KARNATAKA STATE OPEN UNIVERSITY

MUKTHAGANGOTHRI, MYSORE - 570 006.

DEPARTMENT OF STUDIES AND RESEAARCH IN MANAGEMENT

M.B.A II SEMESTER

COURSE- HC–2.1

INFORMATION TECHNOLOGY FOR MANAGERS

BLOCK - 1 MANAGEMENT INFORMATION SYSTEM

BLOCK - 2 PLANNING IMPLEMENTING THE INFORMATION SYSTEM

BLOCK - 3 DESIGN AND DEVELOPMENT OF INFORMATION SYSTEM

BLOCK - 4 APPLICATIONS OF INFORMATION SYSTEM

CREDIT PAGE

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BLOCK -1 : INFORMATION TECHNOLOGY FOR MANAGERS

MIS, the management information system, speaks about providing the information required to the managers in a systematic way. The information is provided regularly in a fixed format. MIS gathers information from the processes and informs top management. They present the data in such a way that they find the information useful. The data thus presented could be analyzed further. The management may demand report in a particular format so that they initiate the required action. The information presented by MIS helps decision making process.

In this block let us discuss the fundamental concepts of Management information system

Unit 1: Introduction to Management Information Systems

Unit 2: Data and information

Unit 3: Types of Information systems

Unit 4: The Decision making process

In the previous block, you have understood the importance of MIS for an organization. In this block, let us explore how to implement MIS in an organization. The implementation of MIS may be for the first time in an organization or it can replace the existing information system. For this planning is necessary. The system development takes places in phases.

The system development always throws complicated challenges to the developer as well as the organization employees. The employees have sound knowledge about the processes in the company. But they may not have idea on collecting, interpreting and reporting the data in a meaningful manner. On the other hand the system analyst could have idea about the logical flow of information but may not know the operations. Hence flow chart and decision tables are employed. Further the information so implemented shall be tested and maintained. Is should be updated periodically. In this block let us discuss about the following topics.

Unit 5: Introduction to systems and system planning

Unit 6: System Analysis and design, SDLC

Unit 7: Flow chart and decision tables

Unit 8: Testing and maintenance of information system

In the previous block, you have understood the development of MIS, now let us discuss it in detail. In this block you will learn about designing of input and output interactions. You will also learn about data mining and data warehousing. You will have knowledge of cybercrime which is an another important issue that needs to be considered. Since most of the companies transact through their websites cybercrime has to be avoided. In this block you will find information on the following concepts.

Unit 9: Introduction to Design and Development of Information System-Data Base of Development

Unit 10: Input and Output Design, Data and Information Flow, Front End and Back End Software

Unit 11: Data Mining and Warehouwing, Knowledge Management, Data Security

Unit 12: Cyber Crime and Privacy Issues, Ethical Issues for IT Managers

In the previous block, you have learnt about developing of MIS. In this block let us study about application of information system. Information system has large number of applications in various fields of business such as Accounting information system, financial information system, marketing information system, human resource information system and so on. Complete package which cater to all such needs are also available in the form ERP. Through softwares CRM issues can also be addressed. The complete supply chain right from processing of raw material to supply of final product and payment follow up to the end customer can be tracked on line. In this final block, you will study the following issues.

Unit 13: Introduction to Applications of Information System

Unit 14: Enterprise Resource Planning and E-Business

Unit 15: Customer Relationship Management

Unit 16: Supply Chain Management

UNIT -1: INTRODUCTION TO MANAGEMENT INFORMATION SYSTEM

STRUCTURE

1.0 OBJECTIVES

After studying this unit, you should be able to:

* Define Management Information System (MIS);
* Explain System approach in business and
* Explain benefits of MIS.

1.1 INTRODUCTION

Information isa critical resource in the operation and management of organizations. Timely availability of relevant information is vital for effective performance of managerial functions such as planning, organizing, leading, and control. An information system in an organization is like the nervous system in the human body: it is the link that connects all the organization's components together and provides for better operation and survival in a competitive environment. Indeed, to day's organizations run on information.

1.2 AN OVERVIEW OF MIS

Information consists of data that have been processed and are meaningful to a user. A system is a set of components that operate together to achieve a common purpose.Thus a management in formation system collects, transmits, processes, and storesdataonan organization's resources, programmers, and accomplishments. The system makes possible the conversion of the sedatain to management information for use by decision makers with in the organization. A management information system, therefore, produces information that supports the management functions of anorganization. Aninstitution's MIS should be designed to achieve the following goals

Enhance communication among employees. Deliver complex material through out the institution

Provide an objective system for recording and aggregating information.

Reduce expenses related to labor- intensive manualactivities.

The incorporation of knowledge and reasoning methods inuserinter face design can provide high-quality solutions for alluser categories by, amongst others **:**

1. Supportinguser-adaptability and (technological) platform independence;
2. Automating the syntactic and lexicalde sign of the user interface;and
3. Providing intelligent help facilities and cooperative services(e.g.interfaceagents).

MIS is a computer system designed to help managers plan and direct business and organizational operations.

It's a computer-based or manual system that transforms data into in formation use ful in the support

of decision making. MIS can be classified as performing three functions :

1. To generatereports- for example, financialstatements, inventory status reports,or performance reports needed for routine ornon - routine purposes.
2. To answer what-if questions asked by management.Forexample,questions such as "What would happen to cashflow 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 typeof MIS is appropriately called Decision Support System(DSS). DSS attempts to integrate the decision maker, the database,and thequantitative models be ingused.

Despite the fact that the computer is nothing more than a tool for processing data, many managers view it as the central element in an information system. -This attitude tends to overrate and distort the role of the computer. Its real role is to provide information for decisions and for planning and controlling operations.

Despite this proliferation of books, articles, seminars, and courses surrounding this area, few efforts have managed to synthesize the separate subjects of management, information, and systems and to show how these are related to computers. Let us begin by defining the concept.

A Management Information System Defined : MIS is not new; only its computerization is new. Before computers, MIS techniques existed to supply managers with the information that would permit them to plan and control operations. The computer has added one or more dimensions, such as speed, accuracy, and increased volumes of data, that permit the consideration of more alternatives in a decision. The scope and purpose of MIS is better understood if each part of the term is defined. Thus,

Management : Management has been defined in a variety of ways, but for our purposes it comprises the processes or activities that describe what managers do in the operation of their organization: plan, organize, initiate, and control operations. They plan by setting strategies and goals and selecting the best course of action to achieve the plan. They organize the tasks necessary for the operational plan, set these tasks up into homogeneous groups, and assign authority delegation. They control the performance of the work by setting performance standards and avoiding deviations from standard. Because decision making is such a fundamental prerequisite to each of the foregoing processes, the job of an MIS becomes that of facilitating decisions necessary for planning, organizing, and controlling the work and functions of the business.

Information : Data must be distinguished from information, and this distinction is clear and important for our purposes. Data are facts and figures that are not currently being used in a decision process and usually take the form of historical records that are recorded and filed without immediate intent to retrieve for decision making. An example would be any one of the supporting documents, ledgers, and so on that

comprises the source material for profit and loss statements. Such material would only be of historical interest to an external auditor.

Information consists of data that have been retrieved, processed, or otherwise used for informative or inference purposes, argument, or as a basis for forecasting or decision making. An example here would also be any one of the supporting documents already mentioned, but in this case the data could be used by an internal auditor, the management services department of an external auditor, or internal management for profit planning and control or for other decision-making purposes.

Systems : A system can be described simply as a set of elements joined together for a common objective. A subsystem is part of a larger system with which we are concerned. All systems are parts of larger systems. For our purposes the organization is the system, and the parts (divisions, departments, functions, units, etc.) are the subsystems.

Whereas we have achieved a very high degree of automation and joining together of subsystems in scientific, mechanical, and factory manufacturing operations, we have barely scratched the surface of applying systems principles to organizational or business systems. The concept of synergism has not generally been applied to the business organization, particularly as it applies to the integration of the subsystems through information interchange. Marketing, operations, and finance are frequently on diverse paths and working at cross purposes. The systems concept of MIS is therefore one of optimizing the output of the organization by connecting the operating subsystems through the medium of information exchanges.

The objective of an MIS is to provide information for decision making on planning, initiating, organizing, and controlling the operations of the subsystems of the firm and to provide a synergistic organization in the process.

In summary, we are concerned with three systems: (1) that social system called the organization, (2) a system of management that is used in practice to improve the operations and productivity of the organization and its subsystems, and (3) the management information system, which provides the information for making decisions regarding the integration of the organization through the process of management.

1.4 THE SYSTEM APPROACH

The system approach can be explained by describing what it is not. As one chief executive recently commented, "Marketing seems to be selling what can't be designed and what manufacturing can't produce and to customers that finance wouldn't approve anyway.

The system approach in business was an idea born in the decade of the 1960s. The notion was one

of synergism—the sum of the parts is greater than the whole—2 + 2 = 5—the output of the total organization can be enhanced if the component parts can be integrated. This concept was the rationale for the conglomerate form of organization—a concept that subsequently fell into disrepute because of widespread conglomerate near failure.

For our purposes the systems approach to management is designed to utilize scientific analysis in complex organizations for (1) developing and managing operating systems (e.g., money flows, personnel systems), and (2) designing information systems for decision making. The link between these two is obvious because the reason for information systems design is to assist in decision making regarding the management of operating systems.

A basic and fundamental notion of the systems approach to organization and management is the interrelationship of the parts or subsystems of the organization. The starting point of the approach is a set of objectives, and the focus is on the design of the whole as distinct from the design of components or subsystems. The synergistic characteristic of the systems approach cannot be overemphasized. In organizational and information systems design we want to achieve synergism, which is the simultaneous action of separate but interrelated parts that together produce a total effect greater than the sum of the individual parts. The result obtained by a team of 11 well-coached football players is greater than that achieved by 11 individual players "doing their own thing." The analogy for the business organization is clear. The MIS can go a long way toward achieving the integration we seek.

In the past, the effectiveness of business organizations has been somewhat less than optimum because managers failed to relate the parts or functions of the systems to each other and to the whole. The sales function was performed without a great deal of integration with design or production; production control was frequently not coordinated with financial or personnel planning; and the classic management information system was concerned largely with variance reporting on an historical basis and was constructed around the chart of accounts without too much regard for organizational information needs.

A basic tenet of systems theory is that every system is held together by information exchange. This is certainly true of the business system or the organizational system. Yet information systems and computers have not focused in on this essential characteristic or need for integration.

Students of management, and business people, frequently express some criticism of an overemphasis on the systems approach. They say that it is nothing new, that managers have intuitively known of synergism and reckoned with it in the past. While this is a valid comment, it becomes necessary to point out two shortcomings of "systems thinking" in the past. First, we have been unable to design very many MIS that facilitate organizational integration, and second, the absolute need for the systems approach will continue to accelerate in the 1980s. There are two major reasons for this acceleration: (1) the increased complexity

of business and (2) the increased complexity of management.

The Increased Complexity of Business： This complexity can be attributed to four primary causes: (1) the technological revolution, (2) research and development, (3) product changes, and (4) the information explosion.

The Technological Revolution： We need only look around the home and workplace to witness the fantastic changes wrought by the technological revolution of the past 20 to 25 years. We have walked on the moon and returned. Time and space have been dwarfed. Transportation, communications, agriculture, and manufacturing are among the many industries undergoing vast changes in products, techniques, output, and productivity. The "technological revolution" is not a continuation of the Industrial Revolution; it is a vast and fundamental change in its own right, as advanced mechanization and automation techniques are adopted and improved across a broad range of industries. The future of this revolution is not entirely clear, but two things are quite certain: change will continue at an accelerated pace, and this change will demand giant steps in improved management. It is fundamental that in order to cope with these changes, the manager of the future will require large amounts of selective information for the complex tasks and decisions ahead. Thus the technological revolution will require a managerial revolution,

Research and Development： The breathtaking rate of the technological change racing through all types of industry is due in large part to increasing expenditures for research and development. Despite the fact that relatively few firms engage in research and development and that these concentrate in a few areas, the impact of these expenditures is felt by all. Not only are products and supporting operations becoming more complex but the life cycle of products is being shortened. For example, consider how the DC-6, a reciprocating engine airplane, was made obsolete in less than five years by the pure jets.

Charles Kettering, a General Motors executive, once commented, "By its very nature research is a gamble.. .but the only risk that is greater than doing research is not doing it." This comment was not intended to imply that all companies should perform research. However, all should be aware of its impact on their operations and should provide for better planning, better management, and better information to accommodate the effects.

Product Changes： Technological advances resulting partly from research and development, partly from growing customer sophistication, have resulted in the third cause of complexity—product changes. Whereas the manager of the past could depend upon a high percentage of his or her product ideas becoming marketable, today's manager must deal with an enormously high product mortality rate. Moreover, the modern organization is faced with the necessity to optimize return from a given product in a much shorter time. The Model T Ford may have been good for a product life span of 10 years, but

today's automobile manufacturer must offer more than a thousand combinations of model, color, and power selections.

DuPont's nylon, invented in the 1930s, had no competition for many years. Today the head start of many chemical fabrics is measured in months. It is a point of pride with many companies that over half their income today is derived from products that did not exist 5 to 10 years ago. New industries are being born overnight. The computer and electronics industries provide dramatic examples.

These factors contributing to complexity combine to form another element that calls for better management and the systems approach the lengthening time span required between decisions and realization of commitments. These commitments are for such large amounts of money and for such long periods of time that the manager cannot afford to make mistakes. Major oil companies plan 20 years ahead for acquisition sources. Consider also the complexity of decisions required by airlines, heavy equipment manufacturing, and other industries that cannot afford to guess wrong.

The implication emerges that today's manager must keep abreast of the factors influencing his or her firm's products and future operations. This requirement demonstrates once again the need for a properly designed management information system, particularly with regard to environment-an environment that includes competitors who are themselves using up-to-date methods.

The Information Explosion： Finally, the information explosion has profound impacts upon the complexity of management and organizations. As a decision maker, the manager is essentially a processor of information. The modern manager knows that the ability to obtain, store, process, retrieve, and display the right information for the right decision is vital. This is, after all, the basic reason for an information system -better decisions.

Various estimates have been made concerning the information explosion. It is said, for example, that people's knowledge is doubling in each 5- to 10-year period and that this rate of knowledge accumulation is accelerating. It is estimated that 85 to 90 percent of the scientists of all time are now living, an indication of the accelerated growth of knowledge and information in recent years. Here we are interested not so much in the precise degree to which information is expanding as in the knowledge that information available to and required by today's manager is expanding enormously. To remain ahead of competitors and to keep pace with the technological revolution and its impact on the firm's products or services, the manager must keep abreast of selected information and organize it for decision making.

Increased Complexity of Management： What new techniques have become available that make the 1980s the era of the systems approach? There have been four developments that, when integrated with what we already know about managing, may give us a breakthrough in improving the management

process. Essentially, these four developments are (1) the theory of information feedback systems, (2) a better understanding of the decision making process, (3) operations research or management science techniques that permit an experimental or simulation approach to complex problems, and (4) the electronic computer.

Information Feedback Systems : Basic to the understanding of the systems approach and to the design of management information systems is the concept of information feedback systems. This concept or theory is something more than our old exception principle. It explains the goal-seeking, self-correcting interplay between the parts of a system, whether the system is business, mechanical, or otherwise. Essentially, feedback systems are concerned with the way information is used for the purpose of control, and they apply not only to business or management systems but to engineering, biological, and many other types of systems. Examples of information feedback systems include the thermostat-furnace-temperature system, as well as the subsystems comprising the missile, the automobile, the body, the economic system, the inventory control system, and countless others. All have a vital trait in common: the output of the system leads to a decision resulting in some type of action that corrects the output, which in turn leads to another decision. Although the theory of information feedback systems is not entirely new (the speed governor for steam engines dates back to about 1780), it has only recently become available to and applied in business applications. Later chapters explore this theory more fully.

Decision Making : A development of extraordinary importance to building a foundation for the systems approach is the recent notion of automating or programming decisions. Indeed, this concept is at the very core of systems design, as we shall discover later.

Some attribute this improved understanding of automatic decisions and the decision-making process to the military. Prior to 1950, the commander, using "tactical judgment and experience," made such on-the-spot decisions as threat evaluation, weapon selection, enemy identification, alerting of forces, and target assignment. Subsequently, these and similar decisions were "automated" by formal rule and procedure, thus leading to the proposition that formal rules may yield better decisions for routine problems than those based solely on human judgment, given the constraints under which humans must make decisions.

The notion of programming decisions by decision rule is now a basic consideration of management and information systems design. If decisions can be based upon a policy, a procedure, or a rule, they are likely to be made better and more economically. Moreover, if the decision rule can be programmed for computer application, the potential exists for faster, more accurate, and more economical operations. Examples of common decision rules that have been programmed for computer solution are payroll, inventory control, customer billing, and purchasing.

Later chapters explain in detail decision rules in information systems design and the use of management

science in designing these rules.

Management Science : Closely allied to programmed decisions and decision rules are the techniques of management science. Indeed, one of the primary purposes of these techniques is the design of programmed decision rules. Another purpose, often overlooked, is that of assisting managers to make complex decisions. The techniques of management science combine with the computational ability of the computer to provide problem solutions that were not practical heretofore.

Linear programming, system simulation, the Monte Carlo technique, queuing, gambling, probability theory, and other quantitative approaches are available to the management scientist. However, we are interested not so much in specific tools or techniques as in the management science approach to problem solving.

A powerful tool of management science is simulation. Although this technique was used relatively infrequently prior to 1970, it offers great potential breakthroughs for applications of the systems approach. The technique involves construction of a mathematical model of the system (e.g., business or function) under study. The behavior of the model under manipulation simulates the behavior of the real system to the extent that the consequences of different management policies, marketing assumptions, or resource alternatives can be forecast prior to final decision.

The Electronic Computer : The fourth major development making the systems approach to management possible is the electronic digital computer. Without it, the vast amount of data handling connected with storage, processing, and retrieval of information would not be possible, nor could the arithmetic computations required in many problem-solving situations be economically undertaken.

Despite the fact that the computer is nothing more than a tool for processing data or making computations, many managers view it as the central element in an information system. This attitude tends to overrate and distort the role of the computer. The vital element in an information system is the human one; it is the managerial talent that designs and operates the system!

The computer's capability to process and store information has outraced man's ability to design systems that adequately utilize this capability. "Brain-ware" has fallen woefully behind "hardware." Unfortunately, it appears that the human talent available for the design of managerial applications will lag behind the technology of the computer for many years to come.

In the past, managers sought information from miscellaneous—haphazard sources and processed the information on a personal basis. Too often they failed to ask for information concerning the impact of a decision in one area on other areas of the company.

Three changes are now occurring in progressive companies:

1. Management has become systems oriented and more sophisticated in management techniques.
2. Information is planned for and made available to managers as needed.
3. A system of information ties planning and control by managers to operational systems of implementation.

The combined result of these concepts is the management information system. The purpose of an MIS is to raise managing from the level of piecemeal spotty information, intuitive guesswork, and isolated problem solving to the level of systems insights, systems information, sophisticated data processing, and systems problem solving. Managers have always had "sources" of information; the MIS provides a system of information. It thus is a powerful method for aiding managers in solving problems and making decisions.

1.4 THE SYSTEM VIEW OF BUSINESS

In the past, managers have tended to solve problems as isolated situations, independent of other operations of the company. For example, if a shoe manufacturer noted a sales decline and traced it to lack of aggressive effort by sales representatives, the problem was assumed to be a sales management problem. Solutions were sought through better training or replacement of their salespeople. The thought that there are many contributing factors to increasing sales was simply not brought to the surface. Better advertising, better management of sales representatives' routes, better quality control in the factory, better design, fewer styles, more sizes, prompt and correct shipment of orders, better credit arrangements, and better market strategy all may be part of the problem. Partial substandard performance in several areas may have caused salespeople to regard their task as hopeless.. These activities are related in a "system" of which the business is comprised.

A system is a set of elements forming an activity or a processing procedure / scheme seeking a common goal or goals by operating on data and / or energy and / or matter in a time reference to yield information and / or energy and / or matter.

Some specific cases illustrate the somewhat abstract definition :

1. Manufacturing system. A group of people, machines, and facilities (a set of elements) work to produce a specified number and type of products (seek a common goal) by operating on product specifications, schedules, raw materials, subassemblies, and electrical power converted to mechanical power (operate on data, matter, and energy) to yield the specified products and information by the date the customer wants them (to yield matter in a time reference).
2. Management information system. A group of people, a set of manuals, and data processing

equipment (a set of elements) select, store, process, and retrieve data (operate on data and matter) to reduce the uncertainty in decision-making (seek a common goal) by yielding information for managers at the time they can most efficiently use it (yield information in a time reference).

1.5 APPLICATIONS OF MIS

With computers being a subiquitous as they are today, there's hardly any large business that does not rely extensively on their IT systems. However, there are several specificfields in which MIS has become invaluable.

1.6 BENEFITS OF MIS

The benefits of MIS includes the following :

1. It provides report in fixed and standard formates.
2. End uses can develop customs report.
3. It enables managers to compare results to established.
4. It provides essential, reliable, Time Information.
5. Its a largical and well structured method in of information, collection, processing and determinating to support decision makers.
6. Company goals and identify the problems areas and opportunities for improvment.

1.7 SUMMARY

This unit gives an insight of MIS, It throws a light upon system view of business. It discusses the application of MIS. It also explains about the benefits of MIS.

1.8 KEY WORDS

1. System Approach
2. Electronic Computer
3. System View
4. Research and Development

1.9 SELF ASSESSMENT QUESTIONS

1. Define MIS.
2. Give an overview of MIS.
3. Explain MIS as a system.
4. Discuss the application of MIS.
5. Give an account on benifits of MIS.

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UNIT 2:DATA AND INFORMATION

STRUCTURE

2.0 OBJECTIVES

After studying this unit, you should be able to :

* Define data and information;
* Explain managerial need of information and
* Explain master file and transaction file.

2.1 INTRODUCTION

Data is the raw material from which useful information is derived. The word Data is the plural of Datum. Data is commonly used in both singular and plural forms. It is defined as raw facts or observations, typically about physical phenomenon or business transactions. Example: A sale of a machine tool or an automobile would generate a lot of data describing those events. Data are objective measurements of attributes (the characteristics) of entities (such as people, place, things and events). These measurements are usually represented by symbols such as numbers, words, codes, composed of a mixture of numerical, alphabetical and other characters. It takes a variety of forms, including numeric data, text, voice and images.

