less than the actual cash flow because interest rate always has a value greater than zero. Therefore, the present worth values are referred to as discounted cash flows and the interest rate as the discounted rate.
- Present worth analysis is used to determine present value of future money receipts and disbursements. This assists in determining the present worth of any income producing asset like a farm land, mine, house, or machine, etc. If the future costs and incomes are known, then using a suitable interest rate the present worth of the asset can be ascertained. This would provide a good idea as to whether the investment is worth its while.
- In this method of analysis careful consideration should be given to the time period covered by the analysis. Every investment has a time period associated with it, hence each investment alternative should be considered

according to the time period called as the analysis period.

- As discussed earlier the economic criterion is :
  - Fixed Input - Maximize the Output
  - Fixed Output - Minimize the Input
  - Varying Input and Output - Maximize (Output - Input)

The first step in the selection of an alternative using the present worth method would be the formulation of alternatives. Various alternatives are developed from project proposals to enable the organization to accomplish an objective. Projects which are technically as well as economically viable are selected as alternatives. There are basically two types of alternatives and each is evaluated differently.

Mutually Exclusive Alternatives

Mutually Exclusive Alternatives only one alternative from the alternatives can be selected for investment. Example, an entrepreneur has to select one particular machine from the complete range of competing models. Hence mutually exclusive alternative selection is the most commonly encountered problem. Each mutually exclusive alternative is the same as the viable project, each alternative is selected and one best alternative is finally selected. Each alternative is mutually exclusive which means that they compete with each other for selection. One of the easiest ways to compare mutually exclusive alternatives is to resolve their consequences to present time.

Independent

Independent here more than one viable alternative may be selected for investment. Independent projects are designed to accomplish different purposes thus depending on the capacity of the company it could select more than more than one project. As these projects do not compete with one another, they are evaluated separately and then compared with the MARR.

MARR

In business and engineering, the minimum acceptable rate of return, often abbreviated MARR, or hurdle rate is the minimum rate of return on a project a manager or company is willing to accept before starting a project, given its risk and the opportunity cost of forgoing other projects. For example, suppose a manager knows that investing in a conservative project, such as a bond investment or another project with no risk, yields a known rate of return. When analyzing a new project, the manager may use the conservative project's rate of return as the MARR. The manager will only implement the new project if its anticipated return exceeds the MARR by at least the risk premium of the new project.

Cash Flows :

Cash flows need to be classified as

1. Revenue cash flows
2. Cost cash flows

1. **Revenue Cash Flows :** each alternative generates cost and revenue cash flow estimates and possible savings. Savings are to also be treated as revenue. The revenue generated by every alternative is different. Every alternative involves certain new system, products and services that require investment in capital equipment to generate revenue and savings. Investment in new equipment is a revenue alternative.
2. **Cost Cash Flows :** each alternative has certain cost cash flow estimates which are usually mandatory in nature. Here the revenue generated by the alternatives is considered to be the same.

Present Worth Analysis of Equal-life Alternatives :

- In present worth analysis the value P is calculated at MARR for each alternative. All future cash flows are converted to their present equivalent monetary value. This conversion to equivalent present values makes it possible to compare the economic advantage of one alternative over the other.
- Equal-life alternatives are used in identical capacities for the same period of time. The present worth analysis of such alternatives is simple.

For mutually exclusive alternatives :

- Where there is only one alternative, the value P is calculated at MARR. When $P \geq 0$ the project is considered to be economically viable.
- Where there are more than one alternative, calculate the value of P of each alternative at MARR and select that alternative with the highest value.

Prob. 5.3.1 : A company is considering purchase of some equipment for its printing unit. Two different manufacturers have provided their quotes. An analysis of their quotes provides the following information;

Name of Manf	Cost	Useful life	Salvage Value
Mak Enterprises	15000	5	2000
Excel Enterprise	16000	5	3250

Both the equipments are expected to provide the same output. The rate of interest is 7%. Which equipment should be selected?

Soln. :

For fixed output the criteria is to minimize the present worth of cost.

PW of Mak Enterprise = 15000 – 2000 (P/F, 7%,5)

= 15000-2000(0.7130)

= 15000-1430

= 13570

PW of Excel Enterprise = 16000-3250(P/F, 7%,5)
= 16000-3250(0.7130)
= 16000-2317
= 13683

Though the Present Worth of the alternatives is nearly similar, still we should select the one with the minimum present worth i.e. the proposal of Mak Enterprise.

5.3.1 Decision Making in Selection of Alternative by Rate of Return Method:

Q. Write Short Notes on :
(i) Accounting Rate of Return
(ii) Discounted Cash Flow Method
(iii) Net Present Value
(iv) Internal Rate of Return

5.3.1.1 Accounting Rate of Return (ARR):

The accounting rate of return (ARR) method of evaluating capital budgeting projects is so named because it parallels traditional accounting concepts of income and investment. A project is evaluated by computing a rate of return on the investment, using accounting measures of net income. The formula for the accounting rate of return is,

$$ARR = \frac{\text{Annual revenue from project} - \text{Annual exp. of project}}{\text{Project investment}} \times 100$$

This rate is compared with the rate expected on other projects, had the same funds been invested alternatively in those projects. Sometimes, the management compares this rate with the minimum rate (called cut of rate) they may have in mind.

(A) Merits :

This method is quite simple and popular because it is easy to understand and includes income from the project throughout its life.

(B) Limitations :

(i) This method ignores the timing of cash flows, the duration of cash flows and the time value of money.

(ii) It is based upon a crude average of profits of the future years. It ignores the effect of fluctuations in profits from year to year.

(C) Conclusion :

The traditional techniques of appraising capital investment decision have two major drawbacks:

(i) They do not consider, total benefits throughout the life of the project and

(ii) Timing of cash inflows is not considered.

Hence two essential ingredients of a theoretically sound appraisal method are that :

(i) It should be based on total cash stream through the project life and

(ii) It should consider the time value of money of cash flows in each period of a projects life.

The discounted cash flows technique (also known as time adjusted techniques satisfy these requirements and provide a more objective basis for selecting and evaluating investment projects.

5.3.1.2 Discounted Cash Flow Methods:

Discounted Cash flow refers to the fact that all projected cash inflows and outflows for a capital budgeting project are discounted to their present value using an approximate interest rate. Three discounted cash flow methods are generally used in capital budgeting.

Discounted cashflow

1. **Present value even cash flow = (cash flow per annum)/$(1+i)^{n \times n}$**

or

Present value even cash flow = (Cash flow × P.V. factor of annuity)

2. **Present value of Uneven cash flow** = $\sum_1^n \frac{cf_1}{(1+i)} + \frac{cf_2}{(1+i)^2} + \frac{cf_2}{(1+i)^2} \cdots \frac{cf_n}{(1+i)^n}$

c.f. = Cash flow of n^{th} period.

i = Interest rate.

Example :

The project investment is ₹. 5,00,000 Cash inflows of a project is as given below :

Year = n	Cash Inflows
1	1,00,000
2	2,00,000
3	1,50,000
4	2,00,000
Total	**6,50,000**

You are required to evaluate

(i) Ascertain discounted cash flow assuming interest rate 15% p.a.

Year = n	Cash Inflows	× P.V. Factor 15%		= Discounted Cash flow
1	1,00,000	$1/(1+0.15)^1$	0.869565	86,956.52
2	2,00,000	$1/(1+0.15)^2$	0.756144	1,51,228.73
3	1,50,000	$1/(1+0.15)^3$	0.657516	98,627.43
4	2,00,000	$1/(1+0.15)^4$	0.571753	1,14,350.65
Total	6,50,000		Total	4,51,163.34

We can also find P.V. factor @ 15% from present value table.

One is called Net Present Value Method (NPV); the other is called Profitability Index or Desirability factor and the third Internal Rate of Return (IRR).

All the three methods focus on the timing of cash flows over the entire life of the project. The spotlight is on the cash flows as opposed to accounting measures of revenue and expense.

5.3.1.3 Net Present Value (NPV) :

Under this method, all cash inflows and Cash outflows are discounted at a minimum acceptable rate of return, usually the firm's cost of capital. If the present value of the cash inflows is greater than the present value of the cash outflows, the project is acceptable i.e. NPV > 0, accept and NPV < 0, reject. In other words, a positive NPV means the project earns a rate of return higher than the firm's cost of capital.

Net Present value = Net Investment – Total Discounted cash inflows

If Net present value > 0 Project is feasible and vice versa.

Prob. 5.3.2 : The project investment is ₹. 5,00,000 Cash inflows of a project is as given below :

Year = n	Cash Inflows
1	1,00,000
2	2,00,000
3	1,50,000
4	2,00,000
Total	6,50,000

You are required to evaluate by net present value method whether the project is feasible.

Soln. :

Year = n	Cash Inflows	× P.V. Factor 15%		= Discounted Cash flow
1	1,00,000	$1/(1+0.15)^1$	0.869565	86,956.52
2	2,00,000	$1/(1+0.15)^2$	0.756144	1,51,228.73
3	1,50,000	$1/(1+0.15)^3$	0.657516	98,627.43
4	2,00,000	$1/(1+0.15)^4$	0.571753	1,14,350.65
Total	6,50,000		Total	4,51,163.34

We can also find P.V. factor @ 15% from present value table.

Net Present value = Net Investment – Discounted cash inflows @ 15%

= ₹ 5,00,000 – ₹ 4,51,163 = (–) ₹ 48,837.

Since Net present value is negative the project is not feasible.

As a decision criterion, this method can be used to make a choice between mutually exclusive projects. The project with the highest NPV would be assigned the first rank, followed by others in the descending order.

Merits of NPV :

1. It recognizes the time value of money.
2. The whole stream of cash flows throughout the project life is considered.
3. A changing discount rate can be built into the NPV calculations by altering the denominator.
4. NPV can be seen as the addition to the wealth of shareholders. The criterion of NPV is thus in conformity with basic financial objectives.
5. This method is useful for selection of mutually exclusive projects.
6. An NPV use the discounted cash flows i.e. expresses cash flows in terms of current rupees. The NPV's of different projects therefore can be added/ compared. This is called the value additive principle implying that NPV's of separate projects can be added. It implies that each project can be evaluated independent of others on its own merit.

Limitations :

1. It is difficult to calculate as well as understand and use in comparison with the payback method or even the ARR method.
2. The calculation of discount rate, presents serious problems. In fact, there is difference of opinion even regarding the exact method of calculating it.
3. PV method is an absolute measure. Prima facie between the two projects this method will favor the project, which has Higher Present Value (or NPV). But it is likely that this project may also involve a larger initial outlay. Thus, in case of projects involving different outlays, the present value method may not give dependable results.
4. This method may not give satisfactory results in case of projects having different effective lives.

5.3.1.4 Desirability factor / Profitability Index (PI) :

NPV of a project is a function of the discount rate, the timings of the cash flow and the size of the cash flows. Other things being equal, large investment proposals yield larger net present values. Logic tells, cash flows of the larger machine are merely a multiple of cash flows of the smaller machines. To adjust, the size of the cash flows, we can calculate a profitability index, which is the ratio of the present value of cash inflows to the present value of the cash outflows.

Thus,

$$\text{Profitability index (PI)} = \frac{\text{P.V. of cash inflow}}{\text{P.V. of cash outflows}}$$

The higher the PI, the more desirable the project in terms of return per rupees of investment. A PI of I.O. is the cut-off point for accepting projects and is equivalent to being NPV positive. A PI of less than 1.0 indicates negative net present value for the project.

5.3.1.5 Internal Rate of Return (IRR) :

Internal rate of return is the interest rate that discounts an investment's future cash flows to the present so that the present value of cash inflows exactly equals the present value of the cash outflows i.e. at that interest rate the net present value equals to zero.

The discount rate i.e. cost of capital is considered in determination of the net present value while in the internal rate of return calculation, the net present value is set equal to zero and the discount rate which satisfies this condition is determined and is called Internal rate of return.

Any investment that yields a rate of return greater than the cost of capital should be accepted because the project will increase the value of the firm.

Unlike, the NPV method, calculating the value of IRR is more difficult. The procedure depends on whether the cash flows are annuity (equal year wise) or non-uniform.

The following steps are taken in determining IRR for an annuity (equal cash flows):

1. Determine the payback period of the proposed investment.
2. From the table of Present value of Annuity look for year that is equal to or closer to the life of the project.
3. From the year column, find two Present Value or discount factor closest to payback period, one larger and other smaller than it.
4. From the top row of the table note, the two interest rates corresponding to these Present values as in (3) above.
5. Determine IRR by interpolation.

When cash flows is not uniform, an interest rate cannot be found using annuity tables.

Instead trial and error methods or a computer can be used to find the IRR. If the IRR is computed manually, the first step is to select an interest rate that seems reasonable (this can be done by calculating average annual cash flows by the annuity method as mentioned earlier) and then compute the present value of the individual cash flows using that rate.

If the net present value is positive, then the interest rate used is low, i.e. IRR is higher than the interest rate selected. A higher interest rate is then chosen and the present value of the cash flows is computed again.

If the new interest rates yield a negative net present value, then a lower interest rate is to be selected. The process is repeated until the present value of cash inflow is equal to the present value of the cash outflows. Finding the rate of return using trial and error methods can be tedious, but a computer can accomplish the task quite easily.

Advantages :

1. It possess the advantages, which are offered by the NPV criterion such as it considers time value of money, it takes into account the total cash inflows and outflows.
2. IRR is easier to understand. Business executives and non-technical people understand the concept of IRR much more readily that they understand the concepts of NPV.
3. It does not use the concept of the required cost of return (or the cost of capital). It itself provides a rate of return which is indicative of the profitability of the proposal. The cost of capital enters the calculation, later on.
4. It is consistent with the overall objective of maximizing shareholders wealth since the acceptance or otherwise of a project is based on comparison of the IRR with the required rate of return.

Limitations :

1. It involves tedious calculations.
2. It produces multiple rates, which can be confusing.
3. In evaluating mutually exclusive proposals, the project with the highest IRR would be picked up to the exclusion of all others. However, in practice, it may not turnout to be one which. is the most profitable and consistent with the objectives of the firm i.e. maximization of the wealth of the shareholders.
4. Under IRR method, it is assumed that, all intermediate cash flows are reinvested at the IRR rate. It is not logical to think that the same firm has the ability to re-invest, the cash flows at different, rates. In order to have correct and reliable results it is obvious, therefore, that they should be based on realistic estimates of the interest rate at which the income will be re-invested.
5. The IRR rule requires comparing the projects IRR with the opportunity cost of capital. But sometimes there is an opportunity cost of capital for 1 year cash flows, a different cost of capital for 2 year cash flows and so on. In these cases there is no simple yardstick for evaluating the IRR of a project.

5.3.1.6 Payout/Payback Method :

Also called the payout method it is a computationally simple project evaluation approach that has been used for many years. The procedure is to determine how long it takes a project to return the cost of the original investment.

Prob. 5.3.3 : M/s. A Ltd. has to invest ₹. 5 Lakhs in project A or Project B the estimated inflows of each project are as follows.

Year	Project A	Project B
Year 1	1,80,000	2,50,000
Year 2	1,10,000	1,50,000
Year 3	2,50,000	1,00,000
Year 4	1,80,000	1,10,000

You are required to evaluate both the projects by payback period method and suggest the best suitable to invest if company can invest anyone of the two.

Soln. :

Option I :

Step 1 : Calculate Cumulative Cash flow :

Year	Project A	Cumulative
1	1,80,000	1,80,000
2	1,10,000	2,90,000
3	1,50,000	4,40,000
*4	1,80,000	6,20,000

* Breakeven Year is the year in which Cash inflows = Cash flows. Since in the year 4 Cash inflow of ₹.6,20,000 > Cash outflow of ₹. 5,00,000. Year 4 is the breakeven year.

Step 2 :

$$\text{Payback period} = \text{Year previous to B.E.P} + \frac{\text{Cum.Cash Flow of B.E.P} - \text{Total Cash Outflow}}{\text{Cash flow during breakeven year}} \times 12 \text{ months}$$

$$= 3 \text{ Years} + \frac{6,20,000 - 5,00,000}{1,80,000} \times 12 \text{ months}$$

= 3 Years + 8 months. = 3 years and 8 months.

Option II :

Step I : Construct Cumulative cash flow

Year	Project B	Cumulative
1	2,50,000	2,50,000
2	1,50,000	4,00,000
*3	1,00,000	5,00,000
4	1,10,000	6,10,000

* Since in the 3rd year Cash inflows = Cash outflow 3rd year is breakeven year.

Conclusion :

Since Project B breakeven in 3rd year whereas Project A breakevens in 3 year and 8 months. We suggest the company to invest in Project B

Merits :

(i) This method is quite simple and easy to understand, it has the advantage of making it clear that there is no profit of any project unless the payback is over. When funds are limited it is always better to select projects having shorter payback periods. This method is suitable to industries where the risks of obsolescence are very high.

(ii) The payback period can be compared to a break-even point, the point at which costs are fully recovered but profits are yet to commence.

(iii) The risk associated with a project arises due to uncertainty associated with the cash inflows. A shorter payback period means less uncertainty towards risk.

Limitations :

(i) The method does not give any considerations to time value of money. Cash flows occurring at all points of time are simply added.

(ii) This method becomes a very inadequate measure of evaluating two projects where cash inflows are uneven.

(iii) It stresses capital recovery rather than profitability. It does not take into account the returns from a project after its payback period. Therefore, this method may not be a good measure to evaluate where the comparison is between two projects one involving a long gestation period and other yielding quick results only for a short period.

The Payback Reciprocal :

A simple method of calculating the internal rate of return is the payback reciprocal which is 1 divided by the payback period.

For example, a project has an initial cash outlay of Rs. 2,00,000 followed by 10 years of annual cash savings, of Rs, 50,000. The payback period is Rs. 2,00,000 / Rs. 50,000 = 4 years and the payback reciprocal is

$$\frac{1}{\text{Payback period}} = \frac{1}{4} = 25\%.$$

A major drawback of the payback reciprocal that it does not indicate any cutoff period for the purpose of investment decision. It is however, argued that the reciprocal of the payback would be a close approximation of the internal rate of return if the life of the project is at least twice the payback period and the project generates equal amount of the annual, cash inflows.

Syllabus Topic : Annual Equivalence Analysis

5.4 Annual Equivalence Analysis :

Introduction :

Q. Why is Annual Equivalence Analysis preferred over Present Worth Method ?

– We all have at some stage faced this dilemma of having bought a car, bike, television set or a washing machine and not known when it would make economic sense to replace it with a new one. How long should we keep the asset prior to replacing it? Now, it is simple that if the asset is kept for a longer period of time its initial cost, less any residual value that it will generate from its sale is spread over more years which is likely to reduce the cost per year of ownership. On the other hand, as the asset ages it is likely to require more maintenance and also there may be a loss in its efficiency. Hence, it becomes essential to determine the optimal time to replace the asset.

– On a personal level we may not think so deeply about this dilemma and most of our decisions when in such situations are based on what appeals to us rather than adopting a more logical and scientific approach. However, the same cannot be done when it comes to asset replacement decisions in companies as the stakes

in terms of money and other resources are high. In such a situation the company undertakes an annual equivalence analysis to arrive at a decision.

- Annual Equivalence Analysis (AE) and present worth analysis are the two main analysis techniques that are used by companies as decision making tools. However of the two, Annual Equivalence Analysis is recommended as its values are easy to use and are relevant to annual results. Also, the calculation of unit cost is required to determine price of items for sale. This also assists in the make-or-buy decisions which require the development cost to compare with the cost of buying the item from outside. Another important application of Annual Equivalence Analysis is the capital recovery factor that allows companies to calculate the annual equivalent cost of capital. The annual equivalent cost of capital plus the salvage value of the asset is capital recovery.
- Apart from the above mentioned benefits of annual equivalence analysis another drawback of the present worth analysis was that it required a common analysis period for all alternatives. However, similar restrictions do not apply to annual equivalence. Annual equivalence enables comparison between investment alternatives with different service lives. Analysis is required for a more or less continuing requirement irrespective of the useful service life of the asset. Naturally, we would select the asset with minimum annual cost. Thus, it is possible for an annual cost comparison among alternatives of different service lives provided there is a continuing need for the item. While comparing between alternatives with varying service lives the underlying assumption is that when the shorter-lived alternative has reached the end of its useful live, it can be replaced with an identical item with identical costs. This means that the equivalent annual cost of the initial alternative is equal to the new item that is replacing it. However, if the requirement for the item is only for a specific period means the requirement is not continuing then in such cases each item should be evaluated to see what costs will be incurred during the analysis period and the salvage value recoverable at the end of the analysis period.

5.4.1 Terms used in Annual Equivalence Analysis

Annual Equivalence (AE) comprises of two components :

1. Capital recovery (CR) for the initial investment at the stated interest rate (MARR)
2. Equivalent annual amount (A).

Meaning of few terms used in AE,

- **Initial Investment (P)** – is the total cost of all the assets and services used in initiating the project.
- **Salvage Value (SV)** – the recoverable value of the asset at the end of its useful life.
- **Equivalent Annual Amount (A)** – this is the annual operating cost
- **Operating Cost** – cost incurred in the operation of a physical plant or equipment and includes labour and raw material
- **Capital Cost** – is the cost incurred in purchasing assets to be used in production. Capital Costs are non recurring while operating costs are recurring and are incurred as long as the plant or equipment is in production
- **Capital Recovery Cost (CR)** – is the annual equivalent of capital cost

5.4.2 Calculation of Capital Recovery and Annual Worth Analysis

Capital Recovery (CR) is the equivalent annual cost of obtaining the asset plus the salvage value. Capital Recovery is a function of Initial Investment (P), Salvage Value (SV), interest (i%) and period (n).

Annual Worth (AW) comprises of Capital Recovery for the initial investment (P) at a stated interest rate (MARR) and the equivalent annual amount (A).

To find Capital Recovery Cost

Method I :

First compute the annual worth (AW) of the original cost and then add the AW of the salvage value.

Capital Recovery (CR) = – Initial Investment (P) $(A|P, i, n)$ + Salvage Value (SV) $(A|F, i, n)$

Method II :

The present worth of the salvage value is added to the original cost and then the annual worth of the sum is computed.

Capital Recovery (CR) = $\{ -P + SV (P|F, i, n) \} (A|P, i, n)$

Annual Worth = CR – A

Prob. 5.4.1 : A printing press owner purchased a printing machine for Rs 1,00,000/- . His operating cost is expected to be Rs 20,000/- per year and he expects to sell the machine for Rs 50,000/- five years from now. Calculate the equivalent annual worth of the printing machine at an interest rate of 10%.

Soln. :

Formula:

Capital Recovery (CR) = – Initial Investment (P) $(A|P, i, n)$ + Salvage Value (SV) $(A|F, i, n)$

$CR = -P(A|P, i, n) + SV(A|F, i, n)$

$= -1,00,000 (A|P, 10\%, 5) + 50,000 (A|F, 10\%, 5)$

$= -1,00,000 (.2638) + 50,000 (.1638)$

$= -26,380 + 8190 = -18,190$ /-

Annual Worth = CR – A

AW = – 18,190 – 20,000 = – 38,190

Prob. 5.4.2 : You have bought a new Honda Activa at a cost of Rs 60,000/- for commuting to the college. You plan to use it for the next four years and then sell it at a price of Rs 20,000/- . The annual maintenance of the vehicle is Rs 2,000/-. Calculate the equivalent annual worth of the vehicle at an interest rate of 8%.

Soln. :

Capital Recovery (CR) = – Initial Investment (P) (A|P, i, n) + Salvage Value (SV) (A|F, i, n)

$CR = -P(A|P, i, n) + SV(A|F, i, n)$

$= -60,000(A|P, 8\%, 4) + 20,000(A|F, 8\%, 4)$

$= -60,000(.3019) + 20,000(.2219)$

$= -18114 + 4438 = -13,676$

Annual Worth = CR – A

$= -13,676 - 20,000 = -33,676$

Prob. 5.4.3 : A machine proposes to purchase a machine costing Rs 2,50,000. The salvage value of the machine after 5 years is expected to be 1,25,000/- and the interest rate is 10%. Will a revenue of 39,000/- be sufficient to cover the capital cost ?

Soln. :

Capital Recovery (CR) = – Initial Investment (P) (A|P, i, n) + Salvage Value (SV) (A|F, i, n)

$CR = P(A|P, i, n) + SV(A|F, i, n)$

$= -2,50,000(A|P, 10\%, 5) + 1,25,000(A|F, 10\%, 5)$

$= -2,50,000(.2638) + 1,25,000(.1638)$

$= -65,950 + 20,475 = -40,950$

No a yearly revenue of 39,000 will not be sufficient to cover the capital cost an additional revenue of 1,950/- will be required.

Prob. 5.4.4 : Calculate the Annual Worth for the following cash flow. Assume MARR to be 9% per year.

Particulars	Year	Amount
Initial Investment	0	2,00,000
Initial Investment	1	1,00,000
Annual Operating Cost	1 – 5	30,000
Salvage Cost	5	1,00,000

Soln. :

The first step would be to calculate the Capital Recovery

Method I :

$CR = \{-2,00,000 - 1,00,000(P|F, 9\%, 1)\}(A|P, 9\%, 5) + 1,00,000(A|F, 9\%, 5)$

$= \{-2,00,000 - 1,00,000(.6499)\}(.2571) + 1,00,000(.1671)$

$= \{-2,00,000 - 64,990\}(.2571) + 16,710$

$= -68,129 + 16,710 = -51,420$

Method II :

$CR = \{-2,00,000 - 1,00,000(P|F, 9\%, 1) + 1,00,000(P|F, 9\%, 1)\}(A|P, 9\%, 5)$

$= \{-2,00,000 - 1,00,000(.6499) + 1,00,000(.6499)\}(.2571)$

$= -51,420$

Annual Worth :

$CR = -51,420 - 30,000 = -81,420$

5.4.3 Annual Worth Analysis to Evaluate Alternatives

- Rules for Evaluating Alternatives using Annual Worth Analysis
- For alternatives that are mutually exclusive, the annual worth needs to be calculated for one life cycle at MARR
- When there is only one alternative then the $AW \geq 0$ i.e. MARR is met or exceeded
- When there are two or more alternatives the alternative with the higher AW value should be selected

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Prob. 5.4.5 : A printing press owner is in a dilemma as he has to select between two machines with similar printing capabilities. Help him in arriving at a decision based on the following data provided by him also the minimum rate of return is 10% per year.

Particulars	Machine A	Machine B
Initial Cost	2,00,000	3,00,000
Annual Operating Cost	20,000	30,000
Salvage Cost	75,000	1,25,000
Life Years	5	6

Soln. :

$AW_A = -2,00,000(A|P, 10\%, 5) + 75,000(A|F, 10\%, 5) - 20,000$

$= -2,00,000(.2638) + 75,000(.1638) - 20000$

$= -60,475$

$AW_B = -3,00,000(A|P, 10\%, 5) + 1,25,000(A|F, 10\%, 5) - 30,000$

$= -1,04,618$

Thus, your advice should be to select machine A as $AW_A > AW_B$

Prob. 5.4.6 : The owner of the printing press calls you again asking you for your advice as there has been a change in his plans. He plans to quit the business after 3 years and although the other figures remain the same there is a change in the salvage value of both machines.

The salvage value of Machine A is now 90,000 while that of machine B is now 2,25,000. Which machine should he now select ?

Soln. :

$AW_A = -2,00,000\,(A|P, 10\%, 3) + 90,000\,(A|F, 10\%, 3) - 20,000$

$= -2,00,000\,(.4021) + 90,000\,(.3021) - 20000$

$= -80420 + 27189 - 20000 = -73231$

$AW_B = -3,00,000\,(A|P, 10\%, 3) + 2,25,000\,(A|F, 10\%, 3) - 30,000$

$= -3,00,000\,(.4021) + 2,25,000\,(.3021) - 30000$

$= -1,20,630 + 67,972 - 30000 = -82,658$

As the AW of machine B is lower than AW of machine A he should still persist with machine A.

5.4.4 Annual Worth of a Permanent Investment

- If an investment has an infinite life it is a permanent investment. The annual worth of such an investment is i times the present worth (P) of that investment.

$$AW = P \times i$$

Prob. 5.4.7 : The municipal corporation has two alternatives with respect to a cricket stadium. The first alternative is to repair the existing stadium and the second is to construct a new stadium. Interest for both the projects is 8%. The cost for each alternative is given below.

Alternative I :

Repairing will be required each 6 years at a cost of 5,00,000/-. The annual cost of maintenance shall be 30,000/-. New equipment worth 50,000/- purchased for repair work will have to be replaced after 3 years with a salvage value of 5000.

Alternative II :

The cost of rebuilding the stadium is 50,00,000/- and is expected to last indefinitely. However, maintenance cost is expected to be 30,000/-.

Soln. :

The Annual Worth (AW) of Alternative I:

Cycle – 6 years

Repairing Cost $= -5,00,000\,(A|P, 8\%, 6) = -1,08,150$

First three years

$\{-50,000 + 5000\,(P|F, 8\%, 3)\}\,(A|P, 8\%, 6) = -9957$

Second three years

$\{[-50,000 + 5000\,(P|F, 8\%, 3)](P|F, 8\%, 3)\}\,(A|P, 8\%, 6) = -7432$

Thus, the total annual cost for repair and maintenance shall be $= -1,08,000 - 9957 - 7432 - 30000 = -1,55,389$

Annual Worth of Alternative B

Cost of Construction $= -50,00,000$

Annual Cost $= 50,00,000\,(.08) = 4,00,000$/-

Maintenance Cost $= -30,000$/-

Total Cost $= -4,00,000 - 30,000 = -4,30,000$/-

The corporation should continue with the existing stadium.

Prob. 5.4.8 : A person has purchased a second hand car which is not in very good condition both mechanically as well as aesthetically. Now he has the to select between the two options that he has, one of merely servicing and carrying out some minor touch ups to the car or to totally overhaul the car and paint it totally. The cash flows for both the options are available with him and if the interest rate is 10% help him select between the two options.

Option A :

Initial Cost of Car – 5,00,000

Initial Maintenance Cost – 25,000

Annual Maintenance Cost – 10,000

Salvage Value after 3 years – 2,00,000

Life Years - 3

Option B :

Initial Cost – 5,00,000

Initial Maintenance Cost – 75,000

Annual Maintenance – 5,000

Salvage Value – 2,80,000

Life Years - 3

Soln. :

$AWA = -5,25,000(A|P, 10\%, 3) + 2,00,000(A|F, 10\%, 3) - 10,000$

$= -5,25,000(.4021) + 2,00,000(.3021) - 10,000$

$= -2,11,102 + 60,420 - 10000 = -1,60,682$

$AW_B = -5,75,000(A|P, 10\%, 3) + 2,80,000(A|F, 10\%, 3) - 5,000$

$= -5,75,000(.4021) + 2,80,000(.3021) - 5,000$

$= -2,31,207 + 80588 - 5000$

$= -1,55,619$

The Annual Worth of option B is better than the annual worth of option A and therefore it makes sense to go with option B.

Prob. 5.4.9 : A person has two proposals with respect to his existing bungalow which is in a very bad state. The first proposal is to undertake minor repair work and repaint the bungalow. The second proposal is to demolish the existing bungalow and construct a new one in its place. The cash flows for both these proposals are given below and if the interest rate is 10% which proposal should he implement.

Proposal A :

Initial Cost – 2,00,000

Annual Maintenance – 20,000

Salvage Cost – 50,000

Life Years – 5

Proposal B :
Initial Cost – 7,00,000
Annual Maintenance – 5,000
Repair Work every 5 years – 20,000
Life Years – permanent

Soln. :

$AW_A = -2,00,000(A|P, 10\%, 5) + 50,000\ (A|F, 10\%,5) - 20,000$

$= -2,00,000(.2638) + 50,000(.1638) - 20,000$

$= -64,570$

$AW_B = -7,00,000\ (0.10) - 20,000(A|F, 10\%,5) - 5,000$

$= -78,276$

The person needs to select the first proposal.

Prob. 5.4.10 : The initial investment for a project with infinite life is Rs 10,00,000/-. The annual maintenance charge will be Rs 40,000/- with an additional charge of 60,000/- which will be incurred every 5 years. Determine the perpetual equivalent annual worth at an interest rate of 10%.

Soln. :

$AW = -10,00,000(0.10) - 40,000 - 60,000\ (A|F, 10\%,5)$

$= -1,00,000 - 40,000 - 60,000(.1638)$

$= -1,49,328$

Case Study

Comparative Analysis of Software Enterprises from Similar Domain

Introduction :

When it comes to carrying out a comparative analysis between software enterprises from similar domains the obvious choice for any person would be the highly competitive and burgeoning e-commerce market of India. Nowhere in the business world do we get to experience such cut throat competition to get a larger piece of the pie. Why it becomes a very interesting case study is because of the intensifying battle between the top three players in the Indian e-commerce arena and that too when the losses for all three major players are mounting at an alarming pace. The three top players are at each other's throat, the competition is fierce would be an understatement.

E-Commerce in India is one of the fastest growing & emerging economies of the world, having a very huge consumer base & a big mass connected to Internet. The E-business trend have been catching up in the country with the increasing rates of local& domestic firms using the E-business model to do business which is very different from the traditional way of doing business in India, it has lead to a interesting trend in the market for the online shopping starting right from ordering food, grocery, vegetables, fruits, taxis, etc.

The top three players in the Indian e-commerce market are Flipkart with an estimated market share of 40% followed by Snapdeal at second position with 30% share and last but hot on heals of the top two is Amazon with an estimated market share of 20%. This is the picture of the Indian e-commerce industry. Although, Amazon is the latest entrant in market it has crossed a billion dollar in sales and is growing at a rapid pace.

Flipkart :

The first in the then nascent e-commerce market of India was Flipkart. Flipkart was founded in year 2007 by the Bansal brothers, Sachin and Binny who were former employees of Amazon. The founders initially thought of a price comparison website – an aggregator of e-commerce sites but they realized that there was hardly any e-commerce sites in India then and thus decided to launch their own e-commerce site Flipkart. Based on their experience with Amazon the brothers innovated and offered many firsts like 24/7 customer support, cash on delivery which was very unique and tailor made for the Indian market, as well as a return policy. The Flipkart model is similar to that of Amazon and banks on controlling end to end value chain i.e. right from procurement to delivery is controlled by service provider.

Perhaps the biggest success factor for Flipkart is its site which is very easy to navigate, helps users to easily search for the contents or products online, it even allows users to search by using various filters like by price range, search by brands, by age group, by hot-selling etc. If a certain product is not available or is out of stock it even ask users to input its details & then when the products is available the desired users are informed, this really helps one connected to the products they are seeking & leads to repeat & frequent purchases. The Flipkart site is fast & powerful, i.e. if you Search any products in the Flipkart search bar and you'll find exactly what you looking in likes no time & it's very quick to process the payments & transactions by a very efficient & flexible payment mechanisms of the portals. Approximately 60% of orders are placed in cash on delivery system. So there is high possibility scams & frauds, so users have to have their email account linked & with verified details & receives a confirmation code message on their cell phones or email, after which the users confirms the unique code& the transaction is processed & usually get delivered in 2-3 business days on the confirmed mailing address. Flipkart manages to deliver the item in 2-3 business days. If the order placed is not delivered in the specified time, immediate enquiry goes to nearest supplier and the item becomes available. It will then be delivered within 24 hour depending on the cause of delay. Flipkart is continuously aiming to bring down the delivery time of regular orders, in doing so its investing in its own delivery system & network, As the time to delivery is one of the important aspects of selling products online as users want a fast turnaround time, it's an excellent marketing strategy by Flipkart marketing team to increase the sales revenues & to optimize the user shopping experience & increasing loyalty by repeat purchases. The portals offers a good pricing offers & deals to its users by the means of cash rewards, loyalty points, discounts, coupons, Frequent buyer rewards points. It even offers goods relatively cheaper pricing points than it is available in the physical market which in total helps users save money & at the same time get benefited by the means of rewards points

Snapdeal :

The next to enter the e-commerce market was Snapdeal which was founded in the year 2010 by Kunal Bhal and Rohit Bansal in the year 2010. Snapdeal is a daily deals website that features discount offers across lifestyle segments such as dining, health & beauty, entertainment and travel. It also offers discounts on products like electronics, perfumes, watches, bags, sunglasses, coaching classes, apparels and mobile phones. Snapdeal.com serves as an advertising platform for merchants and a discount platform for customers. For the merchants who partner with Snapdeal, it is a cost- effective channel for acquiring new customers. It also works as a risk-free alternate marketing channel. From the merchant's standpoint, they are passing on the customer acquisition cost in the form of a discount offer. Snapdeal gets the best offer possible from the merchants from around 65 cities across India and then deducts a small amount of commission.SD aims at showing at least 40- 90% off in the deals from what actually one has to pay. Depending upon how good the offer is, Snapdeal deducts their commission starting from Rs. 99 going up to Rs. 299. More than 50-60 thousand products are available online for customers to choose from.