Data is the collection of facts, which is unorganized but can be organised into useful information. The term data and information come across in our daily life and are often interchanged. Example: Dates, weights, prices, costs, number of items sold, employees' names, product names etc.

2.2 INFORMATION

The data which has been converted into a useful and meaningful form is *information.* As already mentioned, the terms data and information are used interchangeably. Data are raw material resources that are processed into finished information products. Information can be defined as data that has been converted into a meaningful and useful context for specific end users. Data is usually not useful until subjected to a **"Value added"** process where

i. Its form is aggregated, manipulated and organised.

ii. Its content is analyzed and evaluated.

iii. It is placed in a proper context for a human user.

Information is processed data, placed in a context that gives it value for specific end users.

The conversion of facts into meaningful information is known as data processing. It is also Called in general as information processing. It is the processing of data to make it more usable and meaningful, thus transforming it into information.

Data Processing is the execution of a systematic sequence of operations performed upon data to transform it into information whereas a concept that covers both the traditional concept of processing numeric and alphabetic data, and the processing of text, images and voices is *information processing.* Information processing further emphasizes that the production of information products for users should be the focus of processing activities.

The information management control problems are faced by not only large international organisations, but also by smaller organisations, who are experiencing information management difficulties. As the problems of information management increase, new information technologies provide organizations with such tools as decision support systems, expert systems, artificial intelligence, transaction processing systems, telecommunications, automated offices, electronic mail, voice mail, networking and database management systems.

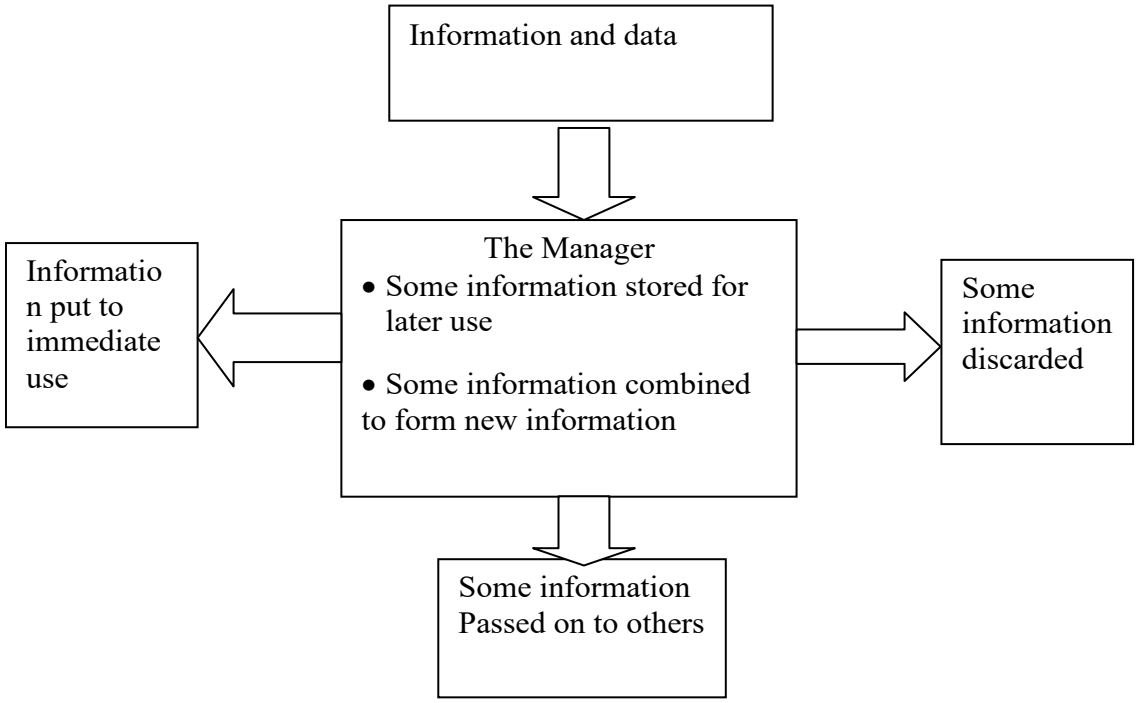
This proliferation of information technology can be effectively overwhelming, unless managers learn to understand and manage the basic skills of designing, implementing and controlling the information system.

Understanding complex information systems begins with a clear understanding of information and its general characteristics. Information can be considered as the very blood of an organisation, but it must be properly understood and appropriately distinguished from data. Too many times, the terms 'data' and 'information' are used interchangeably, but the terms most clearly mean entirely different things. Data should be defined as raw, unsummarised and unanalyzed facts. Information is data that has been presented in such a way as to alter the receiver's understanding. Data are the raw material from which information is derived. This is a necessary distinction for the manager to make, because loads of data can be generated, without producing one iota of useful information.

2.3 MANAGER AND INFORMATION

Management needs only information but not data, to help them make effective decisions. Every manager is deluged with both data and information, sometimes to the point of information overload. The manager may do various things with that data information including:

Figure 1 Managers as Information processors



Storing it for further use.

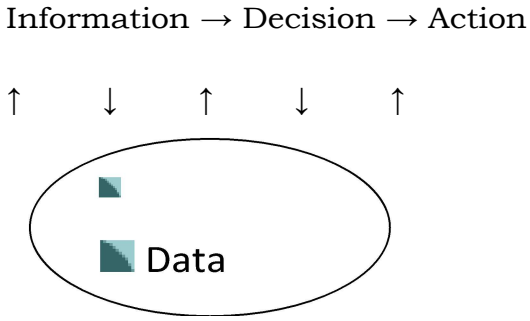
Disseminating it to others.

Putting it to immediate use.

Discarding it.

The figure 2 below illustrates the roles that data play in the events of an organisation. The large labelled **'data'** represents the overall data resource of the organisation. This resource is an active participant in the organisation's operations and planning. The small circles represent individual elements of data and are considered to be raw facts. They are aggregated and summarised in various meaningful ways to form information. Decisions are made on the basis of this information. The results of these are actions, which in turn generate further data, which can be incorporated into another cycle of the decision-making process.

Figure 2



2.4 MASTER FILE AND TRANSACTION FILE

A Master Fileis a data file containing relatively permanent information, which is utilized an authoritative reference and is usually updated periodically.

A Transaction File is a data file containing relatively transient data to be processed in combination with a master file.

Data processing involves a number of transactions and file maintenance in order to provide a database for generating and providing information to various users at the management levels. A transaction is an activity like making a" purchase or sale, manufacturing a product or recruiting an employee. It may be internal in nature and can also involve an external agency.

The records to be transacted can be :

i. Direct transaction to take place (Action),
ii. Report or explain the performance (Information),
iii. Communicate the transaction for a background information or reference (Investigation).

The other processing activities are master file maintenance, report generation, inquiry and creating support applications. The output of these processing functions provides the base to other management activities. They are more routine and are in a programmed form.

A MIS is more comprehensive than data processing which only processes transactions and produces reports. Before the advent of computers, data processing was performed manually or with simple machines. MIS encompasses processing in support of a wider range of organisational functions and management processes. The system also includes transaction processing.

One important aspect of the difference between *MIS* and routine data processing is the capability to provide analysis, planning and decision-making support. An MIS orientation means users have access to decision models and methods for querying the database. Information resources are utilized so as to improve decision-making and achieve improved organizational effectiveness.

2.5 CHARACTERISTICS OF INFORMATION

Information is processed data and serves current or prospective users. It reduces uncertainty and enables informal decision-making. It has a cost for acquisition, storage and maintenance. It is regarded as a resource, and its value depends on the difference between the gain which results from its use and its cost. Only if the difference is positive, acquisition of that information is economically justified.

There are four important characteristics of information which have to be, remembered in order for information to be of maxmium value to the manager. The characteristics of useful management information.

i. Quality

ii. Timeliness

iii. Completeness

iv. Relevance

* **Quality :** *Quality* information is that which accurately represents reality. It is the quality or accuracy of information that makes the information system function properly. If the managers come to know that the information system is having errors in it, they will avoid using it and its value to the decision-making process is severely limited.

  Quality of information is difficult to measure. One may have to ask the user about the quality of information he is getting and ask him to rate it. The user should be asked when the current information provided to him is to his satisfaction.

  Roman R. Andrus suggests that information can be evaluated in terms of its utilities. Four utilities are as under:

  i. **Form utility :** The closer the form matches the decision maker's requirement, greater is its value.
  ii. **Place utility :** If it can be had or accessed easily, information has greater value.
  iii. **Time utility :** If information is available when needed, its value is greater.
  iv. **Possession utility :** The possessor of information influences its value by controlling its flow to others in the organisation.

* **Timeliness :** Timeliness means that information is available when it is needed. Most managers function in a dynamic environment of change, demanding updated and current information. Computerized information systems have the ability to gather, sort, analyze, store, *retrieve,* and transmit large amounts of information in a very short period of time.

* **Completeness :** Completeness of information is the extent to which it is all there. Information that is complete means, information that covers key issues and is sufficient to support the decision-making situation at hand without critical omissions. The more complete a body of information, is obviously the more expensive it is to develop and maintain. Care must also be taken not to provide extra information than needed, due to its expense, and not to provide so much information that the recipient will suffer from information overload.

* **Relevance :** Information relevance refers to the extent to which information is appropriate for the decision-making situation facing the manager. Extraneous information distracts the decision maker from the assigned task and information overload frustrates the decision maker and impairs the decision-making process. Relevant information must pertain to the problems, decisions and responsibilities of

the recipient.

Evaluating information : It involves determining whether the expected value of the information exceeds the expected cost. It is the process of determining whether the acquisition of specified information is justified.

The first major step in evaluating organizational information is determining the value of that information by pinpointing the data to be analysed and then determining the expected value or return to be received from obtaining *perfect* information based on these data. Next, this *expected* value of organizational information should be compared with the expected cost of obtaining that information. *Before* this, an evaluation is to be done to ensure that this expected value should be reduced by the amount of benefit that will not be realized, because of deficiencies and inaccuracies expected to appear in the information.

If the expected cost does not exceed the expected value, the information should be gathered. If it does exceed, managers either must increase the information expected value, or decrease its *expected* cost before the information gathering can be justified.

Suppose a market research firm claims to have information of great value. What requirements must information meet in order for this assertion to be valid?

i. It must have surprise content that is, it must tell us something we do not already know (or strongly suspect).

ii. The new information must cause us to take an action, otherwise that would not have been taken, e.g. we might hold back on the introduction of a new product that we previously felt to be profitable. Value information is derived indirectly from the change in decision behaviour due to provision of information. Information has a cost and it must be detected from the gain from its use to arrive at its value.

iii. The action taken must lead to a higher pay off than we otherwise would have experienced:we gain increased profit, reduced risks, greater safety or improved corporate image.

Information plays such a critical role in the essential management function of control that is it imperative for the manager to appreciate the instrumentality of control information. Preliminary controls are to ensure that the right information is collected. Screening control is used to ensure that information is effectively used. Finally post action controls ensure that the information leaving the organisation is appropriate.

Effective information management contributes power to the managerial control systems

i. Assisting managers to obtain and use resources more efficiently.

ii. Helping to integrate the many elements of the organisation through organisation-wide objectives.

iii. Helping to gather more complete and timely data for strategic, tactical and operational decisions.

Information is data that has been made useful for problem-solving and decision-making. An information system is a set of interrelated parts working together to provide useful information as needed by the problem solvers and decision makers. The information system functions strategically to gather, organize and disseminate needed information.

The components of an information system include :

i. Hardware

ii. Software

iii. People

iv. Procedures

v. Data

The information needs of managers depend on their place in the management hierarchy. Lower level management, who are concerned with operational control, requires frequent and highly detailed information - predominantly from internal sources. Top managers are primarily concerned with strategic planning and control, so they need information that is highly summarised and focused on identifying general trends and performance.

The information *needed* by managers to make decisions and solve problems varies in accordance with their level in the organisation. Managers at the top of the organisation's hierarchy have a unique need for information related to the formulation of strategy, policies, long-range plans, and long-term objectives. Middle managers tend to have greater need for information required to formulate tactical and operation plans and objectives, to implement strategies and to make operational decisions. Finally, first level managers, that is lower level managers have unique needs for information that will help them implement operational plans, make short-term decisions and conduct day-to-day business.

For the strategic roles performed by the top management, a great deal of information comes from external sources to the organisation. Top management should have current information on such environmental super ordinates as the government, customers, creditors, suppliers, competitors and so on. Conversely, first-line of managers need operational information from internal sources within the organisation. Although each level has critically different information needs, there is still a great deal of information that they must share. This fact reinforces the need to integrate and coordinate the overall information system.

The sources could be

i. Internal

ii. external

For the management control functions of top managers, however, the sources of information must be both internal and external. Top managers are generally concerned with the overall financial performance of their organisations. They therefore need information on quarterly sales and profits, on the other relevant indicators of financial performance (such as stock value) and on the performance of competitors. Internal control report, for top managers come in at monthly, quarterly and sometimes even annual intervals. There are firms which require computer based reports on an hourly basis.

External information originates outside the organisation. Such information is needed by upper levels of management to plan and to guide the organisation in a profitable direction. Examples are **:**

i. Description of customer satisfaction with products and services.
ii. Demand for new products or services.
iii. Knowledge of promotions, price changes or products planned by competing firms.
iv. Details of changes in government regulations.
v. Information describing changes in suppliers or policies of suppliers.

Many firms supply information to external users. A few common ones may include :

i. Sales revenues and profits to the internal revenue service.
ii. Quantity of items in orders for goods placed with suppliers.
iii. Prices of items and service quoted to customers.

Management is process of four major functions of planning, organising, leading, and controlling the resources of an organisation in the efficient and *effective* pursuit of specified

The primary purpose or objective of any information is decision-making, coordination and control and planning. Information may be used either within the organisation or outside the organisation.

2.6 USERS OF INFORMATION WITHIN THE ORGANISATION

i. **Accounting :** The accounting department creates, maintains, processes and retrieves quantitative data related to the amount of profit or loss, cash flow, inventory control, payroll, cost allocation, and expense classification. Management seeks information relevant to its decision-making such as data on investments in new projects, the current financial position of the firm and the control of expenses. Plant managers seek information relevant to material, labour and overhead costs. Sales managers are anxious to know the amount of contribution margin of different products.

ii. **Finance :** The finance department is in charge of activities related to borrowing, funding and ascertaining necessary liquidity. Therefore, data related to capital structure, the number of outstanding shareholders, the degree of leverage, and the maturity dates of debits and treasury stocks must be available. Data related to prime interest rates, capital and each market condition must be constantly maintained. Top management seeks information relevant to decisions that would maximize the ultimate

welfare of the outstanding shareholders.

iii. **Personnel :** Service contracts, fringe benefits, hourly/monthly rates, service seniorities and aptitude tests are a few examples of the duties of the personnel department. Personnel information is provided to other responsibility centers. For example, the payroll division is furnished with periodic reports containing names of current authorized employees and members; plant managers receive similar updated weekly reports. Management seeks information pertaining to the number of full-time and part-time employees, supervisor's reports and ethnic and sex manpower.

iv. **Public relations :** The public relations department bridges the gap between the outside world and the organization. Union contract negotiations, scholarship and educational contributions and service rendered to the community are typical information aspects maintained by the public relations department.

v. **Sales :** The sales department is the major revenue generating responsibility centre where efforts are geared towards sound planning and control of sales. Data in the sales department are used to produce a flow of indicative information pertaining to regional and total sales forecasts, actual sales, performance reports. Sales managers use periodic sales reports with breakdown sales by products in evaluating the contribution margin of each territory. The management must be given information on any significant deviations from pre-determined forecasts along with justification for these differences. The accounting department receives daily documentary evidences and information related to cash and credit sales.

vi. **Market research :** The market research department gathers information pertaining to the firm's market potential, consumer behaviour and competitive circumstances. Management must be furnished with information pertinent to market strategy and trends. To illustrate, a manufacturer has designed software for the users of a major hardware manufacturer. The firm's ability to achieve its sales forecasts was greatly hindered when the marketing research department failed to predict and account for a major modification that took place in the hardware feature which made the firm's products quite obsolete.

vii. **Production :** In this department, data must be maintained relative to utilization, scheduling priority, number of machines, equipments and facilities. Periodic reports are generated and provided to the plant managers to inform them of their production status. The control of manufacturing costs is a prime objective of the production department. Therefore, data concerning the physical flow of direct labour, and actual *overhead* costs are processed, maintained and transmitted to other responsibility centres involved in either the constant flow of input factors of production or the receipt of finished goods. The quality control department must be furnished with periodic reports

containing the number of units produced and number of production batches in order to determine the sample size for quality inspection.

viii. **Purchasing:** The purchasing department is responsible for receiving a constant flow of raw materials, machinery, equipment and office supplies. Purchasing departments are interested in information relevant to such areas as sources of supplies, favourable bids, terms of delivery and quantity discounts. The accounts payable division needs documentary evidence supporting various supplier claims. Warehouse-keepers must be furnished with copies of purchase acquisition forms relating to the inflow of raw materials and supplies.

Users of information outside the organization : A variety of external information users seek pertinent data from the firm as a business entity.

i. **Government :** The government requires various reports from time to time about income tax matters and other regulations.

ii. **Auditor :** An external auditor or a certified public accountant is responsible for determining the validity of the firm's financial statements. He seeks multipurpose information to serve as supporting evidence in his course of investigation. Accounts receivable and accounts payable balance, petty cash vouchers, depreciation schedules and inventory evaluation sheets are some examples of processed data tailored to satisfy the auditor's needs.

iii. **Shareholders and prospective investors :** Outstanding shareholders and prospective investors are interested in information relating to the interim and annual earnings, price earning ratios, earmarking of retained earnings, and projections for future expansion. Investors generally want to be informed of material decisions affecting the firm, asset valuation, and income determination.

iv. **Customer :** A customer requires unlimited amounts of information depending upon the type of business firm with which he deals. For example, a prospective airline traveller needs to know the timings and types of flights available and he may require the terms of excess luggage payments and the time of arrival. A customer of a savings bank wants to know the amount due to him and the interest accrued on his account at any given time. The purchaser of an automobile needs to know pertinent information regarding warranty clauses, safety and economy features.

Effective planning, decision-making and control all depend on the effective management of information through MIS, a general term for any computer based information system that is used to collect, store, organise and distribute information that is useful to managers. The term data refers to raw, unanalysed numbers and facts, while information refers to data that have been organised or analysed in some way. Increasingly, an organisation information is seen as one of its most valuable assets.

The usefulness of information is evaluated on the basis of its quality, timeliness, and relevance to management. Computers are effective and efficient ways of gathering, storing, organising and distributing substantial information.

2.7 SUMMARY

This unit speaks about significance of information. It gives link between manager and information. It also explains about master file and transaction file. Further, this units throws light on uses of information with in organization.

2.8 KEY WORDS

1. Information

2. Quality

3. Master File and Transaction File

2.9 SELF ASSESSMENT QUESTIONS

1. Define data and information.

2. What are the characteristics of information?

3. Explain master file and transaction file.

4. Explain the uses of information within and outside the organization.

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UNIT 3:TYPES OF INFORMATION SYSTEM

STRUCTURE

3.0 OBJECTIVE

After studying this unit, you should be able to:

* Identify trends in Information System (IS);
* Explain management support System and
* Explain the functional areas of information system

3.1 INTRODUCTION

There are many kinds of information systems in the real world. All of them use hardware, software, network, and people resources to transform data resources into "information products. Some are simple manual information systems, where people use simple tools such as pencils and paper, or even machines such as calculators and typewriters. Others are computer-based information systems that rely on a variety of networked computer systems to accomplish their information processing activities.

As a business end user, you should be able to recognize the fundamental components of information systems you encounter in the real world. This means that you should be able to identify:

- The people, hardware, software, data, and network resources they use.
- The types of information products they produce.
- The way they perform input, processing, output, storage, and control activities.
- How they support the business operations, managerial decision making, or competitive advantage of a business.

This kind of understanding will help you be a better user, developer, and manager of information systems. And that, as we have pointed out in this unit, is important to your future success as a manager, entrepreneur, or professional in business.

3.2 TRENDS IN INFORMATION SYSTEMS (IS)

Until the 1960s, the role of information systems was simple: transaction processing, record-keeping, accounting, and other Electronic Data Processing (EDP) applications. Then another role was added, as the concept of Management Information systems (MIS) was conceived. This new role focused on providing managerial end users with predefined management reports that would give managers the information they needed for decision-making purposes.

By the 1970s, it was evident that the prespecified information products produced by such management information systems were not adequately meeting many of the decision-making needs of management.

So the concept of Decision Support Systems (DSS) was born. The new role for information systems was to provide managerial end users with ad hoc and interactive support of their decision-making processes. This support would be tailored to the unique decision-making styles of managers as they confronted specific types of problems in the real world.

In the 1980s, several new roles for information systems appeared. First, the rapid development of microcomputer processing power, application software packages, and telecommunications networks gave birth to the phenomenon of end user computing. Now, end users can use their own computing resources to support their job requirements instead of waiting for the indirect support of corporate information services departments.

Second, it became evident that most top corporate executives did not directly use either the reports or information reporting systems or the analytical modeling capabilities of decision support systems, so the concept of executive information systems (EIS) was developed. These information systems attempt to give top executives an easy way to get the critical information they want, when they want it, tailored to the formats they prefer.

Third, breakthroughs occurred in the development and application of artificial intelligence (AI) techniques to business information systems. Expert systems (ES) and other knowledge-based systems forged a new role for information systems. Today, expert systems can serve as consultants to users by providing expert advice in limited subject areas.

An important new role for information systems appeared in the 1980s and continues into the 1990s. This is the concept of a strategic role for information systems, sometimes called strategic information systems (SIS). In this concept, information technology becomes an integral component of business processes, products, and services that help a company gain a competitive advantage in the global marketplace.

Finally, the rapid growth of the Internet, intranets, extranets, and other interconnected global networks in the 1990s is dramatically changing the capabilities of information systems in business as we move into the next century. Such enterprise and global internetworking is revolutionizing end user, enterprise, and interorganizational computing, communications, and collaboration that supports the business operations and management of successful global enterprises.

3.3 TYPES OF INFORMATION SYSTEMS

Conceptually, information systems in the real world can be classified in several different ways. For example, several types of information systems can be classified conceptually as either operations or

management information systems. Let's look briefly at some examples of how information systems exist in the business world.