Amazon :

Amazon, which launched its Indian arm in 2013 - six years after Flipkart was founded and three years after Snapdeal - already has a formidable presence in the country.

The company's investment commitment to India is now higher than the total funds raised till now by both Flipkart and Snapdeal together. And it looks like Amazon is rapidly rising to the top. On May 28, it had 24.1% monthly active users (MAU), way higher than Snapdeal's 13.1%. MAU represents the share of mobile users in India who open a company's app at least once in a given month.

The Challenge :

The common thread between all the three e-commerce giants is that they advertise aggressively on television and print to build their recall value. They battle to be the first to announce category launches, new services and funding. All the three companies resort to 'gap funding' i.e. they make up for the difference by paying sellers and charging the difference in cost to their promotional expenses. The extent to which this is bleeding all the three companies is unbelievable. It is estimated that all the three have to bear a loss of 100 million dollars every month. Flipkart has the highest cash burn rate but then it also raised the largest amount - some $2.3 billion so far. Snapdeal has raised close to $1 billion in 2014, while Amazon India is backed by a parent which has pledged $2 billion investment in the Indian marketplace. All will probably need even more money. To win market share, all three discount constantly and add to their already humungous losses. Flipkart, in 2013/14, ran losses of Rs 400 crore whereas Snapdeal lost Rs 265 crore, and Amazon Rs 321 crore. Some estimates say Flipkart and Snapdeal have roughly enough cash to last out a year and a half at current burn rates. And this war is unlikely to be settled within that time period.

The Question :

It seems that no one wants to back out of the fight which is bleeding them all. As a new entrant in the management of any of the three companies what would your advice be to stem the rot. Will you advice them to compete on continuous new offerings and more selection of products and services and faster delivery. Will low prices still remain the defining factor or will other factors dominate. How can these e-tailers innovate to reduce the seller's expenses. How can 'gap funding' be reduced or eliminated.

Study this market and try and find answer to these questions.

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UNIT - VI

CHAPTER

6

Understanding Cash Flow and Taxes

Syllabus

Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up companies.

6.1 Introduction of Cash Flow & Taxes :

Cash Flow Statement reveals the causes of changes in cash position of business concern between two dates of Balance Sheets.

According to Accounting Standard an enterprise should prepare a cash flow statement and should present it for each period with financial statements prepared. Accounting Standard has also given the meaning of the words cash, cash equivalent and cash flows.

1. **Cash :** This includes cash on hand and demand deposits with banks.
2. **Cash equivalents :** This includes purely short term and highly liquid investments which are readily convertible into cash and which are subject to an insignificant risk of changes in value. Therefore an investment normally qualifies as a cash equivalent only when it has a short maturity, of say three months or less.
3. **Cash flows :** This includes inflows and outflows of cash and cash equivalents. If the effect of transaction results in the increase of cash and its equivalents, it is called an inflow (source) and if it results in the decrease of total cash, it is known as outflow (use cash of).

In the succeeding section, we shall be discussing cash flows particularly in relation to projects along with the study of the various elements of cost that are needed in its analysis.

Syllabus Topic : Accounting for Depreciation

6.2 Accounting for Depreciation :

Introduction :

- Apart from assets such as land, goodwill, livestock, and research and development, all other assets (building, machines & equipments) degrade (efficiency reduces) with the passage of time. The degradation could be on account of wear and tear caused by its constant use or by the advent of new technology rendering the older technology redundant.
- Whatever be the reason for degradation it finally impacts the value of the asset. The reduction in the value of the asset is known as depreciation. Hence, to overcome this loss and to be able to replace the asset, every organization sets aside certain percentage of the cost of the asset from its profits (permissible deduction by tax authorities) to raise a depreciation/sinking fund to enable it to replace the asset with a new one.
- The sum is calculated using this simple formula "Initial cost of asset + Repair cost – Scrap value", and is charged to overheads and spread over the estimated useful life of the asset. The amount is deducted from the profits of the organization and is kept in a separate account.

6.2.1 Definition of Depreciation :

Q. What is Depreciation ?

- Depreciation is a measure of the wearing out, consumption or other loss of value of a depreciable asset arising from use, effluxion of time or obsolescence through technology and market changes. In other words "Depreciation is allocated so as to charge a fair proportion of the depreciable amount in each accounting period during the expected useful life of the asset". Depreciation includes amortization of assets whose useful life is predetermined.
- According to **W. Pickles**, "Depreciation is the permanent and continuing diminution in the quality, quantity or value of an asset".
- According to **Spicer and Pegler**, "Depreciation may be defined as the measure of the exhaustion of the effective life of an asset from any cause during a given period".
- According to **American Institute of Chartered Public Accountants (AICPA)** "Depreciation accounting is a system of accounting which aims to distribute the cost or other basic value of tangible capital assets, (fixed assets) less salvage (if any) over the estimated useful life of the unit (which may be group of assets) in a systematic and rational manner. It is process of allocation, not of valuation".

6.2.2 Causes of Depreciation :

Q. State the causes of depreciation.

The main causes of depreciation are as follows:

a. Physical deterioration : Physical deterioration is caused by :

(i) Normal wear and tear resulting from use.

(ii) Rust, rot, erosion etc. arising from exposure to wind, rain, sun and other climatic factors.

(iii) Careless handling of the asset when it is used or operated.

b. Economic factors : These factors prove the use of asset uneconomical though the asset is in good physical condition. This arises due to

(i) Obsolescence caused by invention of improved techniques or equipment.

(ii) Decline in demand by change in customers taste for articles producible from the existing machinery or plant.

(iii) Inadequacy which refers to the termination of the use of present asset due to increase in the volume of activities. In other words an asset may get exhausted through working. This is the case with ore mines, oil wells. On account of continuous extraction of minerals or oil a stage may come when the mines or wells get completely exhausted and work has to be terminated or stopped. Reduction in value of mine is thus considered as depreciation.

c. Passage of time (Effluxion) : There are certain assets, such as lease, patents, licenses, copy right, which lose their value to zero at the end of fixed period of time. It is immaterial whether it is used or not. Hence, it should be written off gradually during the entire period of its legal life in order to write it off fully by the end of the life. Any provision made to write off this type of asset is known as amortization rather than provision for depreciation.

d. Depletion: Depletion is one of the internal causes of decrease in the value of wasting assets as mine, quarries, oil wells, forest-stand etc. This decrease in value of wasting asset is called depletion and not depreciation.

e. Accident: An asset may meet an accident and thus lose its value. Such reduction in value is also treated as depreciation.

6.2.3 Different Methods of Depreciation :

Q. Briefly describe the different methods of depreciation.

The following are the popular methods applied by the various enterprises. These methods may be classified as follows:

I. Straight line method/ Fixed Installment Method/ Original Cost Method:
II. Written down value method/ Reducing Balance method/ Diminishing Balance method of charging depreciation.
III. Sinking Fund Method

I. Straight Line Method/ Fixed Installment Method/ Original Cost Method :

The amount of depreciation to be charged or written off every year under this method is same or equal.

The amount is calculated by deducting the estimated value of scrap from the cost of the asset (cost means original cost plus installation charges) and dividing the result by estimated life of the asset. Thus the amount of depreciation depends on the :

a) Cost price of the asset.

b) Estimated scrap value of the asset.

c) Estimated life (period) of the asset.

In this method asset is written – down in value each year by the same or fix amount. This amount is such that the book value of an asset is reduced to zero at the end of its life. This method assumes that the cost expiration of an asset is uniform throughout in its effective life. This method is useful for those assets whose working life can easily be estimated i.e. period based assets i.e. patent rights or lease, where the effective life of asset is measured in terms of time irrespective of the use or service from the asset.

Formula for charging yearly depreciation

$$\textbf{Depreciation (p.a.)} = \frac{\text{Cost of Asset + Installation charges – Estimated scrap value}}{\text{Estimated useful life of asset}}$$

6.2.4 Illustration on Straight Line Method

Prob. 6.2.1 : A printing machine has been purchased by M/s Excel Printing for Rs 15, 00,000/-. An additional expenditure of Rs 1, 00, 000/- has been incurred on transportation and erection of the machine. The machine is expected to have a working life of ten years. The estimated scrap value of the machine is estimated to be Rs 2, 00, 000/-.

a) What should the rate of depreciation of the machine per year be assuming straight line method of depreciation?

b) What amount would be available in the depreciation fund after half the life of the machine ?

c) Suppose a major accident were to happen after five years needing repairs of Rs 2, 00, 000/- what will the new rate of depreciation then be?

Soln. :

(a) Total cost of the machine = Cost of machine + Erection cost

= 15, 00, 000 + 1, 00, 000

= 16, 00, 000

Scrap Value = 2, 00, 000

Life of the machine = 10 years

Rate of Depreciation

$$= \frac{\text{Cost of Asset + Installation charges – Estimated scrap value}}{\text{Estimated useful life of asset}}$$

$$= 16,00,000 - 2,00,000 / 10$$

$$= 1,40,000$$

Total money in the depreciation fund at the end of 5 years

$$= 5 * 1,40,000$$

$$= 7,00,000$$

Book value of the Machine at the end of 5 years

$$= 15,00,000 - 7,00,000$$

$$= 8,00,000$$

Cost of Repairs = 2,00,000

New Book Value = 10,00,000 (8,00,000 + 2,00,000)

Residual Life of Machine = 5 years

New Rate of Dep = 10,00,000 / 5

= 2,00,000

6.2.4.1 Advantages of Straight Line Method :

Q. State the advantages of straight line method of depreciation

a) The method is simple and easy to understand.

b) No details records of yearly output or usage of hours are required.

c) Since the life of certain assets such as patent rights and lease etc. depends on the agreement and period of time, almost similar benefits may be derived from these assets throughout their life.

d) This method is most useful since it assumes that favorable impacts of some factors are offset by unfavorable effects of some other factors.

6.2.4.2 Disadvantages of Straight line Method :

Q. State the disadvantages of straight line method of depreciation

a) This method does not take into consideration the interest on capital invested in fixed assets.

b) Initial period the repairs of any new assets are low and later when it becomes older its service rendering capacity reduces while repairing charges increases and hence there will be excess burden of depreciation on profit and loss account than its absorbing capacity.

c) The method becomes complicated in case various machines are frequently purchased and sold.

d) Under this method the amount of depreciation remains constant even during the period of inflation where maintenance of capital becomes difficult.

e) This method is not recognized by Income Tax authorities.

II) Written Down Value Method / Reducing Balance Method / Diminishing Balance Method of Charging Depreciation.

This method of depreciation is also known as reducing balance method or diminishing balance method. Under this method, a fixed rate on the Opening balance of the asset is charged as depreciation every year. Since a fixed rate of depreciation is applied to the written down value, the amount of depreciation charged every year decreases over the life of the asset. In other words though the percentage at which depreciation is charged remains fixed, the amount of depreciation goes on reducing year after year, because fixed percentage is applied to the diminishing value of the asset. Thus the amount of depreciation is higher at the earlier periods and then becomes lower in the subsequent period when repairs and maintenance charges increase gradually. This method is suitable for those assets which have a longer life and which is difficult to be estimated.

This method is used in cases of those fixed assets where the initial repair charges are less and the repair charges are gradually increasing in the years to come. The written down value of an asset is calculated by applying the following formula.

Formula :

Annual Depreciation = Opening Balance × Rate of Depreciation.

$$\text{Depreciation rate} = 1 - (\text{Scrap / Cost of Machine})^{1/\text{Years}} \times 100$$

Or

$$\text{Depreciation rate} = \sqrt[\text{Year}]{\left(1 - \frac{\text{Scrap Value}}{\text{Cost of Assets}}\right)} \times 100$$

Annual Depreciation

Written down value = W = C (1 – r/100)

Where,

W = Stands for written down value

C = The original cost

R = Rate of depreciation

6.2.5 Illustration on Reducing Balance Method

Prob. 6.2.2 : Cost of the machine ₹ 1,00,000 Erection/Installation charges ₹10,000 Estimated scrap value at the end ₹ 10,000 Estimated life of the machine 5 years.

Find out :

a) The rate of depreciation

b) The written down value of the asset.

Soln. :

$$\text{Depreciation rate} = \sqrt[\text{Year}]{\left(1 - \frac{\text{Scrap Value}}{\text{Cost of Assets}}\right)} \times 100$$

$$= \sqrt[5]{\left(1 - \frac{10,0000}{1,10,000}\right)} \times 100 = 38.09\ \%.$$

Reducing Balance method.			
	Cost	Depreciation	Balance
1st Year	1,10,000	41,899	68,101
2nd Year	68,101	25,940	42,161
3rd Year	42,161	16,059	26,102
4th Year	26,102	9,942	16,160
5th Year	16,160	6,155	10,005

We see from above table the approximate value remaining in the Machinery account will be ₹ 10,000 and by selling the scrap the amount will be credited and it will be get closed.

6.2.5.1 Advantages of Reducing Balance Method

1. This method is recognized under Income Tax Act and The Companies Act.
2. The combined charge for depreciation and repairs is almost equal every year.
3. The value of asset is never completely reduced to zero. Hence, the existence of the asset is always disclosed by the accounts and as long as it is in use in business.
4. Re-calculation is not necessary when additional assets are purchased.
5. The amount of depreciation decreases continuously with the gradual decrease in service available from the asset.

6.2.5.2 Disadvantages of Reducing Balance Method

1. Under this method asset is never completely depreciated.
2. The method does not take into account interest on capital invested in the asset.
3. Under this method longer period is required to reduce the assets value to negligible amount.
4. The method does not help to ascertain properly the cost of goods manufactured since the cost of production per unit of goods manufactured will be reduced as a result of reduced amount of depreciation.
5. The calculation of depreciation under this method is difficult than fixed installment method.
6. This method gives too much importance to historical/original cost of the asset.

Though the method has its own disadvantages, it is found suitable for plant and machinery, furniture and fixture, land and building i.e. on those fixed assets which have a longer life and is difficult to estimate.

III. Sinking Fund Method :

Depreciation under the Sinking Fund Method is not calculated on percentage but is charged as a fixed amount per year and is invested at the best possible rate of compound interest. The fixed amount charged every year is based on the assumed life of the asset, the compound interest earned over the amount invested over its life, and the scrap value of the asset. The total of all these should equal the initial cost of the asset.

Formula :

$$D = \{ C - S \} [1/ (1+i)^{n} - 1]$$

Where:

C is the Initial Cost of the asset

S is the Scrap Value of the asset

i is the rate of interest on the accumulated fund

n is the assumed number of years of life of the machine

6.2.6 Illustration on Sinking Fund Method :

Prob. 6.2.3 : A printing machine was purchased for Rs 10, 00, 000/- by M/s Excel Printing and an additional expense of Rs 1, 00, 000/- was incurred for its erection. The estimated life of the machine is 12 years and the resale value or its residual value is estimated to be Rs 2, 00, 000/-. The money in depreciation fund is invested at an interest rate of 10%. Calculate the depreciation amount per year using the Sinking Fund Method.

Soln. :

Depreciation (D) = $\{ C - S \} [1/ (1+i)^{n} - 1]$

Given :

C – the initial cost of the machine + erection expense = 10,00,000 + 1,00,000 = 11,00,000

S – the residual value of the machine = 2,00,000/-

i – the rate of interest = 10%

n - the assumed number of years of the life of the machine = 12 years

By Substituting :

$\therefore D = \{11,00,000 - 2,00,000\} [1/ (1+10)^{12} - 1]$

$= 9,00,000 \times 0.0468$

$= 42,120$ is the required depreciation per year.

6.2.6.1 Advantages of Sinking Fund Method :

1. This method enables the organization to accumulate the amount of depreciation which can be readily available to replace the asset at the end of its life.
2. This method incorporates the advantages of depreciating the value of the asset as well as accumulating an amount which will enable the organization to replace the asset.
3. Sinking fund method helps to strengthen financial position of a concern.

6.2.6.2 Disadvantages Sinking Fund Method :

1. The burden on profit and loss account goes on increasing as years pass by since the amount of depreciation every year remains same but the amount spent on repairs goes on increasing as the asset become old.
2. Sinking fund method creates complication due to frequent investment.
3. Prices of securities may fall at the time when they are to be realized as a result of which loss may have to be suffered.

6.2.7 Depreciation Entries in Company Accounts :

After ascertaining the amount of depreciation or rate of depreciation, recording of depreciation, recording of depreciation in the books of accounts is made as follows :

When no provision for depreciation account is maintained :

Journal Entries are :

Date	Particulars		L.F.	Amount	Amount
1	**When Asset is purchased**				
	Assets Account	Dr		x	
	To Bank Account	Cr			x
2	**For payment of installation charges**				
	Asset Account	Dr		x	
	To Bank Account	Cr			x
3	**For providing depreciation on Asset**				
	Depreciation Account	Dr		x	
	To Asset Account	Cr			x
4	**For closing depreciation account**				
	Profit & Loss Account	Dr		x	
	To Depreciation Account	Cr			x
5	**For Sale of Asset**				
	Bank Account	Dr		x	
	To Asset Account	Cr			x
6	**For Profit on Sale of Asset**				
	Assets Account	Dr		x	
	To Profit & Loss Account	Cr			x
7	**For Loss on Sale of Asset**				
	Profit & Loss Account	Dr		x	
	To Assets Account	Cr			x

Under this method amount of depreciation is charged to an Assets account by debiting depreciation account and crediting Assets account. Depreciation account is closed by transferring it to Profit and Loss Account. The asset will be shown in the Balance Sheet at its written down value i.e. cost of asset less depreciation every year.

Prob. 6.2.4 : A company purchased a second-hand machinery on 1st Jan 2009 for ₹ 17000 and spent immediately for its repairs ₹ 1800 and for its erection ₹ 1200 on 1st Oct. 2009 it purchased another machine for ₹ 10000 and on 1st April 2010 it sold off the first machine (purchased on 1st Jan 2009) for ₹ 16000. On the same date it purchased a new machine for ₹ 25000. On 1st July 2011 it purchased a second hand machine for ₹ 8000/- and spent for its repairs and erection ₹ 2000 immediately. On the same date it sold the second machine for ₹ 8500.

Depreciation to be charged at 10% on the original cost and accounts are closed on 31st December every year. Give journal entries and prepare machinery account for the year 2009, 2010 and 2011.

Soln. :

Journal entries

Date	Particulars		L/F	Debit ₹	Credit ₹
Jan. 1, 09	Machinery A/c	Dr.		17,000	
	To Bank A/c	Cr.			17,000
	(Being machinery purchased)				
	Machinery A/c	Dr.		1,800	
	To Bank A/c	Cr.			1,800
	(Being incurred for repairs)				
	Machinery A/c	Dr.		1,200	
	To Bank A/c	Cr			1,200
	(Being erection exp. Paid)				
Oct. 1, 09	Machinery A/c	Dr		10,000	
	To Bank A/c	Cr			10,000
	(Being machinery purchased)				
Dec. 31, 09	Depreciation A/c	Dr		2,250	
	To Machinery A/c	Cr			2,250
	(Being dep. charged @ 10% on 20,000 for one year and on 10,000 for three months)				
April 1, 10	Machinery A/c	Dr		25,000	
	To Bank A/c	Cr			25,000
	(Being machinery purchased)				
	Depreciation A/c	Dr		500	
	To Machinery A/c	Cr			500
	(Being dep. charged @10% on 20,000 for three months)				
	Bank A/c	Dr		16,000	
	Loss on sale of machine A/c	Dr		1,500	
	To Machinery A/c				17,500
	(Being machinery purchased on 1st Jan 89 sold off)				
April 31, 10	Depreciation A/c	Dr		2,875	
	To Machinery A/c	Cr			2,875
	(Being dep. charged @10% on 10,000 for one year and on ₹ 25,000 for nine months)				
July 1, 11	Machinery A/c	Dr		8,000	
	To Bank A/c	Cr			8,000
	(Being machinery purchased)				
	Machinery A/c	Dr		2,000	
	To Bank A/c	Cr			2,000
	(Being erection exp. paid)				
	Depreciation A/c	Dr		500	
	To Machinery A/c	Cr			500
	(Being dep. charged @10% on ₹ 10,000 for six months)				
	Bank A/c	Dr		8,500	
	To Machinery A/c	Cr			8,250
	To profit on Sale of Machinery				250
	(Being machinery costing ₹ 10,000 purchased on 1st Oct 89, sold off)				

Date	Particulars		L/F	Debit ₹	Credit ₹
Dec 31, 11	Depreciation A/c	Dr		3,000	
	To Machinery A/c	Cr			3,000
	(Being dep. @ 10% on 25,000 for one year and on 10,000 for six month)				

Dr. Machinery Account Cr.

Date	Particulars	JF	₹	Date	Particulars	JF	₹
1.1. 89	To Bank A/c		17,000	31.12.09	By Dep. A/c		2,250
	To Bank A/c		1,800				
	To Bank A/c		1,200	31.12.09	By Bal C/d		27,750
1.10.09	To Bank A/c		10,000				
			30,000				30,000
1.1.10	To Bal b/d		27,750	1.4.10	By Dep. A/c		500
1.4.10	To Bank A/c		25,000		By Bank A/c		16,000
					By Loss on sale		1,500
				31.12.10	By Dep. A/c		2,875
				31.12.10	By Bal C/d		31,875
			52,750				52,750
1.1.11	To Bal b/d		31,875				
1.7.11	To Bank A/c		8,000	1.7.11	By Dep.		500
	To Bank A/c		2,000		By Bank A/c		8,500
	To Profit on sale		250	31.12.11	By Dep. A/c		3,000
				31:12.11	By Bal C/d		30,125
			42,125				42,125
1.1.12	To Bal b/d		30,125				

Working Note

1) Loss on Sale of Machine = 18,000 – 500 (dep.) – 16,000 (selling price) = 1500
2) Profit on sale of Machine = Selling price – Dep. Value of Machine = 8,500 – (8,750 Less 500)
= 8,500 – 8,250 = 250

Syllabus Topic : Accounting for Taxes

6.3 Accounting for Taxes :

The Finance Minister is the head and incharge of TAX collection for the Central Govt. There are two types of taxes from the point of view of collection and authority, viz. Central Govt. taxes and State Govt. Taxes. There as two main types or categories of taxes as explained below. Taxes are the **"source of revenue"** for the Govt. and paid by the Indian public as well as all types of business forms.

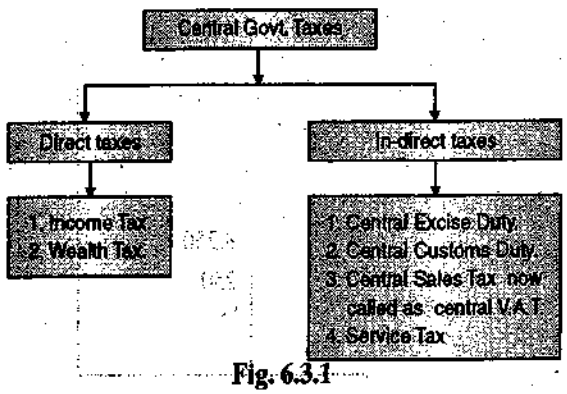

Fig. 6.3.1

Basic terms and Definitions :

1. **Previous Year - (P. Y.)**

Year is a period of 12 months, beginning from 1st April and ending on 31st March next year. Previous year is a year in which **income is earned** by a person (who is called as an Assessee). Previous year is hence called as **income year**. It is a year which is just before (immediately preceding) the Assessment year.

2. **Assessment Year - (A. Y.)**

Assessment year is a period of 12 months, also beginning from 1st April and ending on 31st March. It is a year in which the **income tax** is **calculated or Assessed** and **paid**. Assessment year is the year, which is immediately after the previous year. It is also called as **Tax payment** year.

E.g. Suppose the previous year (income year) is 1st April 2009 to 31st March 2010, then the assessment year will be **2010-11.**

A.Y. and P.Y. will change every year and so does the rules for each year. All changed rules are always applicable to the A.Y. only. The Finance Minister in his

ANNUAL BUDGET SPEECH, which is usually given in the Parliament in the month of Feb., outlines the new changes that will be applicable the next A.Y. Hence it is advisable to only refer current or latest A. Y. rules, i.e. A.Y. 2010-11.

3. **Assessee :**

Section 2 (7) defines Assesses as a person, who is assessed to income tax, on the income which is earned in the previous year, on which the tax is payable in the assessment year.

4. **Person :**

As per Income Tax Act, section 2 (31) defines "person" as :

Person means and includes -

1. Individual,
2. Partnership Firm,
3. Joint stock Company,
4. Hindu Undivided Family – H. U. F,
5. Association Of Persons – A. O. P,
6. Body Of Individual - B. O. I,
7. A local authority,
8. Any other artificial legal person who is not covered above

5. **Income :**

Income is defined under The Income Tax under Section 2 (24). It is an "inclusive" definition. The term "income" also includes those terms which may not ordinarily mean as income. In addition to below mentioned income, any other receipt is also taxable as income by whatever name called :

Income includes :

1. Profits and gains
2. Dividend and Interest
3. Voluntary contribution received
4. Value of all the perquisites
5. All special or general allowance, benefits etc. given by employer including profits in lieu of salary
6. Interest, salary, commission etc. received by a partner of a partnership firm
7. Any benefits / perquisites received in Indian rupees or foreign currency due to any business or profession
8. Any capital gain arising out of sale of capital asset
9. Insurance Profit
10. Wining from lottery, puzzles, games, race, card games or any other game what so ever it may be called or named
11. Contribution by employer to any fund what so ever on behalf of the employee
12. Any money received under Keyman Insurance Policy including bonus, etc...

The term "income" includes and means : receivable or received income, past or future income, regular or one-time/casual income, legal or illegal income, income in kind and in terms of money value or from any source.

All types of incomes from all types of sources including the ILLEGAL ones are taxable under the I. T. Act, 1961.

6. **Agricultural Income:**

Section 2 (1A) defines it as : any income derived out of any agricultural activity is called as agricultural income. However agriculture income is exempted from tax totally – U/s 10 (1). This is so because it is taxed by the State Govt. and hence cannot be taxed twice again by the Central Govt.

Agricultural Income Means :

1. Any rent or revenue received from land which is situated in India an it is used for agricultural purpose.
2. Any income derived from such land due to agricultural operation like processing of agricultural produce, received rent in kind so as to be fit for sale of such products, sale of rent received in kind by a cultivator. Recently, income derived from sapling and seedling is also included.
3. Income from farm house, subject to the condition that the farm house is situated closed by agricultural land, and should be used for residence, store-house of agricultural produce or as an outhouse. Also the land should be taxed under Land Revenue Act of a local authority and should be 8 kms. away from the city limits.

7. **Fully Exempted Income (Sec. 10) :**

Certain incomes are fully exempted from tax. Such incomes do NOT form the part of total taxable income of a person. They are TAX FREE incomes such as:

1. Agricultural income (Land to be situated in India.)
2. Income by/of a member of H.U.F.
3. Partners deriving income from Partnership firm.(share of profits.)
4. Leave Travel Concession (LTC) paid to an Indian citizen.
5. Money received by an employee for his training.
6. Income of a minor (upto Rs. 1,500 only per child.)
7. Interest received by N.R.I. (Non Resident Indian) from specified bonds/ securities.
8. Dividend from Indian / Domestic Company and units of U.T.I. / Mutual Funds.
9. Value of concessional cost of travel to a Foreign National employee.
10. Money received by a foreign diplomat and other foreign nationals.
11. Payment received by a Foreign Technician in India.

12. Technical fees received by a notified foreign company.
13. Income of a foreign govt. employee under co-operative technical assistance programme.
14. Awards whether received in cash, kind – those awards given only by Central or State Government or an approved institution.
15. Gratuity received.
16. Pension and leave salary (on retirement.)
17. Retrenchment compensation upon closure of business.
18. Compensation received by victims of Bhopal gas leak disaster.
19. Payment received by a person from specified public sector company at the time of voluntary retirement. Scheme (VRS.)
20. Amount received from Life Insurance policy on maturity.
21. Payment received from provident fund, approved super-annuation fund.
22. Interest received on notified securities and investments.
23. Educational Scholarships received.
24. Daily allowances of Members of Parliaments.
25. House Rent Allowance received by High Court and Supreme Court Judges.
26. One palace of a former ruler.
27. Income of a local authority.
28. Income of housing authority.
29. Income of scientific research association.
30. Income of educational institutions.
31. Income of Hospitals (New exemption under sec.11)
32. Income of specified news agencies.
33. Income of games association.
34. Income of Professional Institutions (law, medicine, accountancy, engineering, etc.)
35. Income of a Pension Fund.
36. Income from Khadi or Village Industries.
37. Income of Public Charitable Trust.
39. Income of IRDA (Insurance Regulatory and Development Authority).
40. Income of certain National funds.
41. Income of Investors Protection Fund (IPF).
42. Specific income of venture capital companies.
43. Income of trade unions.
44. Income of member of scheduled tribes.
45. Income of marketing authority. eg. State Warehousing Corporation.
46. Income of newly established industrial undertaking.
47. Income of 100 % export oriented undertaking with restrictions and in Free Trade Zones.
48. Income of funds established for the welfare of the employees (Notified one only).
49. Income of specified Commodity Board and Authorities.
50. Income of National Minorities Development and Finance Corporation.
51. Income of Employees' State Insurance Fund.
52. Income of Exchange Risk Administration Fund.
53. Tax on non-monetary perquisites of employee paid by employer.
54. Long term capital gains on shares due to S.T.T. – From A.Y. 2005-06.

8. Residential Status of a Person (Individual) :

Residential status of an individual assessee will determine the tax liability in a particular Previous Year. Residential status differs for individual, HUF, Firm, AOP, Company and every other person.

Residential Status of an INDIVIDUAL is classified under three categories :

(Under Sec. 6)

1. Resident and ordinary resident (ROI)
2. Resident and Not-ordinary resident (RNOI)
3. Non Resident Indian (NRI)

After application of following criteria, an individual's residential status is determined

9. Concept of Capital and Revenue Receipts and Expenditure :

Expenditure and receipts/incomes can be classified as Capital expenditure, Revenue expenditure, Deferred Revenue expenditure, Capital receipts, Revenue receipts. The expenditure and receipts is explained as follows :

(A) Capital Expenditure

Capital Expenditure is that expenditure which is incurred :

a) For acquiring or bringing into existence an asset or advantage of an enduring benefit **or**
b) For extending or improving a fixed asset **or**
c) For substantial replacement of an existing fixed asset.

An asset or advantage of an enduring nature does not mean that it should last forever. Basically, the capital expenditure is incurred with a view to bringing in improvement or increase in productivity or earning capacity. Eg. cost of land and building, plant and machinery, furniture and fixtures, vehicles, etc. Such expenditure normally yields benefits, which extend beyond the current accounting period and for a longer period of time. They are recorded in the Balance Sheet in the final accounts of business.

(B) Revenue Expenditure

Revenue Expenditure is that expenditure which is incurred for maintaining productivity or earning

capacity of a business. Such expenditure is for deriving benefits in the current accounting period.

Examples of revenue expenditure include - Office and Administrative expenses like : Salaries, Rent, Insurance, Telephone Exp., Electricity Charges, etc.. Selling and Distribution expenses like : Advertising, Traveling expenses, Commission to Salesmen, Sales Promotion Expenses, etc.. Non- operating expenses and losses such as interest on loan taken, loss by theft, etc. will also be a part of revenue expenditure. Items appearing on Debit side of P. & L. A/c and Trading A/c relates to revenue nature expenses.

Such expenses are recorded in the P. & L. account.

Difference Between : Capital and Revenue Expenditure :

(i) Earning Capacity :

Capital expenditure increases the earning capacity of the business or reduces working expenses, **whereas** - Revenue expenditure does not increase earning capacity of the business.

(ii) Accounting Period :

Capital expenditure affects the business more permanently in the sense that its effects lingers on the next accounting period, **whereas** - Revenue expenditure is over with specified accounting period say – one year.

(iii) Recurring and Non-recurring :

Capital expenditure are non-recurring nature i.e. they are incurred once in very long time, **whereas** - Revenue expenditure are recurring in nature and repeats in accounting year.

(iv) Carry forward :

Capital expenditure values are carried forward to the next period (year), **whereas** -Revenue expenditure are not carried forward to next period (year).

(v) Purpose of Spending :

Capital expenditure are incurred for increasing production, reducing cost or increasing profit of the business, **whereas** -Revenue expenditure are incurred for day-to-day operations of the business.

(vi) Deduction from the profit :

Capital expenditure are not deducted from the profit of the business but they show the financial position of the business, **whereas** -Revenue expenditure are deducted from the profit of the business during the year.

(vii) Period of benefit :

Capital expenditure creates a benefit for a long period of time i.e. more than a year, **whereas** - Revenue expenditure creates a benefit for a small period which is less than one year.

(viii) Accounting Treatment :

Capital expenditure are shown in the balance sheet, **whereas** - Revenue expenditure are shown in the profit and loss account.

(ix) Possibility of Realization :

Capital expenditure are realizable and encashed afterwards, **whereas** - Revenue expenditure cannot be recovered in cash again.

(C) Capital Receipts and Revenue Receipts :

There is no specific test to draw a clear-cut demarcation between a capital receipt and a revenue receipt. To determine whether a receipt is capital or revenue in nature, one has to look into its true nature and substanc. For example, sale proceeds of land in the hands of a dealer in real estate is revenue receipt whereas the same in the hands of a dealer in cars is a capital receipt. Examples of capital receipts include sale of fixed assets, capital contribution, loan receipts, etc.. Examples of revenue receipts include sale of stock-in-trade, revenue from services rendered in the normal course of business, revenue from permitting others to use the assets of the enterprise, such as interest received., rent received., royalty received, etc.

Capital receipts are non-recurring in nature, are credited to Balance Sheet and are not available for payments as profits. However, Revenue receipts are recurring in nature, available for profit payments to owner and are credited to P & L A/c.

10. Fringes Benefit Tax :

This tax (F.B.T.) which was a tax payable by employer on the free benefits and perquisites given to its employees have been now abolished and hence not discussed. **(Abolished from A. Y. 2010-11.)**

11. Heads of Incomes :

Under Income Tax Act, there are five heads of income :

1. Income from Salaries.
2. Income from House Property.
3. Profits and gains from business or profession.
4. Capital gains.
5. Income from other sources.

12. Tax Deducted At Source [T.D.S.] :

- Who is liable to deduct Tax at source :
- Any person responsible for making payment of incomes or amounts specified below is liable to deduct tax at source on such payments.
- **Individuals [including sole proprietor] and HUF** carrying on a business or profession, whose gross sales, turnover or gross receipts exceed Rs. 40,00,000 [in case of business] or Rs. 10,00,000 [in case of profession] are liable to deduct tax at source on all specified payments except payment of contractors and fees for professional services paid or credited exclusively for personal purposes of the individual / HUF.
- There are various procedures to be followed to deduct tax at source. In the following lines let us see only the procedure for Tax Deduction from Salaries.

13. Advance Payment of Tax :

- Taxpayers are required to pay advance tax on their income, which they expect to earn during the current financial year. Eg: for 2008-09
- [AY 2009-10] advance tax is payable in installments during 2008-09 itself. The advance tax paid will be adjusted in the total tax liability for that particular AY.
- The following persons are liable to pay advance tax.

1. All persons including salaried employees and pensioners in whose case advance tax payable during a financial year is Rs. 5,000 or more.
2. Person who have received an order u/s 210(3) in Form No.28 to pay an amount by the way of advance tax.

The payments have to be made in instalments and are known as 'Advance-Tax' payments. However the liability for payment of advance tax arises only where the amount of such tax payable by the assessee during that year is Rs. 5,000 or more.

14. Methods of Payment of Tax :

a. Deduction of Tax at Source :

- Person responsible for paying any income chargeable to tax under the head 'Salaries' is required to compute the tax liability in respect of such income and deduct tax at source at the time of payment.
- If the employee has any other income he can inform the employer in which case the employer can take that income into consideration for computing his/employee's tax liability. He will also take into account loss from house property.
- Those responsible for paying any income by way of interest on securities or any other interest are required to deduct tax at source at the prescribed rates at the time of credit of such income to the account of the payee or at the time of payment thereof by any mode.

b. Tax Collection at Source :

- In certain cases tax is to be collected at source from the buyer, by the seller at the point of sale.
- Such tax collection is to be made by the seller at the time of debiting the amount payable if the buyer to the account of the buyer or at the time of receipt such amount from the said buyer, whichever is earlier.

c. Advance Tax :

- Tax payers whose total income is likely to be chargeable to tax for the assessment year are required to pay tax in advance during the financial year (April 1 to March 31) on their estimated current income, which will be assessable to tax during the next following financial year called assessment year. The current income for this purpose means the total income which will be chargeable to tax in the relevant assessment year.
- The advance tax payable is the tax on the current income minus the tax deductible at source or collectible out of any income included in the current income.
- If the tax payer does not make payment of advance tax voluntarily, the assessing officer can issue a notice at any time during the financial year, but not later than the last day of February asking him to pay the advance tax in specified instalments.
- Such notice is based on the assessed income of the tax payer for the latest year. The assessee has an option to pay advance tax on the basis of his own estimate if he considers that his current income during the relevant accounting period would be above exempted limits.