3.3.1 OPERATIONS SUPPORT SYSTEMS

Information systems have always been needed to process data generated by, and used in, business operations. Such operations support systems produce a variety of information products for internal and external use. However, they do not emphasize producing the specific information products that can best be used by managers. Further processing by management information systems is usually required. The role of a business firm's operations support systems is to efficiently process business transactions, control industrial processes, support enterprise communications and collaboration, and update corporate databases.

* **Transaction Processing Systems :** Operations support systems include the major category of transaction processing systems (TPS). Transaction processing systems record and process data resulting from business transactions. Typical examples are information systems that process sales, purchases, and inventory changes. (The results of such processing are used to update customer, inventory, and other organizational databases). These databases then provide the data resources that can be processed and used by management information systems, decision support systems, and executive information systems.

  Transaction processing systems also produce a variety of information products for internal or external use. For example, they produce customer statements, employee paychecks, sales receipts, purchase orders, dividend checks, tax forms, and financial statements. Transaction processing systems process transactions in two basic ways. In batch processing, transactions data is accumulated over a period of time and processed periodically. In real time (or online) processing, data is processed immediately after a transaction occurs., For example, point of sale (POS) systems at retail stores may use electronic cash register terminals to capture and transmit sales data over telecommunication links to regional computer centers for immediate (real-time) or nightly (batch) processing.

* **Process Control system :** Operations support systems also make routine decisions that control operational processes. Examples are automatic inventory reorder decisions and production control decisions. This includes a category of information systems called process control systems, in which decisions adjusting a physical production process are automatically made by computers. For example, a petroleum refiner uses electronic sensors linked to computers to continually monitor chemical processes.

* **Enterprise collaboration systems :** Enterprise collaboration systems are information systems that

use a variety of information technologies to help people work together. Enterprise collaboration systems help us collaborate to communicate ideas, share resources, and coordinate our cooperative work efforts as members of the many formal and informal process and project teams and other workgroups that are a vital part of today's organizations. Thus, the goal of enterprise collaboration systems is to use information technology to enhance the productivity and creativity of teams and workgroups in the modern business enterprise.

3.4 MANAGEMENT SUPPORT SYSTEMS

When information systems focus on providing information and support for effective decision making by managers, they are called management support systems. Management support systems began when the concept of management information systems (MIS) originated in the 1960s. MIS became the byword (and the buzzword) of almost all attempts to relate computer technology and systems theory to data processing in organizations. At that time, it became evident that computers were being applied to the solution of business problems in a piecemeal fashion, focusing almost entirely on the computerization of clerical and record-keeping tasks. The concept of management information systems was developed to counteract such inefficient development and ineffective use of computers. Though tarnished by early failures, the MIS concept is still recognized as vital to efficient and effective information systems in organizations for two major reasons:

* It emphasizes the management orientation of information technology in business. A major goal of computer-based information systems should be the support of management decision making, not merely the processing of data generated by business operations.
* It emphasizes that a systems framework used for organizing information systems applications. Business applications of information technology should be viewed as interrelated and integrated computer-based information systems and not as independent data processing jobs.

Providing information and support for management decision making by all types and levels of managers is a complex task. Conceptually, several major types of information systems are needed to support a variety of managerial end user responsibilities: (1) management information systems, (2) decision support systems, and (3) executive information systems.

* **Management information systems :** Management information systems (MIS) are the most common form of management support systems. They provide managerial end users with information products that support much of their day-to-day decision-making needs. Management information systems provide a variety of reports and displays to management. The contents of these information products are specified in advance by managers so that they contain information that managers need. Management information systems retrieve information about internal operations from databases that

have been updated by transaction processing systems. They also obtain data about the business environment from external sources.

Information products provided to managers include displays and reports that can be furnished (1) on demand, (2) periodically, according to a predetermined schedule, or (3) whenever exceptional conditions occur. For example, sales managers could (1) use a Web browser to receive instantaneous visual displays at their workstations of information about the sales of a particular product; (2) access weekly sales analysis reports evaluating sales results byproduct, salesperson, and sales territory; or (3) receive reports produced automatically whenever a salesperson fails to produce sales results during a specified period.

* **Decision support systems :** Decision support systems (DSS) are a natural progression from information reporting systems and transaction processing systems. Decision support systems are interactive, computer-based information systems that use decision models and specialized databases to assist the decision-making processes of managerial end users. Thus, they are different from transaction processing systems, which focus on processing the data generated by business transactions and operations, though they extract data from corporate databases maintained by TPS. They also differ from management information systems, which focus on providing managers with prespecified information (reports) that can be used to help them make more effective, structured types of decisions.

Instead, decision support systems provide managerial end users with information in an interactive session on an ad hoc (as needed) basis. A DSS provides managers with analytical modeling, simulation, data retrieval, and information presentation capabilities.

Managers generate the information they need for more unstructured types of decisions in an interactive, simulation-based process. For example, electronic spreadsheets and other decision support software allow a managerial end user to pose a series of what-if questions and receive interactive responses to such ad hoc requests for information.

Thus, information from a DSS differs from the pre-specified responses generated by management information systems. When using a DSS, managers are simulating and exploring possible alternatives and receiving tentative information based on alternative sets of assumptions. Therefore, managerial end users do not have to specify their information needs in advance. Instead, a DSS interactively helps them find the information they need.

Executive information systems (EIS) are management information systems tailored to '-the strategic information needs of top management. Top executives get the information they need from many sources, including letters, memos, periodicals, and reports produced manually as well as by computer

systems. Other sources of executive information are meetings, telephone calls, and social activities. Thus, much of a top executive's information comes from non-computer sources. Computer-generated information has not played a primary role in meeting many top executives' information needs.

The goal of computer-based executive information systems is to provide top management with immediate and easy access to selective information about key factors that are critical to accomplishing a firm's strategic objectives. Therefore, EIS are easy to operate and understand. Graphics displays are used extensively, and immediate access to internal and external databases is provided. EIS provide information about the current status and projected trends for key factors selected by top executives. EIS have become so popular in recent years that the use is spreading into the ranks of middle management.

3.5 OTHER CLASSIFICATIONS OF INFORMATION SYSTEMS

Several other categories of information systems provide more unique or broad classifications than those we have just mentioned. That's because these information systems can support either operations or management applications. Examples include expert systems, knowledge management systems, strategic information systems, and business information systems.

Expert System : The frontiers of information systems are being affected by developments in artificial intelligence (AI). Artificial intelligence is an area of computer science whose long-range goal is to develop computers that can think, as well as see, hear, walk, talk, and feel. For example, AI projects involve the development of natural computer interfaces, advanced industrial robots, and intelligent computer software. A major thrust is the development of computer functions normally associated with human intelligence, such as reasoning, learning, and problem solving.

One of the most practical applications of AI is the development of expert systems (ES). An expert system is a knowledge-based information system; that is, it uses its knowledge about a specific area to act as an expert consultant to users. The components of an expert system are a knowledge base and software modules that perform inferences on the knowledge and offer answers to a user's questions. Expert systems are being used in many different fields, including medicine, engineering, the physical sciences, and business. For example, expert systems now help diagnose illnesses, search for minerals, analyze compounds, recommend repairs, and do financial planning. Expert systems can support either operations or management activities.

Knowledge Management Systems : Many companies today realize that they must become knowledge-creating companies or learning organizations in order to survive and flourish in a rapidly changing business environment. That means constantly creating new business knowledge, disseminating it within the

organization, and quickly building it into new products and services. The knowledge-creating company must find ways to use knowledge management techniques and information technology co encourage employees to share what they know and make better use of accumulated workplace knowledge.

Thus, many organizations are developing knowledge management systems (KMS) to manage organizational learning and business know-how. Knowledge management systems help knowledge workers create, organize, and share important business knowledge wherever and whenever it is needed. For example, many knowledge management systems rely on Internet and intranet Web sites, knowledge bases, and discussion forums as key technologies for gathering, storing, and disseminating business knowledge. In this way, knowledge management systems facilitate organizational learning and knowledge creation and dissemination within the business enterprise.

Strategic Information Systems : The strategic role of information systems involves using information technology to develop products, services, and capabilities that give a company strategic advantages over the competitive forces it faces in the global marketplace. This creates strategic information systems, information systems that support or shape the competitive position and strategies of an enterprise. So a strategic information system can be any kind of information system (TPS, MIS, DSS, etc.) that helps an organization gain a competitive advantage, reduce a competitive disadvantage, or meet other strategic enterprise objectives.

Business Information Systems : As a future managerial end user,' it is important for you to realize that information systems directly support both operations and management activities in the business functions of accounting, finance, human resource management, marketing, and operations management. Such business information systems are needed by all business functions. For example, marketing managers need information about sales performance and trends provided by marketing information systems. Financial managers need information concerning financing costs and investment returns provided by financial information systems. Production managers need information analyzing resource requirements and worker productivity provided by a variety of manufacturing information systems. Personnel managers need the information concerning employee compensation and professional development provided by human resource information systems. Thus, business information systems provide managers with a variety of information products to support their decision-making responsibilities in each of the functional areas of business.

Integrated Information Systems : It is also important to realize that information systems in the real world are typically integrated combinations of several types of information systems we have just mentioned. That's because conceptual classifications of information systems are designed to emphasize the many

different roles of information systems. In practice, these roles are integrated into composite or cross-functional information systems that provide a variety of functions. Thus, most information systems are designed to produce information and support decision making for various levels of management and business functions, as well as do record-keeping and transaction processing chores.

3.6 MANUFACTURING INFORMATION SYSTEMS

Manufacturing information systems support the production operations function that includes all activities concerned with the planning and control of the processes producing goods or services. Thus, the production/operations function is concerned with the management of the operational processes and systems of all business firms. Information systems used for operations management and transaction processing support all firms that must plan, monitor, and control inventories, purchases, and the flow of goods and services. Therefore, firms such as transportation companies, wholesalers, retailers, financial institutions, and service companies must use production/operations information systems to plan and control their operations. In this section, we will concentrate on computer-based manufacturing applications to illustrate information systems that support the production/operations function.

Computer-Integrated Manufacturing (CIM) : A variety of manufacturing information systems are used to support computer-integrated manufacturing.

The overall goal of CIM and such manufacturing information systems is to create flexible, agile, manufacturing processes that efficiently produce products of the highest quality. Thus, CIM supports the concepts of flexible manufacturing systems, agile manufacturing, and total quality management. Implementing such manufacturing concepts enables a company to quickly respond to and fulfill customer requirements with high-quality products and services.

Manufacturing information systems help companies simplify, automate, and integrate many of the activities needed to produce products of all kinds. For example, computers are used to help engineers design better products using both computer-aided engineering and computer-aided design, and better production processes with computer-aided process planning. They-are also used to help plan the types of material needed in the production process, which is called material requirements planning (MRP), and to integrate MRP with production scheduling and shop floor operations, which is known as manufacturing resource planning.

Computer-Aided Manufacturing (CAM) systems are those that automate the production process. For example, this could be accomplished by monitoring and controlling the production process in a factory through manufacturing execution systems, or by directly controlling a physical process (process control), a machine tool (machine control), or machines with some human like work capabilities (robots).

Manufacturing Execution Systems (MES) are performance monitoring information systems for factory floor operations. They monitor, track, and control the five essential components involved in a production

process: materials, equipment, personnel, instructions and specifications, and production facilities. MES includes shop floor scheduling and control, machine control, robotics control, and process control systems. These manufacturing systems monitor, report, and adjust the status and performance of production components to help a company achieve a flexible, high-quality manufacturing process.

Benefits of CIM : Computer-integrated manufacturing systems can provide major benefits to manufacturing companies. First of all, CIM enables flexible production processes that produce high-quality products to quickly meet changing market and customer demands. CIM gets these results through work simplification and automation, better production schedule planning, and better balancing of production workload to production capacity. There is improved utilization of production facilities, higher productivity, and better quality control resulting from continuous monitoring, feedback, and control of factory operations, equipment, and robots. In addition, CIM results in reduced investment in production inventories and facilities through work simplification, just-in-time inventory policies, and better planning and control of production and finished-goods requirements. Finally, customer satisfaction is improved by quickly producing products to customer orders, by drastically reducing out-of-stock situations, and by producing high-quality products that better meet customers' specifications.

3.7 ACCOUNTING INFORMATION SYSTEMS

Computer-based accounting systems record and report the flow of funds through an organization on a historical basis and produce important financial statements such as balance sheets and income statements. Such systems also produce forecasts of future conditions such as projected financial statements and financial budgets. A firm's financial performance is measured against such forecasts by other analytical accounting reports.

Operational accounting systems emphasize legal and historical record-keeping and the production of accurate financial statements. Typically, these systems include transaction processing systems such as order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger systems. Management accounting systems focus on the planning and control of business operations. They emphasize cost accounting reports, the development of financial budgets and projected financial statements, and analytical reports comparing actual to forecasted performance.

Many accounting software packages are available for these applications. Let's briefly review how several of these systems support the operations and management of a business firm.

A summary of six widely used accounting information systems.

1. **Order Processing :** Captures and processes customer orders and produces data for inventory control and accounts receivable.

2. **Inventory Control :** Processes data reflecting changes in inventory and provides shipping and reorder information.
3. **Accounts Receivable :** Records amounts owed by customers and produces customer invoices, monthly customer statements, and credit management reports.
4. **Accounts Payable :** Records purchases from, amounts owed to, and payments to suppliers, and produces cash management reports.
5. **Payroll :** Records employee work and compensation data and produces paychecks and other payroll documents and reports.
6. **General Ledger :** Consolidates data from other accounting systems and produces the periodic financial statements and reports of the business.

1. **Inventory Control :** Inventory control systems process data reflecting changes to items in inventory. Once data about customer orders are received from an order processing system, a computer-based inventory control system records changes to inventory levels and prepares appropriate shipping documents. Then it may notify managers about items that need reordering and provide them with a variety of inventory status reports. Computer-based inventory control systems thus help a business provide high-quality service to customers while minimizing investment in inventory and inventory carrying costs.
2. **Accounts Receivable :** Accounts receivable systems keep records of amounts owed by customers from data generated by customer purchases and payments. They produce invoices to customers, monthly customer statements, and Credit management reports. Computer-based accounts receivable systems stimulate prompt customer payments by preparing accurate and timely invoices and monthly statements to credit customers. They provide managers with reports to help them control the amount of credit extended and the collection of-money owed. This activity helps to maximize profitable credit sales while minimizing losses from bad debts.
3. **Accounts Payable :** Accounts payable systems keep track of data concerning purchases from and payments to suppliers. They prepare checks in payment of outstanding invoices and produce cash management reports. Computer-based accounts payable systems help ensure prompt and accurate payment of suppliers to maintain good relationships, ensure a good credit standing, and secure any discounts offered for prompt payment. They provide tight financial control over all cash disbursements of the business. They also provide management with information needed for the analysis of payments, expenses, purchases, employee expense accounts, and cash requirements.
4. **Payroll :** Payroll systems receive and maintain data from employee time cards and other work records. They produce paychecks and other documents such as earning statements, payroll reports,

and labor analysis reports. Other reports are also prepared for management and government agencies. Computer-based payroll systems help businesses make prompt and accurate payments to their employees, as well as reports to management, employees, and government agencies concerning earnings, taxes, and other deductions. They may also provide management with reports analyzing labor costs and productivity.

5. **General ledger :** General ledger systems consolidate data received from accounts receivable, accounts payable, payroll, and other accounting information systems. At the end of each accounting period, they close the books of a business and produce the general ledger trial balance, the income statement and balance sheet of the firm, and various income and expense reports for management. Computer-based general ledger systems help businesses accomplish these accounting tasks in an accurate and timely manner. They typically provide better financial controls and management reports and involve fewer personnel and lower costs than manual accounting methods.

3.8 SUMMARY

This unit gives an insight of trends in information system. It is discuss about various types of information. It also throws light upon management support systems. Further it speaks about manufacturing information system and accounting information system.

3.9 KEY WORDS

1. Operations Support System
2. Expert System
3. Accounting Information System

3.10 SELF ASSESSMENT QUESTIONS

1. List the types of information systems.
2. Explain the management support system.
3. Explain the marketing information system.
4. Explain the HR information system.

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UNIT 4: THE DECISION MAKING PROCESS

STRUCTURE

4.0 OBJECTIVES

After studying this unit, you should be able to :

* Explain decision making process;
* List the phases of decision making and
* Describe the methods of decision making.

4.1 INTRODUCTION

Decision making can be regarded as an out come of mental processes (cognitive process) leading to the selection of a course of action among several alternatives. Every decision making process produces a final choice. The output can be an action or an opinion.

Human performance in decision making terms has been subject of active research from several perspectives. From a psychological perspective, it is necessary to examine individual decisions in the context of a set of needs, preferences an individual has and values he/she seeks. From a cognitive perspective, the decision making process must be regarded as a continuous process integrated in the interaction with the environment. From a normative perspective, the analysis of individual decisions is concerned with the logic of decision making and rationality and the invariant choice it leads to.

4.2 PHASES IN THE DECISION MAKING PROCESS

Management Information System(MIS) is basically concerned with the process of collecting, processing, storing and transmitting relevant information to support the management operations in any organizations. Thus, the success of decision-making, which is the heart of administrative process, is highly dependent partly on available information, and partly on the functions or the components of the process.For example, if managerial objectives are absent or unclear, probably due to in adequate information, there is no basis for a search. Without information obtained through a search, there are no alternatives to compare, and without a comparison of alternatives the choice of a particular course of action is unlikely to yield the desired result. The search could be through :

i. **Un directed viewing :** This involves a general exposure to information where. the search could be that the viewer has no specific purpose in mind.

ii. **Conditioned viewing :** The direct exposure does not involve active search to a more or less clearly identified area or type of information.

iii. **Informal search :** This is a relatively limited and unstructured effort to obtain specific information for a specific purpose. The information wanted is actively sought.

iv. **Formal search :** This is a deliberate effort, usually following a pre-established plan, procedure or methodology to secure specific information relating to a specific issue.

It is pertinent to note that the existence of alternatives, based on relevant information, is a necessary condition for making a decision. For effective decisions to evolve in any organization, receiving information from, and supplying information to, people with in the system are a necessity. The information so communicated must be accurate and up-to-date tocope with uncertainty.

MIS is useful in the area of decision making as it can monitor by itself disturbances in a system, determine a course of action and take action to get the system in control. It is also relevant in non programmed decisions a sit provides support by supplying information for the search, the analysis, the evaluation and the choice and implementation process of decision making. MIS is useful in making decisions to solve many of the problems facing educational institutions. There is need for MIS in decision making as it provides information that is needed for better decision making on the issues affecting the organization regarding human and material resources.

Hence, phases in decision making process include :

Phase 1 : Define the problem or issue requiring a decision

Phase 2 : Outline the plan to make a decision [see Decision Making Framework]

Phase 3 : Execute the plan, which results in a decision

Phase 4 : Implement the decision

Phase 1 : Define the Problem or Issue Requiring a Decision

What is it? Specifically, what is the scope(i.e., the boundaries) of the problem? What is the strategic rationale for solving this problem/making this decision? When does it have to be done?

Who are the actors stake holders, and other interested parties (internal/external, individuals/ groups)? (How do we identify them?)

Whose and what expertise is needed to define the problem, analyze the problem, make the decision, and implement the decision?

Who is responsible for shepherding the entire decision process (i.e.,who is the decision sponsor)?

Who is responsible for implementing the decision? Who is the ultimate decision-maker(s)?

How will the ultimate decision be made?

How will the decision challenge/impact cultural norms? How can culture be used to solve the problem?

Phase 2: Outline the Decision Workplan

What is the overall strategy/outline logistics for making this decision (i.e.,the work plan)?

What are the major stages of work? How can work be segmented?

Who is responsible for the work of each stage? What is the decision?

What is the data required for the decision? [e.g.,options, timelines, workflow, trade offs, efficiencies, impact analyses (onenvironment,bottom line$, etc.)]

What are the staffing and funding requirements? Who makes this decision?

How is this decision made?

Whose opinions, expertise, etc.,are required before this decision can be made? By whom,to whom,how,and when will the decision be communicated?

When is this decision required?

What are the contingencies on this decision? What are the show-stoppers, if any?

Phase 3: Make the Decision

Review the principal benefits, risks, impacts,decision criteria in a wholistic way such that decision-maker(s) can formulate a decision. Prepare documents, presentations, conversations, etc., as needed. Conduct a formal decision making process such as Kepner-Tregoe if needed. Include consultation with key experts,stake holders, and interested parties to ensure the decision will stand. Consider how the decision will be implemented-part of the decision should include a decision about a pilot, success criteria, implementation team etc

Decide the appropriate communication plan(including data,documents and other material to be archived as a record of the decision process)

Phase 4: Implement the Decision

Implement communication plan- To whom, how, and when the decision will be communicated

How will the progress/outcome and its effectiveness be monitored and analyzed (if a tall)?

How will the original decision maker(s)be kept involved?

If any additional decisions need to be made, consider iterating the decision- making phases.

4.3 BEHAVIOR MODEL OF ORGANISATIONAL DECISION MAK ING

1. **Quasi-resolution of conflict :** Organisation is collection of conflicting individuals. No inherent internal consensus. Goals are independent constraints imposed by coalition members.

   Conflictre solved through : local rationality factor problems into sub problems for sub-units

   Acceptable decision : level rules local decisions satisfying local demands result in joint solution which satisfies all demands (satisfactory, not optimal) sequential attention to goals resolve goal conflict by attending to different goals at different times.

   The problem solving process involves two main parts : diagnosing the conflict, and developing alternative solutions. Diagnosis emphasizes identifying the parties' underlying interests. The goal of problem solving approaches is to find mutually acceptable solutions to problems. Solutions may take the form of a compromise, or agreement on a fair procedure for generating an outcome.

   Individual and group decision making occurs throughout the conflict resolution process. Individual decisions include choosing strategies,deciding to trust, evaluatin goffers, and prioritizing concerns.

   Rational choice the ory says that people make decisions based on their calculation of the utility of the desired outcome and the chance of that outcome occurring. There are a number off actors that affect these calculations.Whether an outcome is perceived as again or a loss depends on a person's reference point.

   Group decisions include whether to continue problem solving, whether to get help, which procedures to use, and which solution to choose. The authors identify common biases that interfere with good decision making. These include irrationally escalating commitments, assuming resources are fixed and outcomes must be win-lose, using information because it is available rather than relevant, and overconfidence.

   The first step in conflict resolution involves deciding what sort of conflict it is, and understanding the problem by identifying parties interests, goals, reasons, options,etc. Parties need to coordinate the perspectives. The next step is to brain storm for alternative solutions to the problem. Techniques such as idea checklists or What If questions may also be helpful. The third step is to evaluate the alternatives and decide on a solution. Individual evaluative decisions must be brought together to

reach a group decision. Here parties must be on guard against the various factors and biases that can undermineational decision making. Finally, the parties must committ their decision.

2. **Uncertainty Avoidance :** The degree to which people are comfortable with ambiguous situations and with the inability to predict future events with assurance is called uncertainty avoidance.

   People with weak uncertainty avoidance feel comfortable even though they are unsure about current activities or future events.

   People with strong uncertainty avoid anceare most comfortable when they feel a sense of certainty about the present and future

   Uncertainty avoidance focuses on the level of tolerance for uncertainty and ambiguity with in the society. This dimension relates not to risky situations, but rather to unknown or unfamiliar situations.

3. **Problemistic Search :** The behavioral theory of the firm pose that one of the central types of search firms is problemistic search (i.e.,search triggered by a problem). Such search is initiated when managers find that organizational performance is below their perceived aspiration level a level that is in part a function of prior performance.

   Consequently, if an organization is under competitive pressure (in particular through pressure from price competition or rival innovation), it may increase its search for innovation when managers decide that upgrading processes and products can solve the performance problems.

4. **Organisational Learning :** Organizational learning is an area of knowledge within organizational theory that studies models and theories about the way an organization learns and adapts. In Organizational development(OD), learning is a characteristic of an adaptive organization, i.e., an organization that is able to sense changes in signals from its environment (both internal and external) and adapt accordingly. OD specialists endeavor to assist their clients to learn from experience and incorporate the learning as feedback into the planning process.

4.4 METHODS OF DECISION MAKING

One of the goals the of MIS design is to devise decision rules for the problems that lend themselves to solution by decision rule and the programmed approach.

The major reason for distinguishing between these two types of decisions is to arrive at some classification of decision-making methods in order to improve decision making. This is done in two types of decisions, programmed and non-programmed, and two general approaches, old and new, and the techniques involved.

TYPE OF DECISION	METHODS OF DECISION MAKING	
	OLD	NEW
PROGRAMMED Repetitive and Routine	Habit Standard Operating Procedure Organization Structure Policy etc...	Management Information Systems (Includes Management Science Techniques and the Computer)
NON PROGRAMMED One-shot, Ill-structured	Judgment, Intuition, Insight Experience Training and Learning	Systematic Approach to Problem Solving & Decision Making (See Case 3)

FIGURE 1 Methods of Decision Making

Making Nonprogrammed Decisions : It is apparent that we do not have a complete theory of decision making. Equally clear is the lack of understanding among practicing executives and academicians on just how decisions are made in organizations. When asked to explain the decision-making process in business organizations, we usually say that executives exercise **"judgment"** and that this judgment is largely a function of experience, intuition, and insight.

Managers seem to make better decisions when exposed to training in an orderly thinking process. For example, military officers attend war colleges to learn the military problem-solving and planning steps: (1) determination of the mission, (2) description of the situation and courses of action, (3) analysis of opposing courses of action, (4) comparison of own courses of action, and (5) the decision. The Harvard Graduate School of Business exposes the would-be executive to hundreds of case situations, presumably with the expectation that by solving many problems, the student will become proficient at the process. Over the years, the manager has been urged to learn, practice, and acquire the habit of making decisions based on the problem-solving process **:** (1) define the problem, (2) identify the alternatives, and (3) choose the best alternative. This process, done by Dewey decades ago, is largely intact today and is still good advice for solving the unstructured, nonprogrammed problem.

There is some evidence that problem solving can be learned. At least we recognize and reward those who have had some success at it. Selection processes for managerial advancement are largely devoted to identifying past success at decision making and attempting to predict future success.

Making Programmed Decisions： By far the greatest number of business decisions are repetitive and routine. One survey found that about 90 percent of management decisions are routine ones. If this is true, then there is an overriding need to automate or program these decisions so that the executive can get on about his or her true task, the design and plans for improved organizations and operations. If the manager's job is primarily that of decision making, he or she should get away from short-term tactics and routine, place these types of decisions in the programmed category, and have them made by one or more techniques of programmed decisions. To draw an analogy, there is no reason why we should not standardize information for mass production of programmed decisions in much the same way we standardize materials for production of products.

The most general and most pervasive is by force of habit. We go to the office to make decisions regarding the disposition of the in basket correspondence, and take dozens of actions daily that are "programmed" through force of habit. These habits and skills are valuable to the organization; one of the major costs in personnel turnover is involved in having new people acquire the habits of the organization and the job.

Following habit, the most prevalent technique for programming decisions is with the company procedure written, oral, or understood. Standard operating procedures provide a means for indoctrinating and training new personnel and for guiding experienced personnel in the performance of specific tasks. The procedure has the additional advantage of forcing a certain amount of detailed planning, because it cannot be adequately designed, reviewed, or implemented without careful thought. In a strict sense, policy cannot be classified as a programming technique; by definition it provides only a general guide to action. However, the decision-making process in the organization is vastly improved by the establishment and communication of clearly understood policies.

MIS AS A TECHNIQUE FOR MAKING PROGRAMMED DECISIONS

Future prospects for programming the decisions of the organization through the proper design of an MIS are enormous. If we include the computer and management science as integral parts or tools of computer-based information systems, the prospects for a revolution in programmed decision making are very real. Just as the manufacturing process is becoming more and more automated, so is the automation of programmed decisions increasing to support this production and other information needs throughout the organization.

How will this revolution come about? What is there about management information systems that will program so many of our routine decisions? The answer lies in three basic considerations surrounding the

design of an MIS :

1. The problem to be solved, the decision process to be programmed, or the process for which information is desired. The essential element in programming a decision is the decision rule (e.g., reorder if inventory declines below x level).
2. Management science. We define this broadly to include operations research, associated mathematical tools, and the scientific approach to problem solving. Management science, thus defined, gives us the methods and techniques to design the decision rules.
3. The computer. This is a powerful device for processing information and "making" programmed decisions in accordance with predetermined decision rules.

4.5 THE DECISION RULE AND THE COMPUTER

The programmed information system is theoretically the ultimate in design and application because discretion is removed from the human decision maker and turned over to the information decision system. In the "never-never land" of total systems, the complete automation of decisions will have been accomplished and the organization will remain in dynamic equilibrium by means of self-correction obtained by cybernetic feedback.

Note that under the decision rule concept of programmed decision systems the control component of the information system now becomes a part of the processor (the computer), and the human judgment in control and decision making formerly required is now accomplished automatically by computations performed in the computer.

This concept is essential for an understanding of how programmed decision systems are designed for computer-based information systems. A word of caution, however: in actual practice the complete removal of human intervention for management applications is unlikely, owing to the need to periodically review thedecision rule. So in the sense that the decision rule is subject to change, for whatever reason, the system is not 100 percent programmed.

Management Science and the Decision Rule

How do we design the decision rule for programming or automating decisions? The answer lies in the utilization of management science techniques and a general procedure for constructing models and decision rules in complex situations. In general terms, this consists of specifying the management decision, identifying the most influential parameters and variables (controllable and non-controllable) and the interrelations, combining relationships into a system of symbolic relationships, manipulating and solving the equations, and testing and revising the model.

Let us amplify some aspects of this procedure with the aid of the model pictured. We begin with the goals of the manager. The manager is faced with a decision problem in achieving a particular set of goals. The decision problem involves the selection of one alternative from among many possible alternatives that are available because of his or her control over certain variables of the situation. The manager seeks an alternative that will maximize some benefit, minimize some cost, or optimize some conflicting conditions.

The decision maker must identify the factors, internal or external, that will have a bearing on the dependent variable he or she seeks to optimize. In practice, the mathematical model should be kept as simple as possible by selecting the factors that have a significant effect on the goal to be achieved and dropping those that add only small refinements. The relationships should be verbalized in complex situations as the first step in structuring relationships.

4.6 DECISION-ASSISTING INFORMATION SYSTEMS

Unfortunately, all the manager's decisions do not lend themselves to total automation by programmed decision rule. Indeed, the most important and costly ones do not. We must therefore look to computer-based MIS as a source of information to aid the decision maker in the human process of problem solving and decision making. The general concept of the two types of output:

The type of system that we have chosen to call the decision-assisting information system is characterized by the fact that it concentrates on the information required by the manager as decision maker. This information may be furnished independently (as in output reports) or in an interactive sense where there is a person-machine relationship in a problem-solving network. This latter mode usually takes the form of modeling or simulation in which the decision maker can ask "what if" questions.

Notice that in this illustration the characteristics and outputs of this vital type of system are shown :

1. Some outputs are decisions; the computer has "made" a decision in accordance with a programmed decision rule. (The shipment routing order)
2. Some outputs are secondary information in the form of reports to be used by a subsequent human decision maker. (Variance analysis)
3. The methods of management science have been utilized in both types of systems for the design of decision rules.
4. There are provisions for person-machine-type interactions in the sense that the manager/decision maker can "model" his or her decisions prior to commitment.
5. Optimum solutions are provided by management science decision rules.

4.7 SUMMARY

Another example of the distinction between automated decisions and decision assistance is warranted.

In almost any business, there is a billing function. Someone goes through the accounts receivable files and bills all outstanding accounts. This can be completely automated. A computer program can go through the accounts receivable file, decide who owes how much money, and print out the bills and mailing labels. This is truly automated decision making. Most businesses also have sales representatives who market their goods and services. The computer can figure up exactly how much each salesperson sold of each item, how many new customers were contacted, and whether those figures meet the goals set by management. However, a good marketing manager will not make the salesperson's evaluation a completely automated decision. Salespeople could be ridiculously over rewarded if they are given full credit for large "bluebird" orders (orders that come to them with little or no effort). Similarly, they could be grossly under rewarded if sales in their region dropped due to a large customer moving away (e.g., General Motors closing a plant). To avoid these inequities, the marketing manager takes the automated sales analysis output as information to assist in evaluating the sales force. The manager then adds his or her special knowledge of unique, modifying circumstances to reach the final decision.

4.8 KEY WORDS

1. Decision Making
2. Computer
3. Decision Role

4.9 SELF ASSESSMENT QUESTIONS

1. Define Decision-Making process.
2. Describe behavioral model for organizational decision making
3. Decision makings kills are also a key component of time managements kills. Discuss.
4. Explain Behavior Model of Organizational Decision Making
5. Explain the methods of Decision Making.

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UNIT -5: INTRODUCTION TO SYSTEMS AND SYSTEM PLANNING

STRUCTURE

5.0 OBJECTIVES

After studying this unit, you should be able to:

* Describe Organisation as a system;
* Explain Organisation as a planned change and planning for the competitive advantage and
* Develop Business models and IT architecture planning.

5.1 INTRODUCTION

The term system is generally used for a group of actions, personnel and procedures, used for processing data. In general, it is a set of related activities which may or may not involve computers. The first one is known as manual systems. The subsystems are referred to the parts of the system, where the system analyst can work with a smaller group of tasks. The essence of system analysis is to cover the entire problem in context and systematically investigate the objectives of the system and the criteria for system effectiveness and to evaluate the alternatives in terms of effectiveness and cost.

The system analyst is responsible for examining the total flow of data throughout the organisation. Various aspects of an organisation like personnel interactions and procedures for handling problems of the computer are studied by him. The use of system concepts to decompose the information system and define the boundaries and interfaces of each subsystem is generally called structured design.

As shown in the figure 1.1, system consists of elements which operate together to accomplish an objective. The basic model is input, process and output. Systems can be deterministic or probabilistic and open or closed. An information system is a human machine system, with the machine elements relatively closed and deterministic, the human elements are open and probabilistic. The decomposition of systems into subsystems is an important step in simplifying the design of systems. The use of subsystem usually requires some decoupling mechanisms to reduce the complexities of coordination and communication among them. Some methods of decoupling are inventories, buffers, stock and flexible resources and standards. System concepts apply to organisations which are open systems.

Computer Based Information System (CBIS) is a set of software packages, which provide information for decision-making.

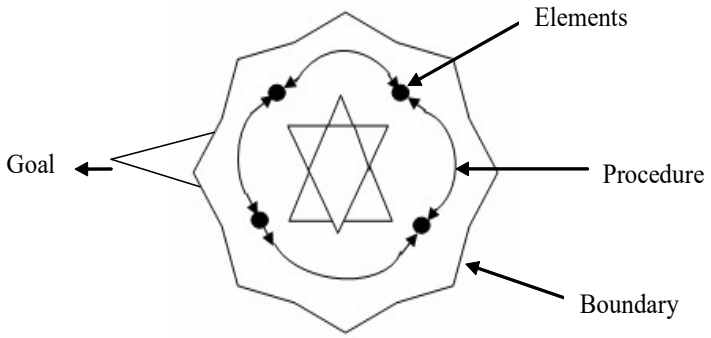

Fig. 1.1 *A System*

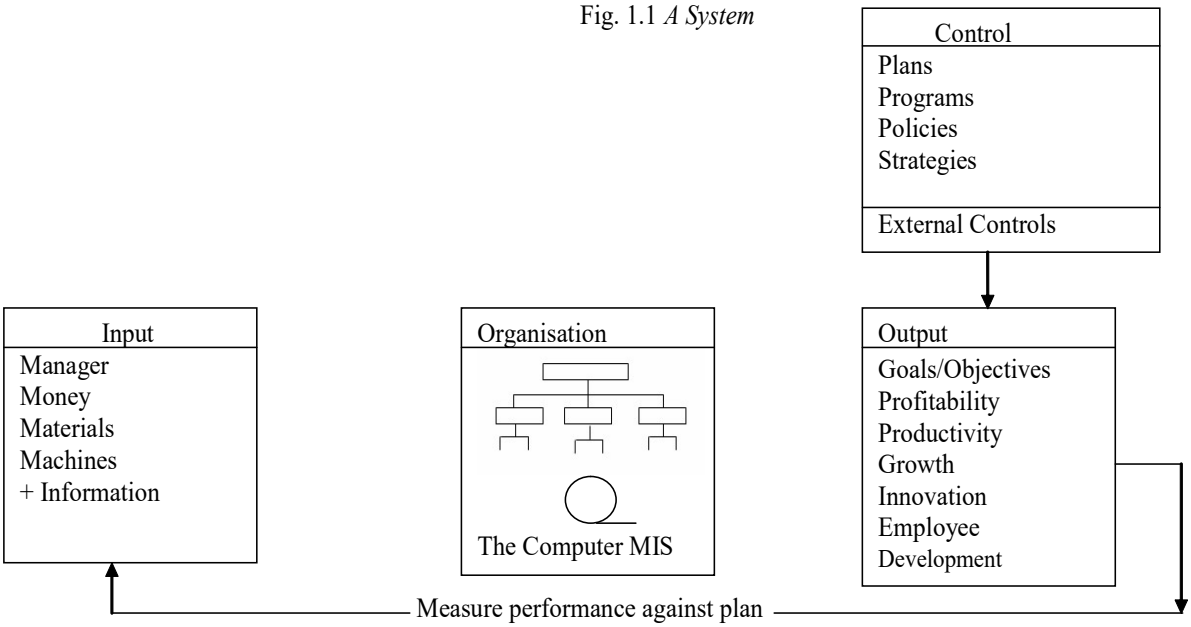

FIG 5.1 ORGANIZATION AS SYSTEM

5.2 SYSTEM AS A PLANNED ORGANISATION CHANGE

Building a new information system is one kind of planned organisational change. The introduction of new information system involves much more than new hardware and software. It also includes changes in jobs, skills, management, and organisation. When we design a new information system, we are redesigning the organisation. System builders must understand how a system will affect the organisation as a whole.

5.3 LINKING INFORMATION SYSTEMS TO THE BUSINESS PLAN

Deciding which new systems to build should be an essential part of the organisational planning process. Organisations need to develop an information sytems plan that supports their overall business plan and in which strategic systems are incorporated into top-level planning. Once specific projects have been selected within the overall context of a strategic plan for the business and the systems area, an

information systems plan can be developed. The plan serves as a road map indicating the direction of systems development , the rationale, the current systems/sitatuation, new developments to consider, the management strategy, the implementation plan and the budget (see table 1-1)

The plan contains statement of corporate goals and specifies how information technology will support the attainment of those goals. The report shows how general goals will be achieved by specific systems projects. It identifies specific target dates and milestones that can be used later to evaluate the plan's progress in terms of how many objectives were actually attained in the time frame specified in the plan. The plan indicates the key management decisions concerning hardware acquisition, telecommunication, centralization/decentralization of authority, data and hardware and required organisational change. Organisational changes are also usually described, including management and employee training requirements, recruiting efforts, changes in business processes and changes in authority, structure or management practice.

1.	Purpose of the plan Overview of plan contents Current business Organization and future organisation Key business processes Management strategy
2.	Strategic business plan rationale Current situation Current business organisation Changing environments Major goals of the business plan Firm's strategic plan
3.	Current systems Major systems supporting business functions and processes Current infrastructure capabilities Hardware Software Database Telecommunications and internet Difficulties meeting business requirements Anticipated future demands
4.	New development New system projects Project descriptions Business rationale Application' role in strategy New infrastructure capabilities required Hardware Software Database Telecommunications and internet

1.	Management strategy Acquisition plan Milestones and timing Organisational realignment Management controls Major training initiatives Personnel strategy
2.	Implementation plan Anticipated difficulties in implementation Progress reports
3.	Budget requirements Requirements Potential savings Financing Acquisition cycle

Table 5.1 Information Systems Plan

5.4 ESTABLISHING ORGANISATIONAL INFORMATION REQUIREMENTS

To develop and effective information systems plan, the organisation must have a clear understanding of both its long-and short term information requirements. Two Principal methodologies for establishing the essential information requirements of the organisation as a whole are enterprise analysis and critical success factors.

5.5 ENTERPRISE ANALYSIS (BUSINESS SYSTEMS PLANNING)

Enterprise Analysis argues that the firms information requirements can be understood only by examining the entire organisation in terms of organisational units, functions, processes and data elements. Enterprise analysis can help identify the key entities and attributes of the organisation's data.

The central method used in the enterprise analysis approach is to take a large sample of managers and ask them how they use information, where they get their information, what their objectives are, how they make decisions and what their data needs are. The results of this large survey of managers are aggregated into subunits, functions, processes, and data matrices. Data elements are organised into logical application groups-groups of data elements that support related sets of organisational processes.

5.6 STRATEGIC ANALYSIS OR CRITICAL SUCCESS FACTORS

The strategic analysis or critical success factors, approach argues that organisational information requirements are determined by a small number of critical success factors (CSFs) of managers. If these goals can be attained, success of the firm or organisation is assured. CSFs are shaped by the industry,

the firm, the manager, and the broader environment. New information systems should focus on providing information that helps the firm meet these goals.

The principal method used in CSF analysis is personal interviews-three or four with a number of top managers identifying their goals and the resulting CSFs. Therese personal CSFs are aggregated to develop a picture of the firms CSFs. Then Systems are built to deliver information on these CSFs.

5.7 PLANNING FOR COMPETITIVE ADVANTAGE

Planning for competitive advantage is especially important in today's competitive business arena and complex information technology environment. So strategic business/IT planning involves an evaluation of the potential benefits and risks a company faces when using IT-based strategies and technologies for competitive advantage. Models of competitive forces (competitors, customers, suppliers, new entrants and substitutes) and competitive strategies (cost leadership , differentiation, growth, innovation and alliances) as well as a value chain model of basic business activities. These models can be used in a strategic planning process to help generate ideas for the strategic use of information technologies to support new e-business initiatives.

Also popular in strategic business /IT planning is the use of a strategic opportunities matrix to evaluate the strategic potential of proposed business/IT opportunities , as measured by their risk/payoff probabilities.

Strategic opportunities matrix helps evaluate the strategic risk/payoff potential of proposed business/ IT opportunities

Fig 5.2 Firms ability to deliver with IT

5.8 BUSINESS MODELS AND PLANNING

A business model is a conceptual framework that expresses the underlying economic logic and system that prove how a business can deliver value to customers at an appropriate cost and make money. A business model answers vital questions about the fundamental components of a business, such as: Who are our customers? What do our customers value? How much will it cost to deliver that value to our customers? How do we make money in this business?

A business model specifies what value to offer customers, and which customers to provide this value to using which products and services at what prices. It also specifies how the business will organise and operate to have the capability to provide this value and sustain any advantage from providing this value to its customers. A business model is a valuable planning tool because it focuses attention on how all the essential components of business fit into a complete system. Done properly, it forces entrepreneurs and managers to think rigorously and systemically about the value and viability of the business initiatives they are planning. Then the strategic planning process can be used to develop unique business strategies that capitalize on a firm's business model to help it gain competitive advantages in its industry and the markets it wants to dominate.

Table 9.2: Questions that illustrate the components of all business models. A good business model effectively answers these questions.

Component of Business Model	Questions for all business Models
Customer value	Is the firm offering its customers something distinctive or at lower cost than its competitors?
Scope	To which customers (demographic and geographic) is the firm offering this value? What is the range of products / services offered that embody this value?
Revenue Source	Where do the dollars come from? Who pays for what value and when? What are the margins in each market and what drives them? What drives value in each source?
Connected activities	What set of activities does the firm have to perform to offer this value and when? How connected (in cross section and time) are these activities?

Implementation	What organisational structure, systems, people and environment does the firm need to carry out these activities? What is the fir between them?
Capabilities	What are the firm's capabilities and capabilities gaps that need to be filled? How does a firm fill these capabilities gaps? Is there something distinctive about these capabilities that allow the firm to offer the value better than other firms and that makes them difficult to imitate? What are the sources of these capabilities?
Sustainability	What is it about the firm that makes it difficult for other firms to imitate it? How does the firm keep making money? How does the firm sustain its competitive advantage?