15. Refund of Tax :

- A tax refund or tax rebate is a refund on taxes when the tax liability or the amount of tax to be paid is less than the amount of taxes paid by the individual.
- However, you can also claim a tax refund in case the taxes were deducted because you did not declare your investments which could have some of the taxes that you paid.
- For salaried individuals, it is possible that that the company deducted excess tax because you did not declare any of your investments to the company. In such a case, a tax refund may be helpful.
- The tax return will show the amount of refund (if any). In case if the tax return already shows that you are getting a tax refund you need not apply for it.
- The tax return cheque directly comes to the address mentioned on the Return of Income document filed with the Income Tax department.
- Tax return can also be debited directly to your bank account which needs to be mentioned on the tax return.
- In a situation where you think that you forgot or did not have the proper documents to show the investments made, a Revised Return of Income needs to be submitted. Also, the actual claim for the tax refund needs to be done

Indirect Taxes :

1. Central Excise Duty :

The Central Excise duties are the largest source of revenue for the country. Approximately 30% of the total revenue receipts are collected from Central Excise duties. The levy and collection of Central Excise duties is under the authority of Central Excise Act, 1944.

Section 3 (also known as the charging section) provides for the levy and collection of Central Excise duty.

The rate and amount of duty as well as the items on which duties are levied are those which are indicated in the Central Excise Tariff Act, 1985 and the schedule therein. The taxable event for Central Excise duty as per Section 3 of CEA (Central Excise Act) 1944 is the manufacture or production of goods.

It means that Central Excise duty is leviable as soon as the goods are manufactured or produced. The items on which the excise duty is levied are known as excisable goods.

For the purpose of administrative convenience the actual collection of duty is done at the time of removal of goods from the place of manufacture of production. The rate of duty, which is levied, is the rate of duty applicable to such goods or which is in force at the time of actual removal.

2. **Value Added Tax (VAT):** Value Added Tax is a multi point sales tax with set off for tax paid on purchases. It is basically a tax on the value addition on the product. The burden of tax is ultimately born by the consumer of goods. In many aspects it is equivalent to last point sales tax. It can also be called as a multi point sales tax levied as a proportion of Valued Added.
3. **Customs Duty:** Customs duty is a kind of indirect tax which is realized on goods of international trade. In economic sense, it is also a kind of consumption tax. Duties levied by the government in relation to imported items is referred to as import duty. In the same vein, duties realized on export consignments is called export duty. Tariff which is actually a list of commodities along with the leviable rate (amount) of Customs duty is popularly understood as Customs duty.

6.4 Project Cost Elements

Q. Enumerate the elements of Project Cost.

The project manager is required to have thorough knowledge of all the project cost elements which in turn helps him in preparing the cost data. Cost data on the different project elements is required to:

- Assist decision making
- Prepare budgets
- Prepare reports

6.4.1 Elements of Cost :

The four broad elements of costs are :

(i) Material cost	(ii) Labor cost
(iii) Expenses	(iv) Overheads

(i) **Material cost :** The substance from which the product is made is known as material. Material cost is the cost of materials and commodities used for production of the final product by the firm. Material can be Direct or Indirect.

(a) Direct Material - is that material that can be identified with the individual cost centers and which becomes an integral part of the final product. Direct material is usually the basic raw material that goes into product and components. E.g. Paper in book printing, steel in car manufacturing, etc.

(b) Indirect Material - is that material which cannot be identified with the individual cost centers and do not form an integral part of the final product. E.g. oil, grease, consumable stores, etc.

(ii) **Labor cost :** It is the amount paid to the employees of the organization. It is the cost of remuneration i.e. wages, salaries, commission, etc paid to the employees of the organization. It can be Direct or Indirect.

(a) Direct Labor cost – It is defined as the wages paid to the workers who are engaged in conversion of raw material into finished products. It is that labor cost which can be identified with the individual cost centers and is usually incurred for those employees who are engaged in the manufacturing activity. E.g. wages to the workers in the foundry, wages to the compositors in a printing press.

(b) Indirect Labor cost – Wages paid to the workers who are not engaged in actual production but help the process of production. It is that cost which cannot be identified with the individual cost centers and is generally incurred for those employees who are themselves not engaged in the manufacturing process but assist those engaged in manufacturing. E.g. wages of store-keeper, foreman, time-keeper, supervisors etc.

(iii) **Expenses :** Other than the material and labor cost, the expenses, which are incurred on the services provided to the organization and the notional cost of the assets owned by the organization. Expenses may be direct or indirect.

(a) Direct Expenses – The expenses which are incurred on a specific cost unit and chargeable to cost unit. E.g. cost of design, special layout drawings, hiring of a particular tool for a job, fees paid to consultant.

(b) Indirect Expenses – The expenses that cannot be directly and wholly allocated to cost units and cost centers. E.g. Rent, rates, taxes paid, insurance, power, lighting and heating, depreciation etc

The aggregate of direct material cost, direct labor cost and direct expenses is termed as prime cost. The aggregate of indirect material cost, indirect labor cost and indirect expenses is termed as overheads.

(iv) **Overheads :** The aggregate of indirect material, indirect labor and indirect expenses is termed as overheads. Overheads may be classified into:

(I) Manufacturing Overheads - these overheads are also termed as factory/works overhead and consist of all indirect expenses incurred in manufacturing right from the procurement of material till the production of finished goods.

- Indirect material – consumable stores, lubricants, cotton waste, etc.
- Indirect Labor – wages of indirect workers such as helpers and handlers, salary paid to works manager and store keeper, etc.
- Indirect Expenses – expenses incurred on transportation of material, factory lighting, rent, insurance, repairs to factory building, depreciation, etc.

(II) Office and Administrative Overheads – these overheads consists of all indirect expenses incurred on overall administration of the organization and include:

- Indirect Material – stationary, office supplies, etc.
- Indirect Labor – salaries paid to office staff, accountants, directors, etc.
- Indirect Expenses – telephone, postage, office premises rent, insurance, depreciation, etc.

(III) Selling and Distribution Overheads – these overheads consists of all indirect expenses from stages of final manufacturing of finished goods till the stage of sale of goods including collection of dues from customers and include:

- Indirect Materials – packing material, samples, etc
- Indirect Labor- salaries paid to sales personnel, sales manager, etc
- Indirect Expenses – transportation of finished product (carriage outward), warehouse rent, advertisement, showroom expenses, bad debts, etc.

6.4.2 Classifying Costs for Financial Statements :

Costs can also be classified according to the financial statements:

- **Matching Costs** – the cost incurred is matched to particular revenue that is generated because of it. Thus, this cost should be recognised as an expense in the same period that the revenue is recognised. The matching costs concept is used for analysing the cash flows of projects.
- **Period Costs** – these costs are charged to expenses in the period in which they are incurred. However, the associated benefits may or may not be received during the same period. Example: marketing expenses, advertising expenses, administrative expenses, insurance, income tax, etc.
- **Product Costs** – these are costs that can be directly attributed to a particular product or a batch and the revenue generated from its sale. These are the costs that are incurred in the purchase of material or other manufacturing expenses. Example: direct material, direct labour and manufacturing overheads.

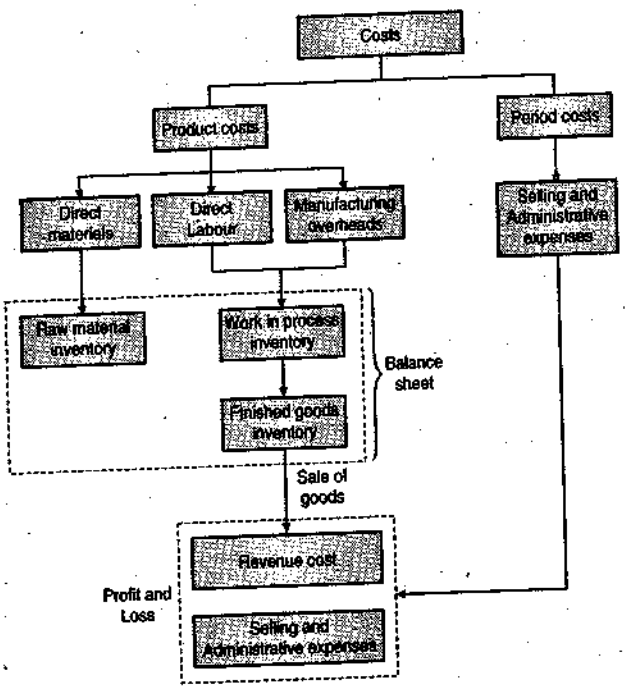

Fig. 6.4.1

6.4.3 Classifying Costs on Cost Behaviours :

Q. Explain the classification of costs on their behavior.

The cost are classified under :

(1) Fixed Cost
(2) Variable cost
(3) Semi-variable or Semi-fixed cost.

(i) **Fixed Cost :** This cost remains fixed irrespective of volume of production. They do not vary directly or indirectly with the volume of production i.e. if volume of production increases or decreases this cost remains fix hence this are called fixed cost. For example Watchman salary, Rent rates and taxes, depreciation on plant and machinery, furniture and fixtures, Administrative staff salary, electricity charges, Printing and stationery etc. This can be explained with help of following table and graph :-

Production level (units)	Fixed Cost (₹.)	Average Fixed Cost (per unit)
0	1,00,000	-
10,000	1,00,000	₹. 1,00,000/10,000 = ₹. 100
20,000	1,00,000	₹. 1,00,000/20,000 = ₹. 50
40,000	1,00,000	₹. 1,00,000/40,000 = ₹. 25

From the above table we can conclude as production volume increases the fixed cost per unit decreases and vice versa.

The graphical presentation of above fixed cost schedules shown in below

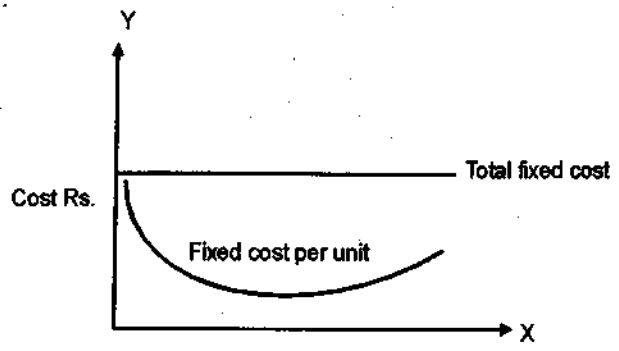

Fig. 6.4.2 : Fixed Cost

They are also called as 'period cost'' standby cost' or 'capacity cost'. Since they have to be incurred irrespective of volume of production hence they are also called as 'unavoidable cost' or 'non-controllable cost'. The fixed cost curve does not start from cost '0' even if production is '0' units and it forms straight line parallel to 'X' axis. The cost per unit falls down but never touches the 'x' axis. This indicates as constant cost hence in equation of line of total cost where "Y = mX + C" the 'C' are fixed cost curve.

(ii) **Variable cost :** This cost varies directly with the volume of production. i.e. If volume of production increase total variable cost also increases and if volume of production decreases total variable cost also decreases. Total variable costs are directly proportionate to change in volume of production. For e.g. raw material cost, direct labour, direct overheads and variable part of factory overheads.

Production level (units)	Variable Cost (Per unit ₹.)	Total Variable Cost (₹.)
0	10	0
10,000	10	1,00,000
20,000	10	2,00,000
40,000	10	4,00,000

They are directly related with output or product. Therefore they are also called as 'Product Cost'. If outputs are increased, variable costs will also be increased. For e.g. Direct material, Direct Labour.

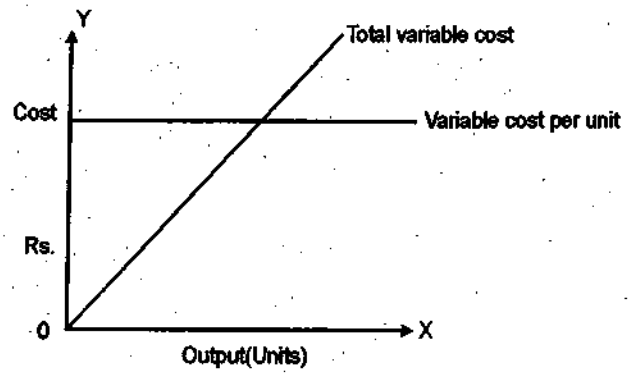

Fig. 6.4.3 : Variable Cost

From Fig. 6.4.3 we conclude variable cost remains fixed per unit at any given level of production, however it varies directly to volume of production. The variable cost curves start from point origin 'o' since when there is no production there is no cost.

This indicated as constant cost hence in equation of line of total cost where "Y = mX + C" the "mX" are total variable cost. Where m = variable cost per unit and X = number of units of output.

(iii) **Semi-variable Cost or Semi-fixed Cost :** These cost carry features of fixed cost as well as variable cost i.e. this cost are fixed upto certain level of output say (0-10,000 units), however if further production are increased and remains fixed upto further certain level say (10,001 – 20,000 units). This cost if plotted on graph forms steps, hence this cost are also called as 'Step cost'. The cost consist of some part of variable and some part fixed When the proportion of variable cost are more than fixed cost they are called as 'Semi variable cost' ; whereas if the proportion of fixed cost are more than variable cost they are called 'Semi fixed cost'.

Production level (units)	Semi-variable cost ₹.
- 10,000	20,000
10,001 - 20,000	20,000
20,001 - 40,000	40,000
40,001 - 60,000	40,000

Such costs are fixed only in relation to specify, constant condition. For e.g., Repairs and maintenance of machinery, Telephone charges, supervision charges, professional tax, electricity bill, etc.

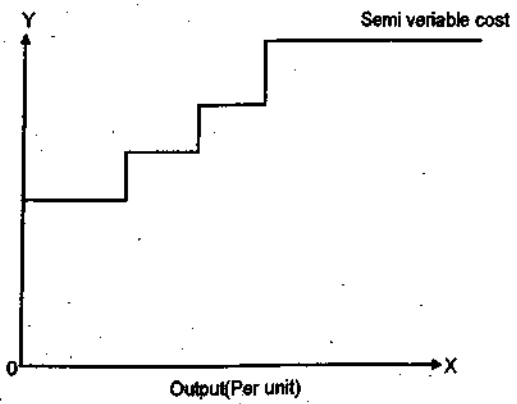

Fig. 6.4.4 : Semi variable Cost

From Fig. 6.4.4 graph we can see that it forms the shape of steps hence they are also called as 'step cost'.

The main purpose of classification of overhead expenses into fixed and variable is to assist in the control of expenditure. As by their very nature, semi-fixed or semi-variable overhead expenses contain elements of both fixed and variable costs, it is necessary in proactive to determine the degree of variability of such expenses. In other words, the extent to which the item is fixed or variable has to be determined.

6.5 Break Even Analysis :

Q. "Break even analysis establishes a relationship between cost and revenue with respect to volume." Explain.

The profit is the most important measure of company's performance. Analysis of the effect of various factors on profits is important step in financial resource planning and decision making. There is one analytical technique used to study the profit behavior with changes in cost, volume and prices. This analytical technique is known as CVP analysis. That is cost - volume – price technique. The break even analysis is most commonly known form of CVP analysis that is cost-volume-profit analysis.

Break even analysis establishes a relationship between cost and revenues with respect to volume.

The important point in Break even analysis is the **break-even point** (BEP), It is the point at which cost or expenses and revenue are equal. That is there are no profit and no loss. It is an equilibrium point which is **broken even.**

Consider following example :

- Consider a manufacturing unit making & selling exactly 500 products per month.
- If this is the **Break-Even Point** (BEP) of that manufacturing unit.
- That means if they sell any quantity **less than** 500 (BEP) products then they are in **loss.**
- Similarly if they sell any quantity **more than** 500 (BEP) products then they are in **profit.**
- **At Break-Even Point** (BEP) there is no profit – no loss situation.

If the above company cannot sell above 500, then to make profit, they have to ensure that:

1. Reduce the fixed costs
2. Reduce variable costs
3. Increase the selling price of their products.

Any of the above would reduce the breakeven point means the business would not need to sell so many products to make sure it could pay its fixed costs.

6.5.1 Calculation :

In the linear CVP (Cost-Volume-Profit) analysis model, the **break-even point** can be measured in terms of Total Revenue (TR) and Total Costs (TC).

Here is the BEP where the total revenue is exactly equal to total cost.

That is Total Revenue = Total Costs

i.e. TR = TC

- **Total revenue** is the amount of revenue generated by the company after sell.
- **Total cost** is addition of fixed costs & variable Costs

TR = TC = fixed costs + variable Costs

Fixed cost is the cost which remains constant at all levels of production. It does not vary according to the volume. E.g. insurance premium, house rent etc

Variable cost is the cost which varies according to the volume of production. It changes according to the volume. E.g. fuel, material, labor etc

Profit volume ratio (P/V ratio):

This is the ratio which shows a relationship between CVP that is cost, volume and profit.

This ratio can be calculated by following formula

P/V ratio = (change in profit) / (change in sales) × 100

&

P/V ratio = (Marginal contribution / sales) × 100

Where,

Marginal contribution = Sales – Variable Cost

Marginal contribution = Profit + Fixed cost

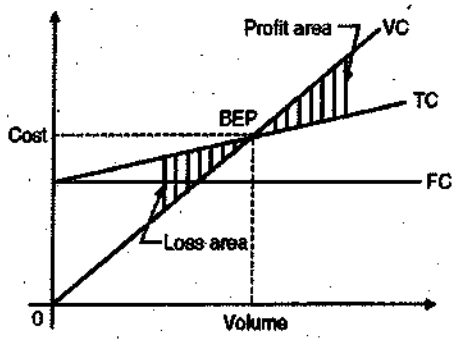

Fig. 6.5.1 : Graphical representation of Break even analysis

6.5.2 Margin of Safety (MOS):

Q. What is the Margin of Safety? How is it calculated?

- Margin of safety (MOS) correspond to the strength of the business.
- MOS enables a business to know the exact amount it has gained or lost.
- MOS finds whether a business are over or below the breakeven point.
- MOS is the area beyond BEP.

Margin of safety (MOS) =(Sales output – Breakeven output)

MOS = (Profit) / (P/V ratio)

MOS % = [(MOS) / (Total sales)] × 100

6.5.3 Limitations and Assumptions of Break Even Analysis :

Q. State the limitations and assumption of break even analysis

1. Break-even analysis is a supply side analysis only. It does not tell you anything about actually likely sales to be for the product at various prices.
2. Break-even analysis assumes that fixed costs are constant but in real situations this is true only in the short period of time. For long term costs can change significantly.

3. Break-even analysis assumes that average variable costs are constant per unit of output. This is at least in the range of probable quantities of sales.
4. Break-even analysis assumes that in multi-product companies, the relative proportions of each product sold and produced are constant that is the sales mix is constant.
5. Break-even analysis assumes that the quantity of goods produced is equal to the quantity of goods sold. That is there is no change in inventory.

6.5.4 Applications of Break Even Analysis :

Break even analysis allows a business organization:

1. To Measure profit and losses at various levels of production.
2. To Measure profit and losses at various levels of sales.
3. To predict and calculate the effect of changes in price of sales.
4. To study the relationship between fixed cost and variable cost.
5. To forecast the effect on profitability when cost and efficiency changes.

6.5.5 List of some Important Formulae of BEP :

1. **BEP = (Fixed cost) / [1 – (Variable cost / Sales)]**
2. **BEP = Fixed cost / (P/V ratio)**
3. **P/V ratio = (Marginal contribution / sales) × 100**
4. **P/V ratio = (Change in profit / Change in sales) × 100**
5. **Marginal contribution = Sales – Variable cost**
6. **Marginal contribution = Profit + Variable cost**
7. **BEP = (Fixed cost / Marginal contribution) × Selling price per unit**
8. **Profit = (Sales × P/V ratio) – Fixed cost**
9. **Sales = (Fixed cost + Desired profit) / (P/V ratio)**
10. **MOS = Actual Sales – BEP Sales**
11. **(MOS) = (Sales output - Breakeven output)**
12. **(MOS) = (Profit) / (P/V ratio)**

6.5.6 Problems based on Break Even Analysis :

Prob. 6.5.1 : In a manufacturing unit the following data is given. Sales revenue is 300,000 Rs. Variable cost is 150,000 Rs. & fixed cost is 90,000 Rs. Calculate (a) BEP (b) P/V ratio (c) MOS

Soln. :

(a) BEP = (Fixed cost) / [1 – (Variable cost / Sales)]
So, BEP = (90,000) / [1 – (150,000 / 300,000)]
Thus, BEP = 180,000 Rs

(b) P/V ratio = (Marginal contribution / sales) × 100
Here Marginal contribution = Sales – Variable cost
So, Marginal contribution = 300,000 – 150,000 = 150,000
P/V ratio = (Marginal contribution / sales) × 100
So, P/V ratio = (150,000 / 300,000) × 100
Thus, P/V ratio = 50 %

(c) MOS = Actual Sales – BEP Sales
So, MOS = 300,000 – 180,000
Thus, MOS = 120,000 Rs

Prob. 6.5.2 : A company producing a single product at Rs. 5 each. The marginal cost of production is Rs. 3 and fixed cost is Rs. 200 P.A.
Calculate (a) P/V ratio (b) Break even point (c) The sales to earn profit of Rs. 250

Soln. :

(a) P/V ratio = (Contribution / Sales) × 100
So, P/V ratio = (5 – 3 / 5) × 100 = (2 / 5) × 100
= 40%
Thus, P/V ratio = 40%

(b) BEP = Fixed cost / (P/V ratio)
So, BEP = 200 / (40 / 100) = 500
Thus, BEP = 500

(c) Sales = (Fixed cost + Desired profit) / (P/V ratio)
So, Sales = (200 + 250) / (40 / 100)
Thus, Sales = 1125 Rs.

Prob. 6.5.3 : A company sells a line of children shoes for Rs 9 per a pair. Each pair that is sold contributes Rs. 3 to the recovery of fixed cost and profit. Company's fixed cost of operation amounts to Rs 42,000 a year.
Calculate Break even point sales and compute the amount of sales required to earn a profit of Rs. 27,000.

Soln. :

Here Marginal contribution is Rs. 3

BEP = 42,000 / 3 = 14,000

Thus, BEP = 14,000 units ...(1)

BEP in Rs. = (BEP in units) × (Selling Price per Unit)

BEP in Rs. = (14,000) × (9)

= Rs. 126,000

Thus, BEP (Rupees) = 126,000 ...(2)

Sales required for earning profit of Rs. 27000

= (Fixed cost + Profit) / (Marginal contribution per unit)] × Selling price

= [(42,000 + 27,000) / (3)] × 9

= 207,000

Thus Rs. 207,000 sales required for earning profit of Rs. 27000.

6.6 Cost Benefit Analysis (CBA) :

Q. What is Cost Benefit Analysis? State its benefits.

One of the approaches for estimating alternatives is cost-benefit analysis (CBA), extensively used in economics and resource management shown in Fig. 6.6.1.

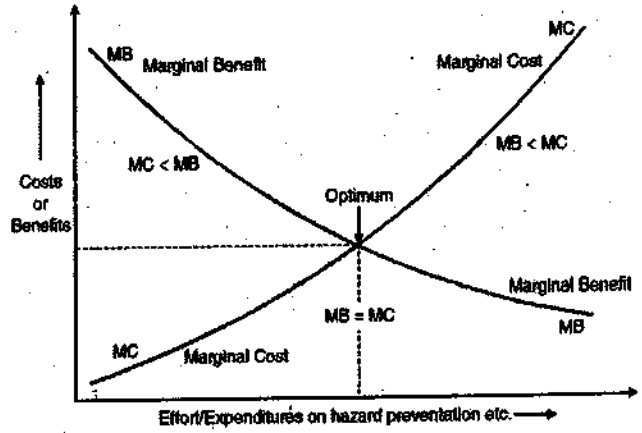

Fig. 6.6.1 : Cost Benefit Analysis

- There are two important factors to analyze namely Marginal Benefit and Marginal Cost.
- The Marginal Benefit (MB) of growing investment for a given alteration represents demand or readiness to pay. This decreases with increasing effort or expenditure on hazard prevention.
- Marginal Cost (MC) represents supply.
- "The optimum state is there when marginal costs and marginal benefits are equal."
- Such types of economic evaluations are helpful, but there are some problems mainly when the genuine impact of hazard events can't be expressed in simple monetary terms.
- **Cost–benefit analysis** (CBA) is a systematic process for comparing and calculating advantages and costs of a project or decision or government policy.

6.6.1 Purposes of CBA :

1. To determine whether the investment or decision is sound by giving justification or checking its feasibility.
2. To provide a base for projects comparisons.
   (It engages comparing the total expected cost of each option against the total expected benefits. This is done to see whether the benefits overshadow the costs, and if yes then by how much.)

6.6.2 CBA Process :

- The following are steps that contain a generic cost-benefit analysis.

1. Make a list of the alternative projects or programs.
2. Make a list of stakeholders.
3. Select measurements & measure all cost and benefits elements.
4. Forecast output of cost and benefits over applicable time period.
5. Convert all costs and benefits into a common currency.
6. Apply a discount rate to them.
7. Calculate NVP (net present value) of project options.
8. Perform 'sensitivity analysis'.
9. Adopt recommended choice.

6.6.3 CBA Evaluation :

CBA tries to calculate the positive or negative penalty of a project that includes:

1. Analyze effects on users / participants
2. Analyze effects on non-users or non-participants
3. Analyze external effects
4. Analyze Option value

- In CBA, costs & benefits are expressed in monetary terms, and they are adjusted for the time value of money. This is done so that all flows of benefits and project costs over time are expressed on a common basis in terms of their NVP (net present value).
- Cost–benefit analysis is frequently used by governments and other companies to calculate the attractiveness of a given policy. It is an analysis of the expected balance of costs & benefits, including an account of inevitable alternatives helping forecast whether the benefits of a policy overshadow its costs, and if yes then by how much.
- An accurate cost-benefit analysis generally identifies choices that increase welfare from a utilitarian perspective.

6.6.4 Solved Examples :

Prob. 6.6.1 : Using the following data, calculate the break even point and margin of safety in units
1. Selling price $50
2. Variable cost $40
3. Fixed cost $70,000
4. Budgeted Sales 7,500 units

Soln. :

Given :

Selling Price (SP)	$50
Variable Cost (VC)	$40
Fixed Cost (FC)	$70,000
Budgeted Sales (BS)	7,500 units

Hence,

Sales Revenue $= SP \times BS = 50 \times 7500 = \$3,75,000$

Variable cost $= VC \times BS = 40 \times 75000 = \$3,00.000$

$$B.E.P = \frac{\text{Fixed Cost}}{\left[1-\left(\frac{\text{Variable cost}}{\text{sales}}\right)\right]} = \frac{70,000}{\left(1-\left(\frac{3,00,000}{3,75,000}\right)\right)}$$

B.E.P = 3,50,000

Margin of safety (MOS) = Actual Sale – B.E.P sale

$= \$3,75,000 - 3,500,000 = \$\ 25,000$

Syllabus Topic : Project Cash Flow Analysis

6.7 Project Cash Flow Analysis :

The process of selecting the more desirable projects among many profitable investments is made possible by the analysis of cash flows. The idea behind the use of cash flows is to maximize the benefit available from using scarce resources. In this case the scarce resources are funds available for capital investments and the benefits are returns on the investments. The objective is to select the project or a combination of projects, which would give maximization of the total NPV.

6.7.1 Format for Cash Flow Statement :

Net Cash Flow Statement

Activities	Add Income	Subtract Expense
Operating Activities	Net Income	
	Depreciation	
Investing Activities	Proceeds from Sale of depreciable asset	Capital investment
	Working Capital Recovery	Tax
		Investment in working Capital
Financing Activities	Borrowed Funds	Repayment of Principal

Classification of Cash Flows :

According to Accounting Standard cash flows are classified into three main categories:

1. Cash flows from operating activities.
2. Cash flows from investing activities.
3. Cash flows from financing activities.

1. **Cash flows from operating activities :** Operating activities are the principal revenue producing activities of the enterprise and other activities that are not investing or financing activities. The amount of cash flows arising from operating activities is a key indicator of the extent to which the operations of the enterprise have generated sufficient cash flows to maintain the operating capability of the enterprise, pay dividends, repay loans, and make new investments without recourse to external sources of financing.

Cash flows from operating activities are primarily derived from the principal revenue-producing activities of the enterprise. The following are the important operating activities.

(i) Cash receipts from the sale of goods and the rendering of services.

(ii) Cash receipts from royalties, fees, commissions and other revenue.

(iii) Cash payments to suppliers for goods and services.

(iv) Cash payments to and on behalf employees.

(v) Cash receipts and cash payments of an insurance enterprise for premiums and claims, annuities and other policy benefits,

(vi) Cash payments or refunds of income taxes unless they can be specifically identified with financing and investing activities and

(vii) Cash receipts and payments relating to future contracts, forward contracts, option contracts and swap contracts when the contracts are held for dealing or trading purposes.

(viii) Some transactions such as the sale of an item of plant, may give rise to a gain or loss which is included in the determination of net profit or loss. However, the cash flows relating to such transactions are cash flows from investing activities.

An enterprise may hold securities and loans for dealing or trading purposes, in which case they are similar to inventory acquired specifically for sale. Therefore, cash flows arising from the purchase and sale of dealing or trading activities are classified as operating activities.

Similarly cash advances and loans made by financial enterprises are usually classified as operating activities since they relate to the main revenue producing activity of that enterprise.

Cash Flow from Operations = Net Income + Non Cash Expenses

2. **Cash flows from investing activities :** Investing activities are the acquisition and disposal of long-term assets and other investments not included in cash equivalents. The separate disclosure of cash flows arising from investing activities is important because the cash flows represent the extent to which expenditures have been made for resources intended to generate future income and cash flows.

Examples of cash flows arising from investing activities are :

(i) Cash payments to acquire fixed assets (including intangibles). These payments include those relating to capitalized research & development costs and self constructed fixed assets.

(ii) Cash receipts from disposal of fixed assets (including intangibles)

(iii) Cash payments to acquire shares, warrants, or debt instruments of other enterprises and interests in joint ventures.

(iv) Cash receipts from disposal of shares, warrants, or debt instruments of other enterprises and interests in joint venture.

(v) Cash advances and loans made to third parties (other than advances and loans made by a financial enterprise).

(vi) Cash receipts from the repayment of advances and loans made to third parties (other than advances and loans of a financial enterprise).

(vii) Cash payments for future contracts, forward contracts, option contracts, and swap contracts except when the contracts are held for dealing or trading purposes or the payments are classified as financing activities and

(viii) Cash receipts from future contracts, forward contracts, option contracts and swap contracts except when the contracts are held for dealing or trading purpose, or the receipts are classified as financing activities.

When a contract is accounted for as a hedge of an identifiable position, the cash flows of the contract are classified in the same manner as the cash flows of the position being hedged.

3. **Cash flows from financing activities :** Financing activities are activities that result in changes in the size and composition of the owners capital (including preference share capital in the case of a company) and borrowing of the enterprise.

The separate disclosure of cash flows arising from financing activities is important because it is useful in predicting claims on future cash flows by providers of funds (both capital and borrowing) to the enterprise.

Examples of cash flows arising from financing activities are :

(a) Cash proceeds from issuing shares or other similar instruments.

(b) Cash proceeds from issuing debentures, notes, bonds and other short-or long-term Cash proceeds from issuing debentures, notes, bonds and other short-or long-term borrowings and

(c) Cash repayments of amounts borrowed such as redemption of debentures, bonds, preference shares.

Example :

From the following calculate differential cash flow streams considering that a firm has an existing machine and is considering the purchase of a new machine:

(a) The new machine is more efficient than the existing machine. This will increase the firm's revenue from products made by the machine from Rs. 4,00,000 to Rs. 4,50,000 and will lower operating cost from Rs. 2,10,000 to Rs. 1,70,000.

(b) The new machine will cost Rs. 2,20,000. It will cost Rs. 20,000 for transportation and installation of machine. The firm will receive Rs. 15,000 investment tax credit as a result of the purchases and installation of the machine.

(c) The new machine will have a service life of 4 years. The existing machine will also be able to produce goods for 4 more years.

(d) The new machine processes raw materials more quickly and works more efficiently on long production runs. Thus, the firm must tie up an additional Rs. 20,000 of goods in inventories to support the new machine.

(e) At the present time, the book value of the existing machine is Rs. 80,000 and it is being depreciated at Rs. 20,000 per year, to a zero book value. If the existing machine were sold today, its cash value would be Rs. 40,000. If it continues to operate for 4 more years, its cash value would be Rs. 10,000.

(f) The new machine will be depreciated using straight-line depreciation. In 4 years, it will have Rs. 40,000 book value and Rs. 30,000 cash salvage value. Take Income Tax @ 50%.

Step 1 : Calculate the Net Cash Outlay :

The net cash outlay is the different amount of money that will be spent when the investment is made in year zero. It may be calculated by = Total cost of new investment including purchase price, transportation, installation and any related charges - tax savings from investment tax credit +/- changes in the working capital requirements - net cash received from replacing existing machines (i.e. selling price or money received less any costs of removing the asset) +/- either the taxes saved or additional taxes to be paid as a result of purchasing the new asset. In our example, Rs. 2,20,000 is the purchase price plus Rs. 20,000 for transportation and installation.

The Investment tax credit produce a tax saving of Rs. 15,000. The working capital tied up is Rs. 20,000 that is treated as an outlay in year zero. It will be an inflow in year 4. The cash for the existing machine is Rs. 40,000. The tax effect is a saving that occurs because the firm sells a Rs. 6,80,000 book value machine for Rs. 40,000, procuring non-cash or book loss. At a 50 per cent tax rate, the loss of Rs.40, 000 in the sale produces a Rs. 20,000 tax savings. Thus, net cash outlay (outflow) is 2,20,000 + 20,000 – 15,000 + 20,000 - 40,000 - 20,000 = Rs. 1,85,000.

Step 2 : Calculate the Depreciation Schedules :

In practice, we use the method employed by the firm for tax purpose since only this method affects the tax shield and cash flow using straight line depreciation, in our example, the depreciation can be calculated with two formulas as follows :

Depreciable Cost = Total Cost of machine – Book salvage value

2,40,000 – 40,000 = Rs. 2,00,000

Annual Depreciation = Depreciable Cost / Years of life

= 2,00,000 / 4 = Rs. 50,000

With the straight-line method, Rs. 50,000 depreciation is the same for each of the four years of the new machines estimated service life. With other methods the amount of depreciation differs each year.

The depreciation on the existing machine is given at Rs. 20,000 per year down to zero book value. Since the Current Book value is Rs. 80,000, the Annual depreciation of Rs. 20,000 will be realised for the remaining four years of service life.

Step 3 : Calculate Annual after Tax Cash flows :

In our example, the annual cash flows will be same each year since the revenues, costs, depreciation and taxes do not change. To compute after tax cash flows from operations or employment of the asset there are 2 methods:

a. We begin with revenues, deduct cash expenses and taxes, and we have the cash flow, or

b. We can begin with revenues; deduct cash expenses, and non-cash expenses. Calculate taxes and deduct them and then add back depreciation. The two methods are shown below :

	New Machine		Existing Machine	
	Accounting	Cash flow	Accounting	Cash flow
Annual-revenues	450,000	400,900	400,000	
Less : Annual Cost of operation	170,000	210,000		
Before tax Cash flow	280,000	190,000		
Less : Annual depreciation	50,000		20,000	
	230,000		170,000	
Less: Income Taxes 50%	115,000	85,000		85,000
Net income after taxes	115,000		85,000	
Add: back Depreciation	50,000		20,000	
After tax cash flow	165,000	105,000		

Step 4 : Calculate Effects in Final year :

In the final year two events occur:

1. The return of the working capital tied up in year zero. In our example, Rs. 20,000 is treated as an inflow in the final year since the money is freed for other uses.
2. In the final year, each machine is sold in its respective cash flow stream. To get the after tax effect, we must estimate the book and cash value and compute the net cash value from the sale of each asset, as given below:

	New Machine	Existing Machine
Book value in 4 years	40,000	0
Cash value in 4 years	30,000	10,000
Gain (Loss) on sale in 4 years	(10,000)	10,000
Tax saving (Additional taxes)	5,000	(5,000)
Plus Cash Received	30,000	10,000
Net Cash Value	35,000	5,000

Thus, we have cash flow in the final year as follows :

	New Machine	Existing Machine
Annual inflows from step 3	1,65,000	1,05,000
Return of working capital	20,000	-
Sale of machine	35,000	5,000
Final year cash flow	2,20.000	1,10.000

Step 5 : Calculate the Differential after Tax stream :

We subtract the existing machine stream from the new machine stream as follows :

Year	New machine	Existing machine	Difference
0	(1,85,000)	0	(1,85,000)
1	1,65,000	1,05,000	60,000
2	1,65,000	1,05,000	60,000
3	1,65,000	1,05,000	60,000
4	2,20,000	1,10,000	1,10,000

This stream shows both the timing and amount of net cash outlay and net cash inflow over the life of the new machine. All effects are differential - the difference between having the investment and not having it, and can be evaluated with time-value of money techniques as have been discussed earlier.

Prob. 6.7.1 : A printing press owner decides to purchase a printing machine for Rs 1,50,000/-. His working capital for the business is Rs 10,000/-. The printing machine has a 10 years life and will be depreciated using straight line method with no salvage value. The expected income is Rs 50,000/- every year and the annual operating expenses estimated to be Rs 20,000/-. In addition he has to pay a rent of Rs 10,000/- and tax at 40%. Calculate the annual rate of return from the investment after taxes.

Soln. :

Income = 50,000/-
Operating Cost = 20,000/-
Rent = 10,000/-
Depreciation = 15,000/-

Taxable Income = 5000/-
Income Tax @ 40% = 2000/-

Net Income 3000

Cash Flow = Net Income + Depreciation
= 3000 + 15,000 = 18,000/-

Syllabus Topic : Understanding Financial Statements

6.8 Understanding Financial Statements :

There are various people who are interested in knowing about the financial health of the company, the intention of these people behind this could be different but each one of them interested in assessing the financial position.

The shareholder is interested as his dividend is dependent on this position while the creditor is interested because his money is locked in the company.

The financial position could be gauged at a given time or over a period. The financial position through the financial statements indicates the sources of finance and the utilization of the same. So let us now study what financial statements are and the types of financial statements.

A **financial statement** (or **financial report**) is a formal record of the financial activities of a business, person, or other entity. In India financial statement is often referred to as an **account.**

For a business enterprise, all the relevant financial information, presented in a structured manner and in a form easy to understand, are called the financial statements. They typically include four basic financial statements, accompanied by a management discussion and analysis.

- **Balance sheet :** Also referred to as statement of financial position or condition, reports on a company's assets, liabilities, and Ownership equity at a given point in time.
- **Income statement :** Also referred to as Profit and Loss statement (or a "P&L"), reports on a company's income, expenses, and profits over a period of time. Profit & Loss account provide information on the operation of the enterprise. These include sale and the various expenses incurred during the processing state.
- **Statement of retained earnings:** Explains the changes in a company's retained earnings over the reporting period.
- **Statement of cash flows :** Reports on a company's cash flow activities, particularly its operating, investing and financing activities.
- For large corporations, these statements are often complex and may include an extensive set of notes to the financial statements and management discussion and analysis. The notes typically describe each item on the balance sheet, income statement and cash flow statement in further detail. Notes to financial statements are considered an integral part of the financial statements.
- The objective of financial statements is to provide information about the financial position, performance and changes in financial position of an enterprise that is useful to a wide range of users in making economic decisions. Financial statements should be understandable, relevant, reliable and comparable. Reported assets, liabilities, equity, income and expenses are directly related to an organization's financial position.
- Financial statements are intended to be understandable by readers who have "a reasonable knowledge of business and economic activities and accounting and who are willing to study the information diligently." Financial statements may be used by users for different purposes:
- Owners and managers require financial statements to make important business decisions that affect its continued operations. Financial analysis is then performed on these statements to provide management with a more detailed understanding of the figures. These statements are also used as part of management's annual report to the stockholders.
- Employees also need these reports in making collective bargaining agreements with the management, in the case of labor unions or for individuals in discussing their compensation, promotion and rankings.
- Prospective investors make use of financial statements to assess the viability of investing in a business. Financial analyses are often used by investors and are prepared by professionals (financial analysts), thus providing them with the basis for making investment decisions.
- Financial institutions (banks and other lending companies) use them to decide whether to grant a company with fresh working capital or extend debt securities (such as a long-term bank loan or debentures) to finance expansion and other significant expenditures.
- Government entities (tax authorities) need financial statements to ascertain the propriety and accuracy of taxes and other duties declared and paid by a company. Vendors who extend credit to a business require financial statements to assess the creditworthiness of the business.
- Media and the general public are also interested in financial statements for a variety of reasons.
- In this section we will be studying the various financial statements and then have a brief glimpse at taxes and then the cash flow information that you infer from the financial statements.

6.8.1 Types of Financial Statements :

Q. Briefly describe the types of financial statements.
Q. Differentiate between tangible and intangible assets.

We have already seen the various types of financial statements in brief here we will be studying a few of them in detail.

(i) **Balance Sheet :** The accounting balance sheet is one of the major financial statements used by accountants and business owners. The balance sheet is also referred to as the statement of financial position.

The balance sheet presents a company's financial position at the end of a specified date. Some describe the balance sheet as a "snapshot" of the company's financial position at a point (a moment or an instant) in time. For example, the amounts reported on a balance sheet dated March 31, 2010 reflect that instant when all the transactions through March 31 have been recorded.

Because the balance sheet informs the reader of a company's financial position as of one moment in time, it allows someone - like a creditor - to see what a company owns as well as what it owes to other parties as of the date indicated in the heading.

This is valuable information to the banker who wants to determine whether or not a company qualifies for additional credit or loans. Others who would be interested in the balance sheet include current investors,

potential investors, company management, suppliers, some customers, competitors, government agencies, and labor unions.

Example Company :

Balance Sheet March 31, 2010

ASSETS		LIABILITIES	
Current Assets		**Current Liabilities**	
Cash	2,100	Notes Payable	5,000
Petty Cash	100	Accounts Payable	35,900
Temporary Investments	10,000	Wages Payable	8,500
Accounts Receivable - net	40,500	Interest Payable	2,900
Inventory	31,000	Taxes Payable	6,100
Supplies	3,800	Warranty Liability	1,100
Prepaid Insurance	1,500	Unearned Revenues	1,500
Total Current Assets	**89,000**	**Total Current Liabilities**	**61,000**
Investments	36,000	Long-term Liabilities	
		Notes Payable	20,000
Property, Plant & Equipment		Bonds Payable	400,000
Land	5,500	Total Long-term Liabilities	420,000
Land Improvements	6,500		
Buildings	180,000		
Equipment	201,000	Total Liabilities	481,000
Less: Accum Depreciation	(56,000)		
Prop, Plant & Equip - net	337,000		
Intangible Assets		STOCKHOLDERS' EQUITY	
Goodwill	105,000	Common Stock	110,000
Trade Names	200,000	Retained Earnings	229,000
Total Intangible Assets	305,000	Less: Treasury Stock	(50,000)
		Total Stockholders' Equity	289,000
Other Assets	3,000		
Total Assets	**$770,000**	**Total Liab. & Stockholders' Equity**	**$770,000**

We will begin our explanation of the accounting balance sheet with its major components namely :

1. Assets 2. Liabilities
3. Owner's (Stockholders') Equity

1. Assets :

In financial accounting, assets are economic resources. Anything tangible or intangible that is capable of being owned or controlled to produce value and that is held to have positive economic value is considered an asset. Simply stated, assets represent ownership of value that can be converted into cash (although cash itself is also considered an asset).

The balance sheet of a firm records the monetary value of the assets owned by the firm. It is money and other valuables belonging to an individual or business. Two major asset classes are tangible assets and intangible assets. Tangible assets contain various subclasses, including current assets and fixed assets. Current assets include inventory, while fixed assets include such items as buildings and equipment.

Intangible assets are nonphysical resources and rights that have a value to the firm because they give the firm some kind of advantage in the market place. Examples of intangible assets are goodwill, copyrights, trademarks, patents and computer programs, and financial assets, including such items as accounts receivable, bonds and stocks.

Basic Characteristics of Assets :

It should be noted that - other than software companies and the like - employees are not considered as assets, like machinery is, even though they are capable of producing value.

The probable present benefit involves a capacity, singly or in combination with other assets, in the case of profit oriented enterprises, to contribute directly or indirectly to future net cash flows, and, in the case of not-for-profit organizations, to provide services;

The entity can control access to the benefit;

The transaction or event giving rise to the entity's right to, or control of, the benefit has already occurred.

In the financial accounting sense of the term, it is not necessary to be able to legally enforce the asset's benefit for qualifying a resource as being an asset, provided the entity can control its use by other means.

It is important to understand that in an accounting sense an asset is not the same as ownership. Assets are equal to "equity" plus "liabilities."

The accounting equation relates assets, liabilities, and owner's equity:

Assets = Liabilities + Stockholder's Equity (Owner's Equity)

The accounting equation is the mathematical structure of the balance sheet.

Assets are listed on the balance sheet. Similarly, in economics an asset is any form in which wealth can be held.

Probably the most accepted accounting definition of asset is the one used by the International Accounting Standards Board . The following is a quotation from the IFRS Framework :

"An asset is a resource controlled by the enterprise as a result of past events and from which future economic benefits are expected to flow to the enterprise."

Assets are formally controlled and managed within larger organizations via the use of asset tracking tools. These monitor the purchasing, upgrading, servicing, licensing, disposal etc., of both physical and non-physical assets. In a company's balance sheet certain divisions are required by generally accepted accounting principles (GAAP), which vary from country to country.

Current Asset :

Current assets are cash and other assets expected to be converted to cash, sold, or consumed either in a year or in the operating cycle (whichever is longer), without disturbing the normal operations of a business. These assets are continually turned over in the course of a business during normal business activity. There are 5 major items included into current assets:

- **Cash and cash equivalents :** it is the most liquid asset, which includes currency, deposit accounts, and negotiable instruments (e.g., money orders, cheque, bank drafts).
- **Short-term investments :** include securities bought and held for sale in the near future to generate income on short-term price differences (trading securities).
- **Receivables :** usually reported as net of allowance for uncollectable accounts.
- **Inventory :** trading these assets is a normal business of a company. The inventory value reported on the balance sheet is usually the historical cost or fair market value, whichever is lower. This is known as the "lower of cost or market" rule.
- **Prepaid expenses :** these are expenses paid in cash and recorded as assets before they are used or consumed (a common example is insurance). See also adjusting entries.

Long-term investments :

Often referred to simply "investments". Long-term investments are to be held for many years and are not intended to be disposed of in the near future. This group usually consists of four types of investments:

- Investments in securities such as bonds, common stock, or long-term notes.
- Investments in fixed assets not used in operations (e.g., land held for sale).
- Investments in special funds (e.g. sinking funds or pension funds).
- Different forms of insurance may also be treated as long term investments.

Fixed asset :

Also referred to as PPE (property, plant, and equipment), these are purchased for continued and long-term use in earning profit in a business. This group includes as an asset land, buildings, machinery, furniture, tools, and certain wasting resources e.g., timberland and minerals. They are written off against profits over their anticipated life by charging depreciation expenses (with exception of land assets). Accumulated depreciation is shown in the face of the balance sheet or in the notes.

These are also called capital assets in management accounting.

Intangible asset :

Intangible assets lack physical substance and usually are very hard to evaluate. They include patents, copyrights, franchises, goodwill, trademarks, trade names, etc. Websites are treated differently in different countries and may fall under either tangible or intangible assets.

Tangible assets;

Tangible assets are those that have a physical substance and can be touched, such as currencies, buildings, real estate, vehicles, inventories, equipment, and precious metals.

Information as an Asset :

In Information technology, chiefly in Information security, data needed to conduct the organization business and the technical equipment to manage (input, store, display, print) are called information asset. They can represent a large portion of intangible and tangible asset of an organization. If these assets become unavailable, business operations can be disrupted. Confidential information disclosure can represent a huge liability. While evaluating the potential loss tied to an asset or a group of assets, the value tied to the largest sum between the related asset and their value should be considered.

2. Liabilities:

In financial accounting, a liability is defined as an obligation of an entity arising from past transactions or events, the settlement of which may result in the transfer or use of assets, provision of services or other yielding of economic benefits in the future.

All type of borrowing from persons or banks for improving a business or person income which is payable during short or long time.

They embody a duty or responsibility to others that entails settlement by future transfer or use of assets, provision of services or other yielding of economic benefits, at a specified or determinable date, on occurrence of a specified event, or on demand;

The duty or responsibility obligates the entity leaving it little or no discretion to avoid it; and,

The transaction or event obligating the entity has already occurred.

Liabilities in financial accounting need not be legally enforceable; but can be based on equitable obligations or constructive obligations. An equitable obligation is a duty based on ethical or moral considerations. A constructive obligation is an obligation that can be inferred from a set of facts in a particular situation as opposed to a contractually based obligation.

The accounting equation relates assets, liabilities, and owner's equity :

Assets = Liabilities + Owner's Equity

The accounting equation is the mathematical structure of the balance sheet.

Liabilities can be defined as: "future sacrifice of economic benefits that the entity is presently obliged to make to other entities as a result of past transactions and other past events."

Examples of types of liabilities include: money owing on a loan, money owing on a mortgage, or an IOU.

Liabilities are debts and obligations of the business they represent creditors claim on business assets.

Example of Liabilities :

All kinds of payable

1. Notes payable - a written promise.
2. Accounts Payable - an oral promise.
3. Interests Payable.
4. Sales Payable

Liabilities are reported on a balance sheet and are usually divided into two categories :

- **Current liabilities :** These liabilities are reasonably expected to be liquidated within a year. They usually include payables such as wages, accounts, taxes, and accounts payables, unearned revenue when adjusting entries, portions of long-term bonds to be paid this year, short-term obligations (*e.g.* from purchase of equipment), and others.
- **Long-term liabilities :** These liabilities are reasonably expected not to be liquidated within a year. They usually include issued long-term bonds, notes payables, long-term leases, pension obligations, and long-term product warranties.

Liabilities of uncertain value or timing are called provisions.

3. Owners (stockholders) Equity :

Owner's or Stockholders equity, also referred to as capital, is an accounting term, and it is a major component of a balance sheet. It indicates the portion of a company's equities that a business owner has rights to in relation to assets and liabilities. Technically, owner's equity is an equation that subtracts liabilities from total assets.

Owner's equity can be expressed in a variety of ways. For instance, it represents any debts that are owed to a business owner. It also reflects any investment made by a business owner. If a company founder uses some of his or her own money to launch a new business, for example, the amount is noted in what's known as a capital account, or an owner's equity account.

Publicly traded companies issue a number of shares in the public markets for investors to buy and sell. The two primary types of shares are common stock and preferred stock, although both grant investors partial equity ownership in a company. The number of shares outstanding, which is the number of stocks held by investors, is also considered part of owner's equity.

Preferred stock grants shareholders the right to regular dividend payments at a predetermined rate. Common shareholders are general investors who receive dividend payments only as a benefit that is decided upon every quarter. In the event that a company is forced into liquidation, preferred shareholders are ranked higher and have a right to equity before common shareholders

Retained Earnings are another type of owner's equity. These are profits generated and preserved by a company over time. Instead of distributing these profits to investors in the form of a dividend or using the capital for a company expansion, earnings are retained, and this enhances the owner's equity stake.

Although a company's owners have equity rights to that entity, creditors do, as well. This is why it is necessary to subtract liabilities or debts from assets in order to determine an owner's right to equity. In the event that a company fails and enters bankruptcy, its creditors, including debt holders, have a right to capital before the owner has a right to equity.

6.8.2 Profit and Loss Account :

Income statement also referred as profit and loss statement (P&L), statement of financial performance, earnings statement, operating statement or statement of operations is a company's financial statement that indicates how the revenue (money received from the sale of products and services before expenses are taken out) is transformed into the net income (the result after all revenues and expenses have been accounted for,). It displays the revenues recognized for a specific period, and the cost and expenses charged against these revenues, including write-offs (e.g., depreciation and amortization of various assets) and taxes. The purpose of the income statement is to show managers and investors whether the company made or lost money during the period being reported.

The important thing to remember about an income statement is that it represents a period of time. This contrasts with the balance sheet, which represents a single moment in time.

Profit and loss account is the account whereby a trader determines the net result of his business transactions. It is the account which reveals the net profit (or net loss) of the trader. The profit and loss account is opened with gross profit transferred from the trading account (or with gross loss which will be debited to profit and loss account). After this all expenses and losses (which have not been dealt in the trading account) are transferred to the debit side of the profit and loss account. If there are any incomes or gains, these will be credited to the profit and loss account. The excess of the gain over the losses is called the net profit and that of the loss over the gain is called the net loss. The account is closed by transferring the net profit or loss to capital account of the trader.

Format of the Profit and Loss Account :

Profit and Loss Account For the year ended

To Gross Loss	xxxx	By Gross Profit	xxxx
To Salaries	xxxx	By Interest Received	Xxxx
To Rent	xxxx	By Discount Received	xxxx
To Rent and Rates	xxxx	By Commission Received	xxxx
To Discount Allowed	xxxx	By Other Receipts	xxxx
To Commission Allowed	xxxx	By Etc., Etc.	xxxx
To Insurance	xxxx		
To Bank Charges	xxxx	By Net Loss (transferred to capital account of the trader)	xxxx
To Legal Charges	xxxx		
To Repairs	xxxx		
To Advertising	xxxx		
To Trade Expenses	ex.		
To Office Expenses	xxxx		
To Bad Debts	xxxx		
To Traveling Expenses	xxxx		
To Etc., Etc.	xxxx		
	xxxx		
To Net Profit (transferred to capital account of the trader)	xxxx		

Profit and Loss Account in Statement Form/Income Statement :

Trading and profit and loss account/income statement may be prepared either in account form (T form) or in report form (statement form). Trading and profit and loss account in both the forms give the same information. The account or T form is traditional and is used widely but in recent years many business houses prefer to present the profit and loss account/income statement in the report form.

Format of Profit and Loss Account/Income Statement in Statement Form :

Trading and Profit and Loss Account/Income Statement For the year ended 31st December, 199 -----

Income From Sales :			
Sales		-	
Less: Sales returns	-		
Sales discount	-	-	
Net Sales			-
Cost of Goods Sold :			
Merchandise is stock on 1st January		-	
Purchases	-		
Less: Purchases returns	-		
Net purchases		-	
Cost of goods available for sale		-	
Less merchandise in stock on 31st December		-	
Cost of goods sold			-
GROSS PROFIT			-
Operating Expenses :			
Selling Expenses :			
Sales salaries	-		
Advertising expenses	-		
Insurance expense – selling	-		
Store supplies expenses	-		
Sundry selling expenses	-		
Total selling expenses			
General Expenses :			
Office salaries	-		
Taxes	-		
Insurance expenses general	-		
Office supplies expenses	-		
Sundry general expenses	-		
Total general expenses		-	
Total operating expenses			-
Net profit from operations			-
Other Income :			
Rent income		-	
Other Expenses :			
Interest expenses		-	
NET PROFIT			-

Explanation of Certain Items of Income Statement :

- **Income from sales:** The total of all charges to customers for goods sold, both for cash and on credit, is reported in this section. Sales returns and allowances and sales discounts are deducted from the gross amount to yield net sales.
- **Cost of Goods Sold:** Cost of goods sold refers to the cost price of goods which have been sold during a given period of time. In order to calculate the cost of goods sold we should deduct from the total cost of goods purchased the cost of goods at the end of the year. This can be explained with the help of following formula/equation:

(Opening stock + Cost of goods purchased) – Closing stock = Cost of goods sold

- **Gross Profit :** The excess of the net income from sales over the cost of goods sold is also called gross profit on sales, trading profit or gross margin. It is as gross because all other expenses for the period must be deducted from it to obtain the net profit or net income of the business.

- **Operating Expenses :** The operating expenses also called operating costs of a business may be classified under any desired number of headings and sub-headings. In small retail business it is usually satisfactory to classify operating expenses as selling or general.
- Expenses that are incurred directly in connection with the sale of goods are known as selling expenses. selling expenses include salaries or the salesmen, store supplies used, depreciation of the store equipment, and advertising.
- Expenses incurred in the general administration of the business are known as administrative expenses or general expenses. Examples of general expenses are office salaries, depreciation of equipment, and office supplied used.
- **Net Profit from Operations:** The excess of gross profit on sales over total operating expenses is called net profit or net profit from operations. If operating expenses should exceed gross profit, the excess is designated as net loss or net loss from operations.
- **Other Income :** Minor sources of income are classified as other income or non-operating income. In a merchandising business this category often include income from interest, rent, dividends and gains from the sale of fixed assets.
- **Other Expenses :** Expenses that cannot be associated definitely with the operations are identified as other expenses or non-operating expenses. Interest expense that results from financing activities and losses incurred in the disposal of fixed assets are examples of items reported in this section.
- The two categories of non-operating items, other income and other expenses, are offset against each other on the profit and loss account. If the total of other income exceeds the total other expenses, the excess is added to net profit from operations; if the reverse is true, the difference is subtracted from net profit from operations.
- **Net Profit :** The final figure on the profit and loss account is labeled as net profit (or net loss) or net profit carried to balance sheet. It is the net increase in capital from profit making activities.

6.8.3 Finance Topics :

Table : Balance Sheet and Topics in Financial Management

Share Capital
Equity
Preference
Reserves and Surplus
Debentures
Loans and Advances
← Capital Structure and Cost of capital

Unsecured Loan
Current Liabilities & Provisions
Trade Creditors
Provisions
← Working Capital Financing Policy

Fixed Assets (Net)
Gross Block
Less Depreciation
← Capital Budgeting

Investment ← Security Analysis
Current Assets, Loans and Advances
Cash and Bank Balances ← Cash Management
Receivables ← Receivables Management
Inventories ← Inventory Policy

Miscellaneous Expenditure and Losses :

Table : Income Statement and Topics in Financial Management

Net Sales ← Revenue risk
Cost of Goods Sold
Materials and stocks
Wages and Salaries
Other Manufacturing Expenses
Gross Profit ← Gross profit margin
Operating Expenses
Selling and Administration Expenses
Depreciation ← Depreciation Policy
Operating Profit
Non operating surplus / deficit
Earnings before interest and tax ← Business risk
Interest ← Financial risk
Profit before tax
Tax ← Tax planning
Profit after tax ← Return on equity
Dividends ← Dividend policy
Retained Earnings

□□□

Case Study

Cash Flow Analysis done in Start-Up Companies

Cash Flow is the tool that enables the management to track the movement of money in and out of any business. It is the cycle of cash inflows and outflows that determine the financial health of the business. Poor management os cash flow has been attributed to be the biggest cause of business failure and especially of start-up companies in any country and hence it is critical that the management monitors its cash flow.

As seen in the chapter cash flow analysis is the study of the cycle of the business's cash inflows and outflows with the objective of maintaining an adequate cash flow for the business. Cash flow analysis forms the basis for cash flow management.

Cash flow analysis involves the examination of those components of the business that affect cash flow such as the account receivable Cash flow analysis involves examining the components of your business that affect cash flow, such as accounts receivables, inventory, accounts payable, and credit terms. By performing a cash flow analysis on these separate components, you'll be able to more easily identify cash flow problems and find ways to improve your cash flow.

A quick and easy way to perform a cash flow analysis is to compare the total unpaid purchases to the total sales due at the end of each month. If the total unpaid purchases are greater than the total sales due, you'll need to spend more cash than you receive in the next month, indicating a potential cash flow problem.

Importance of Cash Flow Analysis for Start-Up Companies :

Cash Flow Analysis is all the more important for start up businesses or those which have taken up some new project or any expansion program. In such scenarios there is bound to be an increase in capital expenditure, higher labour cost, purchase of new equipment and increased inventory which will require large cash flows while on the other hand the sales maybe absent (for Start up) or slow as production is in a nascent stage thereby leading to sluggish cash inflows. Hence, the management should keep track of the cash flow and ensure that the situation does not get out of hand.

The other reason for cash flow problems that has been observed especially when it comes to start ups it that of poor bookkeeping practices. The entrepreneur is too busy focussing on the day-today activity and tend to overlook their books of accounts ad tend to fall behind on paying bills and raising invoices and collecting their dues from their customers in time thereby disturbing the cash flow. Once this cycle is disturbed it becomes difficult to get back on track. Although, it is evident that the entrepreneur, when it comes to start up, is bound to focus on setting the production in order he should never overlook the bookkeeping and ensure that is handled properly. The entrepreneur should use accounting software or hire an accountant who will do the needful for him. If the cash flow problem is temporary the entrepreneur can use temporary lines of credit.

Example Cash Flow Statements :

Excel Printing - Cash Flow by Year				
	2013	2014	2015	2016
Cash Inflow				
Printing Services	4,00,000	4,42,000	4,41,000	4,43,000
Binding Services	2,20,000	2,21,000	2, 23,500	2,23,000
Designing Services	1,15,000	1,17,500	1,18,000	1,18,000
Total Cash Inflow	**7,35,000**	**7,80,500**	**7,82,500**	**7,84,000**
Cash Expenditures				
Wages	3,37,000	3,39,000	400,000	410,000
Capital Costs (Equipment purchases)	50,000	1,00,000	30,000	50,000
Maintenance and Repair	22,400	25,000	29,000	22,000
Advertising	15000	23000	25,000	32,000
Insurance	11500	16000	17,000	17000
Total Cash Expenditures	4,35,900	5,03,000	5,01,000	5,31,000
Net Cash Flow	2,99100	2,77,500	2,81,500	2,53,000

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Fully Solved University Question Papers

- Aug. 2017 (In Sem)
- Dec. 2017

August 2017

Q. 1(a) How do you differentiate information systems from information technology ? What drives what ? **(4 Marks)**

Ans. : [Hint : Add at end of Section 1.8]

- In today's competitive business environment, the key resource of every organization is information. If the organization does not have an efficient and effective mechanism that enables it to give the decision makers the right information, then the chances of the organization succeeding are very remote.
- Although, information systems in their very rudimentary form did exist even before the advent of information technology, their speed, accuracy and reliability were always in doubt. The growing demand for information systems that could meet the information needs of modern business enterprises lead to the adoption of information technology tools.
- An information system is an organized combination of people, hardware, software, communication networks and data resources that collects, collates, transforms and disseminates information in an organization. Thus, information technology guides the evolution and expansion of information systems.
- As information systems become more complex the importance of long range information technology planning increases dramatically.

Q. 1(b) How are information systems classified based on their scope ? *(Ans. : Refer Section 1.12.7)* **(6 Marks)**

Ans. :

The information systems that are used in today's business world can be classified in several ways. We will broadly classify the information system as :

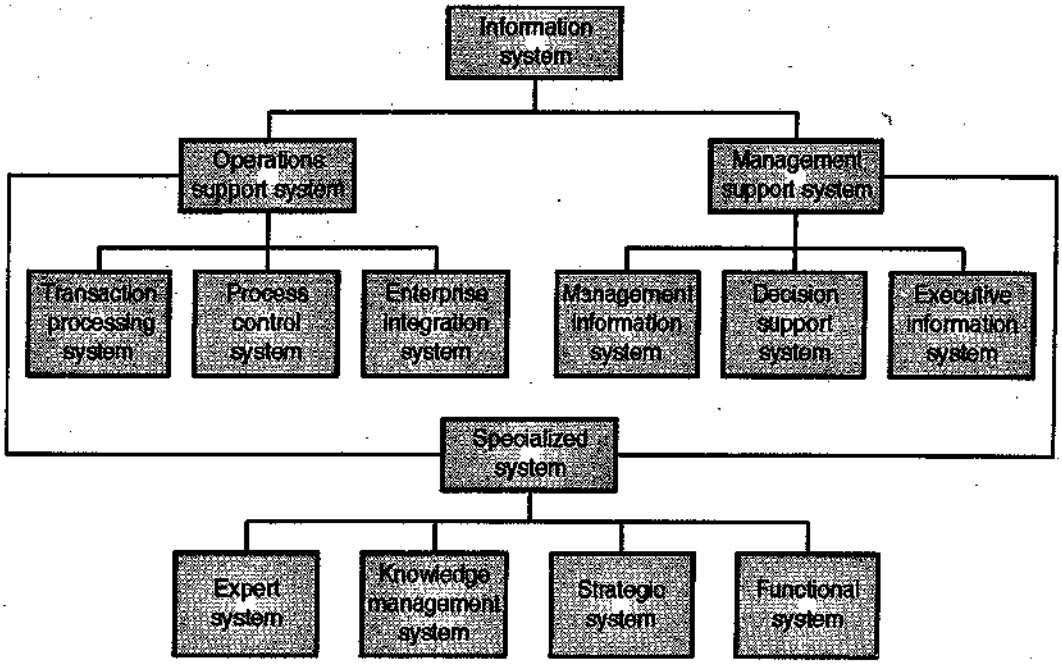


Fig. 1- Q. 1(b) : Types of information system

(I) Operation support system
(II) Management support system
(III) Specialized processing system

Information systems are classified as per the roles they play in the operations and management of a business. In this section we will be studying the various types of information system that are used in an organization.

(I) Operation support system

- There has always been a need for an information system that processes the data generated by and used in business applications. Operation support system suffices this need by monitoring the day-to-day elementary activities and transaction of the organization.
- Operation Support System produces information products that can be used internally as well as externally by the managers. The information products of the operation support system cannot

be used as it is by the managers further processing by management information system is needed.

- The basic role played by operation support system is to process the business transactions, control the various industrial processes within the organization.
- Operation Support System is also supposed to support the communication and collaboration within the organization. Updating the databases for further use is another role played by the Operation Support System.
- As seen in the classification figure there are basically three types of operation support system namely :

(1) Transaction processing system.
(2) Process control system.
(3) Communication and collaboration system.

This classification is done as per the role played by each of these sub system of the operation support system.

(1) Transaction processing system

- The Transaction Processing System is designed to handle transactions between two or more parties. The transaction processing system is a type operation support system that records and processes data that emanates from business transaction.
- The transaction processing system collects stores, modifies and retrieves transaction of an organization. What we mean by a transaction is any event that generates or modifies data stored in the information system.
- Transaction Processing System uses data files, master files, and transaction records. Transaction processing system processes the data in a manner which it has been designed to process the data.
- The output of a transaction processing system is itself a transaction and updating the various records based on the result of output of the transaction processing system is a part of the transaction execution.
- There are two ways of processing transactions.
  (a) **Batch processing :** in this data is accumulated over a period and is processed periodically.
  (b) **Real time processing :** in this data is processed as soon as the transaction occurs. This type is also called as online processing.
- In many retail stores the Point Of Sale (POS) system uses electronic cash register system. This system captures and then transmits sales data electronically to regional computers using telecommunication links.
- The sales data is sent to the regional computers for processing which could be done immediately as in real time or online processing or at particular intervals or designated period called as **batch processing.**
- The essence of a transaction program is that it manages data that must be left in a consistent state. E.g. if an electronic payment is made, the amount must be both withdrawn from one account and added to the other; it cannot complete only one of those steps. Either both must occur, or neither.
- In case of a failure preventing transaction completion, the partially executed transaction must be 'rolled back' by the TPS.
- While this type of integrity must be provided also for batch transaction processing, it is particularly important for online processing: if e.g. an airline seat reservation system is accessed by multiple operators, after an empty seat inquiry, the seat reservation data must be locked until the reservation is made, otherwise another user may get the impression, a seat is still free while it is actually being booked at the time. Without proper transaction monitoring, double bookings may occur.
- Other transaction monitor functions include deadlock detection and resolution (deadlocks may be inevitable in certain cases of cross-dependence on data), and transaction logging (in 'journals') for 'forward recovery' in case of massive failures.
- The payroll system is another example of transaction processing system. The payroll system is used to calculate the monthly salary payable to an employee the data that is used is payable days, payment terms and the payment rules. Employee master file and salary computing algorithm is used to compute the salary. The parties to the transaction are the employee and the organization.

(2) Process control system

- The process control system is another type of operation support system and is used to monitor and control the physical processes within an organization.
- Computers could be used to monitor the processes and take corrective action in case of any deviation.

(3) Communication and collaboration system

- It is also called as the office automation system. This system is used to enhance communication between the various workgroups. This communication and collaboration improves the productivity of an organization.
- Office automation refers to the varied computer machinery and software used to digitally create, collect, store, manipulate, and relay office information needed for accomplishing basic tasks

and goals. Raw data storage, electronic transfer, and the management of electronic business information comprise the basic activities of an office automation system. Office automation helps in optimizing or automating existing office procedures.

(II) Management support system

- The prime focus of the management support system is to provide information and support to the management for effective decision making. The information and support needed for decision making should be provided at all levels within an organization.
- The information needed at different levels is different in its type and format thus making the management support system a complex process. The management support system comprises of :

(1) Management Information System
(2) Decision Support System
(3) Executive Information System
(4) Executive Support System.

(1) Management information system

- A **Management Information System (MIS)** is a detachment of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing a product, service or a business-wide strategy.
- Management information systems are different from usual information systems in that they are used to scrutinize other information systems applied in operational activities in the association.
- Academically, the term is commonly used to refer to the group of information management methods tied to the computerization or support of human decision making, e.g.
- Decision Support Systems, Expert systems, and Executive information systems. It has been described as, MIS 'lives' in the space that intersects technology and business.
- MIS combines tech with business to get people the information they need to do their jobs better/faster/smarter.
- Information is the lifeblood of all organizations - now more than ever. MIS professionals work as systems analysts, project managers, systems administrators, etc., communicates directly with staff and management across the organization."

(2) Decision support system

- **Decision Support Systems (DSS)** are a computer-based information system that supports business or organizational decision-making activities.
- DSS's serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.
- DSS's include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

(3) Executive information system

- An **Executive Information System (EIS)** is a type of management information system intended to facilitate and support the information and decision-making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization. It is commonly considered as a specialized form of a Decision Support System (DSS)
- The emphasis of EIS is on graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities. In general, EIS are enterprise-wide DSS that help top-level executives analyze, compare, and highlight trends in important variables so that they can monitor performance and identify opportunities and problems. EIS and data warehousing technologies are converging in the marketplace.

(4) Executive support system

- **Executive Support Systems (ESS)** supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as "educated guesses." Executives rely as much, if not more so, on external data than they do on data internal to their organization.
- Decisions must be made in the context of the world outside the organization.
- The problems and situations senior executives face are very fluid, always changing, so the system must be flexible and easy to manipulate.

(III) Specialized processing system

The specialized processing systems support the operation and the management support system. The specialized Processing System comprises of :

(1) **Expert system :** Provides expert advice. Generally the advice of an outside professional is employed. An expert in his area could be in finance, marketing or operations. He assists in the decision making process by providing valuable insight into the area.

(2) **Knowledge management system :** as the name suggest knowledge management system support creation and dissemination of knowledge to its employees and managers. This knowledge in various areas assists them in their decision making.

(3) **Functional business system :** This system supports the basic functions of a business. Basic functions like accounting, marketing and distribution are supported by the functional business system.

(4) **Strategic information system :** This system applies the technique and tools of information technology to the firm's products, processes and services to enable it to gain an advantage over its competitors.

Q. 2(a) What benefits can a business derive from a properly implemented information system ?

(Ans. : Refer Section 1.10) **(4 Marks)**

Ans. :

The three primary roles that information systems play in an organization are :

(1) **Information storage and analysis :** Gone are the days when companies used to manage their data and information with physical registers. By adopting information systems, companies can make full use of state of the art databases that contain all the required data. Information systems provide its users with information that they can utilize to solve business problems and take decisions. Modern information systems do not limit themselves with data and information that is internal to the organization, these systems can integrate data from various internal and external sources and keep the user abreast with the most relevant information.

Such systems provide the user information not only of the internal performance but also looming threats and business opportunities.

(2) **Assist in decision making :** Perhaps the most important role of information systems is the assistance that they provide in the decision making process. In the current competitive business environment, the long term success of a company depends upon its strategic plans. Information systems are used to formulate strategic plans and assist in the decision making process. The information made available by various sources needs to be evaluated by the information systems before it is used in the decision and strategic planning process.

(3) **Assist with business processes :** Another relevant role of information systems is their ability to integrate with the various business processes of the organization to ensure that the output produced adheres to the quality standards. Thus, information systems can be used in developing various value added systems. Integrating the information system with the various business processes simplifies and helps reduce the number of activities and invariably the time spent on these activities. Repetitive tasks are totally eliminated from the system and greater accuracy is provided. Also, information systems ensure that access is provided to only authorised employees. Information system plays a very critical role in project management as they facilitate effective monitoring and control as well as comparison with standards.