Table 9.3: Questions that illustrate the components of e-business models that can be developed as part of the strategic business /it planning process

Component of Business Model	**Questions specific to e-business Models**
Customer value	What is it about Internet technologies that allow your firm to offer its customers something distinctive? Can internet technologies allow you to solve a new set of problems for customers?
Scope	What is the scope of customers that internet technologies enable your firm to reach? Does the internet alter the product or service mix that embodies the firm's products?
Pricing	How does the internet make pricing different?
Revenue Source	Are revenue sources different with the internet? What is new?
Connected activities	How many new activities must be performed as a result of the internet? How much better can internet technologies help you to perform existing activities?
Implementation	How do Internet technologies affect the strategy, structure, systems, people and environment of you firms?
Capabilities	What new capabilities do you need? What is the impact of Internet technologies on existing capabilities?
Sustainability	Do Internet technologies make sustainability easier or more difficult? How can your firm take advantage of it?

5.9 BUSINESS / IT PLANNING

The business/IT planning process, which focuses on discovering innovative approaches to satisfying a company's customers value and business value goals. This planning process leads to development of strategies and business models for new e-business and e-commerce platforms, processes, products and services. Then a company can develop IT strategies and an IT architecture that supports building and implementing their newly planned business application.

The Business/IT planning process has three major components:

5.9.1 Strategy Development : Developing business strategies that support a company's business vision .For example, using information technology to create innovative e-business systems that focus on customer and business value.

5.9.2 Resource Management : Developing strategic plans for managing or outsourcing company's IT resources, including IS personnel, hardware, software, data, and network resources.

5.9.3 Technology architecture : making strategic IT choices that reflect information technology architecture designed to support a company's e-business and other business /IT initiatives.

5.10 INFORMATION TECHNOLOGY ARCHITECTURE:

The IT architecture that is created by the strategic business/IT planning process is a conceptual design, or blue print , that includes the following major components.

* **Technology Platform :** The internet, intranets, extranets and other networks, computer systems, system software, and integrated enterprise application software provide a computing and communications infrastructure or platform that supports the strategic use of information technology for e-business, e-commerce and other business/IT applications.
* **Data Resources :** Many types of operational and specialized databases, including data warehouses and internet/ intranet databases strore and provide data and information for business processes and decision support.
* **Application architecture :** Business applications of information technology are designed as an integrated architecture of enterprise systems that support strategic business initiatives, as well as cross-functional business processes. For example, applications architecture should include support for developing and maintaining interenterprise supply chain applications, and integrated enterprise resource planning and customer management applications.
* **IT organisation :** The organisational structure of the IS function within a company and distribution of IS specialists are designed to meet the changing of a business. The form of the IT organisation depends on the managerial philosophy and business/IT strategies formulated during the strategic

planning process.

5.11 BUSINESS APPLICATION PLANNING:

The business application planning process begins after the strategic phase of business/IT planning has occurred. Figure shows that the application planning process includes the evaluation of proposals made by the IT management of a company for using information technology to accomplish the strategic business priorities developed earlier in the planning. Then, the business case for investing in proposed e-business development projects is evaluated by company executives and business unit managers based on the strategic business priorities that they decide are most desirable and necessary at that point in time. Finally, business application planning involves developing and implementing business applications of IT and managing their development projects.

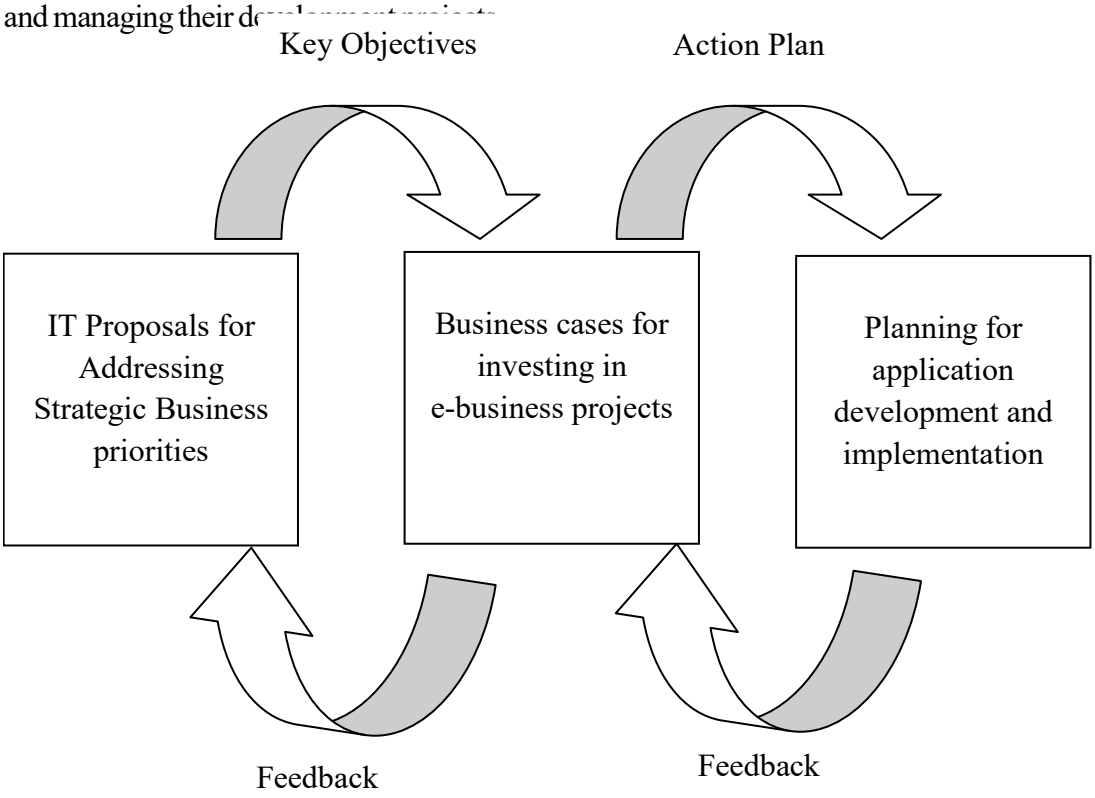

Fig 5.3 Business Application Planning

5.12 BUSINESS /IT ARCHITECTURE PLANNING

As illustrated in figure below, strategic e-business initiatives, including strategic goals, constraints, and requirements are developed based on SWOT analysis and other planning methods. Then application developers use business process engineering methods to define how strategic business requirements are to be implemented, using organisational process and data models to create new internal and interenterprise

e-business processes among a company's customers, suppliers and other business partners.

Components based e-business and e-commerce applications are then developed to implement the new business processes using application software and data components stored in a repository of reusable business models and application components. Of course, the business process engineering and component-based application development activities are supported by a company's technology infrastructure, which includes all the resources of its IT architecture, as well as the necessary component development technologies. So e-business architecture planning links strategy development to business modelling and components development methodologies in order to produce the strategic e-business applications needed by a company.

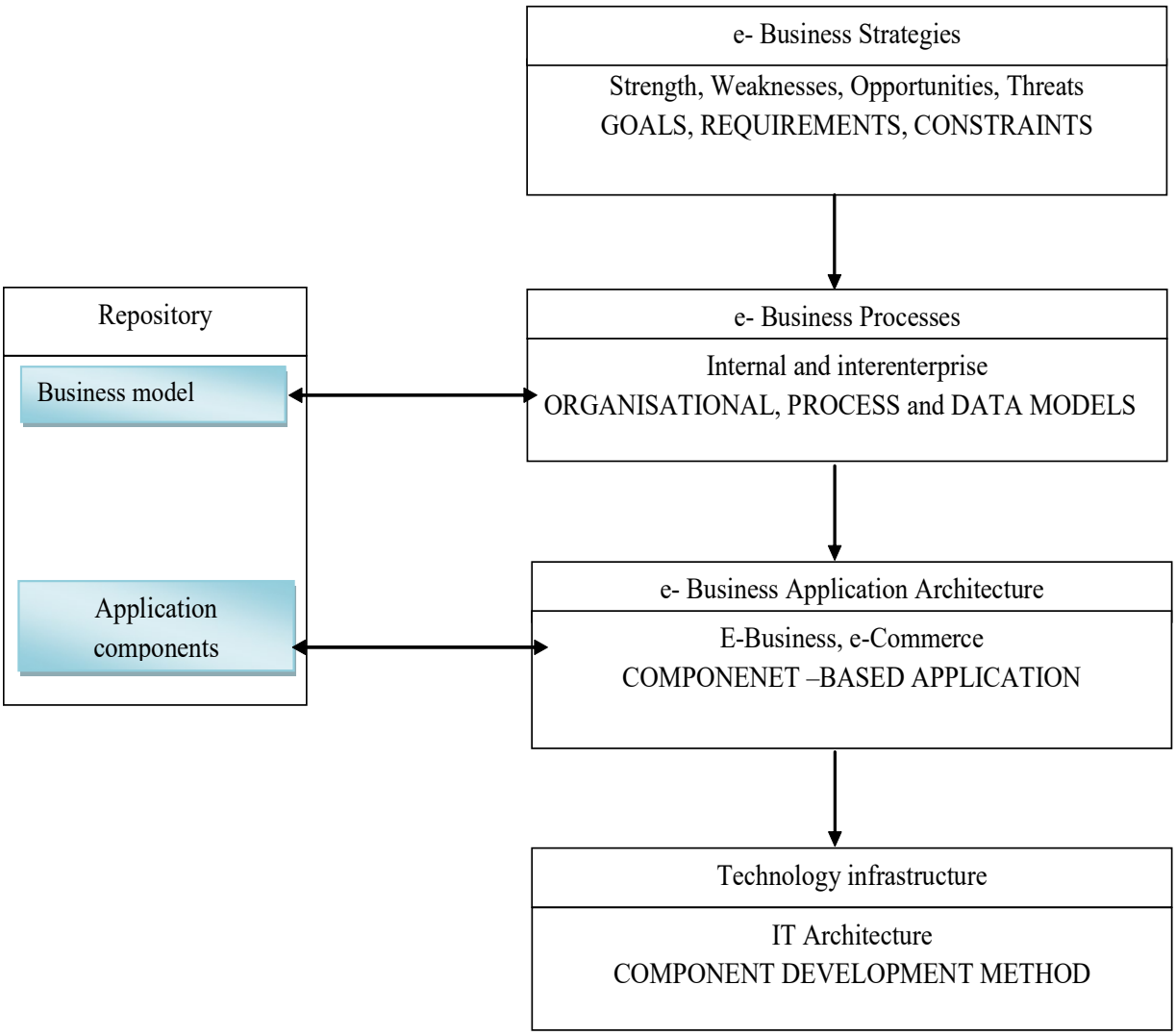

Figure1.4, business/IT architecture Planning

5.13 SYSTEMS DEVELOPMENT AND ORGANISATIONAL CHANGE

Information technology can promote various degrees of organisational change, ranging from incremental to far-reaching. There are four kinds of structural organisational change that are enabled by information technology.

1. Automation
2. Rationalisation
3. Reengineering
4. Paradigm shifts.

Each carries different rewards and risks.

5.14 BUSINESS PROCESS REENGINEERING

Business process reengineering is the popular term for comprehensive reoptimization of organizational processes and structures, often following the introduction of new information technologies into an organization.

Many companies today are focusing on building new information systems that will improve their business processes. Some of these system projects represent radical restructuring of business processes, whereas others entail more incremental process change.

One of the most important strategic decisions that a firm can make is not deciding how to use computers to improve business processes but rather understanding what business processes need improvement. When systems are used to strengthen the wrong business model or business processes, the business can become more efficient at doing what it should not do. As a result, the firm becomes vulnerable to competitors who may have discovered the right business model. Considerable time and cost can also be spent improving business processes that have little impact on overall firm performance and revenue. Mangers need to determine what business are the most important to focus on when applying new information technology and how improving theses processes will help the firm execute its strategy.

5.15 SUMMARY

Managing information technology requires planning for changes in business goals, processes, structures, and technologies. Planning is a vital organisational process that uses methods like the scenario approach and planning for competitive advantage to evaluate an organisations internal and external environments; forecast new developments, establish an organisation's mission, goals and objectives, develop strategies, tactics and policies to implement its goals; and articulate plans for the organisation to act upon. A good planning process helps organisations learn about themselves and promotes organisational change and

renewal. Business/IT planning involves aligning investment in information technology with a company's business vision and strategic goals such as reengineering business processes or gaining competitive advantages. It results in a strategic plan that outlines a company's business/IT strategies and technology architecture. The technology architecture is a conceptual blueprint that specifies a company's technology platform, data resources, applications architecture and IT organisation.

5.16 KEY WORDS

1. Business / IT Planning
2. Strategic Planning
3. Revenue Source
4. Automation

5.17 SELF ASSESSMENT QUESTIONS

1. How can systems planning be made relevant to the challenges facing a business?
2. What are the planning methods used to develop IT applications?
3. Explain the business /IT planning process.

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UNIT 6: SYSTEM ANALYSIS AND DESIGN AND SDLC

STRUCTURE

6.0 OBJECTIVES

After studying this unit, you should be able to:

* Differentiate between the System analysis and system design;
* Explain the different approaches used for system development and
* Analyse the various stages in system development life cycle.

6.1 INTRODUCTION

The overall process by which information systems are designed and implemented within organisations is referred to as Systems analysis and Design (SA & D). Within this process are contained activities that include the identification of business problems; the proposed solution, in the form of an information system (IS), to one or more of the problems identified; and the design and implementation of that proposed solution to achieve the desired and stated goals of the organisation.

Today, there are many approaches to System Analysis and Design. The two most common approaches are object-oriented analysis and design and the life cycle approach. Although each has its advantages and disadvantages, the two approaches differ in many respects; both are concerned with the analysis and design of a successful information system. In most cases, the choice will depend upon the type of system under study and the degree to which users are able to specify their needs and requirements clearly.

6.2 OVERVIEW OF SYSTEMS DEVELOPMENT

Whatever their scope and objectives, new information systems are an outgrowth of a process of organisational problem solving. A new information system is built as a solution to some type of problem or set of problems the organisation perceives it is facing. The problem may be one in which managers and employees realize that the organisation is not performing as well as expected, or it may come from the realization that the organisation should take advantage of new opportunities to perform more successfully.

The activities that go into producing an information system solution to an organisational problem or opportunity are called systems development. Systems development is a structured kind of problem solving with distinct activities. There are different types of system development.

6.3 DIFFERENT TYPES OF SYSTEM DEVELOPMENT

1. SDLC (Traditional method or waterfall method)
2. Object-oriented Development

3. Computer-Aided Software Engineering
4. Prototyping
5. End-User Development
6. Application Software Packages and Outsourcing

6.4 THE SYSTEMS DEVELOPMENT LIFE CYCLE

One method of using the systems approach to develop information system solutions and the most prevalent one in organisation systems analysis and design can be viewed as a multistep, iterative process called the System Development Life Cycle (SDLC). Figure 2.1 illustrates what goes on in each stage of this process. The stages in the SDLC are

1. Feasibility study
2. Systems analysis
3. Systems Design
4. Programming
5. Testing
6. Conversion
7. System Implementation and Maintenance

After the completion of one stage only it goes to the next stage so it is also called as Waterfall Method.

It is important to realize, however, that all of the activities involved in the SDLC are highly related and interdependent. In actual practice, therefore, several developmental activities may be occurring at the same time , while certain activities within a given step may be repeated. This means both users and system analysts may repeat previous activities at any time of modify and improve a system under development. We will discuss the activities and products of each step of the systems development cycle in this chapter.

6.5 STARTING THE SYSTEMS DEVELOPMENT PROCESS

Do we have business opportunities?

What are out business priorities?

How can information technologies provide information system solutions that address our business priorities?

These are the questions that have to be answered in the systems investigation stage, which is the first step in the systems development process. This stage may involve consideration of proposals generated by a business/IT planning process. The investigation stage also includes the preliminary feasibility study of proposed information system solutions to meet a company's business priorities and opportunities as identified in a planning process.

6.6 FEASIBILITY STUDIES

Because of process of development can be costly, the systems investigation stage typically requires the development of a feasibility study. At this stage, this a preliminary study where the information needs of prospective users and the resource requirements, costs, benefits and feasibility of a proposed project are determined. A team of business professionals and IS specialists might then formalize the findings of this study in a written report that includes preliminary specifications and a development plan for a proposed business application. If the management of the company approves the recommendations of the feasibility study, the development process can continue.

The goal of the preliminary feasibility study is to evaluate alternative system solutions and to propose the most feasible and desirable business application for development. The feasibility of a proposed business system can be evaluated in terms of five major categories, as illustrated in figure 2.1

Operational Feasibility	Economic Feasibility
• How well the proposed system supports the business priorities of the organisation. • How well the proposed system will solve the identified problem. • How well the proposed system will fit with the existing organisational structure.	• Cost savings. • Increased revenue. • Decreased investment requirements. • Increased profits. • Cost /benefit analysis.

Technical Feasibility	Human Factor Feasibility
• Hardware, software and network capability, reliable and availability.	• Employee, customer, supplier acceptance. • Management support. • Determining the right people for the various new or revised roles.
Legal/ Political Feasibility	
• Patent, copyright and licensing. • Governmental restrictions. • Affected stakeholders and reporting authority	

Table 2.1, Feasibility Study

* **Operational feasibility :** The operational feasibility assessment focuses on the degree to which the proposed development project fits in with the existing business environment and objectives .It determines the degree to which the project meets the specific business objectives set forth during the proposal phase.
* **Schedule feasibility :** Can we identify and solve the problem at hand within a reasonable time period? What is the development schedule and delivery date?
* **Economic Feasibility :** the purpose of the economic feasibility assessment is to determine the extent to which the proposed system will provide positive economic benefits to the organisation. This determination involves the identification, and qualification, of all benefits expected from the system, as well as the explicit identification of all expected costs of the project.
* **Technical Feasibility :** The assessment of technical feasibility is focused on gaining an understanding of the present technical resources of the organisation and their applicability to the expected needs of the proposed system.
* **Human factor feasibility :** It focuses on the most important components of a successful system implementation: the managers and end users.
* **Legal/Political feasibility :** this category of assessment is often overlooked during the early stages of project initiation and analysis. This includes a thorough analysis of any potential legal ramifications resulting from the construction and implementation of the new system. Such legal issues include copyright or patent infringements, violation of existing antitrust laws, foreign trade restrictions.

* **System analysis :** System analysis is not a preliminary study; however it is an in-depth study of end-user information needs that produces functional requirements that are used as the basis for the design of a new information system. System analysis traditionally involves a detailed study of,
    1. The information needs of a company and end users
    2. The activities, resources, and products of one or more of the present information systems being used.
    3. The information system capabilities required to meet your information needs and those of other business stakeholders that may use the system.

System analysis of the activities includes :

i. Analysis of the organisational environment
ii. Analysis of any present systems
iii. System requirements analysis
iv. System requirements

* **Systems Design :** Once the analysis portion of the life cycle is complete, the process of systems design can begin. Here is where the logical model of the current system is modified until it represents the blueprint for the new system. This version of the logical model represents what the new system will do. During the physical design portion of this step, users and analysts will focus on determining how the system will do. During the physical design portion of this step, users and analysts will focus on determining how the system will accomplish its objectives. This is where issues related to hardware, software, networking, data storage, security and many others will be discussed and determined. As such, systems design consists of design activities that ultimately produce physical system specifications satisfying the functional requirements that were developed in the systems analysis process.

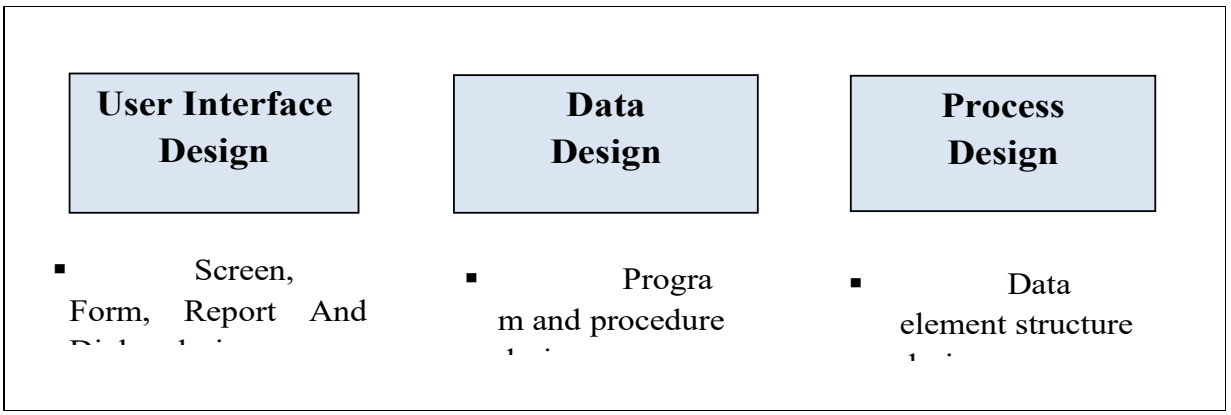

Figure 6.2 Systems Design

* **System specification :** System specifications formalise the design of an applications user interface methods and products, database structures, and processing and control procedures. Therefore, systems designers will frequently develop hardware, software, network, data and personal specifications for a proposed system. Figure 1.5 shows examples of system specifications that could be developed for an e-commerce system of a company.

Examples of system specification
• **User interface specifications** Use personalized screens that welcome repeat web customers and that makes product recommendation
• **Database specification** Develop database that use object/rational database management software to organise access to all customer and inventory data and to multimedia product information.
• **Software specifications** Acquire an e-commerce software engines to process all e-commerce transactions with fast responses, i.e., retrieve necessary product data and compute all sales amounts in less than one second.
• **Hardware and network specifications** Install redundant network web servers and sufficient high-bandwidth telecommunications lines to host the company e-commerce web site.
• **Personal specifications** Hire an e-commerce manger and specialists and a webmaster and web designer to plan, develop and manage e-commerce operations.

Table 6.3 System specification

Programming : During the programming stage, system specifications that were prepared during the design stage are translated into software program code. Today, many organisations no longer do their own programming for new systems. Instead, they purchase the software that meets the requirements for a new system from external sources such as software packages from a commercial software vendor, software services from an application service provider or outsourcing firms that develop custom application software for their clients.

Testing : Exhaustive and thorough testing must be conducted to ascertain whether the system produces the right results. Testing answers the question, "will the system produce the desired results under known conditions?"

Testing an information system can be broken down into three types of activities:

Unit testing, or program testing, consists of testing each program separately in the system. It is widely believed that the purpose of such testing is to guarantee that programs are error free, but this goal is realistically impossible. Testing should be viewed instead as a means of locating errors in programs, focusing on finding all the ways to make a program fail. Once they are pinpointed, problems can be

corrected.