However, the entire capacity of the information system needs to be harnessed to gain maximum benefits from the company's information system. The effectiveness of the information system can be increased by either adding more data to make the information more accurate or use the information in new ways. In addition to the above mentioned roles information systems play the following roles:

- Information systems can gather and distribute information thereby enabling managers to communicate more efficiently and rapidly.
- Information systems can be used to store documents that can be accessed by other employees who need the information in the documents.
- Changes in the original document can be made by authorised employees that can be tracked by the system tracker. Once the process is complete the manager can send the revised document to the final recipient for approval. Thus, information systems enable employees to collaborate in a more efficient and systemic manner.
- Information systems provide more complete and current information enabling the management to better manage the company.
- The information provided by information system can be used to gain a competitive advantage over competitors.
- Information systems provide all the relevant information needed for decision making.
- The information provided is current and thus instils confidence in the decision maker. The system can also run different scenarios if more than one choice looks appealing.
- Information systems are used to store documents, communication records and operational data. This can be processed by the system and presented as useful information to prepare cost estimates and forecasts.

Q. 2(b) What are ethical and social issues related to an information system ?

(Ans. : Refer Section 2.3.3) **(6 Marks)**

Ans. :

Ethical and social issues related to systems

- It probably goes without saying that the security and ethical issues raised by the Information Age and

specifically the Internet are the most explosive to face our society in decades.

- It will be many years and many court battles before socially acceptable policies and practices will be in place and that too will surely be put to test when the user is introduced to new developments.
- Many a times we are surprised and love it when a particular site that we visit often display products which we like. These sites are very well aware of our likes and dislikes and hence won't bother us with products which we don't like.

Five moral dimensions of the information age

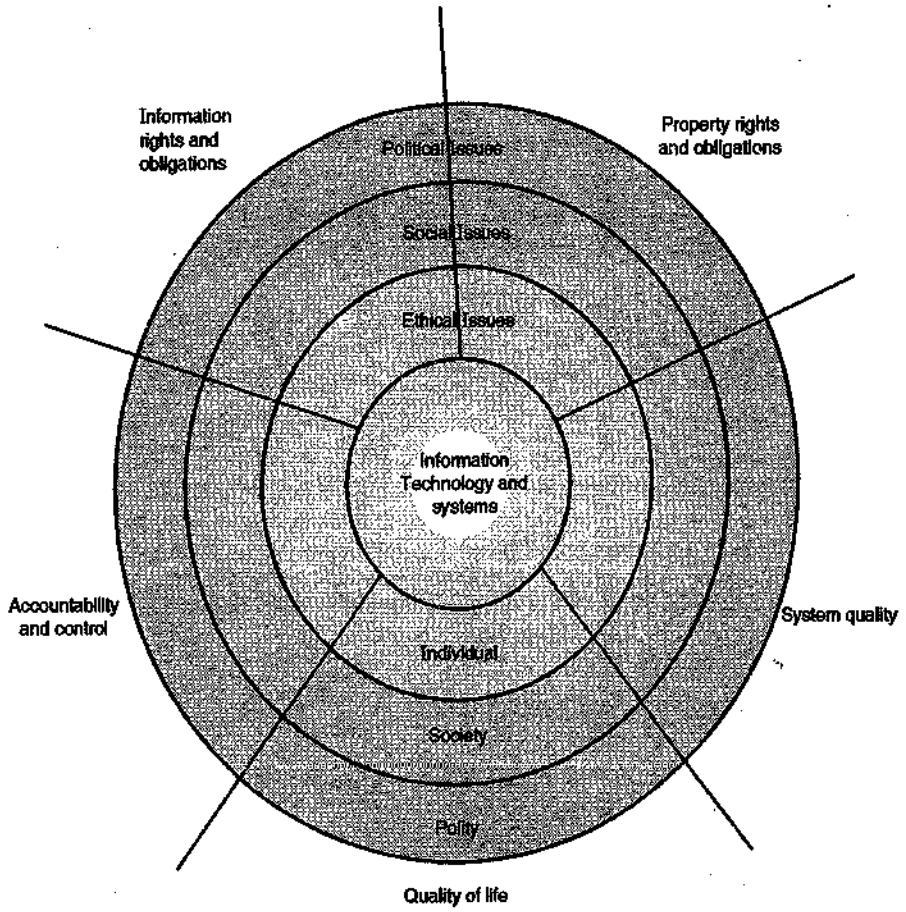


Fig. 1-Q. 2(b) : Ethical, Moral, Political issues in an Information Society

- Fig. 1-Q. 2(b) shows the relationship between ethical, social, and political issues in an information society. Information technologies pose problems and threats to established societal rules, and new advances pose new situations and possible threats to privacy and ethics.
- There is a normal tendency to think that no one will care what you do on the net, you need to think twice before you do that. Companies are accessing databases from various sources as a part of the screening process to determine the kind of websites the prospective employees has visited and this is all possible because of data mining.
- Ethics is easily managed in small groups because the group itself tends to control the individual's behavior but as the group grows, the harder it is to manage the actions of individuals.

Q. 3(a) What are the steps involved in developing an information systems ?

(Ans. : Refer Section 3.3.7) **(4 Marks)**

Ans. :

The information systems development methodology comprises of five steps which are as follows :

Step I : Information system conceptualization and initialization

- This is the first step is responsible for preparing the ground work for further development.
- In this step the idea behind the information system is hatched and the goal or purpose of the system is defined.
- The primary information system goal is very important as it provides a basis for future decisions and aids in defining the systems scope. The systems goal also serves as a parameter for evaluating the systems success after its completion.
- If the primary goal of the system is achieved the system could be termed as a success, however, there are other factors like the time and cost which also are also to be considered while determining systems success.

- System's Initiation is the first official step in the project methodology and marks the commencement of the development. Initiation is based on the business needs that justify the allotment of resources and the expenses that will be incurred on it.
- The primary idea behind Initiation is to ensure that the business need is properly understood by the system's manager and is kept in mind throughout its lifecycle.
- The Initiation stage enables the creation of the charter that is the official document authorizing the system's manager to undertake the development within the organization. As everyone who is party to the system or who is likely to be affected by it is part of the initiation stage it is easy for the manager to identify the stakeholders.

Step II : Developing project plan and charter

- As information system development is new or unique and never been done before in the organization, planning is essential.
- The planning process should complement the size and complexity of the system i.e. the larger and more complex the system greater the planning effort while small routine system require very less planning effort. Although, planning is an intrinsic part of each phase of the methodology it is all the more relevant in this phase where the project plan and charter are developed.
- Another very critical feature of planning is that it is never over, planning is an iterative process, and may require constant changes in its budget, scope, schedule or quality, as per the requirement of the client, stakeholder or the management. The system manager will have to depend on his wisdom and experience in developing a good and pragmatic plan.
- The system manager needs to focus on the specifics and narrow the description. It is the time to draft the Project Charter. A project charter is a detailed official document prepared in line with the company's vision and goal describing in detail the finer nuances of the system and chalking out deadlines for the milestones within the system development.

Step III : Execution and control

- After having developed the project plan it is time to execute the plan.
- Although, the execution process is a part of every system phase it is more active and prominent during the execution and control phase.
- The second part of this step is the controlling process. The primary objective of the controlling process is to measure and manage the system activities and ensure that they are on the right track towards the goal and adhere to the scope, budget, schedule, and quality parameters.
- The control process identifies deviation from the plan and makes it possible to take corrective action.
- Although, controlling process is present in each of the phases it has more emphasis in this phase.

Step IV : Closure

- The primary objective of Closure is to ensure that the development reaches its logical conclusion and to bring the development to an orderly completion. The system closure phase is reached when all the system deliverables have been achieved and accepted.
- At this step the system team has to also ensure that the system integrates with the day-to-day operations of the organization and delivers information products as required. The closure of a project is marked by contract and administrative closure.
- Contract closure indicates that all the deliverables have been successfully completed and all the agreed upon terms and conditions of the contract have been adhered too.
- Contract closure paves the way for the settlement of dues of outside parties, namely, suppliers and consultants. Administrative closure involves the documentation of all project activities and experiences for future references.
- Although, each project process group has closure of its activities, the major systems closing process occurs in this phase.

Step V : Project evaluation

- The evaluation phase focuses on evaluating the previous four steps. The systems review conducted by the system's manager and his team should focus on assessing the positive and negative outcome of the system, things that worked in favour of the system and what went against.

Q. 3(b) Discuss various social and ethical issues that need to be addressed by the information system of a manufacturing/process industry ? **(6 Marks)**

Ans. : [Hint : Add at the end of Section 2.3.3]

Information Systems are integrated software packages that cover all business functions of an enterprise. Information systems for manufacturing/process industry consists mainly of functions of general planning and management of core business such as sales management, production management, accounting and financial planning, etc.

Ethical and social issues related to information systems in manufacturing industry

Reasons for creation of ethical and social issues due to the introduction of information systems

- Increased dependence on computer systems for critical operations.
- Reduced data storage costs enable organizations to maintain detailed databases.

- Advances in networking and the internet facilitate copying of data from one location to the other and accessing information from multiple locations.
- Improved data analysis techniques enable companies to analyze vast quantities of data.
- The doubling of computer power every few months has enabled manufacturing firms to use information systems for core production processes. This sudden dependence on information systems has increased the vulnerability of these firms to system errors and poor data quality.
- The dependence of manufacturing firms on information systems have not been matched by rules and laws that will ensure the accuracy and reliability of information systems.
- Thus, the ethical issues raised by the widespread use of information system in manufacturing industry include establishing accountability for the consequences of information system, setting standards to safeguard system quality that will protect the interests of individuals and the society and preserving values that are essential to the quality of life in an information system.
- It has been observed that in the manufacturing industry the manager will have to deal with data quality and software problems that could impede the smooth and accurate flow of information among disparate manufacturing and production systems and among supply chain partners.
- Hence, it is the responsibility of the information systems manager in making management aware of the ethical implications of the technologies used by the firm and help management establish code of ethics for information systems.

Q. 4(a) List various technical challenges in using information systems by an e-commerce organization ? **(4 Marks)**

Ans. : [Hint : Add at the end of Section 3.14]

- The technological challenges in using information systems by an e-commerce are abundant. Technology in information systems and e-commerce are advancing at a rapid pace and users are having difficulties in keeping pace with these developments.
- E-commerce organizations that are using information systems should keep abreast of the latest technological developments and implement what is required in order to survive and thrive.
- Some of the technological challenges are software functionality, technological obsolescence, application portfolio management, upgrading, etc. Let us discuss a few of them in detail.
- **Software functionality :** Every information system can offer a myriad of features and functions. However, all these features and functions are not required by all organizations. So, the management has to decide on what features are required and what it can do without. Merely adding features and functions because they are available is a sure shot recipe for disaster.
- **Technological obsolescence :** Technology in information systems is changing at a rapid pace and what is current today tends to become obsolete tomorrow. Therefore, the organization has to be very prudent in selecting the information system and ensure that the system will have the best chance of returning the investment or selecting those features that will not become obsolete in the near future.
- **Application management :** The e-commerce organization is an ever expanding organization with an ever growing inventory applications and supporting infrastructure. The e-commerce needs to keep a check on its existing applications.
- **Upgrading :** The information system needs to be upgraded and kept up-to-date and this is the responsibility of the people who are in-charge of maintaining the system.

Q. 4(b) Discuss the information technology choices to be considered while developing an information system for a bank.

(Ans. : Refer Section Chap. 2 case study) **(6 Marks)**

Ans. :

Information technology infrastructure in a bank

Information technology infrastructure can be defined as the physical services, and the management that supports all computing resources in an organization and include operations, documentation, integration, and maintenance. Thus, information technology infrastructure includes both the technical and managerial expertise to provide reliable service.

These resources include :

1. Computer hardware and software (e.g. operating systems);
2. Network and telecommunications technologies;
3. Key Data;
4. Core data - processing applications;
5. Shared information technology services

Information technology infrastructure include the alignment of information technology plans to business objectives, the information technology architecture, and the skills of information technology personnel.

It is the enabling foundation of shared information technology capabilities upon which the entire business depends. This foundation is standardized and shared by business functions within the organization, and typically used by different organizational applications. From the above discussion we can deduct that information technology infrastructure is composed by two components :

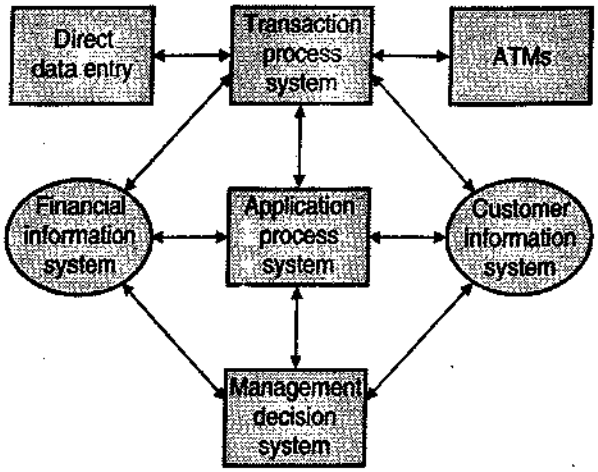


Fig. 1-Q. 4(b)

Technical information technology infrastructure

Human information technology infrastructure

- The technical aspect of information technology infrastructure consists of the applications, data and technology while the human aspect of Information Technology Infrastructure consists of the knowledge and capabilities required to handle organizational Information Technology resources. Information Technology Infrastructure capabilities provide the foundation for competitive advantage.
- A robust IT Infrastructure enables employees to be able to perform their respective jobs, both from having the available technology and the necessary technological skills.
- There is direct link between the firm's information technology and its performance. There are three factors that influence performance, namely, the quality of IT management practices, IT management processes should sense, gather, organize and disseminate information in other words IT management is positively related to a firms performance and continual existence.
- Information technology infrastructure capabilities in firm impacts customer focus and market focus. This in other words means that IT infrastructure capabilities enable firms to position their IT asset so as to capture information about customers as well as disseminate information to customer in other to create satisfaction.

Q. 5(a) What is an ERP ? What are its various components ?

(Ans. : Refer Section 3.13.3.1) **(5 Marks)**

Ans. :

ERP

Enterprise Resource Planning (ERP) is the technique of integrating the various processes within the organization with the aim of better and effective utilization of management resources for the improvement of the efficiency of the organization.

Generic model of ERP

ERP involves the effective and efficient planning of material and resources of the company. This planning of material and resources is carried out at the Strategic and Operational Level. Modern ERP models need to be designed and managed with a more global and tightly integrated perspective.

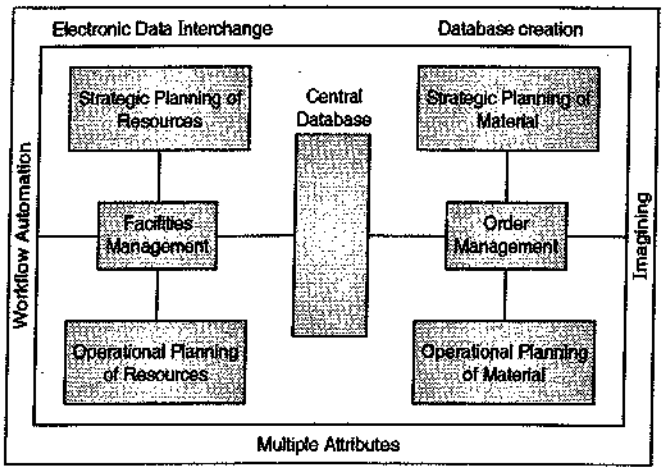


Fig. 1-Q. 5(a) : Generic Model of Enterprise Resource Planning

The generic model of ERP comprises of five major quadrants namely;

- **Central database :** the Central Database is at the centre of all the activities as it comprises of entities that are shared by all the functions of the enterprise. Entities which form the Central Database in a generic ERP model are Accounts Information (Receivable & Payable), General Ledger, Employee Database (Skills, Payroll), Fixed Assets, Inventory, Logistics Management, Budgeting etc.
- **Strategic planning of resources :** Strategic planning of resources plans the optimal utilization of two of the enterprises major resource namely human resource and equipment. Management of human resource will include maintaining of employee database, job profile and description, application tracking, performance review, career planning and identifying training needs. The other important resource which needs to be managed and planned for effectively is equipment. An up-to-date record of the status of equipment and its location needs to be made available online. Another area of concern for every enterprise that needs to be addressed under Strategic Planning of Resources is Quality Management.
- The strategic planning application is connected to facilities management application. This application caters to the management and maintenance of facilities.
- **Operational planning of resources :** The operational planning of resources comprises of activities like the Management Information System of Resources. The management works out the requirement for resources for a particular period based on forecasts for that

particular period. Management Information of Resources should ensure that no resource lies unused or is over committed. The Quality Control resource enables the monitoring of the specifications of the product and/or process.

- Time and Attendance is another resource which is covered here and is linked to payroll, performance appraisal and job evaluation. The tracking and analysis of costs that are directly related to the production process is enabled through Cost Accounting of Manufacturing.
- **Strategic planning of material :** The most important activity in this quadrant is the management of engineering change, be it by way of introduction of new product or changes to existing product. Another important application in this quadrant is the Bill of Materials which depicts the structure of products.
- The material database should take the form of a single repository and should enable the sharing of data by various functions (Sales, Purchase, Costing, Warehousing, Material Planning etc) and in the measure and form that they require.
- **Operational planning of material :** This quadrant involves the actual execution of the materials function as it is more convenient to do forecasting at various levels. The other applications related to material like its distribution, routing etc are carried out in this quadrant. The integration of these applications should provide for free flow of information.
- The entities that lie outside the inner boundary represent the cross enterprise functionality and need to be shared by all the functions within the enterprise.
- **Electronic Data Interchange (EDI) :** modern enterprises need to be more flexible in their approach and hence need information on the move this is made possible by EDI. Electronic Data Interchange is the structured transmission of data between organizations by electronic means.
- It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention hence customer information, orders, invoices can now be shared in real time.
- **Imaging :** imaging is another tool which enhances the integration process within the enterprise. It enables the sharing and storing of images, pictures, structures, sales orders, invoices, drawings etc.
- **Electronic approval process :** the electronic approval process enables the speedy approval of documents needing the consent of higher authorities. This is made possible by integrating Email for effective workflow automation.
- **Database creation :** possibly the most important cross enterprise functionality. It enables the creation of various forms and types of data needed throughout the enterprise.
- **Multiple capabilities :** another important aspect of the cross enterprise functionality is the multiple capabilities needed by the system. To operate on a global level the software solution has to be multilingual and multicurrency. In addition to these capabilities modern enterprises have to incorporate multiple manufacturing strategies. Modern enterprises operating in global markets have multiple divisions and hence the software solution should support multiple facilities.

Q. 5(b) Explain various data formats and data characteristics that a typical information system has to deal with ? *(Ans. : Refer Section 3.7.1)* **(5 Marks)**

Ans. : [Hint : Refer Sections 3.12.4]

- The success or failure of most businesses depends on the quality of their data. Effective planning and decision making depends on the systems that make data available to decision makers in usable formats on a timely basis. A continuous plan is needed to guide, control and govern IT development.
- Business information is scattered throughout the organization, stored in separate systems dedicated to specific purposes. An average organization has many such data storage repositories with very less integration between these disparate systems.
- The user's ability to access all the information needed is limited. Therefore, despite all the information flowing through the organization, employees struggle to find the information they need to make sound decisions. Thus, the objective of information management is to eliminate this struggle through proper data formatting and data governance.
- Many organizations have planned and implemented data governance and master data management. Master data is the data that is critical to business and contains data on customers, products, finance, accounts, production, etc.
- Master Data Management (MDM) links and synchs business critical data from disparate systems within the organization into a consolidated file, called a master file that provides a common point of reference. The larger the organization the more effective is MDM.
- Data governance and MDM manage the availability, usability, quality and security of the data used throughout the organization. MDM can standardize and unify data across systems.
- Master data describe key entities such as customers, products and services, vendors, locations and employees around which business is conducted. As compared to other forms of data master data is quite stable.

Data characteristics

- Timeliness – Appropriateness – Accuracy
- Relevant – Conciseness – Complete
- Frequency – Current – Economical
- Understand ability

- **Timeliness :** Data must reach the user in a timely manner, just when it is needed; not too early, because by the time it is used it would be out-of-date; not too late because the user will not be able to incorporate it into his/her decision-making.
- **Appropriateness :** Data must be relevant to the person who is using it. It must be within the sphere of his/her activities so that it can be used to reduce uncertainty in his/her decision-making.
- **Accuracy :** Accuracy costs. We don't always need 100% accurate data so long as we know the degree of accuracy it represents (e.g.: ± 5%).
- **Conciseness :** Data should always contain the minimum amount of detail that is appropriate for the user. Too much detail causes information overload.
- **Frequency :** Frequency is related to timeliness. Too often the data presented is linked to the calendar (end of the week, beginning of the month); its frequency should be synchronized with the timing of the decision making of the user.
- **Understand ability :** The format and presentation of information are very important. Some people prefer tabular information, whereas others may need it in a graphical form. Also the use of colors enhances the understandability of what is presented.
- **Relevant :** It pertains to the particular problem. What data is relevant depends on the decision-making model used. E.g. University admissions officials may choose to consider the results of some high-school test irrelevant, if they believe that it does not improve the chances of some applicant later becoming a successful student.
- **Complete :** All the relevant parts are included. E.g. Marketing data about household incomes may lead to bad decisions, if not accompanied by consumption habits of the target population.
- **Current :** Decisions are often based on the latest data available
- **Economical :** The costs of gathering data should be justified by the overall benefits
- **Errors and bias :** The decision maker will always prefer data which has quality and not the quantity. The quality of the data is bound to get affected due to the bias of the presenter and the errors that may occur due to various reasons.
- Now if the presenter is known to the decision maker then he anticipates the degree of bias and can make the necessary adjustments in his decision making. But the same is not possible with errors as errors pose a more serious problem as errors can creep in at various stages and it is not possible to make the adjustments in the decision making.

Q. 6(a) What is the role of information and communication technology in the successful utilization of an information system ? **(4 Marks)**

Ans. : [Hint : Add as Section 3.14.2]

ICT (Information and Communication Technology) incorporates electronic technologies and techniques used to manage information and knowledge, including information-handling tools used to produce, store, process, distribute and exchange information. Benefits of ICT can be achieved directly, through improved information sharing and faster decision making. ICT, if properly designed and implemented, can generate many positive outcomes: improved access for even those in remote areas; support of professionals; real-time information; data sharing; and data capture, storage, interpretation, and management.

Q. 6(b) List what would be various challenges in developing and managing the information systems for UIDAI Unique Identification Authority of India project.

*(Ans. : Refer Sections Chap 3 case study II)***(6 Marks)**

Ans. :

Challenges

The UIDAI is a government body mandated with the task of assigning every single one of India's 1.2 billion citizens a Unique Identity (UID) number. To do that, the Authority will photograph a staggering 1.2 billion Indians, scan 2.4 billion irises, collect twelve billion fingerprints and record 1.2 billion addresses.

The other challenges facing UIDAI are :

- Challenge of making the card secure
- Overcoming errors in biometrics
- Fingerprinting errors

There are major issues of sensor noise and poor image quality in large scale deployment of Automatic Fingerprints Identification System. Thus, critical techniques during enrolment should be consistently followed for good quality capturing of fingerprint images. Further, in India, where a large population belongs to rural areas, presence of scars, warts and deteriorating patterns in the fingerprints will lead to change in biometrics over time.

Absence of birth records and address proof with a large number of people add to the problem. There is also a high likelihood for data recording errors. As per directions of UIDAI, it can alert the authority for erroneous information in database but has no right to correct it.

There is also a fear among experts that comprehensive information data of an individual might be misused by its possessor. Furthermore, GoI lacks to some extent public trust and confidence, where the residents have a fear of coming into radar of government with UID. Scaling needs of UID project are unprecedented.

Dec. 2017

Q. 1(a) Explain different challenges for the information Systems manager.

(Ans. : Refer Section 1.11) **(5 Marks)**

Ans. :

- The challenges that an information manager encounters during the course of development and implementation can be attributed to :

(1) Human challenges
(2) Operational challenges
(3) Technical challenges
(4) Financial challenges
(5) Managing the data flow
(6) Data security challenges
(7) Environmental challenges

(1) Human challenges

- The information systems manager will need the support of his people to ensure the smooth sailing of the system. The human factor is the factor that is related to every person in the organization. Humans create perhaps the biggest obstacle when it comes to implementing information systems.
- The primary challenge for an information system is the lack of resources to engage in user education, inability in recruiting appropriate staff and experts who can suitably accomplish the development and implementation process.
- Another challenge facing the information system manager is to be able to fulfil the expectations of users. Also, the lack of computer skill has been identified as key challenge and major difficulty to the development of information systems.

(2) Operational challenges

- Information systems were originally designed to support the accounting function within the organization and once it had proved its use there, it was rolled out to the other functions within the organizations.
- However, this meant that the implementation was fragmented thereby creating data silos that supported various functions but failed to support cross functional business processes.
- For example, in an online business taking customer order is an easy process, but the order fulfilment process which involves moving product from warehouse to customer, collecting payment if not done earlier, packing the product, pasting the address, shipping the product and informing the customer is a rather tedious process.

(3) Technical challenges

- Technical challenges are very much similar to operational challenges and are related to hardware and software issues of the information system as well as barriers such as telecommunication issues.
- The transition from the old system to the new system in terms of hardware, software and training also poses a major challenge to the information systems manager.

(4) Financial challenges

- Once the information systems strategy has been developed it needs the approval of the top management. An approval would mean the sanctioning of budget, personnel and time.
- Rising project costs have always been a challenge for the manager. Many a times it has been observed that a new information system is being developed when the existing system is not being utilized to its full potential.

(5) Managing the data flow

- The flow of information is irregular and subject to strong fluctuations. This poses challenge to the manager as he has to control the flow of information. Information controlling is the analysis, evaluation and importance attached to the data that is collected and provided.
- The first step in this direction is to make employees aware of the importance of the data they help gathering. The manager should ensure the accuracy of the data being collected by employees. Accuracy of the data will help in improving speed, quality of the system while reducing costs.

(6) Data security challenges

- With increasing complexity of the information system there is always a likelihood of compromise of data security.
- Compromise of data security not only poses problems of breach but may also have legal ramifications in some cases. The information security manager has to ensure that all protective measures are in place and all its data is secure.

(7) Environmental challenges

- Environmental challenges include organizational culture, change management, resource capabilities, coordination, distribution of responsibilities, unaligned organizational systems and resources, etc.

- Other less important environmental challenges include political environment, lack of commitment to strategy on the part of top management and confusion of the strategies.

Q. 1(b) Explain DSS (Decision Support system) in detail. *(Ans. : Refer Section 1.12.7)* **(5 Marks)**

Ans. :

Decision Support System (DSS)

- **Decision Support Systems (DSS)** are a computer-based information system that supports business or organizational decision-making activities. DSS's serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance.
- DSS's include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, personal knowledge, or business models to identify and solve problems and make decisions.

Q. 2(a) List and explain characteristics of a Transaction Processing System. *(Ans. : Refer Section 1.12.7)* **(5 Marks)**

Ans. :

(1) Transaction processing system

- The Transaction Processing System is designed to handle transactions between two or more parties. The transaction processing system is a type of operation support system that records and processes data that emanates from business transaction.
- The transaction processing system collects stores, modifies and retrieves transaction of an organization.
- Transaction Processing System uses data files, master files, and transaction records. Transaction processing system processes the data in a manner which it has been designed to process the data.
- The output of a transaction processing system is itself a transaction and updating the various records based on the result of output of the transaction processing system is a part of the transaction execution.
- There are two ways of processing transactions :
  - (a) **Batch processing :** In this, data is accumulated over a period and is processed periodically.
  - (b) **Real time processing :** In this, data is processed as soon as the transaction occurs. This type is also called as online processing.
- In many retail stores the point of sale (POS) system uses electronic cash register system. This system captures and then transmits sales data electronically to regional computers using telecommunication links.
- The sales data is sent to the regional computers for processing which could be done immediately as in real time or online processing or at particular intervals or designated period called as **batch processing**.
- The essence of a transaction program is that it manages data that must be left in a consistent state. E.g. if an electronic payment is made, the amount must be both withdrawn from one account and added to the other; it cannot complete only one of those steps. Either both must occur, or neither.
- In case of a failure preventing transaction completion, the partially executed transaction must be 'rolled back' by the TPS.
- While this type of integrity must be provided also for batch transaction processing, it is particularly important for online processing: if e.g. an airline seat reservation system is accessed by multiple operators, after an empty seat inquiry, the seat reservation data must be locked until the reservation is made, otherwise another user may get the impression, a seat is still free while it is actually being booked at the time. Without proper transaction monitoring, double bookings may occur.
- Other transaction monitor functions include deadlock detection and resolution (deadlocks may be inevitable in certain cases of cross-dependence on data), and transaction logging (in 'journals') for 'forward recovery' in case of massive failures.

Q. 2(b) What is ICT and explain its role in rural development. *(Ans. : Refer Section 3.14)* **(5 Marks)**

Ans. :

- Information and Communication Technologies (ICT) play a key role in the economic development and rural growth of developing countries such as India and China.
- ICTs can play a critical role in sustainable human development and poverty eradication. Till date the ability of the government has always been hampered by its inability to access, gather, analyse and utilize information through which it could undertake socio-economic development.
- Even the noblest of intentions of the government would be let down due to non availability of information and inability to reach to the masses. However, things are changing as ICTs have emerged as a powerful enabler of developmental goals because of the manner in which it improves communication and exchange of information and knowledge necessary for socio-economic development.
- ICTs are all pervasive and have the ability to impact every human activity and hence will become one of the main enablers in the pursuit of poverty alleviation and wealth creation especially in developing countries and also in developed countries.

- ICTs serve as conduit that transmits information and knowledge to the citizens of the country to widen their choices for economic and social empowerment. Governments in developing countries have ambitious plans of transforming citizen-government interaction through these ICTs.
- ICTs are slated to transform the way in which government and citizens interact. The challenge for each country, according to United Nations Development Programme (UNDP), is to create, develop and sustain a system of governance that promotes, supports, and sustains human development.
- India is no different and has made huge investments in ICTs aimed at improving governance processes.

Q. 3(a) What is metadata? Give its importance. **(5 Marks)**

Ans. : [Hint : Add at the end of Section 1.9.1]

What is metadata?

- Metadata is the data behind the data. Metadata describes data models, data source, collection of data be it a file or a database or a table or a class, an instance of data or data associated with the values of an attribute in a domain or particular value of an attribute in one instance.
- Metadata is also used to describe the processing system, a particular process, component of a process or the environment of the processing system and the process model. Metadata can describe a suite of software, a particular program, and fragment of a program or a specification. Metadata can also describe an event system, an individual event, a constraint system an individual system and an event model.
- Metadata is also used to describe the role played by people in an information system, the entire organization and the various departments within the organization.

Importance of metadata

- Metadata has gained importance primarily because of the increase; in the available information sources, the users and the information requests.
- Complexity in information systems has increased because of the following factors :
  - Heterogeneity of the information sources, language, quality, structure, etc.
  - Queries with complex syntax and semantics.
  - Use of Graphical interfaces.
  - Improved queries.
  - Increased complexity of the logic of processes that act over the information sources.
  - Increased complexity of integrating information from multiple sources.
- The other reason for the increased importance of metadata is its ability to optimize queries, explain answers, mediate between information sources and the user and the source.

Q. 3(b) What is outsourcing ? Specify the benefits of outsourcing. **(5 Marks)**

Ans. : [Hint : Add at the end of Section 3.4.2]

1. The term **outsourcing** refers to dealing with the outside agencies to complete the project which cannot be dealt with or handled inside the organization.
2. The necessity of the outsourcing is compiled and the by comparing the inside resources and the cost of outsourcing.
3. The cost calculations justifies the product to be outsourced as the inside development will cost more.
4. The various technological development and the research is done before outsourcing.
5. To outsource the product and to deal with the external resources is termed as the procurement of the items from outside.
6. To have the successful completion of the procurement of product from outsourcing, Project Procurement Management is done.

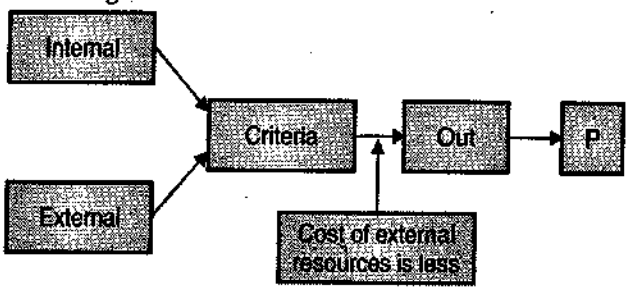


Fig.Q.3(b)

Q. 4(a) Explain the concept of Supply Chain Management.

(Ans. : Refer Section 3.13.4.2) **(5 Marks)**

Ans. :

- In every business there is a stream of processes of moving goods from the customer order through the raw materials stage, supply, production, and distribution of products to the customer. All organizations have supply chains of varying degrees, depending upon the keeping costs down.
- The first step is obtaining a customer order, followed by production, storage and distribution of products and supplies to the customer site. Customer satisfaction is paramount. Included in this supply chain process are customer orders, order processing, inventory, scheduling, transportation, storage, and customer service. A necessity in coordinating all these activities is the information service network.
- The decisions associated with supply chain management cover both the long-term and short-term. Strategic decisions deal with corporate policies, and look at overall design and supply chain structure.
- Operational decisions are those dealing with every day activities and problems of an organization. These decisions must take into account the strategic decisions already in place.

- Therefore, an organization must structure the supply chain through long-term analysis and at the same time focus on the day-to-day activities.
- Furthermore, market demands, customer service, transport considerations, and pricing constraints all must be understood in order to structure the supply chain effectively. These are all factors, which change constantly and sometimes unexpectedly, and an organization must realize this fact and be prepared to structure the supply chain accordingly.
- Structuring the supply chain requires an understanding of the demand patterns, service level requirements, distance considerations, cost elements and other related factors.
- There are six key elements to a supply chain :

(i) Production	(ii) Supply
(iii) Inventory	(iv) Location
(v) Transportation, and	(vi) Information

Q. 4(b) Explain Decision making with the help of an Management information System.

(Ans. : Refer Section 1.12.7) **(5 Marks)**

Ans. :

The prime focus of the management support system is to provide information and support to the management for effective decision making. The information and support needed for decision making should be provided at all levels within an organization.

The management support system comprises of :

(1) Management information system
(2) Decision support system
(3) Executive information system
(4) Executive support system.

Management information system

- A **Management Information System (MIS)** is a detachment of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing a product, service or a business-wide strategy.
- Management information systems are different from usual information systems in that they are used to scrutinize other information systems applied in operational activities in the association.
- Academically, the term is commonly used to refer to the group of information management methods tied to the computerization or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems. It has been described as, MIS 'lives' in the space that intersects technology and business.
- MIS combines tech with business to get people the information they need to do their jobs better/faster/smarter.
- Information is the lifeblood of all organizations - now more than ever. MIS professionals work as systems analysts, project managers, systems administrators, etc., communicates directly with staff and management across the organization."

Q. 5(a) What makes economic decisions different from other design decisions? *(Ans. : Refer Section 4.4)* **(8 Marks)**

Ans. :

- The role of an engineer in an engineering project starts from the conceptual design of the product to its production and finally till its shipping and after sales service. At every stage the engineer has to take decisions of which some may be related to the design of the product while others maybe economic decisions. However, if we delve deeper into any design decision we will find that it too has certain amount of economic logic behind it.
- Economic decisions account for majority of product costs. Engineers must consider the effective use of capital assets such as building and machinery. As part of long range planning process decision needs to be taken on the various projects the company can undertake and the appropriate resources that need to be allocated to each project over the next few years.
- Engineers have to plan for the acquisition of equipment that will enable them to design and produce products economically. This will involve capital investment and the allocation of resources that are limited.
- Whenever the purchase of a new machinery is being planned the first thing that needs to be estimated is the profits or in financial terms the cash flows that this new fixed asset would generate for the firm during its period of service. Evaluation of capital investment proposals is difficult since the benefits from investment are received in some future period. Hence there is a substantial risk involved in estimation of the future benefits.
- Add to this, the possibility of shift in consumer preferences, the action of competitors, technological developments and changes in the economic and political environment. Even to quantify the future benefits in monetary terms is not an easy task.
- This underlines the need for thoughtful and correct investment decisions.
- An inaccurate estimate of the need of the asset could have serious implications on the cash flows of the firm and could detriment its financial health. On the other hand, spending too little on fixed assets could also prove harmful for the firm's existing machinery may be too obsolete to produce products competitively and without an adequate capacity the firm may lose its market share to its competitors.

- Also, investment in new machinery may improve the productivity of the firm and enable it to lower its cost of production and offer its products to its customer at a lower price. However, if the firm delays this decision it may lose some of its customers and regaining lost customers involves heavy marketing expenses and may necessitate price reduction and/or product improvement.

Q. 5(b) Explain the following : **(8 Marks)**

(i) Time value of money *(Ans. : Refer Section 4.5)*

(ii) Earning power

(iii) Purchasing power

(iv) Inflation *(Ans. : Refer Section 5.2.1)*

Ans. :

(i) Time value of money

- Time Value of Money (TVM) is an important concept in financial management. It can be used to compare investment alternatives and to solve problems involving loans, mortgages, leases, savings, and annuities.
- TVM is based on the concept that a rupee that you have today is worth more than the promise or expectation that you will receive a rupee in the future. Money that you hold today is worth more because you can invest it and earn interest.
- After all, you should receive some compensation for foregoing spending. For instance, you can invest your rupee for one year at a 6% annual interest rate and accumulate 1.06 at the end of the year.
- You can say that the future value of the rupee is 1.06 given a 6% interest rate and a one-year period. It follows that the present value of the 1.06 you expect to receive in one year is only 1.
- A key concept of TVM is that a single sum of money or a series of equal, evenly-spaced payments or receipts promised in the future can be converted to an equivalent value today. Conversely, you can determine the value to which a single sum or a series of future payments will grow to at some future date.

(ii) Earning power : [Hint : Add at the end of Section 4.6]

The earnings generated by a business relative to its asset base. Asset earning power is a common performance measure in corporate finance, used to determine a firm's efficiency in generating earnings from its asset base. Asset earning power is calculated as : Asset Earning Power = Earnings Before Taxes (EBT)/Total Assets.

(iii) Purchasing power : [Hint : Add at the end of Section 4.6]

Purchasing power is the extent to which a person or a firm has funds available to make purchases. A firm with higher purchasing power has a vantage position as it is able to get better deals or purchase when the prices are low.

(iv) Inflation

The common person relates the term 'inflation' to a sizeable and a rapid increase in the general price level. Inflation is generally associated with rapidly rising prices, which cause a decline in the purchasing power of money.

Characteristics of inflation

1. A continuous and persistent rise in the General Price Level.
2. A continuous process of rising prices.
3. A fall in the value of money Aggregate Demand exceeds Aggregate Supply.
4. Inflation is a Monetary Phenomenon.
5. Inflation is persistent and Irreversible.
6. Inflation is endogenous to the economic system.
7. Inflation is fostered by the interaction of a multitude of economic factors.
8. Inflation, in a real sense, is a post-full employment phenomenon.

Q. 6(a) State and explain in short the four fundamental principles that are followed in any engineering economic decision? **(8 Marks)**

Ans. : [Hint : Add at the end of Section 4.4]

Principle 1 : Time value of money

This a fundamental concept of engineering economics and it means that it is better to receive money earlier rather than later. E.g. If you have the option of receiving one lakh rupees today or six month later, it is better to get it today than 6 months later as you will be able to invest it and earn interest. This concept forms the foundation for evaluating all engineering projects.

Principle 2 : Differential analysis

While evaluating alternative investment opportunities, only the difference between the alternatives need to be taken into consideration. Thus all economic decisions should be based on the difference between the alternatives considered. All the common features among the alternatives are irrelevant to the decision.

Option	Monthly Running Cost	Monthly Maintenance	Initial Cost Outlay	Monthly Payment	Salvage Value after period of 3 years
Buy	50,000	10,000	5,00,000	15,000	1,50,000
Lease	50,000	10,000	2,00,000	20,000	-

Principle 3 : Marginal revenue and marginal cost

This principle states that marginal revenue must exceed marginal cost. Marginal revenue means the additional revenue made possible my increasing the activity by one unit.

Marginal costs represent those resources that are limited and hence should be utilized in alternatives that yield maximum output.

Principle 4 : Trade-off between risk and return

Additional risk is not taken without the expected additional return. Investors demand minimum return that is greater than the anticipated inflation rate of the perceived risk. Therefore, greater the risk greater are the returns expected. E.g. Return on savings account in banks is lower than returns from the stock market.

Q. 6(b) Explain the terms, simple interest or compound interest with correct equations. Suppose you deposit Rs. 1,000 in a banks savings account that pays interest at a rate of 8%'per year. Assume that you don't withdraw the interest earned at the end of each period (year), but instead let it accumulate for 3 years. Depict all the returns calculations based on (i) Simple interest and (ii) compound interest ?

(Ans. : Refer Sections 4.5.2 and 4.5.2.1) **(8 Marks)**

Ans. :

Simple interest

Interest that is paid solely on the amount of the principal is called **simple interest.** Simple interest is usually associated with loans or investments which are short-term in nature. The computation of simple interest is based on the following formula:

$$\text{Simple interest} = \text{Principal} \times \text{Interest rate per time period} \times \text{Number of time period}$$

Compound interest

Compound Interest occurs when interest earned during the previous period itself earns interest in the next and subsequent periods.

Compound interest

$$A = p\left(1+\frac{2}{100}\right)^n = 1000\left(1+\frac{8}{100}\right)^3$$

$$= 1000\left(\frac{108}{1000}\right)^3 = 1000\,(1.259)$$

$$= \mathbf{1259}$$

Simple interest

$$A = p\left(1+\frac{hr}{100}\right)$$

$$= p\left(1+\frac{3\times 8}{100}\right) = p\,(1+0.24)$$

$$= 1000\,(1.24) = \mathbf{1240}$$

Q. 7(a) List and explain the five main types of engineering economic decisions.

(Ans. : Refer Section 4.4.2) **(8 Marks)**

Ans. :

Types of engineering economic decisions :

1. Service or quality improvement
2. New product or product expansion
3. Equipment and process expansion
4. Cost reduction
5. Equipment replacement

1. Engineering economic decision I - Equipment replacement

- In our daily lives we regularly take decisions as to which new car or mobile to purchase? However, it is not always that a choice between new alternatives is to be made.
- Sometimes, a choice needs to be made between the existing and the new; should we replace a consumer product or repair it. Electronic products and automobiles are two areas in which the replace/repair decision is very difficult to make.
- Likewise, engineering economists too have a classical dilemma; should a firm trade its existing machinery on a cyclical basis or wait till their productive age is over. From an economic point of view it could be proved that replacing machines on a cyclical basis would be beneficial even though they need not be replaced.
- Another trend that exists within firms is to adopt new technologies despite the existing technologies working and delivering good results. With the advent of computer control systems we are experiencing rapid conversion from existing manual systems to system wherein the computer controls the processes.
- The mass movement to computerization could be attributed to the various advantages and economic edge that they provide.

2. Engineering economic decision II - New product or product expansion

- The designing and developing of new products is quite different than the well defined analytical problems that we have studied in the other engineering subjects throughout this course of engineering.
- The most glaring difference that is encountered while designing and developing new products is the lack of information which forces one to depend on his judgment and assumptions which is in sharp contrast to the abundance of information in other engineering areas.
- The other difference is that there is no one correct solution/design/method of development. The designer or the developer cannot be assured that this is the only and the best way of doing. The problems encountered need more time and effort to understand.

3. Engineering economic decision III – Equipment or manufacturing process selection

This engineering economic decision selects the best equipment or manufacturing process out of the several that meet the project requirements. The choice of equipment or manufacturing process depends on various factors that we shall be discussing later on here, but whatever be the choice, it must meet two basic objectives :

(i) It should be able to meet the specifications of the final product.

(ii) It should be cost effective.

4. Engineering economic decision IV - Service or quality improvement

The impact of quality upon the profit of the company is highly significant. Quality is a route to higher profits, by bringing down the cost in terms of wastes, rework, and rejects and doing continuous improvement. However, there is a cost attached to the improvements in service or quality which have to be taken into consideration by the engineer before implementing the improvement program. The cost incurred on the improvement program has to justify the benefits of the program.

5. Engineering economic decision V - Cost reduction

When it becomes difficult for a firm to increase the price of its products or services to maintain or improve its bottom line the only option that remains with the firm is to implement a cost reduction project that attempts to reduce operating costs. Value analysis is one of the major techniques of cost reduction. Value analysis ensures cost reduction without affecting the quality, reliability, performance and appearance of the product.

The objective of value analysis is not to degrade the product but to improve its value by reducing cost. The elimination of unnecessary costs causes no adverse effect on quality, reliability, maintainability or saleability of the product.

Q. 7(b) Explain the following with proper examples :

(i) Economic Equivalence
(Ans. : Refer Section 4.6.4)

(ii) Cash Flows
(Ans. : Refer case study of chapter 6) **(8 Marks)**

Ans. :

(i) Economic equivalence

- Equivalence is a fundamental concept that forms the basis of personal finance. Equivalence concept is a must to explain financial products that involve a series of payments over a period of time. Equivalence indicates that different amount of money at different time periods are equivalent by considering the time value of money.
- A payment received in lump sum today has to be equated with a series of payments received over time using interest rate. The following example will explain the meaning of equivalence.
- The following simple example will explain the meaning of equivalence.

Example

What are the equivalent amounts of Rs.1,00,000 (today) at an interest rate of 12% per year one year from now and one year before ?

Ans. :

(a) At interest rate of 12% per year, Rs.100,000 (now) will be equivalent to Rs.1,12,000 one year from now.
Amount accumulated at the end of one year = Rs. (100,000 × 1.12) = Rs. 1,12,000/-

(b) Similarly Rs. 1,00,000 now was equivalent to Rs. 89,285/- one year ago at interest rate of 12% per year.

Thus due to the effect of time value of money, these amounts Rs.89,285 (one year before), Rs.1,00,000 (today) and Rs.1,12,000 (one year from now) are equivalent at the interest rate of 12% per year.

(ii) Cash flows

- Cash Flow is the tool that enables the management to track the movement of money in and out of any business. It is the cycle of cash inflows and outflows that determine the financial health of the business.
- Poor management of cash flow has been attributed to be the biggest cause of business failure and especially of start-up companies in any country and hence it is critical that the management monitors its cash flow.
- Cash flow analysis is the study of the cycle of the business's cash inflows and outflows with the objective of maintaining an adequate cash flow for the business. Cash flow analysis forms the basis for cash flow management.
- Cash flow analysis involves the examination of those components of the business that affect cash flow such as the account receivable Cash flow analysis involves examining the components of your business that affect cash flow, such as accounts receivables, inventory, accounts payable, and credit terms. By performing a cash flow analysis on these separate components, you'll be able to more easily identify cash flow problems and find ways to improve your cash flow.
- A quick and easy way to perform a cash flow analysis is to compare the total unpaid purchases to the total sales due at the end of each month.

- If the total unpaid purchases are greater than the total sales due, you'll need to spend more cash than you receive in the next month, indicating a potential cash flow problem.

Example:

Example cash flow statements

Excel Printing - Cash Flow by Year				
	2013	2014	2015	2016
Cash Inflow				
Printing Services	4,00,000	4,42,000	4,41,000	4,43,000
Binding Services	2,20,000	2,21,000	2, 23,500	2,23,000
Designing Services	1,15,000	1,17,500	1,18,000	1,18,000
Total Cash Inflow	**7,35,000**	**7,80,500**	**7,82,500**	**7,84,000**
Cash Expenditures				
Wages	3,37,000	3,39,000	400,000	410,000
Capital Costs (Equipment purchases)	50,000	1,00,000	30,000	50,000
Maintenance and Repair	22,400	25,000	29,000	22,000
Advertising	15000	23000	25,000	32,000
Insurance	11500	16000	17,000	17000
Total Cash Expenditures	4,35,900	5,03,000	5,01,000	5,31,000
Net Cash Flow	2,99100	2,77,500	2,81,500	2,53,000

Q. 8(a) Explain Capital Expenses (Cap Ex) and Operating Expenses (Op Ex) with proper examples.

(Ans. : Refer Sections 6.3 and 6.8.2) **(8 Marks)**

Ans. :

Capital Expenses (Cap Ex)

Capital Expenditure is that expenditure which is incurred :

(a) For acquiring or bringing into existence an asset or advantage of an enduring benefit **or**

(b) For extending or improving a fixed asset **or**

(c) For substantial replacement of an existing fixed asset.

An asset or advantage of an enduring nature does not mean that it should last forever. Basically, the capital expenditure is incurred with a view to bringing in improvement or increase in productivity or earning capacity. Eg. cost of land and building, plant and machinery, furniture and fixtures, vehicles, etc. Such expenditure normally yields benefits, which extend beyond the current accounting period and for a longer period of time. They are recorded in the Balance Sheet in the final accounts of business.

Operating Expenses (Op Ex)

- The operating expenses also called operating costs of a business may be classified under any desired number of headings and sub-headings. In small retail business it is usually satisfactory to classify operating expenses as selling or general.
- Expenses that are incurred directly in connection with the sale of goods are known as selling expenses. selling expenses include salaries or the salesmen, store supplies used, depreciation of the store equipment, and advertising.
- Expenses incurred in the general administration of the business are known as administrative expenses or general expenses. Examples of general expenses are office salaries, depreciation of equipment, and office supplied used.

Q. 8(b) Assume you borrowed Rs. 21,000 to finance your educational expenses for your remaining year of college. The loan has to be paid off over five years. The loan carries an interest rate of 6% per year and is to be repaid in equal annual installments over the next five years. Assume that the money was borrowed at the beginning of the year and that the first installment will be due a year later. Compute the amount of the annual repayment installments. Depict all the necessary cash-flows correctly.

(Ans. : Refer Ex. 4.5.3) **(8 Marks)**

Ans. :

Equated Annual Instalment (EAI)

$$EAI = \frac{A}{M} = \frac{P\left(1+\frac{rn}{100}\right)}{M}$$

We have

$P = 21,000$

$r = 6\%$ $\quad n = 5$

$$\therefore EAI = \frac{21000}{5}\left(1+\frac{6\times 5}{100}\right)$$

$$= 4200\left(1+\frac{30}{100}\right) = 4200\,(1.3) = 5460$$

The Equated Annual Instalment assuming flat interest rate shall be 5460/- per annum.

Q. 9(a) Explain various financial statements with their need.

(8 Marks)

Ans. : [Hint : Add as Section 6.8]

- There are various people who are interested in knowing about the financial health of the company, the intention of these people behind this could be different but each one of them interested in assessing the financial position.

- The shareholder is interested as his dividend is dependent on this position while the creditor is interested because his money is locked in the company.
- The financial position could be gauged at a given time or over a period. The financial position through the financial statements indicates the sources of finance and the utilization of the same. So let us now study what financial statements are and the types of financial statements.
- A **financial statement** (or **financial report**) is a formal record of the financial activities of a business, person, or other entity. In India financial statement is often referred to as an **account.**
- For a business enterprise, all the relevant financial information, presented in a structured manner and in a form easy to understand, are called the financial statements. They typically include four basic financial statements, accompanied by a management discussion and analysis.
- **Balance sheet :** Also referred to as statement of financial position or condition, reports on a company's assets, liabilities, and Ownership equity at a given point in time.
- **Income statement :** Also referred to as Profit and Loss statement (or a "P&L"), reports on a company's income, expenses, and profits over a period of time. Profit & Loss account provide information on the operation of the enterprise. These include sale and the various expenses incurred during the processing state.
- **Statement of retained earnings**: Explains the changes in a company's retained earnings over the reporting period.
- **Statement of cash flows :** Reports on a company's cash flow activities, particularly its operating, investing and financing activities.
- For large corporations, these statements are often complex and may include an extensive set of notes to the financial statements and management discussion and analysis. The notes typically describe each item on the balance sheet, income statement and cash flow statement in further detail. Notes to financial statements are considered an integral part of the financial statements.
- The objective of financial statements is to provide information about the financial position, performance and changes in financial position of an enterprise that is useful to a wide range of users in making economic decisions. Financial statements should be understandable, relevant, reliable and comparable. Reported assets, liabilities, equity, income and expenses are directly related to an organization's financial position.
- Financial statements are intended to be understandable by readers who have "a reasonable knowledge of business and economic activities and accounting and who are willing to study the information diligently." Financial statements may be used by users for different purposes:
- Owners and managers require financial statements to make important business decisions that affect its continued operations. Financial analysis is then performed on these statements to provide management with a more detailed understanding of the figures. These statements are also used as part of management's annual report to the stockholders.
- Employees also need these reports in making collective bargaining agreements with the management, in the case of labour unions or for individuals in discussing their compensation, promotion and rankings.
- Prospective investors make use of financial statements to assess the viability of investing in a business. Financial analyses are often used by investors and are prepared by professionals (financial analysts), thus providing them with the basis for making investment decisions.
- Financial institutions (banks and other lending companies) use them to decide whether to grant a company with fresh working capital or extend debt securities (such as a long-term bank loan or debentures) to finance expansion and other significant expenditures.
- Government entities (tax authorities) need financial statements to ascertain the propriety and accuracy of taxes and other duties declared and paid by a company. Vendors who extend credit to a business require financial statements to assess the creditworthiness of the business.
- Media and the general public are also interested in financial statements for a variety of reasons.
- In this section we will be studying the various financial statements and then have a brief glimpse at taxes and then the cash flow information that you infer from the financial statements.

Q. 9(b) What is the importance of having cash-flow statements? What points do they depict?

(Ans. : Refer Section case study of Chap. 6)

(10 Marks)

Ans. :

Cash flow is the tool that enables the management to track the movement of money in and out of any business. It is the cycle of cash inflows and outflows that determine the financial health of the business.

Poor management of cash flow has been attributed to be the biggest cause of business failure and especially of start-up companies in any country and hence it is critical that the management monitors its cash flow.

As seen in the chapter cash flow analysis is the study of the cycle of the business's cash inflows and outflows with the objective of maintaining an adequate cash flow for the business. Cash flow analysis forms the basis for cash flow management.

Cash flow analysis involves the examination of those components of the business that affect cash flow such as the account receivable Cash flow analysis involves examining the components of your business that affect cash flow, such as accounts receivables, inventory, accounts payable, and credit terms. By performing a cash flow analysis on these separate components, you'll be able to more easily identify cash flow problems and find ways to improve your cash flow.

Quick and easy way to perform a cash flow analysis is to compare the total unpaid purchases to the total sales due at the end of each month. If the total unpaid purchases are greater than the total sales due, you'll need to spend more cash than you receive in the next month, indicating a potential cash flow problem.

Importance of Cash Flow Analysis for Start-Up Companies

Cash flow analysis is all the more important for start up businesses or those which have taken up some new project or any expansion program. In such scenarios there is bound to be an increase in capital expenditure, higher labour cost, purchase of new equipment and increased inventory which will require large cash flows while on the other hand the sales maybe absent (for Start up) or slow as production is in a nascent stage thereby leading to sluggish cash inflows. Hence, the management should keep track of the cash flow and ensure that the situation does not get out of hand.

The other reason for cash flow problems that has been observed especially when it comes to start ups it that of poor bookkeeping practices. The entrepreneur is too busy focussing on the day-today activity and tend to overlook their books of accounts ad tend to fall behind on paying bills and raising invoices and collecting their dues from their customers in time thereby disturbing the cash flow. Once this cycle is disturbed it becomes difficult to get back on track.

Although, it is evident that the entrepreneur, when it comes to start up, is bound to focus on setting the production in order he should never overlook the bookkeeping and ensure that is handled properly. The entrepreneur should use accounting software or hire an accountant who will do the needful for him. If the cash flow problem is temporary the entrepreneur can use temporary lines of credit. Example Cash Flow Statements :

Excel Printing - Cash Flow by Year				
	2013	2014	2015	2016
Cash Inflow				
Printing Services	4,00,000	4,42,000	4,41,000	4,43,000
Binding Services	2,20,000	2,21,000	2, 23,500	2,23,000
Designing Services	1,15,000	1,17,500	1,18,000	1,18,000
Total Cash Inflow	**7,35,000**	**7,80,500**	**7,82,500**	**7,84,000**
Cash Expenditures				
Wages	3,37,000	3,39,000	400,000	410,000
Capital Costs (Equipment purchases)	50,000	1,00,000	30,000	50,000
Maintenance and Repair	22,400	25,000	29,000	22,000
Advertising	15000	23000	25,000	32,000
Insurance	11500	16000	17,000	17000
Total Cash Expenditures	4,35,900	5,03,000	5,01,000	5,31,000
Net Cash Flow	**2,99100**	**2,77,500**	**2,81,500**	**2,53,000**

Q. 10(a) Explain various patterns of cash-flows correct examples. What are Positive and Negative cash flows ? *(Ans. : Refer Section 6.7)* **(8 Marks)**

Ans. :

Project cash flow analysis

The process of selecting the more desirable projects among many profitable investments is made possible by the analysis of cash flows. The idea behind the use of cash flows is to maximize the benefit available from using scarce resources. In this case the scarce resources are funds available for capital investments and the benefits are returns on the investments. The objective is to select the project or a combination of projects, which would give maximization of the total NPV. A positive cash flow indicates the ability of the company to fully fund its operations through its sales. On the other hand a negative cash flow indicates that the company needs outside financing to run its operations.

Format for cash flow statement

Net Cash Flow Statement

Activities	Add Income	Subtract Expense
Operating Activities	Net Income	
	Depreciation	
Investing Activities	Proceeds from Sale of depreciable asset	Capital investment
	Working Capital Recovery	Tax
		Investment in working Capital

Activities	Add Income	Subtract Expense
Financing Activities	Borrowed Funds	Repayment of Principal

Classification of cash flows

According to Accounting Standard cash flows are classified into three main categories :

1. Cash flows from operating activities.
2. Cash flows from investing activities.
3. Cash flows from financing activities.

1. **Cash flows from operating activities :** Operating activities are the principal revenue producing activities of the enterprise and other activities that are not investing or financing activities. The amount of cash flows arising from operating activities is a key indicator of the extent to which the operations of the enterprise have generated sufficient cash flows to maintain the operating capability of the enterprise, pay dividends, repay loans, and make new investments without recourse to external sources of financing. Cash flows from operating activities are primarily derived from the principal revenue-producing activities of the enterprise. The following are the important operating activities.
   (i) Cash receipts from the sale of goods and the rendering of services.
   (ii) Cash receipts from royalties, fees, commissions and other revenue.
   (iii) Cash payments to suppliers for goods and services.
   (iv) Cash payments to and on behalf employees.
   (v) Cash receipts and cash payments of an insurance enterprise for premiums and claims, annuities and other policy benefits,
   (vi) Cash payments or refunds of income taxes unless they can be specifically identified with financing and investing activities and
   (vii) Cash receipts and payments relating to future contracts, forward contracts, option contracts and swap contracts when the contracts are held for dealing or trading purposes.
   (viii) Some transactions such as the sale of an item of plant, may give rise to a gain or loss which is included in the determination of net profit or loss. However, the cash flows relating to such transactions are cash flows from investing activities.

   An enterprise may hold securities and loans for dealing or trading purposes, in which case they are similar to inventory acquired specifically for sale. Therefore, cash flows arising from the purchase and sale of dealing or trading activities are classified as operating activities.

   Similarly cash advances and loans made by financial enterprises are usually classified as operating activities since they relate to the main revenue producing activity of that enterprise.

   Cash Flow from Operations = Net Income + Non Cash Expenses

2. **Cash flows from investing activities :** Investing activities are the acquisition and disposal of long-term assets and other investments not included in cash equivalents. The separate disclosure of cash flows arising from investing activities is important because the cash flows represent the extent to which expenditures have been made for resources intended to generate future income and cash flows.

Examples of cash flows arising from investing activities are :

(i) Cash payments to acquire fixed assets (including intangibles). These payments include those relating to capitalized research & development costs and self constructed fixed assets.
(ii) Cash receipts from disposal of fixed assets (including intangibles)
(iii) Cash payments to acquire shares, warrants, or debt instruments of other enterprises and interests in joint ventures.
(iv) Cash receipts from disposal of shares, warrants, or debt instruments of other enterprises and interests in joint venture.
(v) Cash advances and loans made to third parties (other than advances and loans made by a financial enterprise).
(vi) Cash receipts from the repayment of advances and loans made to third parties (other than advances and loans of a financial enterprise).
(vii) Cash payments for future contracts, forward contracts, option contracts, and swap contracts except when the contracts are held for dealing or trading purposes or the payments are classified as financing activities and
(viii) Cash receipts from future contracts, forward contracts, option contracts and swap contracts except when the contracts are held for dealing or trading purpose, or the receipts are classified as financing activities.

When a contract is accounted for as a hedge of an identifiable position, the cash flows of the contract are classified in the same manner as the cash flows of the position being hedged.

3. **Cash flows from financing activities :** Financing activities are activities that result in changes in the size and composition of the owners capital (including

preference share capital in the case of a company) and borrowing of the enterprise.

The separate disclosure of cash flows arising from financing activities is important because it is useful in predicting claims on future cash flows by providers of funds (both capital and borrowing) to the enterprise.

Examples of cash flows arising from financing activities are :

(a) Cash proceeds from issuing shares or other similar instruments.

(b) Cash proceeds from issuing debentures, notes, bonds and other short-or long-term Cash proceeds from issuing debentures, notes, bonds and other short-or long-term borrowings and

(c) Cash repayments of amounts borrowed such as redemption of debentures, bonds, preference shares.

Example

From the following calculate differential cash flow streams considering that a firm has an existing machine and is considering the purchase of a new machine:

(a) The new machine is more efficient than the existing machine. This will increase the firm's revenue from products made by the machine from Rs. 4,00,000 to Rs. 4,50,000 and will lower operating cost from Rs. 2,10,000 to Rs. 1,70,000.

(b) The new machine will cost Rs. 2,20,000. It will cost Rs. 20,000 for transportation and installation of machine. The firm will receive Rs. 15,000 investment tax credit as a result of the purchases and installation of the machine.

(c) The new machine will have a service life of 4 years. The existing machine will also be able to produce goods for 4 more years.

(d) The new machine processes raw materials more quickly and works more efficiently on long production runs. Thus, the firm must tie up an additional Rs. 20,000 of goods in inventories to support the new machine.

(e) At the present time, the book value of the existing machine is Rs. 80,000 and it is being depreciated at Rs. 20,000 per year, to a zero book value. If the existing machine were sold today, its cash value would be Rs. 40,000. If it continues to operate for 4 more years, its cash value would be Rs. 10,000.

(f) The new machine will be depreciated using straight-line depreciation. In 4 years, it will have Rs. 40,000 book value and Rs. 30,000 cash salvage value. Take Income Tax @ 50%.

Step 1 : Calculate the net cash outlay

The net cash outlay is the different amount of money that will be spent when the investment is made in year zero. It may be calculated by = Total cost of new investment including purchase price, transportation, installation and any related charges - tax savings from investment tax credit +/- changes in the working capital requirements - net cash received from replacing existing machines (i.e. selling price or money received less any costs of removing the asset) +/- either the taxes saved or additional taxes to be paid as a result of purchasing the new asset. In our example, Rs. 2,20,000 is the purchase price plus Rs. 20,000 for transportation and installation.

The Investment tax credit produce a tax saving of Rs. 15,000. The working capital tied up is Rs. 20,000 that is treated as an outlay in year zero. It will be an inflow in year 4. The cash for the existing machine is Rs. 40,000. The tax effect is a saving that occurs because the firm sells a Rs. 6,80,000 book value machine for Rs. 40,000, procuring non-cash or book loss. At a 50 per cent tax rate, the loss of Rs.40, 000 in the sale produces a Rs. 20,000 tax savings. Thus, net cash outlay (outflow) is 2,20,000 + 20,000 – 15,000 + 20,000 - 40,000 - 20,000 = Rs. 1,85,000.

Step 2 : Calculate the depreciation schedules

In practice, we use the method employed by the firm for tax purpose since only this method affects the tax shield and cash flow using straight line depreciation, in our example, the depreciation can be calculated with two formulas as follows :

Depreciable Cost = Total Cost of machine – Book salvage value

2,40,000 – 40,000 = Rs. 2,00,000

Annual Depreciation = Depreciable Cost / Years of life

= 2,00,000 / 4 = Rs. 50,000

With the straight-line method, Rs. 50,000 depreciation is the same for each of the four years of the new machines estimated service life. With other methods the amount of depreciation differs each year.

The depreciation on the existing machine is given at Rs. 20,000 per year down to zero book value. Since the Current Book value is Rs. 80,000, the Annual depreciation of Rs. 20,000 will be realised for the remaining four years of service life.

Step 3 : Calculate annual after tax cash flows :

In our example, the annual cash flows will be same each year since the revenues, costs, depreciation and taxes

do not change. To compute after tax cash flows from operations or employment of the asset there are 2 methods:

a. We begin with revenues, deduct cash expenses and taxes, and we have the cash flow, or

b. We can begin with revenues; deduct cash expenses, and non-cash expenses. Calculate taxes and deduct them and then add back depreciation. The two methods are shown below :

	New Machine		Existing Machine	
	Accounting	Cash flow	Accounting	Cash flow
Annual-revenues	450,000	400,900	400,000	
Less : Annual Cost of operation	170,000	210,000		
Before tax Cash flow	280,000	190,000		
Less : Annual depreciation	50,000		20,000	
	230,000		170,000	
Less: Income Taxes 50%	115,000	85,000		85,000
Net income after taxes	115,000		85,000	
Add: back Depreciation	50,000		20,000	
After tax cash flow	165,000	105,000		

Step 4 : Calculate effects in final year

In the final year two events occur:

1. The return of the working capital tied up in year zero. In our example, Rs. 20,000 is treated as an inflow in the final year since the money is freed for other uses.
2. In the final year, each machine is sold in its respective cash flow stream. To get the after tax effect, we must estimate the book and cash value and compute the net cash value from the sale of each asset, as given below :

	New Machine	Existing Machine
Book value in 4 years	40,000	0
Cash value in 4 years	30,000	10,000
Gain (Loss) on sale in 4 years	(10,000)	10,000
Tax saving (Additional taxes)	5,000	(5,000)
Plus Cash Received	30,000	10,000
Net Cash Value	35,000	5,000

Thus, we have cash flow in the final year as follows :

	New Machine	Existing Machine
Annual inflows from step 3	1,65,000	1,05,000
Return of working capital	20,000	-
Sale of machine	35,000	5,000
Final year cash flow	2,20.000	1,10.000

Step 5 : Calculate the Differential after Tax stream :

We subtract the existing machine stream from the new machine stream as follows :

Year	New machine	Existing machine	Difference
0	(1,85,000)	0	(1,85,000)
1	1,65,000	1,05,000	60,000
2	1,65,000	1,05,000	60,000
3	1,65,000	1,05,000	60,000
4	2,20,000	1,10,000	1,10,000

This stream shows both the timing and amount of net cash outlay and net cash inflow over the life of the new machine. All effects are differential - the difference between having the investment and not having it, and can be evaluated with time-value of money techniques as have been discussed earlier.

Q. 10(b) What is Depreciation ?

A company ABC Ltd. purchased a machine costing Rs. 1000 on 1st January 2001. It had a useful life of three years over which it generated annual sales of Rs. 800. ABC Ltd's annual costs during the three years were Rs. 300. Its income statement at the end of the three years looks as follows :

Income Statement	2001	2002	2003
Sales	800	800	800
Cost of Sales	(300)	(300)	(300)
Fixed Asset Cost	(1000)	-	-
Net Profit (Loss)	(500)	500	500

Instead charging the entire cost of fixed asset at once, if ABC Ltd. depreciates the capital expenditure over its useful life, depict the corresponding Income Statement and Balance Sheet at the end of the three years.

(Ans. : Refer Section 6.2.1) **(10 Marks)**

Ans. : [Hint : Refer example as Ex. 6.2.1]

Depreciation

– Depreciation is a measure of the wearing out, consumption or other loss of value of a depreciable asset arising from use, effluxion of time or obsolescence through technology and market changes.

- In other words "Depreciation is allocated so as to charge a fair proportion of the depreciable amount in each accounting period during the expected useful life of the asset".
- The entire cost of fixed asset is to be depreciated over a period of 3 years. ∴ The depreciation of the machine shall be Rs. 333.33 every year.
- The New Income statement shall look like this

Income statement	2001	2002	2003
Sales	800	800	800
Cost of sales	(300)	(300)	(300)
Fixed Assets cost	(333.33)	(333.33)	(333.33)
Net Profit	166.67	166.67	166.67

□□□

Note

University In Sem Exam

Questions and Answers

Questions and Answers for In Semester Examination

Chapter 1 : Basics of Management Theory and Practices

Q. 1.1 Define management.

Ans. :

- "Management is art of getting things done through and with people in formally organized groups".
- This definition reveals that a manager works with the cooperation of other employees and through formal organization structure. This highlights the practical side of management. Some other definitions are :
  - **L. Allen** - Management is what management does.
  - **Henry Fayol** - To manage is to forecast, plan, organize, command, coordinate and control.
  - **James Mooney** - Management is the art of directing and inspiring people.
  - **Lawrence Appley** - Management is the art of getting things done through others.

Q. 1.2 State responsibilities of management .

Ans. :

Responsibilities of management : All the three levels of management, i.e. top management, middle management and lower management have obligations towards three social groups :

(a) Those who have appointed them;

(b) Those whom they manage; and

(c) The general community.

Q. 1.3 Why is management important?

Ans. :

The importance of management can be summarized as :

1. Increase efficiency of business
2. Crystallize the nature of management,
3. Improve research and development in management,
4. Attain social goals by way of coordinating the efforts of people so that individual objectives can be translated into social attainments of business.

Q. 1.4 Describe the different levels of management.

Ans. :

Every organization or company follows a particular hierarchy. This helps to keep control on the resources and ensures the reporting structure in the organization. There are different management levels in an organization based on the size of the company. **Broadly speaking the management levels are :**

Top level management

Top level management comprises; board of directors, chief executive or managing director. The top management is the ultimate authority and it sets goals and policies for an enterprise. They focus on planning and coordinating functions.

The role of the top management can be summarized as :

- Top management sets objectives, strategic plans and design broad policies of the enterprise.
- It issues necessary instructions for preparation of department budgets, procedures, schedules etc.
- The important function of top level management is to provide guidance and direction which helps an enterprise to achieve its goal.
- Appoint of executives for middle level is one of the most important functions executed by the top management.
- The top management is also responsible towards the shareholders for the performance of the enterprise.

Middle level management

- Middle level incorporates branch managers and departmental managers. They are accountable for the functioning of their department. They dedicate more time to organizational and directional functions.
- In small organization, there is generally only one layer of middle level of management but in big enterprises, there may be senior and junior middle level management. The functions performed by middle level management are :

- Middle level managers execute the plans of the organization in accordance with the goals and policies of the top management.
- Managers make plans for their departments or section of the organization.
- As a department head they participate in employment & training of lower level management.
- One of the important functions of middle managers is to interpret and explain policies from top level management to lower level.
- They need to ensure the coordination and integration among the activities within their division or department.
- They present the data received from the lower level to upper level in a specific format, which helps top management in the process of decision making
- They inspire and even evaluate the performance of junior managers or lower level managers.

Lower level management

- Lower level Management is referred to as supervisory / operative level of management. It is consist of supervisors, foreman, section officers, superintendent etc.
- People working in lower level management are responsible for direction and controlling functions of management. Their major activities include assigning of jobs and tasks to various workers.
- Their main role is to guide and instruct workers for day to day activities.
- They are responsible for the quality as well as quantity of production.
- Lower level managers are mediator between workers and higher level management. They represent workers problems, suggestions, and recommendatory appeals etc to the higher level.
- They ensure discipline and help solve the grievances of the workers.
- To ensure the efficiency and effectiveness of workers
- Supervisors provide training to workers.
- Arrangement of required materials, machines, tools etc for getting things done.
- They prepare periodical reports about the performance of workers and present it to higher level management.

Q. 1.5 Differentiate between administration and management.

Ans. :

Administration and Management can be distinguished in the following way :

- Administration is concerned with policy making whereas management with policy implementation.
- Functions of administration are legislative and largely determinative while management functions are more executive and governing.
- Administration is concerned with planning and organizing, but motivating and controlling functions are involved in management.
- Board of Directors of any company are normally concerned with administration while personnel below that level are in charge of management.

Q. 1.6 What is Organization ?

Ans. :

- It is a concept of combining the work of individuals or a group. It is a structure which helps in execution of duties and also helps in attaining the goals of the business. It provides for :
- Division of activities into logical groups having properly qualified staff.
- Determination of responsibilities in a manner which is easily understood by the group or individual.
- Delegation of duties and responsibilities with authority for each manager or supervisor so that each person performs his function well.
- Coordination of different activities of business for achieving unity in action of all employees.
- Effective communication between management and workers for better understanding and group efforts in fulfilling goals of business.
- Organization is the vehicle in which administrative directions are accomplished by the management.

Q. 1.7 Briefly discuss the functions of management.

Ans. :

Managers are responsible people; they just do not go out randomly and execute their responsibility. Good managers discover how to master the basic functions of management i.e. planning, organizing, staffing, leading and controlling.

1. **Planning :** Planning is the process of mapping out what has to be done to achieve a particular goal. In other words we can say that It is set of exact steps to be taken to accomplish organization's goal. The manager has to decide what will be the correct steps to be involved in the plan.

   e.g. if company decides to boost the sale. The necessary steps could be inventory management, advertisement or increase in sales staff etc. Once the proper plan gets ready manager has to execute it step by step. A good plan always gives good results.