System Testing tests the functioning of the information system as a whole. It tries to determine whether discrete modules will function together as planned and whether discrepancies exist between the way the system actually works and the way it was conceived. Among the areas examined are performance time, capacity for file storage and handling peak loads, recovery and restart capabilities and manual procedures.

Acceptance testing provides the final certification that the system is ready to be used in a production setting. Systems tests are evaluated by users and reviewed by management. When all parties are satisfied that the new system meets their standards, the system is formally accepted for installation.

Conversion : Conversion is the process of changing from the old system to the new system. Four main conversion strategies can be employed **:**

1. Parallel strategy
2. Direct Cutover
3. Pilot Study
4. Phased Approach

1. **Parallel strategy :** In a parallel strategy both the old system and its potential replacement are run together for a time until everyone is assured that the new one functions correctly. This is the safest conversion approach because; in the event of errors or processing disruptions the old system can still be used as a backup. However, this approach is very expensive and additional staff or resources may be required to run the extra system.
2. **Direct Cutover :** The direct cutover strategy replaces the old system entirely with the new system on an appointed day. It is a very risky approach that can potentially be more costly than running two systems.
3. **Pilot Study :** The pilot study strategy introduces the new system to only a limited area of the organisation, such as single department or operating unit. When this pilot version is complete and working smoothly, it is installed throughout the rest of the organisation, either simultaneously or in stages.
4. **Phased Approach :** The phased approach strategy introduces the new system in stages, either by functions or by organisational units.

System implementation and maintenance : The system implementation stage involves hardware and software acquisition, software development, testing and programs and procedures, training, development of documentation and variety of installation activities.

System maintenance involves the monitoring, evaluating and modifying of a system to make desirable or necessary improvements. This includes a post implementation review process to include that the

SDLC

newly implemented system meets the systems development objectives established for it.

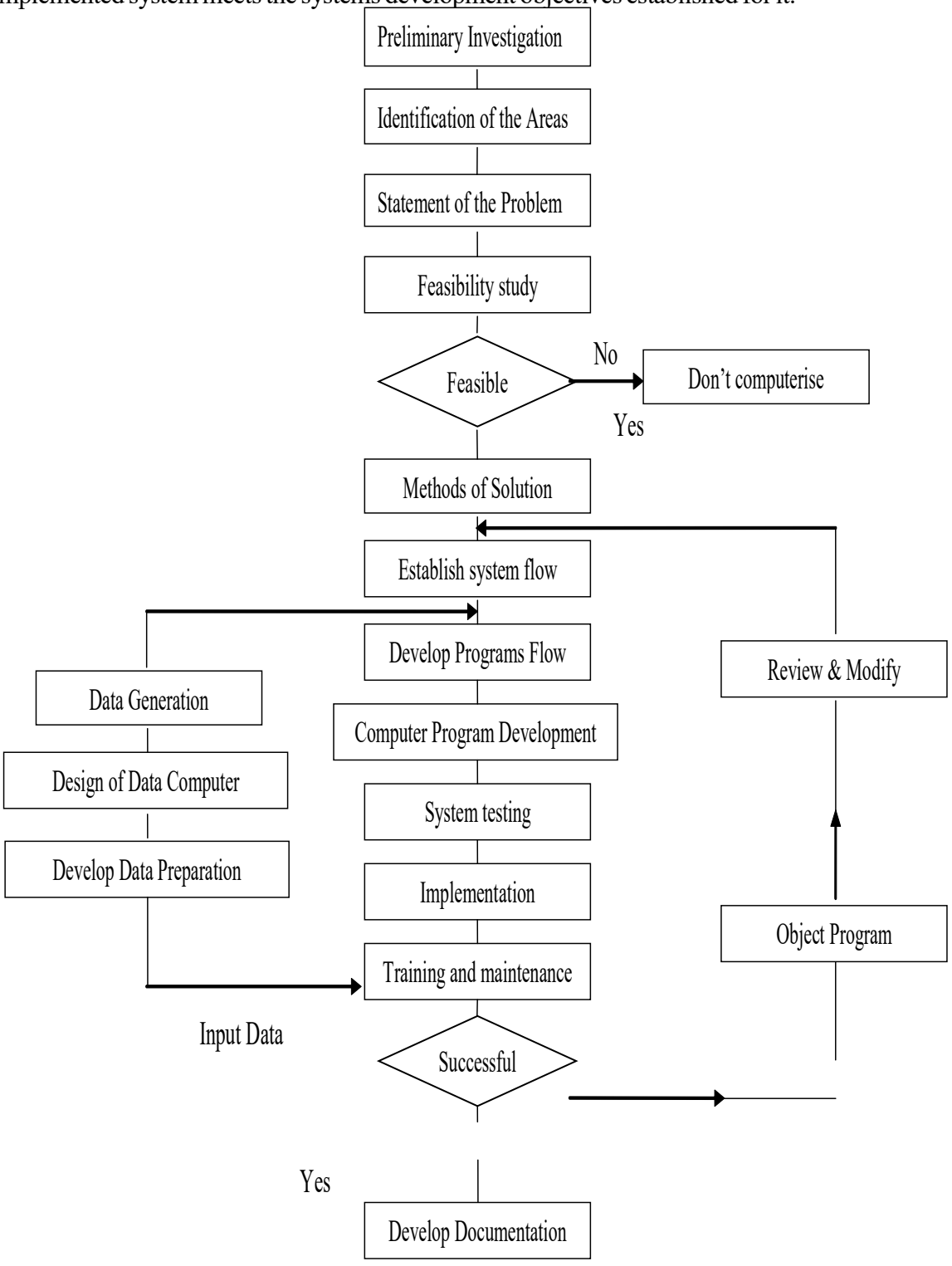

Fig 6.4 SDLC

Modelling and Designing systems: Structured and object-oriented methodologies :

Structured Methodologies: Structured methodologies have been used to document, analyse and design information systems since 1970s. Structured refers to the fact that the techniques are step by step, with each step building on the previous one. Structured methodologies are top-down, progressing from the highest, most abstract level to the lowest level of detail-from the general to the specific.

Structured development methods are process-oriented, focusing primarily on modelling the processes or actions that capture, store, manipulate and distribute data as the data flow through a system. These methods separate data from processes. A separate programming procedure must be written every time someone wants to take an action on a particular piece of data. The procedures act on data that program passes to them.

OBJECT-ORIENTED DEVELOPMENT :

Structured methods are useful for modelling processes, but do not handle the modelling of data well. They also treat data and processes as logically separate entities, whereas in the real world such separation seems unnatural.

Object-oriented development tries to deal with these issues. Object oriented development uses the object as the basic unit of systems analysis and design. An object combines data and the specific processes that operate on those data.

The phases of object-oriented development are similar to those of conventional systems development, consisting of analysis, design and implementation. However, object oriented development is more iterative and incremental than traditional structured development. During analysis, system builders document the functional requirements of the system, specifying its most important properties and what the proposed system must do. Interactions between the system and its users are analysed to identity objects, which include both data and processes. Object oriented design phase describes how the objects will behave and how they will interact with one other. Similar objects are grouped together to form a class, and classes are grouped into hierarchies in which a subclass inherits the attributes and methods from its super class. The information systems is implemented by translating the design into program code, reusing classes that are already available in a library of reusable software objects and adding new ones created during the object-oriented design phase. Implementation may also involve the creation of an object-oriented database. The resulting system must be thoroughly tested and evaluated.

Computer-Aided software Engineering :

It provides software tools to automate the methodologies to reduce repetitive work and to facilitate the creation of clear documentation and the coordination of team development efforts. Team members can share their work easily by accessing each other's files to review or modify what has been done. Modest productivity benefits can also be achieved if the tools are used properly. Many CASE tools are PC-based, with powerful graphical capabilities.

CASE tools provide automated graphics facilities for producing charts and diagrams, screen and report generators, data dictionaries, extensive reporting facilities, analysis and checking tools, code generators, and documentation generators. In general, CASE tools try to increase productivity and quality by doing the following

* Enforce a standard development methodology and design discipline
* Improve communication between users and technical specialists
* Organise and correlate design components and provide rapid access to them using a design repository
* Automate tedious and error prone portions of analysis and design
* Automate code generation and testing and control rollout.

Prototyping :

During the design phase, the development process frequently takes the form of, or includes, a prototyping approach. Prototyping is the rapid development and testing of working models, or prototypes, of new applications in an interactive, iterative process that can be used by both IS specialists and business professionals. Prototyping, as a development tool, makes the development process faster and easier, especially for projects where end-user requirements are hard to define. Prototyping has also opened up the application development process to end users because it simplifies and accelerates systems design. Thus prototyping has enlarged the role of the business stakeholders affected by a proposed system and helps make possible a quicker and more responsive development process called Agile systems development (ASD).

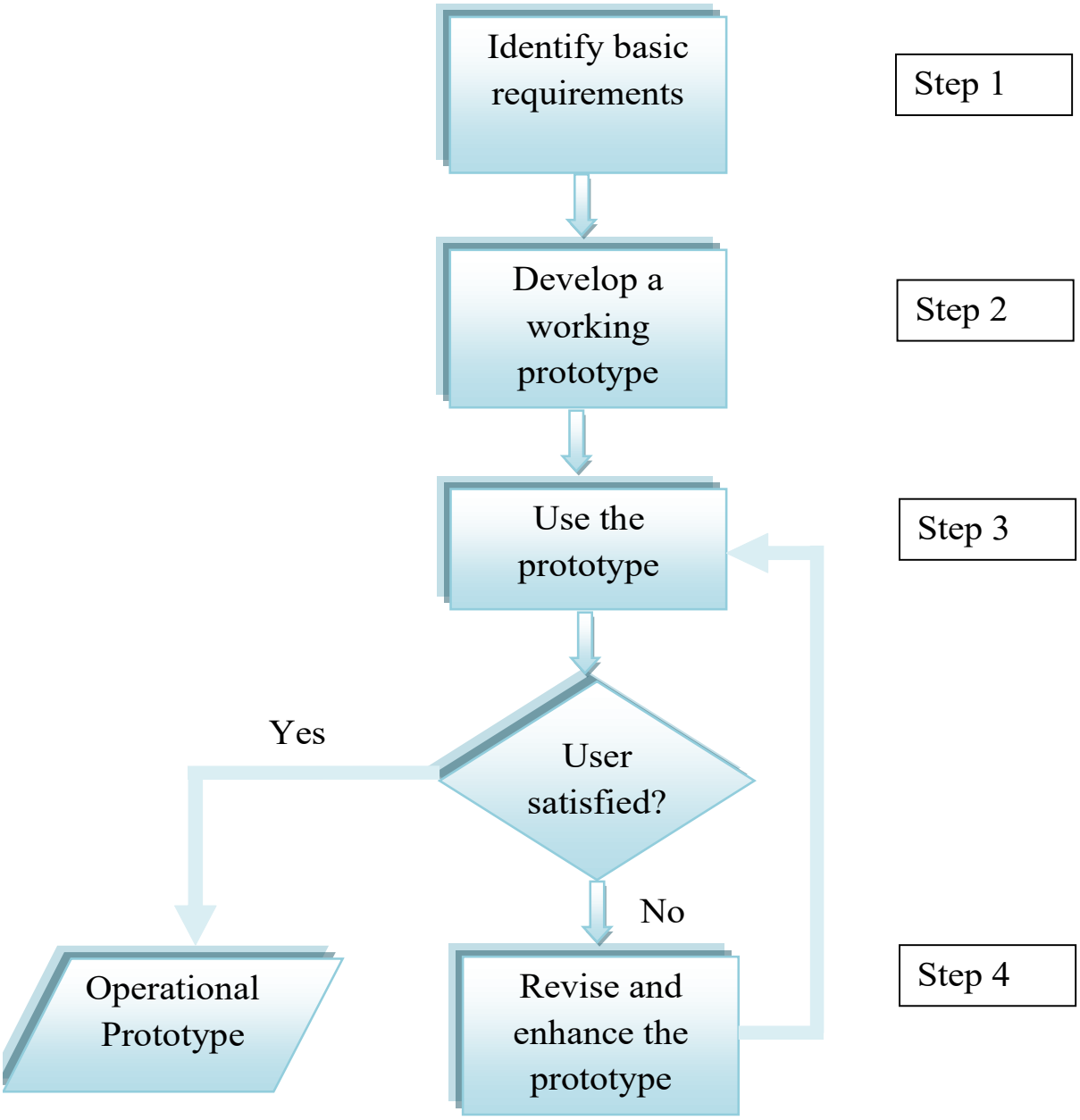

Fig 6.4 Steps in Prototyping

Figure 2.4 shows a four-step model of the prototyping process, which consists of the following

1. **Step1 :** Identify the User's basic requirements: The system designer works with the user only long enough to capture the user's basic information needs.
2. **Step2 :** Develop an Initial Prototype: The system designer creates a working prototype quickly, using tools for rapidly generating software
3. **Step3 :** Use the prototype. The user is encouraged to work with the system to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.
4. **Step4 :** Revise and enhance the prototype. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to step3 and 4 are repeated until the user is satisfied.

When no more iterations are required, the approved prototype then becomes and operational prototype that furnishes the final specifications for the application. Sometimes the prototype is adopted as the production version of the system.

Advantages and Disadvantages of Prototyping :

Prototyping is most useful when there is some uncertainty about requirements or design solutions. Prototyping is especially useful in designing an information system's end-user interface. Because prototyping encourages intense end user involvement throughout the systems development life cycle, it is more likely to produce systems that fulfil user requirements.

However, rapid prototyping can gloss over essential steps in systems development. If the completed prototype works reasonably well, management may not see the need for reprogramming, redesign, or full documentation and testing to build a polished production system. Some of these hastily constructed systems may not easily accommodate large quantities of data or a large number of users in a production environment.

End-User Development :

Some types of information systems can be developed by end users with little or no formal assistance from technical specialists. This phenomenon is called end-user development. A series of software tools categorized as fourth-generation languages makes this possible. Fourth-generation languages are software tools that enable end users to create reports or develop software application with minimal or no technical assistance. Some of these fourth-generation tools also enhance professional programmer's productivity.

Fourth-generation languages tend to be non procedural, or less procedural, than conventional programming languages. End-user developed systems can be completed more rapidly than those developed through the conventional systems life cycle. Allowing users to specify their own business

needs improves requirements gathering and often leads to higher level of user involvement and satisfaction with the system. However, fourth generation tools still can not replace conventional tools for some business applications because they cannot easily handle the processing of large numbers of transactions or applications with extensive procedural logic and updating requirements.

Application software packages and outsourcing :

Software for most systems today is not developed in-house but is purchased from external sources. Firms can rent the software from an application service provider, they can purchase a software package from a commercial vendor or they can have a custom application developed by an outside outsourcing firm.

During the past several decades, many systems have been built on an application software package foundation. Many applications are common to all business organisations-for example, payroll, accounts receivable, general ledger, or inventory control. For such universal functions with standard processes that do not change a great deal over time, a generalised system will fulfil the requirements of many organisations.

Outsourcing: If a firm does not wan to use its internal resources to build or operate information systems, it can outsource the work to an external organisation that specializes in providing these services. Outsourcing has become popular because some organisations perceive it as providing more value than an in-house computer center or information systems staff. The provider of outsourcing services benefits from economies of scale and complementary core competencies that would be difficult for a firm that does not specialise in information technology services to replicate.

Approach	Features	Advantages	Disadvantages
System life cycle	• Sequential step-by-step process • Written specification and approvals • Limited role of users	• Useful for large, complex systems and projects	• Slow and expensive • Discourages changes • Massive paperwork to mange
Prototype	• Requirements specified dynamically with experimental system • Rapid, informal and iterative process • Users continually interact with the prototype	• Rapid and relatively inexpensive • Useful when requirements uncertain or when end user interface is very important promoters user participation	• Inappropriate for large, complex systems • Can gloss over steps in analysis, documentation and testing

Table 6.5 Comparision of systems development approaches

Application software packages	• Commercial software eliminates need for internally developed software programs	• Design, programming, installation and maintenance work reduces • Can save time and cost when developing common business applications • Reduces need for internal information systems resources	• May not meet organisation's unique requirements • May not perform many business functions well • Extensive customization raises development costs
End-user development	• System created by end users using fourth-generation software tools • Rapid and informal • Minimal role of information systems specialists	• Users control systems-building • Saves development time and cost • Reduces application backing	• Can lead to proliferation of uncontrolled information systems and data • System do not always meet quality assurance standard
Out sourcing	• Systems built and sometimes operated by external vendors	• Can reduce or control costs • Can produce system when internal resources are not available or technically deficiency	• Loss of control over the information systems function • Dependence on the technical direction and prosperity of external vendors

6.7 SUMMARY

Business and Users and IS specialists may use a systems approach to help them develop information systems solutions to meet business opportunities. This frequently involves a sytems development cycle where IS specialists and end users conceive , design and implement business systems. Prototyping is a major alternative methodology to the traditional information systems development cycle. It includes the use of prototyping tools and methodologies, which promotes an iterative, interactive process that develops prototypes of user interfaces and other information system components.

6.8 KEY WORDS

1. Feasibility
2. Testing
3. Parallel Strategy
4. Prototyping

5. Outsourcing

6.9 SELF ASSESSMENT QUESTIONS

1. Explain the various stages in SDLC.

2. Why has prototyping become a popular way to develop business applications?

3. What are the different types of system development approaches?

4. Explain the different types of feasibility studies conducted while developing systems.

6.10 REFERENCES

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UNIT 7 : FLOW CHART AND DECISION TABLES

STRUCTURE

7.0 OBJECTIVES

After studying this unit, you should be able to:

* Define the flow chart and Different symbols used in the flow chart and
* Explain importance of Decision Table.

7.1 INTRODUCTION

A graphical representation in which symbols are used to represent operations, data, flow, logic, equipment and so on. A program flowchart illustrates the structure and sequence of operations of a program, whereas a system flowchart illustrates the components and flows of information system.

The following is a basic overview, with descriptions and meanings, of the most common flowchart symbols - also commonly called *flowchart shapes*, *flow diagram symbols* or *process mapping symbols*, depending upon what type of diagram you're creating. The table below lists the flowchart symbol drawing, the name of the flowchart symbol in Microsoft Office (with aliases in parentheses), and a short description of where and how the flowchart symbol is used.

7.2 VARIOUS SYMBOLS IN FLOWCHART

Table 7.1 Process / Operation Symbols

SYMBOL	NAME (ALIAS)	DESCRIPTION
	Process	Show a Process or action step. This is the most common symbol in both process flowcharts and process maps.
	Predefined Process (Subroutine)	A Predefined Process symbol is a marker for another process step or series of process flow steps that are formally defined elsewhere. This shape commonly depicts sub-processes (or subroutines in programming flowcharts). If the sub-process is considered "known" but not actually defined in a process procedure, work instruction, or some other process flowchart or documentation, then it is best not to use this symbol since it implies a formally defined process.

	Alternate Process	As the shape name suggests, this flowchart symbol is used when the process flow step is an alternate to the normal process step. Flow lines into an alternate process flow step are typically dashed.
	Delay	The Delay flowchart symbol depicts any waiting period that is part of a process. Delay shapes are common in process mapping.
	Preparation	As the names states, any process step that is a Preparation process flow step, such as a set-up operation.
	Manual Operation	Manual Operations flowchart shapes show which process steps are not automated. In data processing flowcharts, this data flow shape indicates a looping operation along with a loop limit symbol (which is not supported by Microsoft Office, but a Manual Operation symbol rotated 180° will do the trick.)

SYMBOL	NAME (ALIAS)	DESCRIPTION
	Flow Line (Arrow, Connector)	Flow line connectors show the direction that the process flows.
	Terminator (Terminal Point, Oval)	Terminators show the start and stop points in a process. When used as a Start symbol, terminators depict a *trigger action* that sets the process flow into motion.
	Decision	Indicates a question or branch in the process flow. Typically, a Decision flowchart shape is used when there are 2 options (Yes/No, No/No-Go, etc.)
	Connector (Inspection)	**Flowchart**: In flowcharts, this symbol is typically small and is used as a Connector to show a jump from one point in the process flow to another. Connectors are usually labeled with capital letters (A, B, AA) to show matching jump points. They are handy for avoiding flow lines that cross other shapes and flow lines. They are also handy for jumping to and from a sub processes defined in a separate area than the main flowchart. **Process Mapping**: In process maps, this symbol is full sized and shows an Inspection point in the process flow. *[Just to confuse things further, some people will use a circle to indicate an operation and a square to indicate an inspection. That's why it's important to include a symbol key in the flowchart.]*

	Off-Page Connector	Off-Page Connector shows continuation of a process flowchart onto another page. When using them in conjunction with Connectors, it's best to differentiate the labels, e.g. use numbers for Off-Page Connectors and capital letters for Connectors. In actual practice, most flowcharts just use the Connect shape for both on-page and off-page references.
	Merge (Storage)	**Flowchart**: Shows the merging of multiple processes or information into one. **Process Mapping**: commonly indicates storage of raw materials.
	Extract (Measurement)	**Flowchart:** Shows when a process splits into parallel paths. Also commonly indicates a Measurement, with a capital 'M' inside the symbol. **Process Mapping:** commonly indicates storage of finished goods.
	Or	The logical Or symbol shows when a process diverges - usually for more than 2 branches. When using this symbol, it is important to label the out-going flow lines indicate the criteria to follow each branch.
	Summing Junction	The logical Summing Junction flowchart shape is show when multiple branches converge into a single process. The merge symbol is more common for this use, though This symbol and the Or symbol are really more relevant data processing flow diagrams than in process flowchar

Input and Output Symbols

SYMBOL	NAME (ALIAS)	DESCRIPTION
	Data (I/O)	The Data flowchart shape indicates inputs to and outputs fron process. As such, the shape is more often referred to as an I/C shape than a Data shape.
	Document	Pretty self explanatory - the Document flowchart symbol is fc process step that produces a document.
	Multi-Document	Same as Document, except, well, multiple documents. This shape is not as commonly used as the Document flowchart shape, even when multiple documents are implied.
	Display	Indicates a process step where information is displayed to a person (e.g., PC user, machine operator).
	Manual Input	Manual Input flowchart shapes show process steps where the operator/ user is prompted for information that must be manually input into a system.
	Card	This is the companion to the punched tape flowchart shapes. This shape is seldom used.
	Punched Tape	If you're very good at stretching all the life out of a machine, you may still have use for the Punched Tape symbol - used fo input into old computers and CNC machines.