2. **Organizing :** Once the plan gets ready, for its execution manager has to organize the resources in terms of manpower as well as material. Assigning work i.e. delegation and granting authority are two important aspects of organizing function.

3. **Staffing :** Staffing is another important function which manager needs to perform. After determining the human resource requirement from the plan, manager has to speed up the process of staffing by selecting, recruiting, training and developing the employees. Manager has to work with the human resource department to execute this function.

4. **Directing or leading :** Beyond planning, organizing and staffing manager has to do many things to achieve the desired goal. A manager has to be a leader as he directs the whole team towards the completion of the organizational goal. It involves motivating, communicating, guiding and encouraging employees.

5. **Controlling :** When all functions are well executed manager is still left with the important function called controlling. He has to continuously take the feedback and check the results against the predetermined goal. He has to take corrective actions if required to ensure that the plan remains on the track.

Q. 1.8 Enumerate IT-IS related business applications.

Ans. :

The top ten most important IT-IS related business application would be to :

- Improve customer service.
- Establish service continuity and availability.
- Ensure compliance to legal aspects of business.
- Manage IT related business risks.
- Enable business entity to offer competitive products and services.
- Maintain and improve business process functionality.
- Provide good return on investments made in IT-IS related products.
- Recruit, maintain and develop skilled and motivated people.
- Create agility in responding to changing business requirements.
- Obtain reliable and useful information for strategic business decisions.

Q. 1.9 Explain Data and Information.

Ans. :

- Although data, information and knowledge sound synonymous they are different and it is essential from information systems point of view to understand what constitutes knowledge and what falls under the category of information or data and also how they interact with one another.
- According to Theirauf, of the three components, data is the lowest point, an unstructured collection of facts and figures; information is the next level, and is regarded as structured data, finally knowledge is defined as "information about information".
- According to Theirauf, "Data is nothing but unstructured facts and figures that have the least impact on the typical manager." Although, data is an unorganized assimilation of facts and figures it has the potential to relay something specific.
- In simple words, data is the raw material for information. It can be defined as groups of non random symbols which are used to represent quantities, actions or objects or entity, attribute or value.

- The basic distinction between Data and Information is that Data Items in their raw form cannot be used as information, they need to be processed before they can be used as information.
- The other important point that needs to be considered is that, what is information at one stage could be raw data items for the next stage which needs to be processed for it to be considered to be information.
- Information is data with relevance and purpose. Thus, for data to become information, it must be contextualized, categorized, calculated and condensed. Information conveys a trend or pattern for a given period of time.
- Information is nothing but data that is processed into a form that is as per the needs of the receiver and has value within a specific decision making context. This decision making could be within the present context or within the context of future decisions and actions.
- Information is processed data that is used to trigger certain action or gain more knowledge on what the data implies.

Q. 1.10 Describe the role of information systems in an organization.

Ans. :

The three primary roles that information systems play in an organization are :

(1) Information storage and analysis

- Gone are the days when companies used to manage their data and information with physical registers.
- By adopting information systems, companies can make full use of state of the art databases that contain all the required data. Information systems provide its users with information that they can utilize to solve business problems and take decisions.
- Modern information systems do not limit themselves with data and information that is internal to the organization, these systems can integrate data from various internal and external sources and keep the user abreast with the most relevant information.
- Such systems provide the user information not only of the internal performance but also looming threats and business opportunities.

(2) Assist in decision making

- Perhaps the most important role of information systems is the assistance that they provide in the decision making process.
- In the current competitive business environment, the long term success of a company depends upon its strategic plans. Information systems are used to formulate strategic plans and assist in the decision making process.
- The information made available by various sources needs to be evaluated by the information systems before it is used in the decision and strategic planning process.

(3) Assist with business processes

- Another relevant role of information systems is their ability to integrate with the various business processes of the organization to ensure that the output produced adheres to the quality standards.
- Thus, information systems can be used in developing various value added systems. Integrating the information system with the various business processes simplifies and helps reduce the number of activities and invariably the time spent on these activities.
- Repetitive tasks are totally eliminated from the system and greater accuracy is provided.
- Also, information systems ensure that access is provided to only authorised employees. Information system plays a very critical role in project management as they facilitate effective monitoring and control as well as comparison with standards.

However, the entire capacity of the information system needs to be harnessed to gain maximum benefits from the company's information system. The effectiveness of the information system can be increased by either adding more data to make the information more accurate or use the information in new ways. In addition to the above mentioned roles information systems play the following roles :

- Information systems can gather and distribute information thereby enabling managers to communicate more efficiently and rapidly.
- Information systems can be used to store documents that can be accessed by other employees who need the information in the documents.
- Changes in the original document can be made by authorised employees that can be tracked by the system tracker. Once the process is complete the manager can send the revised document to the final recipient for approval. Thus, information systems enable employees to collaborate in a more efficient and systemic manner.
- Information systems provide more complete and current information enabling the management to better manage the company.
- The information provided by information system can be used to gain a competitive advantage over competitors.
- Information systems provide all the relevant information needed for decision making.
- The information provided is current and thus instils confidence in the decision maker. The system can also run different scenarios if more than one choice looks appealing.
- Information systems are used to store documents, communication records and operational data. This can be processed by the system and presented as useful information to prepare cost estimates and forecasts.

Q. 1.11 Describe the components and resources of information systems.

Ans. :

In an organization, information systems consist of the following components and resources :

(1) Data

- In simple words Data is the raw material of the information system. It is the input that the system takes to produce information.
- Data is a valuable organizational resource that should be managed and used effectively to gain maximum benefit from it.
- Data as an organizational resource has gained momentum after organizations discovered its true potential and the valuable information that it could generate. Data is considered to be the lifeblood of every organization and is considered very important from the decision making point.
- Various software's that are used to process the data, allow the building up of complex relationship amongst the various elements within the organization.
- We have already studied Data at great length in the previous section and therefore we won't delve into it in great detail in this section.

(2) Hardware

- The hardware resource comprises of the physical devices that are used in processing.
- It not only includes machines such as the computer but also its peripheral equipment : input, output, storage devices; includes data communication equipment. As we have already seen that the storage devices are very important in the information system.

(3) Software

Sets of instructions that tell the computer how to input, process, output and store data i.e. a set of information processing programs which control the hardware that is used in the information system.

(4) Communication networks

- There is rampant use of communication technology and networks like the internet, intranet and extranet in modern business especially after the advent of the electronic markets like e-commerce and e-business.
- When we study the modern information systems we find network resources are an inherent part of these systems.

(5) People

- People resource is a vital component of the information system especially the IS professionals who design, construct, operate and maintain IS and the end-users who use the information system or the output it delivers.
- End-users are found in all levels of the organization they could be the customer, manager or the operator.

(6) Procedures

- Procedures are set of information processing instructions which are a set of operating instructions for the operators of the system.
- Rules to process data, e.g. priorities in running different applications, security measures, routines for malfunctioning IS, etc.

Q. 1.12 Discuss the Local Area Network (LAN) ?

Ans. :

Local Area Network (LAN)

- The Local Area Network (LAN) is a network which is designed to operate over a small area such as home, office, computer labs, firm, factory or a group of buildings. However, there is a limitation of distance over which can be effective.
- It is mostly used to connect the workstation or sharing resources etc.
- LAN's are distinguishable according to following three criteria :
  1) Size of the LAN
  2) Transmission Technology
  3) Topology
- LAN configuration consist of,
  1) **A file server :** It stores all of the software that controls the network, as well as the software that can be shared by the computers attached to the network.
  2) **A workstation :** Computers connected to the file server (Mac or PCs). These are less powerful than the file server.
  3) **Cables :** Cables are generally used to connect the network interface cards in each computer
- In this type of LAN, one of the computers acts as specially designed computer which is server for the rest of the client computer machines.
- The speed of the LAN are normally 100 megabits per second (Mbps) to 1000Mbps. Now a days LANs have data rates in the 4 to 16 Mbps range.
- As seen in the figure bus and star topology are used for connection of the LAN. Ring topology is also used for this purpose.

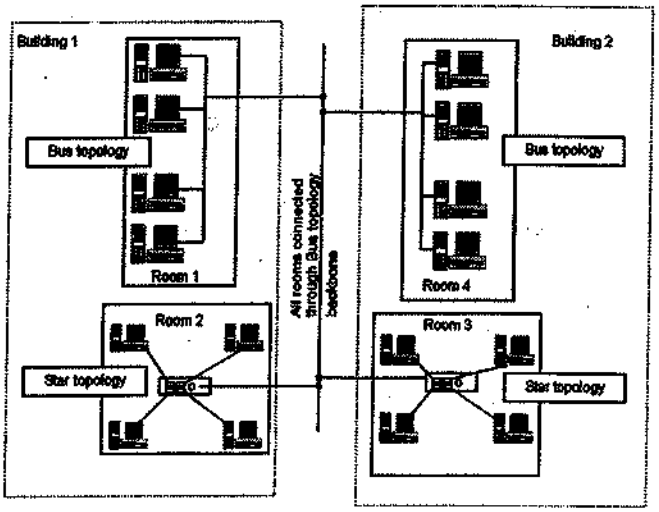


Fig. 1-Q. 1.12 : Local Area Network LAN is limited by distance and can be used to connect nearby workstations and share different resources like printers, software's or data.

Q. 1.13 Discuss Metropolitan Area Network (MAN).

Ans. :

Metropolitan Area Network (MAN)

- Metropolitan Area Network (MAN) basically covers the entire city or entire town. Means when LAN is restricted to a single room or building for resource sharing then for large distance MAN and WAN are used.
- The general examples of the MAN are cable television network within the city - cable network for city, telephone company network that provide high DSL line to the customer.
- Suppose we want to share the Internet connection in the city for high speed then MAN is used.

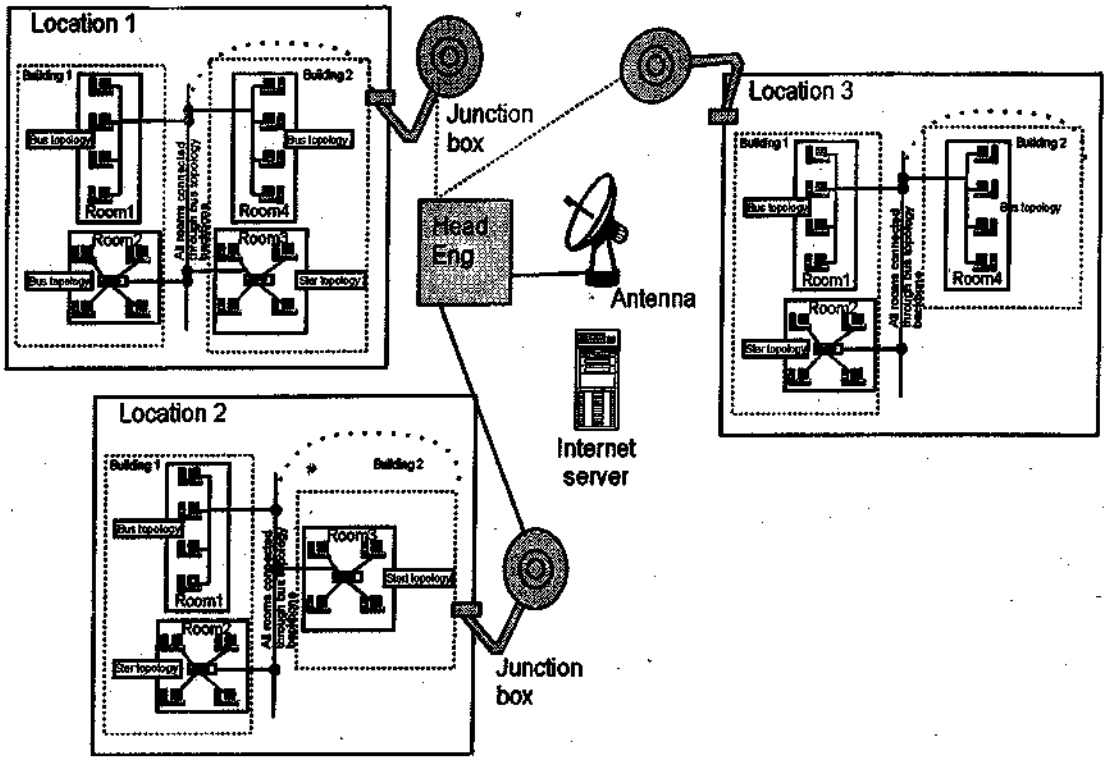


Fig. 1-Q. 1.13 : Metropolitan Area Network

Q. 1.14 Discuss the Wide Area Network (WAN) ?

Ans. :

Wide Area Network (WAN)

- The **router** is used for the Wide Area Network (WAN) for connection of the interconnected LANs.
- WAN connection is spread over the large geographical area, like one country or continent.
- WAN, consists of two distinct components, one is **transmission lines** and **switching element.**
- Transmission lines are made up of Optic fiber, copper wires or radio frequency links.
- If we use switching element on specially computers that connect three or more transmission lines then data arrives on incoming lines, the switching element must choose an outgoing line on which to forward them. These switching computers are called router.
- It is cheaper and more efficient to use the phone networks for the lines.

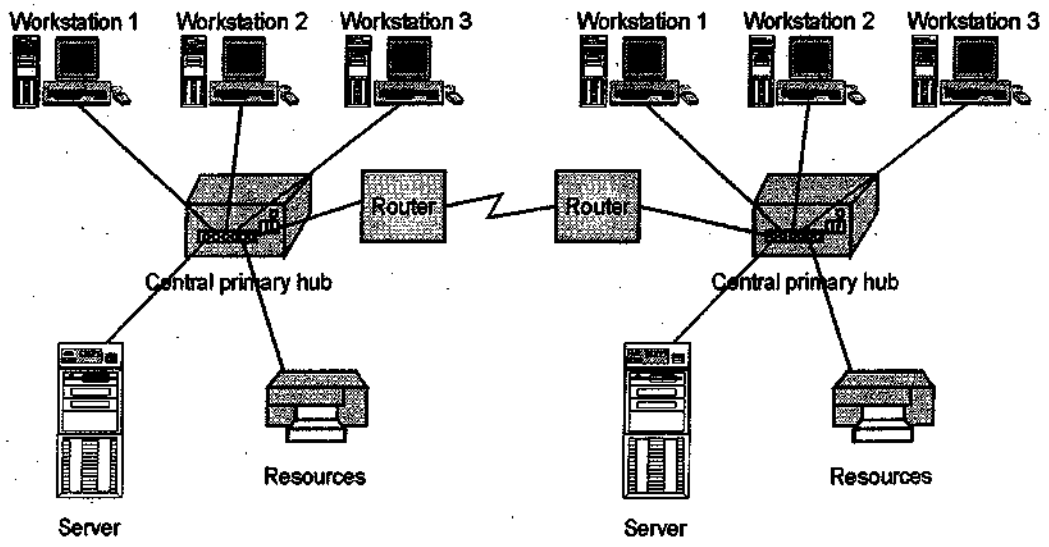


Fig. 1-Q. 1.14 : Concept of Wide Area Network

Q. 1.15 What are Operation Support Systems?

Ans. :

Operation support system

- There has always been a need for an information system that processes the data generated by and used in business applications. Operation support system suffices this need by monitoring the day-to-day elementary activities and transaction of the organization.
- Operation Support System produces information products that can be used internally as well as externally by the managers. The information products of the operation support system cannot be used as it is by the managers further processing by management information system is needed.
- The basic role played by operation support system is to process the business transactions, control the various industrial processes within the organization.
- Operation Support System is also supposed to support the communication and collaboration within the organization. Updating the databases for further use is another role played by the Operation Support System.

Q. 1.16 State types of operation support system.

Ans. :

(1) Transaction Processing System.
(2) Process Control System.
(3) Communication and Collaboration System.

Q. 1.17 Briefly describe the BSC development process.

Ans. :

The BSC system development process

Step	Process	Explanation of the step
1	Develop Vision for the organization.	Enables the management to understand where the organization is currently and where it aims to be after a certain period.
2	Formulate strategies to achieve vision.	Strategies to enable the organization to reach the desired position.
3	Develop strategic actions to implement formulated strategies.	Actions and decisions which will ensure the success of the strategies.
4	Link the four BSC perspectives to the strategies and actions.	Determine which critical success factor will be affected by the strategy and action.
5	Develop measures to evaluate the four perspectives and critical success factors.	Helps measure the effectiveness and impact on critical success factors.
6	Implement BSC.	Fix responsibility.

Q. 1.18 Discuss the human challenges faced by information system manager.

Ans. :

- Although, other resources such as materials, facilities, tools and equipment are also vital to the development and implementation of information system, the primary resource in information systems is its people.
- The information systems manager will need the support of his people to ensure the smooth sailing of the system. The human factor is the factor that is related to every person in the organization. Humans create perhaps the biggest obstacle when it comes to implementing information systems.
- The primary challenge for an information system is the lack of resources to engage in user education, inability in recruiting appropriate staff and experts who can suitably accomplish the development and implementation process.
- Another challenge facing the information system manager is to be able to fulfil the expectations of users. Also, the lack of computer skill has been identified as key challenge and major difficulty to the development of information systems.
- There is a lack of general computer skill amongst the uneducated employees of the organization. It has been observed that the older employees in the organization lack the interest and willingness to adopt the new system and may create obstacles in its implementation.

- It will always be a challenge for the information systems manager to get everybody on board and ensure that the change is accepted by all.
- It is necessary for the information system to impress upon every user that the change in system will in no way affect their job. Reluctance to accept change stems from insecurity and it is upto the manager to ensure that this insecurity is addressed.

Q. 1.19 Discuss the operational challenges faced by information system manager.

Ans. :

- Information systems were originally designed to support the accounting function within the organization and once it had proved its use there, it was rolled out to the other functions within the organizations.
- However, this meant that the implementation was fragmented thereby creating data silos that supported various functions but failed to support cross functional business processes.
- For example, in an online business taking customer order is an easy process, but the order fulfilment process which involves moving product from warehouse to customer, collecting payment if not done earlier, packing the product, pasting the address, shipping the product and informing the customer is a rather tedious process.
- For such a process to work smoothly the data flows between departments need to be coordinated else it will result in delays, errors in shipments, customer grievances and end in losses for the company.
- Hence, integration of the information system has been one of the biggest challenge for the information systems manager. However, integration the company simply does not mean combining the data silos within the company.
- Integration demands a redefinition of how data is stored, accesses, shared, and archived. The information systems manager must provide a detailed description of how the integration process will work and improve the system.
- Integrated information systems give organizations the technology to improve data-access efficiency and reduce infrastructure costs. Integrating all aspects of the organizations data architecture to achieve these goals can pose new challenges.
- In such a scenario the information systems manager should make an assessment of the company's requirement rather than surveying the off-the shelf software. The information systems manager should quantify what the integration must accomplish, who needs to access which information, the expansion plans the system must accommodate, and the shortcomings of the current technology.
- The challenge before the information systems manager is to design a system to manage business data on an integrated basis that would in turn mean configuring the data architecture to ensure that information is available companywide.
- However, it is difficult for the current network to provide access to user's companywide without compromising on the security of the information. The systems manager should ensure that the security of the information is not compromised in any manner.

Q. 1.20 Discuss the technical challenges faced by information system manager.

Ans. :

- Technical challenges are very much similar to operational challenges and are related to hardware and software issues of the information system as well as barriers such as telecommunication issues.
- The transition from the old system to the new system in terms of hardware, software and training also poses a major challenge to the information systems manager.

Q. 1.21 Discuss the financial challenges faced by information system manager.

Ans. :

- Once the information systems strategy has been developed it needs the approval of the top management. An approval would mean the sanctioning of budget, personnel and time.
- Sometimes the senior management may fail to understand the purpose or raise doubts on the proposed strategy. Therefore it is recommended that the top management should be convinced of the strategy before the allotment of the budget. The top management has to ensure the information system strategy is aligned with its business strategy.
- Rising project costs have always been a challenge for the manager. Many a times it has been observed that a new information system is being developed when the existing system is not being utilized to its full potential.

- Thus, the information system manager has to take the call before proceeding with the development of the new system and ensure that the existing system is being utilised to the fullest before undertaking any further cash outlay.
- For this the information systems manager may need to ask what the primary challenge is with the existing system. There may be many untapped resources of the existing system that may provide solution to the problem in hand. The information systems manager needs to work with the users to understand their problems and arrive at solutions.

Q. 1.22 Discuss the data security challenges faced by information system manager.

Ans. :

- With increasing complexity of the information system there is always a likelihood of compromise of data security.
- Compromise of data security not only poses problems of breach but may also have legal ramifications in some cases. The information security manager has to ensure that all protective measures are in place and all its data is secure.

Q. 1.23 Discuss the environmental challenges faced by information system manager.

Ans. :

- Environmental challenges include organizational culture, change management, resource capabilities, coordination, distribution of responsibilities, unaligned organizational systems and resources, etc.
- Other less important environmental challenges include political environment, lack of commitment to strategy on the part of top management and confusion of the strategies.

Chapter 2 : Management Information System

Q. 2.1 Define MIS organization.

Ans. :

An 'MIS' is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management. In a way it is a documented report of the activities those were planned and executed.

Q. 2.2 State the primary functions of MIS.

Ans. :

Computer-based or manual system transforms data into information useful in the support of decision making. MIS can be classified as performing three functions :

1. **To generate reports :** For example, financial statements, inventory status reports, or performance reports needed for routine or non-routine purposes.
2. **To answer what-if questions asked by management :** For example, questions such as "What would happen to cash flow if the company changes its credit term for its customers?" can be answered by MIS. This type of MIS can be called Simulation.
3. **To support decision making :** This type of MIS is appropriately called Decision Support System (DSS). DSS attempts to integrate the decision maker, the data base, and the quantitative models being used.

Q. 2.3 Enumerate the benefits of MIS.

Ans. :

An MIS provides the following benefits

1. **It facilitates planning :** MIS improves the quality of plants by providing relevant information for sound decision making. Due to increase in the size and complexity of organizations, managers have lost personal contact with the scene of operations.
2. **In minimizes information overload :** MIS change the larger amount of data in to summarize form and thereby avoids the confusion which may arise when managers are flooded with detailed facts.
3. **MIS encourages decentralization :** Decentralization of authority is possibly when there is a system for monitoring operations at lower levels. MIS is successfully used for measuring performance and making necessary change in the organizational plans and procedures.
4. **It brings coordination :** MIS facilities integration of specialized activities by keeping each department aware of the problem and requirements of other departments. It connects all decision centers in the organization.
5. **It makes control easier :** MIS serves as a link between managerial planning and control. It improves the ability of management to evaluate and improve performance. The used computers has increased the data processing and storage capabilities and reduced the cost.

- MIS assembles, process, stores, retrieves, evaluates and disseminates the information. To function effectively as an interacting, interrelated, and interdependent feedback tool for management and staff, MIS must be "useable."

Q. 2.4 Describe the five elements that render an MIS useful.

Ans. :

- The five elements of a useable MIS system are: timeliness, accuracy, consistency, completeness, and relevance.
- The usefulness of MIS is hindered whenever one or more of these elements are compromised.

(1) Timeliness

To simplify prompt decision making, an institution's MIS should be capable of providing and distributing current information to appropriate users. Information systems should be designed to expedite reporting of information. The system should be able to quickly collect and edit data, summarize results, and be able to adjust and correct errors promptly.

(2) Accuracy

A sound system of automated and manual internal controls must exist throughout all information systems processing activities. Information should receive appropriate editing, balancing, and internal control checks. A comprehensive internal and external audit program should be employed to ensure the adequacy of internal controls.

(3) Consistency

To be reliable, data should be processed and compiled consistently and uniformly. Variations in how data is collected and reported can distort information and trend analysis.

In addition, because data collection and reporting processes will change over time, management must establish sound procedures to allow for systems changes. These procedures should be well defined and documented, clearly communicated to appropriate employees, and should include an effective monitoring system.

(4) Completeness

Decision makers need complete and pertinent information in a summarized form. Reports should be designed to eliminate clutter and voluminous detail, thereby avoiding "information overload."

(5) Relevance

Information provided to management must be relevant. Information that is inappropriate, unnecessary, or too detailed for effective decision making has no value. MIS must be appropriate to support the management level using it. The relevance and level of detail provided through MIS systems directly correlate to what is needed by the board of directors, executive management, departmental or area mid-level managers, etc. are in the performance of their jobs.

Q. 2.5 Describe the organizational change ensued by the introduction of an information system.

Ans. :

The introduction of an information system ensue organizational change which may vary from incremental to ones which have far reaching consequences. These changes can be categorized as :

(i) Automation

- The first and most evident form of organizational change is the process of automation that is an outcome of the introduction of the new information system.
- The new information system assists employees in performing their tasks more efficiently and effectively. Payroll system, computerised stock checking, and rail reservation system as seen in the case are all examples of automation.

(ii) Rationalization of procedures

- After automation the next effect of the information system is bound to be on the various procedures that run within the organization.
- Automation automatically induces rationalization of the procedures. Automation brings forth bottlenecks in the production system and makes one question the existing arrangement of procedures and structures.

  One of primary objective of information systems is to simplify the processes and streamline the workflows to take advantage of the system.
- Also, the rationalization of procedures which is imbibed in the programs brings about a series of continuous improvement in the quality of the organizations products and services.

(iii) Business process redesign

- The third and more powerful organizational change is business process redesign in which the existing business processes are analysed, simplified and redesigned.
- The redesign of business processes warrants the reorganization of workflows, elimination of unnecessary and repetitive steps, restructuring of some jobs made redundant by the new system, etc.

- Thus, it is evident that business process redesign brings about a bigger change in the functioning of the organization. Many organizations had to redesign their processes to make them more effective and efficient.
- A look at any bank in your vicinity is a fine example of the effect that information systems have brought in organizations.

(iv) Paradigm shift

- However, the final effect that the information system may have on the organization will overshadow the previous two steps of **rationalization of procedures** and **business process redesign**.
- The new information system may ultimately affect the basic organizational design by transforming how the organization carries out its business and the nature of its business. This step brings about a radical change in the manner in which the organization carries out its business and hence is called as **paradigm shift**. A paradigm shift denotes a basic shift in the very nature of the organization. Such a shift is justified because of its benefits.

Q. 2.6 Describe the ethical issues in information systems.

Ans. :

- While using the internet or just the computer the user should be aware of;
  - (i) **Responsibility :** accepting potential costs, duties, and obligations for your decisions.
  - (ii) **Accountability :** determining who should take responsibility for decisions and actions.
  - (iii) **Liability :** legally placing responsibility with a person or group.
  - (iv) **Due Process :** ensuring the laws are applied fairly and correctly.
- The **responsibility, accountability** and **liability** are always of the user when it comes to the internet. Using information technology in a socially responsible manner means that the user will be held accountable for the consequences of his actions.
- Just as, we as citizens are subject to rules, whether we like them or not, in public, we are subject to societal rules in cyberspace. Anonymity should not be taken as a license to carry out socially unacceptable acts.
- The user should be aware that every Internet Service Provider has a "usage policy" and this includes even the email service provider who hides your identity. In the event of your actions violating their usage policy they can terminate your services which may prove to be embarrassing.
- In case you are faced with a situation in which your ethics are challenged, how should you handle the situation?
  - Separate fact from fiction
  - Remember every coin has two sides, hence you need to examine both the sides
  - Identify the violator
  - If possible arrive at a compromise solution
  - Anticipate the outcome as it helps you in arriving at better solutions

Q. 2.7 Discuss the corporate code of ethics for information systems.

Ans. :

- Many firms have not established a Code of Ethics or a policy for employee conduct when computing in today's workplace. Some corporations are confused about what to include and how to approach this new dilemma.
- Following **five moral dimensions** would be a good start that businesses and their managers should recognize :
  1. The information rights to privacy and freedom.
  2. The property rights to individual ideas and efforts.
  3. The accountability, liability and control issues involved in using technology.
  4. The system quality requirements of businesses and individuals.
  5. The quality of life impact of technology.
- Companies can no longer ignore the necessity of establishing rules for technology usage. The issue will only continue to grow. If we work for a company that doesn't have a policy, we should encourage it to establish one immediately.

Q. 2.8 Enumerate the any four various types of cyber crimes.

Ans. :

1. Unauthorized access to computer systems or networks/Hacking

This kind of offence is normally referred as hacking in the generic sense. However, the framers of the Information Technology Act 2000 have nowhere used this term so to avoid any confusion we would not interchangeably use the word hacking for 'unauthorized access' as the latter has wide connotation.

2. Theft of information contained in electronic form

This includes information stored in computer hard disks, removable storage media etc. Theft may be either by appropriating the data physically or by tampering them through the virtual medium.

3. Email bombing

This kind of activity refers to sending large number of mails to the victim, which may be an individual or a company or even mail servers there by ultimately resulting into crashing.

4. Data diddling

This kind of an attack involves altering raw data just before a computer processes it and then changing it back after the processing is completed. The electricity board faced similar problem of data diddling while the department was being computerised.

Q. 2.9 What is hacking?

Ans. :

Hacking is the process of achieving access to a computer or computer network without legal authorization. A hacker is a person who has a great deal of knowledge about the working of computer systems and their security.

Q. 2.10 Describe the different types of hackers.

Ans. :

Types of hackers

We have seen what the term 'hacker' means, but it would not be fair to club every hacker as some sort of a criminal and hence it is essential to study the various **types of hackers** and understand their motives and reasons for their behavior.

1. The White Hat Hacker

- These are the good guys of hacking mostly working as security professionals. These people work within the law and access only those systems which they are permitted to. The objective of their accessing systems is to identify and fix security flaws.
- White hat hackers closely monitor the net to stay abreast with the latest information on hacking, vulnerabilities, and attacks. As it is their job to ensure that the vital information of the organization is protected from other hackers they are privy to the highest level of access and have an in-depth knowledge of a company's security vulnerabilities.
- These hackers need to win over the trust of the management which means that they have to maintain the extremely high ethical standards.
- A new trend has emerged of companies hiring reformed hackers those who have gained their knowledge and expertise through less reputable activities. This is a highly risky practice which may backfire and hence not recommended.

2. The Ethical or Grey Hat Hacker

- These hackers are not employed by the company but find security lapses in the company's system and report them. As these are ethical hackers they may give the company a chance to fix the problem before they make it public.
- In some cases they may immediately publicize the lapse in the company's system, providing an opportunity on a platter to other malicious hackers to exploit the lapse. Although their intentions may not be malicious it is still a crime.
- On their part these hackers feel that they are doing a service to customers by forcing companies to provide better security and products. An attack by an Ethical hacker is obviously better than one by someone with malicious intent.

3. The Script Kiddy

- As the name itself indicates the script for the hacking is written by someone more experienced and carried out by some unskilled hackers. These are usually teenagers seeking some thrill and fame, hence called Script Kiddies.
- Howsoever, novice or un-malicious their intent, they may gain access and disrupt systems, or deface web pages. These hackers are easier to detect and catch but their attacks can still be very damaging and embarrassing.
- Surely would not spell well for the company's reputation if its customers learn that the company's system has been hacked by a kid.

4. The Hacktivist

- These are hackers who hack to spread a social message or awareness. The act is purely to draw attention to a particular cause in which the company may be involved. These hackers use computer knowledge to promote a political or social cause.
- These hackers may be novices or experienced hackers. It has usually been found that the target company or organization has been involved in some controversial business practices.

5. **The Cracker or Black Hat Hacker**

- These are the hacker that everyone should watch out for, they have malicious intent and use their knowledge to commit crimes. These crimes include vandalism, destruction of property, fraud, theft, corporate or government espionage, and terrorism.
- They are aware that their acts are illegal, and consequently. They are highly professional, and sophisticated, they enter systems undetected and leave behind little evidence. As their intent is to cause harm they do not publicize their conquest which makes them the most challenging hackers to detect or catch.

Q. 2.11 What is Cyber Theft ?

Ans. :

- Cyber-Theft is the use of computers and communication systems to steal information in electronic format. Hackers crack into the systems of banks and transfer money into their own bank accounts. This is a major concern, as larger amounts of money can be stolen and illegally transferred.
- There is a vast increase in the number of computer viruses and they are designed in such a way that they steal the personal information such as bank account numbers, credit cards data.
- There had been attacks by many programs, which includes invisible threats such as worms and Trojan horses and they've jumped over 40 percent in the first half of this year, according to the reports.
- Many of the viruses are designed to mine personal computers for data ranging from the house address to the online banking password. Moreover, others can even access and take over the computer, which hackers use to carry out other attacks, and shield their identification from law-enforcement agencies.
- Many newsletters on the internet provide the investors with free advice recommending stocks where they should invest. Sometimes these recommendations are totally bogus and cause loss to the investors. Credit card fraud is also very common.
- Cyber-theft is the most common and the most reported of all cyber-crimes. Cyber-theft is a popular cyber-crime because it can quickly bring experienced cyber-criminal large cash resulting from very little effort. Furthermore, there is little chance, a professional cyber-criminal will be apprehended by law enforcement.

Q. 2.12 How can such thefts be prevented ?

Ans. :

Solutions to prevent cyber thefts

An important question arises that how can these crimes be prevented. A number of techniques and solutions have been presented but the problems still exist and are increasing day by day.

Antivirus and Anti Spyware Software

Antivirus software consists of computer programs that attempts to identify, thwart and eliminate computer viruses and other malicious software. Anti spy wares are used to restrict backdoor program, trojans and other spy wares to be installed on the computer.

Firewalls

A firewall protects a computer network from unauthorized access. Network firewalls may be hardware devices, software programs, or a combination of the two. A network firewall typically guards an internal computer network against malicious access from outside the network.

Cryptography

Cryptography is the science of encrypting and decrypting information. Encryption is like sending a postal mail to another party with a lock code on the envelope which is known only to the sender and the recipient. A number of cryptographic methods have been developed and some of them are still not cracked.

Cyber ethics and laws

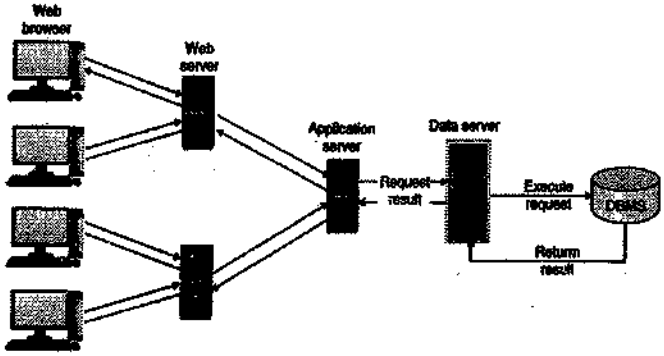
Cyber ethics and cyber laws are also being formulated to stop cyber crimes. It is a responsibility of every individual to follow cyber ethics and cyber laws so that the increasing cyber crimes shall reduce. Security software's like anti viruses and anti spy wares should be installed on all computers, in order to remain secure from cyber crimes. Internet Service Providers should also provide high level of security at their servers in order to keep their clients secure from all types of viruses and malicious programs.

Q. 2.13 Discuss multi-tier client-server architecture.

Ans. :

- This is a complex form of client-server architecture wherein the work of the entire network is divided over several different levels of servers depending upon the kind of services being requested.
- At the first level, a web server serves a web page to the user in response to his request for service. The web server upon receiving request from the user will pass it to the application server. The web server is responsible for locating and managing stored web pages.

- The application server handles all application operations between the user and the back end operations of the organization. The application server may be a dedicated computer or may reside on the same computer as the web server.



Chapter 3 : Leveraging Information Systems

Q. 3.1 List the strategic business objectives that can be leveraged by information systems.

Ans. :

- The extent to which information systems have proliferated the business world can be gauged from the dependence of business entities on them to survive and prosper. Information systems are essential for conducting day-to-day business as well as achieving strategic business objectives.
- There is not a single sector of the economy that is not touched by this technology and business without substantial investments in information systems is practically inconceivable.
- New business models and entities owe their existence to information technologies and systems. Information technology is the foundation for business in the twenty-first century.
- There is growing interdependence between the business entity's ability to use information technology and its ability to implement corporate strategies and achieve its objectives. The future prospects of the business and its objectives depend upon the kind and quality of information systems in the organization.

Thus, information systems can be leveraged to achieve the following strategic business objectives :

- Operational excellence
- New products and services
- Improved relationship with customers and suppliers
- Improved decision making
- Competitive advantage
- Survival

Q. 3.2 What is a project?

Ans. :

To study project management it is necessary to first understand the concept of a project.

- A project is defined as an undertaking of a non-routine, non-repetitive nature having prescribed objectives in terms of scope, time, quality and cost.
- A project is an endeavor to accomplish specific objectives through a unique set of interrelated tasks and effective utilization of resources.
- IT projects involve hardware, software and networks to create product, service, or result. A few examples of IT projects are;
- A new feature is added to an existing software application.
- New system is developed to increase sales force productivity, improve customer relationship management and enhance supply chain management.
- A firm decides to implement an integrated ERP project to consolidate its information systems.
- Replacing the company's manual time keeping system with a web based system within a particular time frame.