File and Information Storage Symbols

SYMBOL	NAME (ALIAS)	DESCRIPTION
	Stored Data	A general Data Storage flowchart shape used for any process step that stores data (as opposed to the more specific shapes to follow next in this table).
	Magnetic Disk (Database)	The most universally recognizable symbol for a data storage location, this flowchart shape depicts a database.
	Direct Access Storage	Direct Access Storage is a fancy way of saying Hard Drive.
	Internal Storage	Used in programming flowcharts to mean information stored in memory, as opposed to on a file.
	Sequential Access Storage (Magnetic Tape)	Although it looks like a 'Q', the symbol is supposed to look like a reel of tape.

Data Processing Symbols

SYMBOL	NAME (ALIAS)	DESCRIPTION
	Collate	The Collate flowchart shape indicates a process step that requires organizing data, information, or materials according into a standard format or arrangement.
	Sort	Indicates the sorting of data, information, materials into some pre-defined order.

Limitations : Sometimes flowcharts are too big which may be of several pages , so it is cumbersome to understand many programs which are big.

7.3 DECISION TABLE

Decision tables are used to lay out in tabular form all possible situations which a business decision may encounter and to specify which action to take in each of these situations.

In situations, where the decisions are based on conditions and there is a set of defined actions, tables are really helpful in arriving at decisions.

A decision table consists of conditions, rules, a list of possible actions and the resultant decisions. Such routine decisions are the part of daily and professional life. The organizational administrative decision can be best served through such decision tables. It narrows down the choices from general to specific actions.

As a beginning point to understand decision tables, a nice example is guess play. One person thinks of an object and then the other one guesses. The questions are to be asked and the result can be reached at finally. Is the object living? The answer "yes" eliminates all the dead things. Is it human being? The answer "no" narrows the field to anything living other than human beings. Can it fly? The answer "yes" reduces the options to birds only. Can it run? The answer "yes" eliminates all but Ostrich.

Decision tables work on such logic from general to specific by phases and levels of elimination, until the specific choice is arrived at and the decision is made. Decision tables are useful in banks, insurance companies, quality assurance, process and product inspection, selection of ticket alternatives, trouble shooting, traffic offence cases, billing in account departments, short listing of candidates and other situations where the criteria and corresponding actions are predefined.

Definition : A decision table is a tabular representation used to describe and analyze decision situations, where the state of a number of conditions determines the execution of a set of actions. Not just any representation, however, but one in which all distinct situations are shown as columns in a table, such that every possible case is included in one and only one column.

According to the definition, the process of decision making - the selection of a course of actions - is done through a table. The tabular form helps to offer visual representation of the process of decision making.

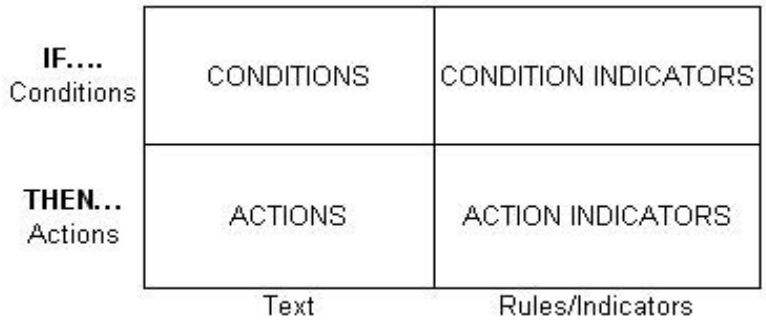
Decision situations are described and analyzed with the help of a table. It ensures clarity, conciseness and completeness necessary for a sound decision making.

The table contains the state of a number of conditions by including all of the possible situations. This helps to ensure that all the possibilities are considered during the decision making process.

Decision tables provide a clear list of all actions executed and provide the description of the sequence for selection of a specific action in respond to a specific situation. The table distinctively represents every possible situation in one single column, ensuring completeness and avoiding contradiction, repetition and redundancy.

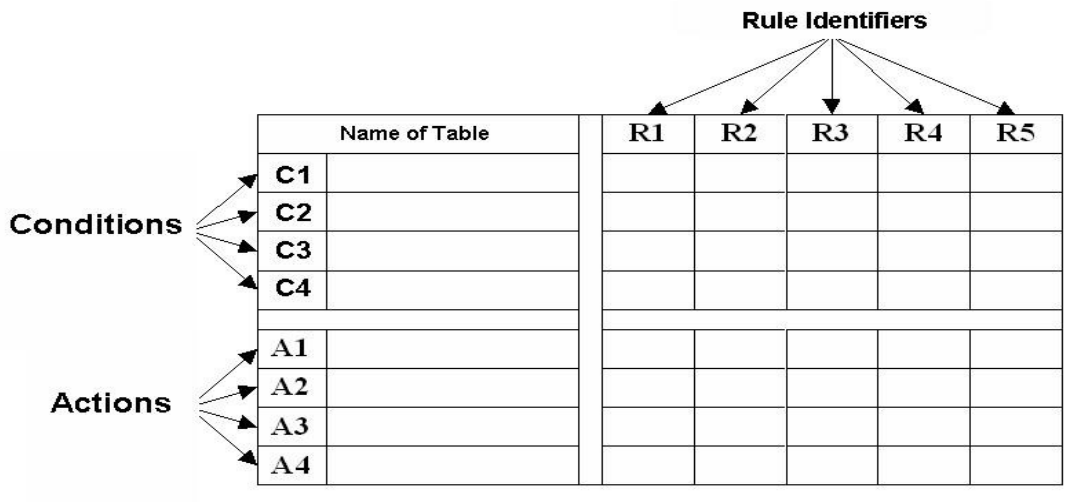
Structure : Decision tables are typically divided into four quadrants. The upper left quadrant is the conditions quadrant. In this part of decision tables all conditions are listed. The lower left quadrant contains the actions. All conditions and actions are listed as text in these two quadrants. All possible states of conditions, in other words the indicators for conditions, are represented in the upper right quadrant of a decision table. The indicators of the actions are shown in the lower right quadrant of a decision table.

Table 7.2 Decision Table



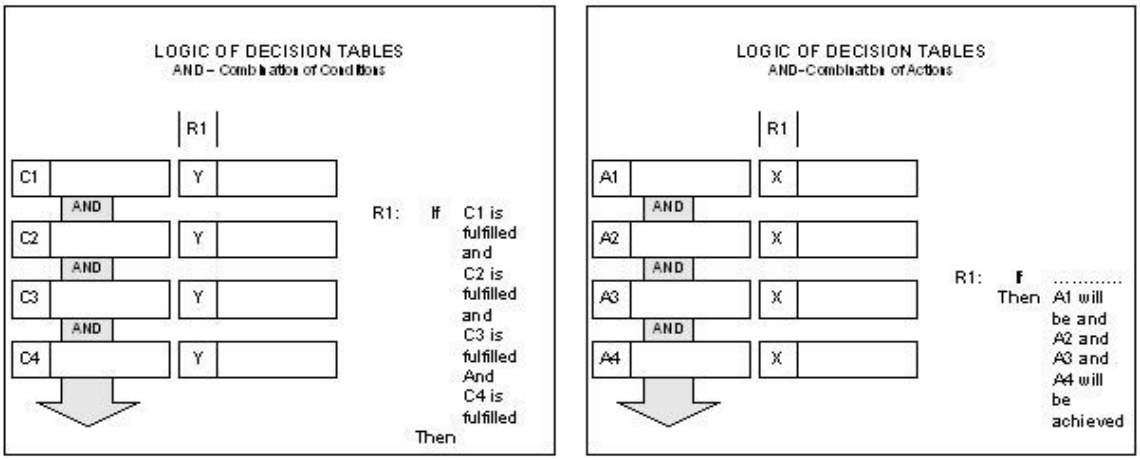
In a nominal limited entry decision table a decision indicator is just a Y(Yes) or N(No) to indicate that the given condition must be fulfilled or not. An indicator of an action is an "X" for those actions to execute and "-" for those actions to drop.

In the right part of a decision table, each column is named by a rule number or rule identifier.



The logic behind decision tables is that if the conditions are indicated Y in the corresponding column, then all of the actions with "X" should be executed.

Table 7.2



Decision tables have to contain complete combinations of conditions. No combination of conditions can be left outside decision tables. The number of rules needed for a complete decision table is "n^1 * n^2 * …..* n^m" where n^i is the number of indicators of condition i and m is the number of conditions.

The encashment procedure of a bank can be taken as a basic example of decision tables. The bank decides on to encash the check or not to encash it. For this decision, the bank has to check

- if the amount in the check is within the credit limits,
- if the check covers the terms of good payment practice and
- if the check fulfils the promise of payment.

The bank encases the check if the amount in the check is within the credit limits or the check covers the terms of good payment practice or the check fulfils the promise of payment. It is not possible to encash the check if the amount in the check is not within the credit limits and the check does not cover the terms of good payment practice and the check does not fulfil the promise of payment.

Check Encashment 1		R1	R2	R3	R4	R5	R6	R7	R8
C1	Stick to Credit limit	Y	Y	Y	Y	N	N	N	N
C2	Good Payment Practice	Y	Y	N	N	Y	Y	N	N
C3	Promise of payment	Y	N	Y	N	Y	N	Y	N
A1	Encash check	X	X	X	X	X	X	X	-
A2	Not encash check	-	-	-	-	-	-	-	X

The table above is the representation of the "Check Encashment" case. In the decision table, the decision criteria are converted to conditions. The possible states of the conditions are "Yes" (Y) and "No" (N). The possible two actions in this case are "Encash the check" or "Not encash the check" as it has been explained in the description of this case. In each column one rule is specified. For example in the first column, named as "R1", it is expressed that "if the amount in the check is within the credit limits and the check covers the terms of good payment practice and the check fulfils the promise of payment, then the check should be encashed". All possible combinations of the condition states are visible in the table in eight (2*2*2) rules each in different columns.

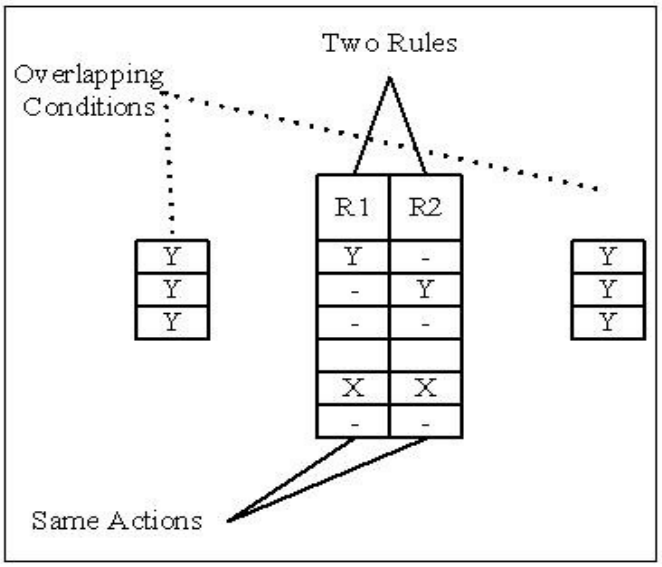
The actions taken in the first seven columns are the same in the table below. The only case in which the check is not encashed is that all three conditions have the state of "N". When the first two columns are compared, in both rules the amount in the check is within the credit limits and the check covers the terms of good payment practice. In other words the states of the first two conditions are "Y" in both of "R1" and "R2". The only difference between these two rules is that in "R1", the check fulfils the promise of payment and in "R2" the check does not fulfil the promise of payment. In other words, the only difference between "R1" and "R2" is the state of the third condition. However, the action to be taken in these two situations is to encash the check. So the state of the third condition does not affect the action to be taken. In this case, it is possible to represent both these rules in one column by using the sign "-"as the state of the third condition in the meaning of "do not care".

Check Encashment 2		R1	R2	R3	R4	R5	R6	R7
C1	Stick to Credit limit	Y	Y	Y	N	N	N	N
C2	Good Payment Practice	Y	N	N	Y	Y	N	N
C3	Promise of payment	-	Y	N	Y	N	Y	N
A1	Encash check	X	X	X	X	X	X	-
A2	Not encash check	-	-	-	-	-	-	X

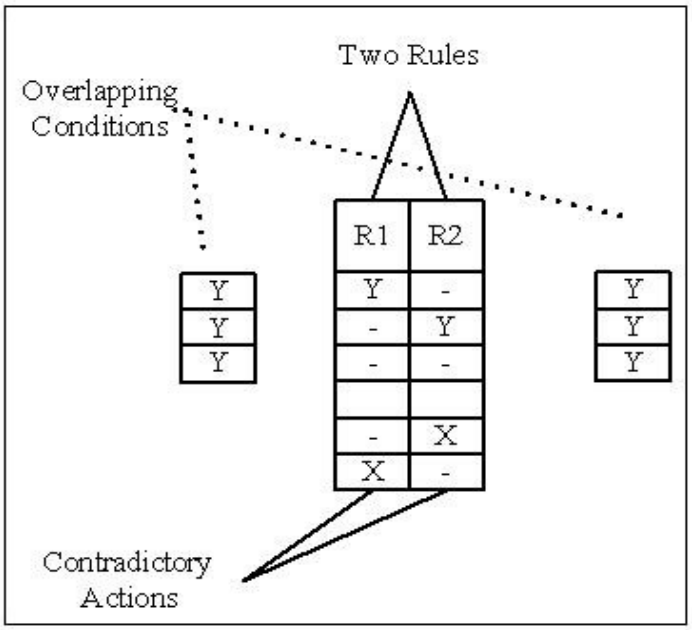
It is possible to simplify this table even more. The action to be taken in the columns "R1", "R2" and "R3" are "Encash check" and the only condition that determines the action is the first condition. As long as the amount in the check is within the credit limits, independent of the other conditions, the check should be encashed. With the same procedure, it is possible to show the same decision case in only four columns as in the table below.

Check Encashment 3		R1	R2	R3	R4
C1	Stick to Credit limit	Y	N	N	N
C2	Good Payment Practice	-	Y	N	N
C3	Promise of payment	-	-	Y	N
A1	Encash check	X	X	X	-
A2	Not encash check	-	-	-	X

It is important that decision tables are free of ambiguities. One of the possibilities that make the decision table ambiguous is explained in the next figure. In this case, the combination of conditions in which the states of all three conditions are "Y" is included in both the first rule (R1) and the second rule (R2). The actions that are specified for both of these rules are the same. The same rule is included in two different columns which makes the decision table ambiguous.



Another possibility is that two different rules can include the same combination of conditions and indicate two different actions which makes the decision table contradictory. In this case, the combination of conditions in which the states of all three conditions are "Y" is included in both the first rule (R1) and the second rule (R2). But the actions specified are different. This causes a contradiction in the decision table.



7.4 TYPES OF DECISION TABLES

Decision tables can be classified into two categories **:**

1. On the basis of the **layout** of the decision tables **:**
   a) Expanded and
   b) Contracted decision tables
2. On the basis of the **expression statements** used for the conditions and actions:
   a) Limited entry,
   b) Extended entry and
   c) Mixed entry tables.

Expanded Decision Tables

In expanded decision tables, all possible combinations of the conditions are shown in different columns. "It is the condition oriented table representation of all single decision columns, used to check whether the table is correct and completely filled out."

In the table below, there are three conditions. Each condition has the states of "Y" and "N". The number of rules needed for a complete decision table in this case is 8 (2*2*2). In each column of the table below, one combination of these two states or indicators is represented and 8 columns are available in total.

Orders		R1	R2	R3	R4	R5	R6	R7	R8
C1	Quantity ordered is smaller than or equal to maximum limit	Y	Y	Y	Y	N	N	N	N
C2	Customer is credit-worthy	Y	Y	N	N	Y	Y	N	N
C3	Inventory is larger than or equal to quantity ordered.	Y	N	Y	N	Y	N	Y	N
A1	Ordered goods are delivered.	X	-	-	-	-	-	-	-
A2	Order is rejected	-	-	X	X	X	X	X	X
A3	Order is deferred	-	X	-	-	-	-	-	-

Contracted Decision Tables :

In some cases, it is possible to contract some combinations of conditions so that columns with the same actions are shown in one column. "It is the compact, condition oriented, table representation of all decision columns."

In the above, "R3" and "R4" have the same actions irrespective of C3 as Y or N. So these rules are brought under R3 for which C3 is "-" in the table below. Similarly, "R5", "R6", "R7" and "R8" have the same action (A2). In other words, as long as the quantity ordered is not smaller or equal to maximum limit, independent of the other conditions' states, the order is rejected. In this case, instead of having one column for each of these combinations "-", these rules are grouped under R4 in the table below.

Orders		R1	R2	R3	R4
C1	Quantity ordered is smaller than or equal to maximum limit	Y	Y	Y	N
C2	Customer is credit-worthy	Y	Y	N	-
C3	Inventory is larger than or equal to quantity ordered.	Y	N	-	-
A1	Ordered goods are delivered.	X	-	-	-
A2	Order is rejected	-	-	X	X
A3	Order is deferred	-	X	-	-

Extended Entry Decision Tables :

In extended entry decision tables, the statements in the stub quadrants are more of open-ended questions. The question does not suggest the answer with limited options, but expects further information from a variety of possible options. The expression of conditions is partly given in the quadrants and the rest is expressed in the entries quadrants in the form of answers.

Selection-of-Motor-Type		R1	R2	R3	R4	R5
C1	Lifting-Capacity	<10	<10	10-20	10-20	>20
C2	Driving-speed	medium	high	medium	high	-
A3	Motor-type	A	B	C	D	E

The statement for C1 in conditions part is only "lifting capacity". This is further extended in the condition indicator part by specific values e.g. <10, 10-20, and >20.

Mixed Entry Decision Tables :

The combinations of limited entry and extended entry rows results in mixed entry table.

Cutting Machines		R1	R2	R3	R4	R5	R6	R7	R8
C1	Turning diameter	D ≤ 200	200 < D ≤ 500	D ≤ 200	200 < D ≤ 500	D ≤ 200	200 < D ≤ 500	D ≤ 200	200 < D ≤ 500
C2	Turning length	L ≤ 1000	L ≤ 1000	1000 < L ≤ 1500	1000 < L ≤ 1500	L ≤ 1000	L ≤ 1000	1000 < L ≤ 1500	1000 < L ≤ 1500
C3	Milling needed	N	N	N	N	Y	Y	Y	Y
A1	Machine 4711	X	-	X	-	-	-	-	-
A2	Machine 4712	-	X	-	X	-	-	-	-
A3	Machine 4713	-	-	-	-	-	-	X	X
A4	Machine 4714	-	-	-	-	X	X	-	-

In this case, C1 and C2 are extended as the expression of the condition is partly stated in the condition stub and the rest is to be described in the entries quadrant. Condition C3 is expressed with the help of limited entries of Y and N. Mixed entry tables represent the flexibility of decision tables. The tables are convertible from one entry type to another and even a combination of both.

7.5 SUMMARY

The diagrammatic representation of the program or process is called flow charts, which, is useful to understand the various stages involved in developing a system. A graphical representation in which symbols are used to represent operations, data, flow, logic, equipment and so on. A program flowchart illustrates the structure and sequence of operations of a program, whereas a system flowchart illustrates the components and flows of information system. Decision tables are used to lay out in tabular form all possible situations which a business decision may encounter and to specify which action to take in each of these situations. In situations, where the decisions are based on conditions and there is a set of defined actions, tables are really helpful in arriving at decisions.

7.6 KEY WORDS

1. Description
2. Decision Tables
3. Mixed Entry
4. Decision Tables

7.7 SELF ASSESSMENT QUESTIONS

1. Illustrate the various symbols used in the flowchart.
2. Define decision table. Explain the various types of decision tables.

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UNIT 8 : TESTING AND MAINTENANCE OF INFORMATION SYSTEMS

STRUCTURE

8.0 OBJECTIVES

After studying this unit, you should be able to:

* Analyse the importance of testing;
* Explain the process and various methods of testing;
* Evaluate the process of testing and the criteria used for testing;
* Discuss the different levels of testing;
* Explain the aspects' relating to when testing should be started and when to end it during the SDLC and
* Discuss the procedures involved in maintenance of information system.

8.1 INTRODUCTION

Testing is the process of evaluating a system or its component(s) with the intent to find that whether it satisfies the specified requirements or not. This activity results in the actual, expected and difference between their results. In simple words testing is executing a system in order to identify any gaps, errors or missing requirements in contrary to the actual desire or requirements.

According to ANSI/IEEE 1059 standard, Testing can be defined as "A process of analyzing a software item to detect the differences between existing and required conditions (that is defects/errors/ bugs) and to evaluate the features of the software item".

In most cases, following professionals are involved in testing of a system within their respective capacities.

- Software Tester
- Software Developer
- Project Lead/Manager
- End User

Different companies have difference designations for people who test the software on the basis of their experience and knowledge such as Software Tester, Software Quality Assurance Engineer, and QA Analyst etc. It is not possible to test the software at any time during its cycle. The next two sections state when testing should be started and when to end it during the SDLC.

i. When to start Testing?

An early start to testing reduces the cost, time to rework and error free software that is delivered to the client. However in Software Development Life Cycle (SDLC) testing can be started from the Requirements Gathering phase and lasts till the deployment of the software. However it also depends

on the development model that is being used. For example in Water fall model formal testing is conducted in the Testing phase, but in incremental model, testing is performed at the end of every increment/iteration and at the end the whole application is tested.

Testing is done in different forms at every phase of SDLC like during Requirement gathering phase, the analysis and verifications of requirements are also considered testing. Reviewing the design in the design phase with intent to improve the design is also considered as testing. Testing performed by a developer on completion of the code is also categorized as Unit type of testing.

ii. When to Stop Testing

Unlike when to start testing it is difficult to determine when to stop testing, as testing is a never ending process and no one can say that any software is 100% tested. Following are the aspects which should be considered to stop the testing:

- Testing Deadlines.
- Completion of test case execution.
- Completion of Functional and code coverage to a certain point.
- Bug rate falls below a certain level and no high priority bugs are identified.
- Management decision.

Difference between Verification & Validation

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Verification	Validation
Are you building it right?	Are you building the right thing?
Ensure that the software system meets all the functionality.	Ensure that functionalities meet the intended behavior.
Verification takes place first and includes the checking for documentation, code etc.	Validation occurs after verification and mainly involves the checking of the overall product.
Done by developers.	Done by Testers.
Have static activities as it includes the reviews, walkthroughs, and inspections to verify that software is correct or not.	Have dynamic activities as it includes executing the software against the requirements.
It is an objective process and no subjective decision should be needed to verify the Software.	It is a subjective process and involves subjective decisions on how well the Software works.