Q. 3.3 State Project attribute.

Ans. :

A few typical project attributes are as follows :

- **Purpose :** A project has a unique purpose and well defined objectives. It begins with rough ideas and an initial plan which is updated as more information emerges. Projects are undertaken to accomplish something of value to the company, maybe, a system or software. The sole purpose of undertaking a project is to produce a tangible product of value to the company.
- **Goal :** a goal drives a project. It is the sole motivating factor and defines each activity, task, work, schedule and budget of the project. It provides direction to the team. Hence, the project goal should be clearly defined, ambiguity in defining the project goal leads to a project with no end.
- **Time frame :** since a project is a temporary endeavour it has to have a definitive start and end. The time frame for achieving the project goal is estimated based on the duration of the various project activities. The completion date of the project is set accordingly. However, for projects where the completion date is fixed, such as the Y2K problem, the starting date has to be set by working backwards.

- **Interrelated tasks and resources :** A project is composed of interrelated tasks and utilizes resources such as people, software, hardware and other assets of the company. The primary asset for an IT project is people who cross departmental and other boundaries to achieve this unique purpose.
- Most projects demand the service of people outside the organization such as consultants. Resources, however, are expensive and limited hence should be used effectively to meet project objectives. A project is unique and hence it is difficult to estimate the time, budget and resources requirement. Hence, a project involves uncertainty.
- **Ownership :** A project has various stakeholders but only one primary customer known as the project sponsor. The project sponsor is the "go to" entity for funds, direction and approvals regarding all project related matters. For the project manager the project sponsor is the owner of the project.
- The problem with project management, particularly with IT projects, is it doesn't have a particularly good reputation, cases of over-budget, over-schedule and under-performing, if not outright cancelled projects, are rife in both the public and private sectors.

Q. 3.4 Why is there a need to professionally manage IT projects?

Ans. :

Following are a few reasons why an increased need is felt for effective and efficient project management :

(i) **To control scope of project and manage change :** Although the project deliverables are defined at the outset of the project, small changes in project deliverables are common. These changes are demanded by customers, stakeholders, management, suppliers or the project team itself.

Individually, these change demands may seem acceptable and manageable, but collectively these change demands can lead to a significant expansion in the project scope and can lead to an overrun in schedule and budget.

However, with project management, if the manager effectively manages the scope of their project, they have a better chance of effectively managing project resources and change.

(ii) **To deliver projects on time and within budget :** The project management process includes cost calculations such as return on investments (ROI). Once ROI is established it is for the project manager to ensure that the project schedule and budget are adhered to else the project will fail to deliver the expected results.

(iii) **To ensure the focus of the project team :** It is common for the project team to drift from the main tasks and spend unnecessary longer time on other tasks. Hence, it is the responsibility of the project manager to ensure that the project team focuses on the right tasks by using a clear and concise project charter and that there are no interferences.

(iv) **To collect user requirement from disparate sources :** The project manager at the initiation phase should collect user requirement, project constraints and conduct a feasibility study to build a strong business case justification.

The primary advantage of collecting input from various sources is that the project manager is able to avoid future dissent from users and is able to communicate project benefits.

(v) **To define the critical path to optimally complete the project :** Every project is made up of connected activities each having their individual constraints. By using the critical path method technique the project manager is able to identify the critical path and thus ensure the successful completion of the project.

Q. 3.5 Enumerate the five most important project goals.

Ans. :

The five most important goals of every project are:

(i) **Ensure that the project is completed within the deadlines set :** Every project has a deadline within which it has to be completed and it is the duty and responsibility of the project manager to ensure that the deadline is adhered to.

Although, the project manager and his team may have a role to play in deciding the schedule and at the outset of the project it may have looked feasible but as time passes and requirements change the project may require new strategies and planning making it difficult to complete the project within the stipulated time frame.

However, the project manager should never lose sight of the deadline and keep pushing the team to complete the project within the time frame originally set.

Hence, the project manager before committing to the deadline should take into account all eventualities which he and his team may have to encounter. It is always better to have a buffer period in hand.

(ii) **Ensure that the project is completed within budget :** Just as every project has a schedule it also has a budget. A budget is a forecast of the expenditure that will be incurred on the project. It is essential that the budget is prepared with considerable thought to all the activities and resources that would be utilized in the project. Hence, a budget is prepared after considerable research and after comparison of prices to get the best possible deals.

Like the schedule a budget should leave no stone unturned. However, as requirements change there is every likelihood that the original budget may go astray. It is therefore the responsibility of the project manager to ensure that things stay within budget.

(iii) **Ensure user satisfaction :** Although user satisfaction should be the utmost priority for any project manager and is achieved by delivering the project on time it should in no way be achieved by compromising on the quality of the results. Quality of the project output is another project goal of which the project manager should never lose sight of.

(iv) **Ensure that all user requirements are duly met :** Another very critical goal for the project manager is to ensure that all the user requirements from the project are duly met. This would mean getting very detailed inputs from the user on his requirements from the project.

(v) **Ensure team management :** Along with ensuring that all project goals are met the project manager has to also ensure that his team is happy and contented. It is the responsibility of the project manager to provide encouragement, incentives and rewards for the hard work put in by the team in the project. Remember, no project is complete without a team and hence it is the responsibility of the manager to ensure the well being of all the team members.

- Achievement of these goals is no mean task as it is akin to juggling with five pins at the same time.
- The project manager should ensure that these goals are outlined to the project management team at the very beginning, there in no way for the delivery of the goals to be delayed in any way as everyone will always be aware of what they need to achieve and by when.

Q. 3.6 Why is it necessary to undertake project feasibility study?

Ans. :

- Information Technology projects are expensive and hence before project initiation a preliminary study called a feasibility study needs to be conducted to determine the validity of the project.
- The primary objective of the feasibility study is to ensure that the organization is on the right track and is focusing on the right problem with respect to the project.
- A feasibility study is undertaken to determine the information needs of the prospective users and the resource requirements, costs, benefits and the technical viability of the project.
- A feasibility study is a report of the research that the project manager has undertaken. It helps in determining the validity or scope of the entire project or a part of the project.
- As the title indicates the feasibility study tells the management if a problem is solvable or a business opportunity is realizable.
- Some feasibility studies may also cover the financial implications of undertaking the project. The financial part of the feasibility study will tell the management whether it makes financial sense in undertaking the project. It will indicate the Return on Investment.
- The project manager while preparing the feasibility report should refrain from expressing his opinion about the feasibility of the project. The report should be highly factual and down to the point.
- It should cover all the aspects of the project, its ability to address the problem or realize the business opportunity, financial implications, and the value that it will add to the organization.
- The project manager should be fair in his assessment and should not be tempted to impose new technology merely for the sake of technology.
- Many a times in IT projects it has been observed that project managers utilize technology merely to display their technical expertise. Technology for the sake of technology is no good; it should add value to the organization. The project manager, in his report, should express how the new technology will benefit the organization.

Q. 3.7 Briefly describe the phases of project management methodology.

Ans. : The IT project management methodology comprises of five phases which are as follows :

Phase I : Project conceptualization and initialization

- This is the first stage in the project methodology and is responsible for preparing the ground work for further development. In this stage the idea behind the project is hatched and the goal or purpose of the project is defined.

- The primary project goal is very important in project methodology as it provides a basis for future project decisions and aids in defining the project scope. The project goal also serves as a parameter for evaluating the project's success after its completion.

Phase II : Developing project plan and charter

- A project is defined as an undertaking of non-routine nature to create a new or unique product, service or result. As the undertaking is new or unique and never been done before in the organization, planning is essential.
- The planning process should complement the size and complexity of the project i.e. the larger and more complex the project the greater the planning effort while small routine project require very less planning effort.
- Although, planning is an intrinsic part of each phase of the project methodology it is all the more relevant in this phase where the project plan and charter are developed.

Phase III : Project execution and control

- After having developed the project plan it is time to execute the plan. There are two types of processes, one which result in products and other which form the supporting processes.
- The product oriented process play an important role during the execution phase of the project. Quality assurance, risk management, team development, etc form the core of the supporting processes in the project execution.

Phase IV : Project closure

- The primary objective of the closing process group is to ensure that the project reaches its logical conclusion and to bring the project to an orderly completion.
- The project closure phase is reached when all the project deliverables have been achieved and accepted by the project sponsor.
- At this phase the project team has to also ensure that the project integrates with the day-to-day operations of the organization and delivers information products as required. The closure of a project is marked by contract and administrative closure.

Phase V : Project evaluation

- The project evaluation phase focuses on evaluating the previous four project process group. The project review conducted by the project manager and his team should focus on assessing the positive and negative outcome of the project, things that worked in favour of the project and what went against the project.
- The experiences gained from the project should be well documented for future references. The project manager should also identify the best practices from the project that could be incorporated in the project management methodology of the organization. Inculcation of such best practices leads to the evolution of the methodology.

Q. 3.8 Who are stakeholders of the project?

Ans. :

The stake holders to the project are :

- **End users** - are the people who will actually be using the project
- **Project in charge/ project sponsor :** the person in the organization who has the authority to grant the resources and sign the charter.
- **Project team :** people actually working on the project.
- **Functional managers :** managers in charge of the various functional departments of the organization.
- **Project manager :** the person in charge of the project.
- **Business partners :** suppliers, customers, and vendors

Q. 3.9 What is a project charter?

Ans. :

- A project charter is a detailed official document prepared in line with the company's vision and goal describing in detail the finer nuances of the project and chalking out deadlines for the milestones within the project.
- The project charter serves as a road map for the project manager and states the goals that are to be achieved from the project.
- A project charter gives a clear definition of the project, its attributes, the end results and the project authorities. Project authorities are the people who are responsible for the implementation and success of the project. These people are namely the project in charge/project sponsor, project manager and the project team leaders.
- A project charter is the final official authorization for the commencement of the project to the project manager. It is a green signal to the project manager to commence work on the project.

Q. 3.10 State purpose of the charter.

Ans. :

Purpose of the project charter

- A project charter serves the following purpose;
- Defines the business need
- Identifies the project sponsor
- Authorizes the project
- Identifies the project manager, grants authority and makes him responsible for the management of the project

Q. 3.11 What is a business case?

Ans. :

- The business case arises out of this need and provides an analysis of the technical feasibility, costs, risks, returns, and organization value of various projects. It provides the basis on which informed decision on the projects can be taken.
- Although, the business case may sound very similar to a project plan or budget it should not be mixed up with one. The business case is a document that provides the top management with all the information needed to select the projects that are to be funded.
- Although creation of the business case document is very much similar to the feasibility report in most of the cases it is a separate document. Like the feasibility study the business case too helps the management in justifying the cost that will be incurred on the project and its return on investment.
- The business case is built on the relevance of the business goals and objectives and the cost of the proposed technology that can get the organization there.
- The business case takes into account the cost of the solution, break-even point, return on investment, and maintenance cost. Along with the quantitative issues the business case may also address qualitative issues such as; working comfort, increased efficiency, improved morale, etc.
- The business case is very similar to an investment proposal. Hence, the developer of the business case has to present compelling facts and figures in favour of the project and base his argument in the most logical manner. However, the business case developer in no way should digress from the facts of the project and the analysis should be as dispassionate as possible. A good business case should;
  - Detail all possible impacts, costs and benefits.
  - Be clear and logical in comparing the cost-benefit impact of each project alternative.
  - Include all pertinent information.
  - Systematically summarize all the findings.

Q. 3.12 List the steps in developing the business case.

Ans. :

Steps in developing the business case :

Step I : Forming the team

Step II : Developing Measurable Organizational Value (MOV)

Step III : Identifying Alternatives

Step IV : Defining Feasibility and Assess Risk

Step V : Defining Total Cost of Ownership

Step VI : Defining Total Benefits of Ownership

Step VII : Analysing alternatives

Step VIII : Recommend Solution

Q. 3.13 What is Measurable Organizational Value (MOV)?

Ans. :

- Projects overall goal and its measure of success.
- For any project the MOV should align with the organization's overall mission, objectives and goals. The term Measurable Organizational Value was coined by Jack Marchewka as an alternative to the more popular return on investment (ROI). According to Jack Marchewka the projects MOV should be :
  - Measurable
  - Provide value to the organization
  - Agreed upon by all the core team members.
  - Verifiable at the end of the project.
  - Guide the project throughout its lifecycle.
  - Align with the organizations strategy and goals.
- A clear MOV will enable the team to know where the project should go, it will be like the road that the whole project lifecycle should take. In case the project deviates from its path, the relevant decisions and adjustments will be based on the MOV which can be vital in achieving the overall goal.

Q. 3.14 Describe the project management process groups.

Ans. :

- Project management process groups have been termed according to the nature of integration between the processes, the interactions within them and the purposes they serve.

- These processes have been grouped into five groups, defined as the project management process group.
- The five process groups are as follows :

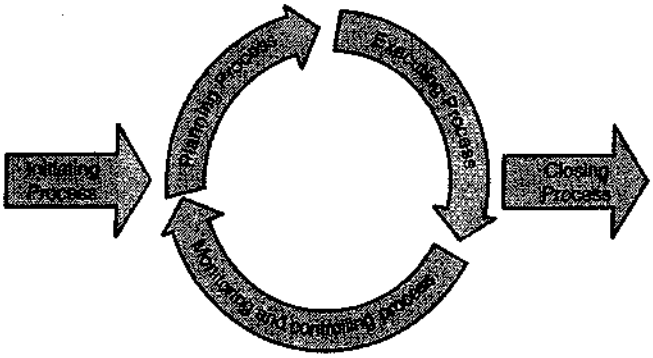


Fig: 1-Q. 3.14 : Project Management Processes

(i) Initiating process group

- The initiating process group signals the formal authorization to start a new project or project phase. Initiating process group processes are done external to the project's scope of control by the organization. Even before beginning the initiating process group activities the organizations business needs are identified and documented.
- The business case is developed to establish the feasibility of the new project through a process of evaluating alternatives to pick the best one that can support the organizations strategy and goals. Along with the documentation of the objectives of the organization, the reason why this project best meets the objectives is also documented.

(ii) Planning process group

- The planning process group's processes and activities are used by the project team to successfully plan and manage the project.
- The planning process is the most critical part of the project management process. The planning process group gathers information from various sources and develops the project management plan.
- The efforts expended on planning should be proportional to the size and complexity of the project i.e. larger and complex projects demand more planning efforts while smaller and simpler projects could do away with less efforts.

(iii) Executing process group

- The developed and approved project plan needs to be executed in order to bring the project to realty. The executing process group consists of the processes used to complete the work defined in the project plan.
- The project team should determine which of the processes are required for the implementation of the plan. The product oriented processes play an important role in the completion of the project plan activities.
- The executing process group involves coordinating people and resources as well as integrating and performing activities in accordance with the project plan. This process group also addresses the scope defined in the project scope statement and implements changes approved by the project team.

(iv) Monitoring and controlling process groups

- The monitoring and controlling process group consists of those processes that observe and control project execution so that potential problems can be identified in a timely manner and corrective action can be initiated.
- This process group also measures the progress made in the direction of the project's MOV as well as the scope, cost, schedule and quality objectives.
- The key benefit of this process group is that project performance is observed and measured regularly to identify variances from the project plan.
- This group also includes proposing controlling changes and preventive action in anticipation of problems. Supporting processes include scope control, schedule control, quality control, budget control and communications plan.

(v) Closing process group

- The closing process group includes all the processes used to formally terminate all the activities of a project or a project phase. In case the project has been successfully completed the project team should ensure that all deliverables have been completed to the satisfaction stakeholders and that the project sponsor accepts the project's products.
- The project team should also ensure that the final product has been successfully integrated into the day-to-day operations of the organizations.
- In case the project has failed the project team has to document all the relevant information with the project sponsor and then close the cancelled project.

- This process group when completed indicates that all the processes within all other process groups have been completed and the project or project phase is ready to be closed. There are primarily two types of closures; contract closure and administrative closure.

Q. 3.15 State the characteristics of good information.

Ans. :

Characteristics of good information :

– Timeliness	– Appropriateness	– Accuracy
– Relevant	– Conciseness	– Complete
– Frequency	– Current	– Economical
– Understand ability		

- **Timeliness :** Information must reach the user in a timely manner, just when it is needed; not too early, because by the time it is used it would be out-of-date; not too late because the user will not be able to incorporate it into his/her decision-making.
- **Appropriateness :** Information must be relevant to the person who is using it. It must be within the sphere of his/her activities so that it can be used to reduce uncertainty in his/her decision-making.
- **Accuracy :** Accuracy costs. We don't always need 100% accurate information so long as we know the degree of accuracy it represents (e.g.: ± 5%).
- **Conciseness :** Information should always contain the minimum amount of detail that is appropriate for the user. Too much detail causes information overload.
- **Frequency :** Frequency is related to timeliness. Too often the information presented is linked to the calendar (end of the week, beginning of the month); its frequency should be synchronized with the timing of the decision making of the user.
- **Understand ability :** The format and presentation of information are very important. Some people prefer tabular information, whereas others may need it in a graphical form. Also the use of colors enhances the understandability of what is presented.
- **Relevant :** It pertains to the particular problem. What data is relevant depends on the decision-making model used. E.g. University admissions officials may choose to consider the results of some high-school test irrelevant, if they believe that it does not improve the chances of some applicant later becoming a successful student.
- **Complete :** All the relevant parts are included. E.g. Marketing data about household incomes may lead to bad decisions, if not accompanied by consumption habits of the target population.
- **Current :** Decisions are often based on the latest information available
- **Economical :** The costs of gathering information should be justified by the overall benefits
- **Errors and bias :** The decision maker will always prefer information which has quality and not the quantity of information that he is receiving. The quality of the information is bound to get affected due to the bias of the presenter and the errors that may occur due to various reasons.
- Now if the presenter is known to the decision maker then he anticipates the degree of bias and can make the necessary adjustments in his decision making. But the same is not possible with errors as errors pose a more serious problem as errors can creep in at various stages and it is not possible to make the adjustments in the decision making.

Q. 3.16 What are the problems of traditional file system?

Ans. :

The traditional file system, which still exists in many organizations, is plagued with many problems. The system is developed without taking an enterprise-wide plan and each system applicable to each functional unit is developed independently. Thus, we have accounts, production, human resources and every functional department within the organization developing their own system and maintaining their own data files. Each application required its own files and its own software to operate. This lead to the creation of multiple master files which were operated by separate functional departments. Now, imagine an organization which is operating in a similar manner for a number of years. It is bound to be saddled with number of programs and applications that are difficult to maintain and manage. This leads to problems of data redundancy, data inconsistency, poor data security, inflexibility, and inability to share data among applications.

- **Data redundancy :** data redundancy is the outcome of multiple systems operating within the enterprise. Multiple systems give rise to the duplication of data as the same data is stored in multiple locations.
- Data redundancy takes place when different groups within the organization collect and store the same data independently. As the same data is collected and stored by multiple departments of the same enterprise it leads to wastage of storage resources and also gives rise to data inconsistency.

- **Program-data dependence :** as each department has its own program that updates and maintains the data files a change in program will automatically lead to changes in data. So data worked upon by one program would be of no use to other programs as they would be making changes in the data that would make them useless for other programs. Such changes could prove to be costly to the organization.
- **Lack of flexibility :** the traditional file systems lack the ability to cater to ad hoc information requirements in a timely manner. These systems have been developed to deliver routine scheduled reports only and although the information requested is there in the system it would be prove to be costly to retrieve.
- **Lack of security :** as there is no central control over the data being collected, accessed and disseminated there is a likelihood of the information being tampered with or being accessed by unauthorised people. All this is not promising from the point of view of the organization.
- **Lack of data sharing :** the sharing of data and information in a timely manner is virtually not possible. Also, as each piece of information has different values it is not possible to trust the accuracy of the information being shared and this hampers the flow of information.

Q. 3.17 Enumerate the advantages of DBMS.

Ans. :

Following can be said to be the major advantages of the DBMS :

1. The DBMS helps reduce the difficulty in the systems surroundings due to the central control/management of data, access, utilization and security.
2. As same data elements are not frequent in all the files, DBMS helps reduce/eliminate data redundancy and inconsistency and promote data integrity throughout the system/organization.
3. The DBMS provides for central control of data creation and definition, thereby reducing/eliminating data confusion.
4. DBMS helps to bring about substantial reduction in the costs related with programmed development and maintenance.
5. DBMS helps separate logical view and physical arrangement, thereby, reducing programmer-data dependence.
6. DBMS, particularly the RDBMS, permits ad-hoc queries, here by ensuring flexibility of information systems. DBMS helps increase access and availability of/to information. It may be mentioned that among the DBMS, Oracle, Ingress, Sybase, Informix and Unify are some of the products on the Server Class machine and dBase, FoxBASE Access and Paradox are some of the products on the client class machines.

Q. 3.18 Discuss the capabilities of DBMS.

Ans. :

A Database Management System has capabilities and tools for organizing, managing and accessing the data in the database. These tools and capabilities are as follows:

1. Data definition language

1. As we know the overall design of the database is nothing but **schema** of that database.
2. If we specify the database schema by a set of definitions expressed by a specific language called a Data- Definition Language. (DDL)
3. This is very important because with the help of DDL we can create the database.
4. The SQL-DDL provides commands for defining relational schemas, deleting relations and modifying relation schema.

2. Data manipulation language

1. A **query** is a statement requesting the retrieval of information. This is used for accessing and manipulating the data.
2. Data manipulation language is used to add, change, delete, and retrieve data from the database.
3. The portion of the DML that involves information retrieval is called a **query language.**
4. The SQL-DML includes the query language based on the both relational algebra and tuple relational calculus.
5. It includes the commands like insert tuple into, delete tuple from and modify tuple in the database.

3. Data dictionary

1. A data dictionary is an automated or manual file that stores definitions of data elements and their characteristics.
2. Data dictionary displays information about the name, description, size, type, format, and other properties of each field in a table.
3. Data dictionaries for large corporate databases may capture additional information, such as usage, ownership, authorization, and the individuals, business functions, programs, and reports thatuse each data element.

Q. 3.19 What are distributed databases?

Ans. :

- A distributed database is a database in which storage devices are not all attached to a common CPU. It may be stored in multiple computers located in the same physical location, or may be dispersed over a network of interconnected computers.
- Collections of data (e.g. in a database) can be distributed across multiple physical locations. A distributed database can reside on network servers on the Internet, on corporate intranets or extranets, or on other company networks. The replication and distribution of databases improves database performance at end-user worksites. The distributed databases may contain operational, analytical or discussion databases.
- To ensure that the distributive databases are up to date and current, there are two processes: replication and duplication. Replication involves using specialized software that looks for changes in the distributive database. Once the changes have been identified, the replication process makes all the databases look the same. The replication process can be very complex and time consuming depending on the size and number of the distributive databases. This process can also require a lot of time and computer resources.
- Duplication on the other hand is not as complicated. It basically identifies one database as a master and then duplicates that database. The duplication process is normally done at a set time after hours. This is to ensure that each distributed location has the same data. In the duplication process, changes to the master database only are allowed. This is to ensure that local data will not be overwritten. Both of the processes can keep the data current in all distributive locations.
- Besides distributed database replication and fragmentation, there are many other distributed database design technologies. For example, local autonomy, synchronous and asynchronous distributed database technologies. These technologies' implementation can and does depend on the needs of the business and the sensitivity/confidentiality of the data to be stored in the database, and hence the price the business is willing to spend on ensuring data security, consistency and integrity.
- Distributed data management enables information to flow freely from the data center to the point of action and back. Distributed data management is a requirement for any organization that needs to :
  - Process extreme transactions that are driven by Internet-enabled business models and highly distributed, global, always-on applications.
  - Fuel analytic applications with comprehensive, timely data in order to drive revenue growth, identify risks and trends, improve products and services, grow market share and enhance customer loyalty.
  - Empower and support remote offices and mobile employees so they can out-think and out-perform competitors.

Q. 3.20 State advantages of distributed database.

Ans. :

Advantages

Management of distributed data with different levels of transparency like fragmentation transparency, replication transparency.. etc..

- Increase reliability and availability.
- Easier expansion.
- Reflects organizational structure - database fragments are located in the departments they relate to.
- Local autonomy or site autonomy - a department can control the data about them (as they are the ones familiar with it.)
- Protection of valuable data - if there were ever a catastrophic event such as a fire, all of the data would not be in one place, but distributed in multiple locations.
- Improved performance - data is located near the site of greatest demand, and the database systems themselves are parallelized, allowing load on the databases to be balanced among servers. (A high load on one module of the database won't affect other modules of the database in a distributed database.)
- Economics - it costs less to create a network of smaller computers with the power of a single large computer.
- Modularity - systems can be modified, added and removed from the distributed database without affecting other modules (systems).
- Reliable transactions - Due to replication of database.
- Hardware, Operating System, Network, Fragmentation, DBMS, Replication and Location Independence.
- Continuous operation.
- Distributed Query processing.
- Distributed Transaction management.

- Single site failure does not affect performance of system. All transactions follow a-atomicity, the transaction takes place as whole or not at all; c-consistency, maps one consistent DB state to another; i-isolation, each transaction sees a consistent DB; d-durability, the results of a transaction must survive system failures. The Merge Replication Method used to consolidate the data between databases.

Q. 3.21 State disadvantages of distributed database.

Ans. :

Disadvantages

- Complexity - extra work must be done to ensure that the distributed nature of the system is transparent. Extra work must also be done to maintain multiple disparate systems, instead of one big one. Extra database design work must also be done to account for the disconnected nature of the database - for example, joins become prohibitively expensive when performed across multiple systems.
- Economics - increased complexity and a more extensive infrastructure means extra labour costs.
- Security - remote database fragments must be secured, and they are not centralized so the remote sites must be secured as well. The infrastructure must also be secured (e.g., by encrypting the network links between remote sites).
- Difficult to maintain integrity - but in a distributed database, enforcing integrity over a network may require too much of the network's resources to be feasible.,
- Inexperience - distributed databases are difficult to work with, and as a young field there is not much readily available experience on proper practice.
- Lack of standards - there are no tools or methodologies yet to help users convert a centralized DBMS into a distributed DBMS.
- Database design more complex - besides of the normal difficulties, the design of a distributed database has to consider fragmentation of data, allocation of fragments to specific sites and data replication.
- Additional software is required.
- Operating System should support distributed environment.
- Concurrency control: it is a major issue. It is solved by locking and time-stamping.

Q. 3.22 What is Data Mining?

Ans. :

- Data-Mining, enables managers to establish relationship between business elements and find out aspects and facts about their business that may not be evident otherwise.
- Data Mining, thus, is an information analysis tool that involves the automated discovery of patterns and relationships in a data warehouse.
- Data mining is a new, but powerful concept that has started to gain popularity in the Business Intelligence World.
- Data Mining aims at extracting patterns, trends and rules from Data Warehouse to evaluate, either predict or scour proposed business strategies, which in turn, will improve competitiveness, improve profits and transform business processes.

Definition

- Data mining is "the process of discovering meaningful, new correlation patterns and trends by sifting through large amount of data stored in repositories, using pattern recognition techniques as well as statistical and mathematical techniques".

Q. 3.23 State objectives of data mining.

Ans. :

Objectives of data mining

As could be observed from the definitions quoted earlier, data mining is expected to lead to the following results :

(a) Discovering unknown associations. Such associations can be found when one event can be co-related to another event that seems completely unrelated.

(b) Sequences, where one event leads to another later event.

(c) Recognizing patterns that lead to classification or new organization of data.

(d) Finding out facts previously not known (event clustering).

(e) Forecasting or simply discovering patterns in the data that can lead to predictions in/about the future.

Q. 3.24 Briefly explain the working of data mining.

Ans. :

- Data mining, as is clear by now, is more empirical and hence application-oriented and applications facilitator. As such, data mining has to be of real value for an organization.
- The outcome of data mining must be measurable and actionable. Hence, data mining should not only enable the analysis to be undertaken/performed but it must enable learning from this activity.

- This learning, in turn, are applied in practice for ensuring qualitative/predictive decision making.
- The typical cyclical functioning of data mining would therefore consist of the following :
  1. Understanding the situation.
  2. Building/Developing (suitable) model/s.
  3. Undertaking analysis based on the model/s.
  4. Initiating appropriate action.
  5. Measuring the results.
  6. Iterations.

Q. 3.25 What is ERP?

Ans. :

- Enterprise Resource Planning (ERP) is the technique of integrating the various processes within the organization with the aim of better and effective utilization of management resources for the improvement of the efficiency of the organization.
- ERP is a powerful planning and execution tool to support and provide seamless dissemination of information across all the business units of an enterprise irrespective of their location.
- ERP has been defined by Jyotindra Zaveri a renowned ERP specialist as: "Complete integrated business management software which captures data in chronological order, links businesses processes automatically and gives real time information to authorized users".
  - An ERP system has a very wide coverage as it is multi-user, multi-location (web based) and multi-company.
  - Though modern ERP system covers all business functions across all forms of industries, initially they were targeted to service the manufacturing industry and catered to functions like sales, production, and finance etc. Current ERP systems are designed to cover all basic processes in a company and their prime objective is to integrate information across the length and breadth of the organization.
  - The ERP system should reflect the major business processes of the organization and its success depends on its ability to connect and integrate the various functions within the organization seamlessly.
- ERP utilizes client - server technology to integrate basic resource planning (men, material, money, machine and methods) of the enterprise according to the requirement of the market. Though it initially utilized client-server technology it now utilizes web based technology.

Q. 3.26 State characteristics of ERP.

Ans. :

Characteristics of ERP

- ERP is a packaged software solution and not custom built for a particular client though some degree of customization can be carried out to meet the requirements of the client.
- ERP uses the best available practices in business processes, provides for their management, and enables cross functional integration.
- ERP provides for data sharing possibilities and making it available to the user on real time basis.
- ERP does not provide strategic solutions it is only an enabler and acts as the transactional backbone of the enterprise.
- ERP packages are evolving at a rapid pace, most of the solutions use the client –server technology while some have progressed to object-oriented design making it totally web based.
- ERP provides for the technology and technique to manage the workflow. It expedites and smoothen the flow of work across the length and breadth of the organization.
- ERP computerizes the business procedures during which documents and information is passed from one computer to another as per the procedure that has been designed.
- ERP is a standard software product which consists of ready to implement seamlessly integrated business application that enables effective and efficient execution of business processes across various functional departments irrespective of their geographic location.

Q. 3.27 What is EDI? State its role.

Ans. :

Modern enterprises need to be more flexible in their approach and hence need information on the move this is made possible by EDI. Electronic Data Interchange is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention hence customer information, orders, invoices can now be shared in real time.

Q. 3.28 State the advantages of ERP.

Ans. :

Advantages of ERP

1. Integration
2. Flexibility
3. Improved planning and decision making
4. Latest technology
5. Tangible benefits
6. Intangible benefits

Q. 3.29 State limitations of ERP.

Ans. :

Limitations of ERP

As is true with every software solution ERP also has its share of limitations which are;

- ERP solutions are primarily designed for the manufacturing sector and project industry. These solutions are not suitable for the service industry and though developments have been, they have still not been so widely accepted. For the service industry better IT solutions are available.
- The prime reason for the failure of ERP is when enterprises try to over customize the package. This in no way means that enterprises should not customize the package with the fear of failure, as in that case it would defeat the very purpose of implementing. Optimum customization of the package should be carried out.
- The existing business processes needs to match the software requirement and vice versa and hence exhaustive detailing is required.
- ERP requires the enterprise to be transparent and fair about its dealings and any enterprise which is not may find this as a limitation. The enterprise may find it difficult to match the requirements of business and software with the legal requirements of the land in which it operates.
- The data that is used is internally generated, has no external intelligence and hence fails to portray a clear picture.
- ERP deals with only current data and past data is not taken into consideration. This does not go well with the decision makers who like to study past trends while making decisions.
- The ERP system proves to be unfeasible from the viewpoint of finite and bottleneck scheduling while considering machine capacity issues.
- ERP is purely driven by data which some of the employees may find cumbersome.
- ERP makes the whole process mechanical thus reducing the creativity of employees.
- ERP is not a total solution to the requirements of the enterprise and add on software solutions are needed to make it complete. This not only increases the cost of implementation but also the complexities of the system.

Q. 3.30 Briefly explain the three phases of CRM.

Ans. :

For any relationship to flourish there needs to be certain level of understanding likewise the relationship with the customer will flourish only if the understanding improves. In today's competitive world the customer has many options from which he can make a choice as to whom he wants to go with.

The three phases in which CRM support the relationship between a business and its customers are to. The phases have been so developed that they develop the understanding between the company and the customer. Each phase has an impact on the relationship and the bond becomes stronger. Remember that this is more the requirement of the company then the customer as the customer always has more options with him so the efforts to improve the relations have to be more form the company. The three phases are as follows :

- **Acquire :** it is always the endeavour of the company to acquire new customers by promoting the products and the services of the company. CRM can help a business acquire new customers through contact management, selling, and fulfilment.
- **Enhance :** in the phase of enhancement of the relationship with the customer that you have just acquired by encouraging excellence in selling. Web-enabled CRM combined with customer service tools offers customers service from a team of sales and service specialists, which offers customers the convenience of one-stop shopping.

- **Retain :** in this phase it is important form the point of view of the company to retain the customer for life means that should be the idea behind this exercise. Care should be taken to deliver value to the customer.
- Today more importance is given to retaining a customer than acquiring new ones though that phase should not be overlooked also. CRM software and databases enable a business to identify and reward its loyal customers and further develop its targeted marketing and relationship marketing initiatives.

Q. 3.31 State the benefits of SCM.

Ans. :

Supply Chain Management (SCM) system is one in which there is a network of businesses that are interconnected to provide services and products required by a customer. A SCM system controls the planning, execution, design, monitoring and control of these activities to create value and improve global performance. That's why more and more organizations are purchasing and implementing supply chain applications.

Benefits of supply chain management are as follows :

Improve your supply chain network

Supply chain software's provide complete, 360 degree visibility across the entire supply chain network – something that cannot be easily achieved with disjointed manual processes. With supply chain, users can monitor the status of all activities across all suppliers, production plants, storage facilities, and distribution centers.

This enables more effective tracking and management of all related processes, from the ordering and acquisition of raw materials, through manufacturing and shipping of finished goods to customers or retail outlets.

Lower costs

By adding an effective SCM system to a business, the added global efficiency can lead to lower costs of raw materials. This system efficiently plans for materials to be brought to your company from the lowest cost provider possible and at just the right time to ensure there is no excess or deficiency in the material.

Improved collaboration

An SCM system wired in to the latest software allows you to know the position your raw materials and your finished products are in by tracking both your suppliers and your distributors. These companies can also track where you are at in receiving or sending those materials. This knowledge can keep relationships between these businesses strong.

Cycle times

The cycle time can be defined as the time it takes your business to turn over a product from raw materials, give it to your distributor to sell and then make enough money to purchase new raw products to start the cycle over. If at any point it takes too long to obtain these raw materials, production may have to stop which will slow down your organization. An SCM system improves cycle times and ensures that raw materials are provided when your business needs them so that you never have to stop production.

Response to conflict

Unfortunately, a business cannot always run smoothly and there are a number of factors that can lead to problems in the production of a product. If an issue occurs with the suppliers of your company, you may have to change how you produce your product. If the distributor goes out of business, you will have to find another way to sell the product.

Increase revenue

Higher utilization of capacity helps you increase revenues. Collaborate with partners and optimize supply planning and execution across enterprise boundaries. Achieve faster responsiveness to unanticipated demand. Reduce order cycle times, enhancing the conversion of materials to revenue. Improve asset use and reduce unnecessary capital expenditures. Introduce new products and promotions with efficiency and accuracy.

Retain customers

Accurate planning improves customer service and in turn customer retention. Detailed order-status information results in higher customer satisfaction. Provide quality products and services at competitive prices. Have the ability to respond to unanticipated demand so you can commit to more orders.

Minimized delays

Many supply chains - particularly those that haven't been enhanced with a supply chain application - are plagued by delays that can result in poor relationships and lost business. Late shipments from vendors, slow downs on production lines, and logistical errors in distribution channels are all common issues that can negatively impact a company's ability to satisfy customer demand for its products. With supply chain software, all activities can be seamlessly coordinated and executed from start to finish, ensuring much higher levels of on-time delivery across the board.

With the increased visibility into the supply chain and adaptive supply chain network, you can be more responsive. You can sense and respond quickly to changes and quickly capitalize on new opportunities.

By offering a common information framework that supports communication and collaboration, SCM enables you to better adapt to and meet customer demands. Better order, product and execution tracking can lead to improvements in performance and quality - and lower costs.

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Note