Difference between Testing, Quality Assurance and Quality Control

Most people are confused with the concepts and difference between Quality Assurance, Quality Control and Testing. Although they are interrelated and at some level they can be considered as the same

Mentioned below are the definitions and differences between them:

Quality Assurance	Quality Control	Testing
Activities which ensure the implementation of processes, procedures and standards in context to verification of developed software and intended requirements.	Activities which ensure the verification of developed software with respect to documented (or not in some cases) requirements.	Activities which ensure the identification of bugs/error/defects in the Software.
Focuses on processes and procedures rather then conducting actual testing on the system.	Focuses on actual testing by executing Software with intend to identify bug/defect through implementation of procedures and process.	Focuses on actual testing.
Process oriented activities.	Product oriented activities.	Product oriented activities.
Preventive activities	It is a corrective process.	It is a preventive process
It is a subset of Software Test Life Cycle (STLC)	QC can be considered as the subset of Quality Assurance.	Testing is the subset of Quality Control.

Difference between Testing and Debugging

Testing : It involves the identification of bug/error/defect in the software without correcting it. Normally professionals with a Quality Assurance background are involved in the identification of bugs. Testing is performed in the testing phase.

Debugging : It involves identifying, isolating and fixing the problems/bug. Developers who code the software conduct debugging upon encountering an error in the code. Debugging is the part of White box or Unit Testing. Debugging can be performed in the development phase while conducting Unit Testing or in phases while fixing the reported bugs.

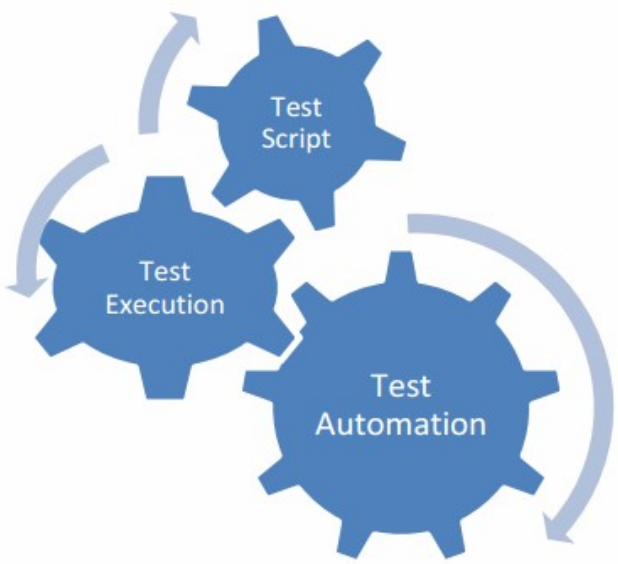
8.2 TESTING TYPES

Manual Testing

This type includes the testing of the Software manually i.e. without using any automated tool or any script. In this type the tester takes over the role of an end user and test the Software to identify any un-expected behaviour or bug. There are different stages for manual testing like unit testing, Integration tests, System tests and User Acceptance testing. Testers use test plan, test cases or test scenarios to test the Software to ensure the completeness of testing. Manual testing also includes exploratory testing as testers explore the software to identify errors in it.

Automation Testing

Automation testing which is also known as "Test Automation" is when the tester writes scripts and



This process involves of a manual process. Automation Testing is used to re-run the test scenarios that were performed manually, quickly and repeatedly. Apart from regression testing, Automation testing is also used to test the application from load, performance and stress point of view. It increases the test coverage; improve accuracy, saves time and money in comparison to manual testing.

What to automate : It is not possible to automate everything in the Software; however the areas at which user can make transactions such as login form or registration forms etc, any area where large amount of users' can access the Software simultaneously should be automated.

Further more all Graphical User Interface items, connections with databases, field validations etc. can be efficiently tested by automating the manual process.

When to Automate : Test Automation should be uses by considering the following for the Software :

- Large and critical projects.
- Projects that require testing the same areas frequently.
- Requirements not changing frequently.
- Accessing the application for load and performance with many virtual users.
- Stable Software with respect to manual testing.
- Availability of time.

How to Automate: Automation is done by using a supportive computer language like VB scripting and an automated software application. There are a lot of tools available which can be used to write automation scripts. Before mentioning the tools lets identify the process which can be used to automate the testing:

- Identifying areas within a software for automation.
- Selection of appropriate tool for Test automation.

- Writing Test scripts.
- Development of Test suits.
- Execution of scripts
- Create result reports.
- Identify any potential bug or performance issue

Following are the tools which can be used for Automation testing:

- HP Quick Test Professional
- Selenium
- IBM Rational Functional Tester
- SilkTest
- Test Complete
- Testing Anywhere
- Win Runner
- Load Runner
- Visual Studio Test Professional
- WATIR

8.3 TESTING METHODS

Black Box Testing : The technique of testing without having any knowledge of the interior workings of the application is Black Box testing. The tester is oblivious to the system architecture and does not have access to the source code. Typically, when performing a black box test, a tester will interact with the system's user interface by providing inputs and examining outputs without knowing how and where the inputs are worked upon.

Advantages :

- Well suited and efficient for large code segments.
- Code Access not required.
- Clearly separates user's perspective from the developer's perspective through visibly defined roles.
- Large numbers of moderately skilled testers can test the application with no
- Knowledge of implementation, programming language or operating systems.

Disadvantages:

- Limited Coverage since only a selected number of test scenarios are actually performed.
- Inefficient testing, due to the fact that the tester only has limited knowledge about an application.
- Blind Coverage, since the tester cannot target specific code segments or error prone areas.
- The test cases are difficult to design.

White Box Testing

White box testing is the detailed investigation of internal logic and structure of the code. White box testing is also called glass testing or open box testing. In order to perform white box testing on an application, the tester needs to possess knowledge of the internal working of the code. The tester needs to have a look inside the source code and find out which unit/chunk of the code is behaving inappropriately.

Advantages:

As the tester has knowledge of the source code, it becomes very easy to find out which type of data can help in testing the application effectively.

- It helps in optimizing the code.
- Extra lines of code can be removed which can bring in hidden defects.
- Due to the tester's knowledge about the code, maximum coverage is attained during test scenario writing.

Disadvantages:

- Due to the fact that a skilled tester is needed to perform white box testing, the costs are increased.
- Sometimes it is impossible to look into every nook and corner to find out hidden errors that may create problems as many paths will go untested.
- It is difficult to maintain white box testing as the use of specialized tools like code analyzers and debugging tools are required.

Grey Box Testing

Grey Box testing is a technique to test the application with limited knowledge of the internal workings of an application. In software testing, the term "the more you know the better" carries a lot of weight when testing an application.

Mastering the domain of a system always gives the tester an edge over someone with limited domain knowledge. Unlike black box testing, where the tester only tests the application's user interface, in grey box testing, the tester has access to design documents and the database. Having this knowledge, the tester is able to better prepare test data and test scenarios when making the test plan.

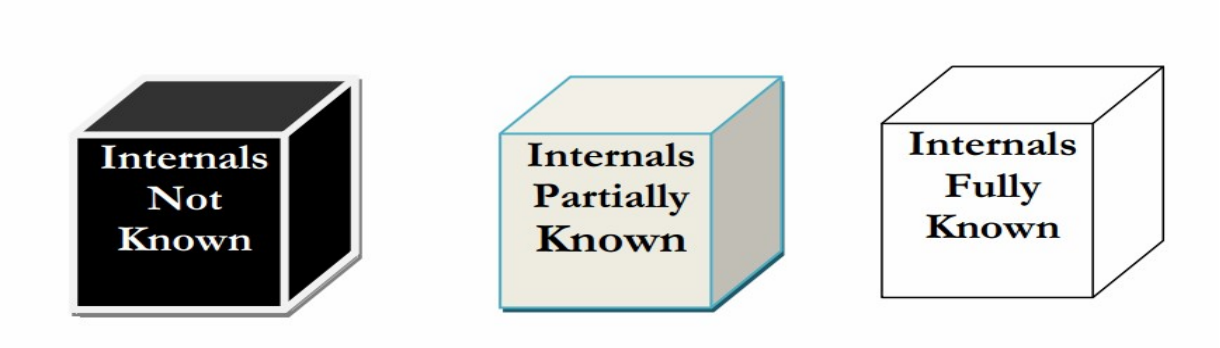
Advantages:

- Offers combined benefits of black box and white box testing wherever possible.
- Grey box testers don't rely on the source code; instead they rely on interface definition and functional specifications.
- Based on the limited information available, a grey box tester can design excellent test scenarios especially around communication protocols and data type handling.
- The test is done from the point of view of the user and not the designer.

Disadvantages:

- Since the access to source code is not available, the ability to go over the code and test coverage is limited.
- The tests can be redundant if the software designer has already run a test case.
- Testing every possible input stream is unrealistic because it would take an unreasonable amount of time; therefore, many program paths will go untested.

Visual Difference between the Three Testing Methods



Comparison between the Three Testing Types

	Black Box Testing	Grey Box Testing	White Box Testing
1.	The Internal Workings of an application are not required to be known	Somewhat knowledge of the internal workings are known	Tester has full knowledge of the Internal workings of the application
2.	Also known as closed box testing, data driven testing and functional testing	Another term for grey box testing is translucent testing as the tester has limited knowledge of the insides of the application	Also known as clear box testing, structural testing or code based testing
3.	Performed by end users and also by testers and developers	Performed by end users and also by testers and developers	Normally done by testers and developers
4.	-Testing is based on external expectations -Internal behavior of the application is unknown	Testing is done on the basis of high level database diagrams and data flow diagrams	Internal workings are fully known and the tester can design test data accordingly
5.	This is the least time consuming and exhaustive	Partly time consuming and exhaustive	The most exhaustive and time consuming type of testing
6.	Not suited to algorithm testing	Not suited to algorithm testing	Suited for algorithm testing
7.	This can only be done by trial and error method	Data domains and Internal boundaries can be tested, if known	Data domains and Internal boundaries can be better tested

8.4 LEVELS OF TESTING : FUNCTIONAL AND NON FUNCTIONAL TESTING

Levels of testing include the different methodologies that can be used while conducting Software Testing. Following are the main levels of Software Testing:

* Functional Testing.
* Non- functional Testing.

* **Functional Testing :** This is a type of black box testing that is based on the specifications of the software that is to be tested. The application is tested by providing input and then the results are examined that need to conform to the functionality it was intended for. Functional Testing of the software is conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. There are five steps that are involved when testing an application for functionality.
  - Step I - The determination of the functionality that the intended application is meant to perform.
  - Step II - The creation of test data based on the specifications of the application.
  - Step III - The output based on the test data and the specifications of the application.
  - Step IV - The writing of Test Scenarios and the execution of test cases.
  - Steps V - The comparison of actual and expected results based on the executed test cases.

An effective testing practice will see the above steps applied to the testing policies of every organization and hence it will make sure that the organization maintains the strictest of standards when it comes to software quality.

Unit Testing

This type of testing is performed by the developers before the setup is handed over to the testing team to formally execute the test cases. Unit testing is performed by the respective developers on the individual units of source code assigned areas. The developers use test data that is separate from the test data of the quality assurance team.

The goal of unit testing is to isolate each part of the program and show that individual parts are correct in terms of requirements and functionality.

Integration Testing

The testing of combined parts of an application to determine if they function correctly together is Integration testing. There are two methods of doing Integration Testing Bottom-up Integration testing and Top down Integration testing.

- Bottom-up integration testing begins with unit testing, followed by tests of progressively higher-level combinations of units called modules or builds.

- Top-Down integration testing, the highest-level modules are tested first and progressively lower-level modules are tested after that. In a comprehensive software development environment, bottom-up testing is usually done first, followed by top-down testing.

System Testing

This is the next level in the testing and tests the system as a whole. Once all the

Components are integrated, the application as a whole is tested rigorously to see that it meets Quality Standards. This type of testing is performed by a specialized testing team.

Why is System Testing so Important?

- System Testing is the first step in the Software Development Life Cycle, where the application is tested as a whole.
- The application is tested thoroughly to verify that it meets the functional and technical specifications.
- The application is tested in an environment which is very close to the production environment where the application will be deployed.
- System Testing enables us to test, verify and validate both the business requirements as well as the Applications Architecture.

Regression Testing

Whenever a change in a software application is made it is quite possible that other areas within the application have been affected by this change. To verify that a fixed bug hasn't resulted in another functionality or business rule violation is Regression testing. The intent of Regression testing is to ensure that a change, such as a bug fix did not result in another fault being uncovered in the application.

Why is System Testing so Important?

- Minimize the gaps in testing when an application with changes made has to be tested.
- Testing the new changes to verify that the change made did not affect any other area of the application.
- Mitigates Risks when regression testing is performed on the application.
- Test coverage is increased without compromising timelines.
- Increase speed to market the product.

Acceptance Testing

This is arguably the most importance type of testing as it is conducted by the Quality Assurance Team who will gauge whether the application meets the intended specifications and satisfies the client's requirements. The QA team will have a set of pre written scenarios and Test Cases that will be used to

test the application.

More ideas will be shared about the application and more tests can be performed on it to gauge its accuracy and the reasons why the project was initiated. Acceptance tests are not only intended to point out simple spelling mistakes, cosmetic errors or Interface gaps, but also to point out any bugs in the application that will result in system crashers or major errors in the application.

By performing acceptance tests on an application the testing team will deduce how the application will perform in production. There are also legal and contractual requirements for acceptance of the system.

Alpha Testing

This test is the first stage of testing and will be performed amongst the teams (developer and QA teams). Unit testing, integration testing and system testing when combined are known as alpha testing. During this phase, the following will be tested in the application **:**

- Spelling Mistakes
- Broken Links
- Cloudy Directions
- The Application will be tested on machines with the lowest specification to test loading times and any latency problems.

Beta Testing

This test is performed after Alpha testing has been successfully performed. In beta testing a sample of the intended audience tests the application. Beta testing is also known as pre-release testing. Beta test versions of software are ideally distributed to a wide audience on the Web, partly to give the program a **"real-world"** test and partly to provide a preview of the next release. In this phase the audience will be testing the following **:**

- Users will install, run the application and send their feedback to the project team.
- Typographical errors, confusing application flow, and even crashes.
- Getting the feedback, the project team can fix the problems before releasing the software to the actual users.
- The more issues you fix that solve real user problems, the higher the quality of your application will be.
- Having a higher-quality application when you release to the general public will increase customer satisfaction.

Non functional Testing

This section is based upon the testing of the application from its non-functional attributes. Non-

functional testing of Software involves testing the Software from the requirements which are non-functional in nature related but important a well such as performance, security, and user interface etc. Some of the important and commonly used non-functional testing types are mentioned as follows.

Performance Testing

It is mostly used to identify any bottlenecks or performance issues rather than finding the bugs in software. There are different causes which contribute in lowering the performance of software:

- Network delay.
- Client side processing.
- Database transaction processing.
- Load balancing between servers.
- Data rendering.

Performance testing is considered as one of the important and mandatory testing type in terms of following aspects :

- Speed (i.e. Response Time, data rendering and accessing)
- Capacity
- Stability
- Scalability It can be either qualitative or quantitative testing activity and can be divided into different sub types such as Load testing and Stress testing.

Load Testing

A process of testing the behaviour of the Software by applying maximum load in terms of Software accessing and manipulating large input data. It can be done at both normal and peak load conditions. This type of testing identifies the maximum capacity of Software and its behaviour at peak time.

Most of the time, Load testing is performed with the help of automated tools such as Load Runner, AppLoader, IBM Rational Performance Tester, Apache JMeter, Silk Performer, Visual Studio Load Test etc.

Stress Testing

This testing type includes the testing of Software behavior under abnormal conditions. Taking away the resources, applying load beyond the actual load limit is Stress testing. The main intent is to test the Software by applying the load to the system and taking over the resources used by the Software to identify the breaking point. This testing can be performed by testing different scenarios such as:

- Shutdown or restart of Network ports randomly.
- Turning the database on or off.

- Running different processes that consume resources such as CPU, Memory, server etc.

Usability Testing

This section includes different concepts and definitions of Usability testing from Software point of view. It is a black box technique and is used to identify any error(s) and improvements in the Software by observing the users through their usage and operation.

Security Testing

Security testing involves the testing of Software in order to identify any flaws ad gaps from security and vulnerability point of view. Following are the main aspects which

Security testing should ensure :

- Confidentiality.
- Integrity.
- Authentication.
- Availability.
- Authorization.
- Non-repudiation.
- Software is secure against known and unknown vulnerabilities.
- Software data is secure.
- Software is according to all security regulations.
- Input checking and validation.
- SQL insertion attacks.
- Injection flaws.
- Session management issues.
- Cross-site scripting attacks.
- Buffer overflows vulnerabilities.
- Directory traversal attacks.

Portability Testing

Portability testing can be considered as one of the sub parts of System testing, as this testing type includes the overall testing of Software with respect to its usage over different environments. Computer Hardware, Operating Systems and Browsers are the major focus of Portability testing. Following are some pre-conditions for Portability testing:

Software should be designed and coded, keeping in mind Portability Requirements.

- Unit testing has been performed on the associated components.
- Integration testing has been performed.

- Test environment has been established

8.5 TESTING DOCUMENTATION

Testing documentation involves the documentation of artefacts which should be developed before or during the testing of Software. Documentation for Software testing helps in estimating the testing effort required, test coverage, requirement tracking/tracing etc. This section includes the description of some commonly used documented artefacts related to Software testing such as **:**

- Test Plan
- Test Scenario
- Test Case
- Traceability Matrix

Test Plan :

A test plan outlines the strategy that will be used to test an application, the resources that will be used, and the test environment in which testing will be performed, the limitations of the testing and the schedule of testing activities. Typically the Quality Assurance Team Lead will be responsible for writing a Test Plan. A test plan will include the following.

- Introduction to the Test Plan document
- Assumptions when testing the application
- List of test cases included in testing the application
- List of features to be tested
- What sort of Approach to use when testing the software
- List of Deliverables that need to be tested
- The resources allocated for testing the application
- Any Risks involved during the testing process
- A Schedule of tasks and milestones as testing is started

Test Scenario

A one line statement that tells what area in the application will be tested. Test Scenarios are used to ensure that all process flows are tested from end to end. A particular area of an application can have as little as one test scenario to a few hundred scenarios depending on the magnitude and complexity of the application. The term test scenario and test cases are used interchangeably however the main difference being that test scenarios has several steps however test cases have a single step. When viewed from this perspective test scenarios are test cases, but they include several test cases and the sequence that they

should be executed. Apart from this, each test is dependent on the output from the previous test.

Test Case

Test cases involve the set of steps, conditions and inputs which can be used while performing the testing tasks. The main intent of this activity is to ensure whether the Software Passes or Fails in terms of its functionality and other aspects. There are many types of test cases like: functional, negative, error, Logical test cases, physical test cases, UI test cases etc. Furthermore test cases are written to keep track of testing coverage of Software. Generally, there is no formal template which is used during the test case writing, however following are the main components which are always available and included in every test case：

- Test case ID.
- Product Module
- Product version
- Revision history
- Purpose
- Assumptions
- Pre-Conditions.
- Steps.
- Expected Outcome.
- Actual Outcome.
- Post Conditions

Many Test cases can be derived from a single test scenario. In addition to this, some time it happened that multiple test cases are written for single Software which is collectively known as test suites.

Traceability Matrix ：

Traceability Matrix (also known as Requirement Traceability Matrix - RTM) is a table which is used to trace the requirements during the Software development life Cycle. It can be used for forward tracing (i.e. from Requirements to Design or Coding) or backward (i.e. from Coding to Requirements). There are many user defined templates for RTM.

Each requirement in the RTM document is linked with its associated test case, so that testing can be done as per the mentioned requirements. Furthermore, Bug ID is also include and linked with its associated requirements and test case. The main goals for this matrix are:

- Make sure Software is developed as per the mentioned requirements.
- Helps in finding the root cause of any bug.

- Helps in tracing the developed documents during different phases of SDLC.

8.6 ESTIMATION TECHNIQUES

Estimating effort for test is one of the major and important tasks in SDLC. Correct estimation helps in testing the Software with maximum coverage. This section describes some of the techniques which can be useful during the estimating of effort for testing.

Some of them are :

- Delphi Technique
- Analogy Based Estimation
- Test Case Enumeration Based Estimation
- Task (Activity) based Estimation
- IFPUG method
- MK-II method

Functional Point Analysis : This method is based on the analysis of functional user requirements of the Software with following categories:

- Outputs
- Inquiries
- Inputs
- Internal files
- External files

Test Point Analysis : It is estimation process used for function point analysis for Black box or Acceptance testing. It is use the main elements of this method are: Size, Productivity, Strategy, Interfacing, Complexity and Uniformity etc.

Mark-II method : It is estimation method used for analysis and measuring the estimation based on end user functional view. The procedure for Mark-II method is:

- Determine the View Point
- Purpose and Type of Count
- Define the Boundary of Count
- Identify the Logical transactions
- Identify and Categorize Data Entity Types
- Count the Input Data Element Types

- Count the Functional Size

8.7 MAINTENANCE OF TECHNIQUES

After the systems implementation phase, the maintenance phase takes over. Systems maintenance is the on-going maintenance of a system after it has been placed into operation.

When developing information strategy plans, organizations cannot afford to neglect the fact that systems maintenance is the longest and costliest phase of the systems life cycle. The implications of the maintenance workload upon the information strategy plans for an organization are a subject that deserves special attention. The organization structure needs flexibility to support the maintenance of existing systems concurrently with the implementation of new technologies.

It is important to consider the evaluation and monitoring of a system for needed maintenance and consequently, to lower or contain maintenance costs. Systems maintenance can be categorized into four groups. Each of these four categories can affect an organization's information strategy plan in different ways:

Corrective Maintenance : Regardless of how well designed, developed, and tested a system or application may be, errors will inevitably occur. This type of maintenance deals with fixing or correcting problems with the system. This usually refers to problems that were not identified during the implementation phase. An example of remedial maintenance is the lack of a user-required feature or the improper functionality of it.

Customized Maintenance : This type of maintenance refers to the creation of new features or adapting existing ones as required by changes in the organization or by the users, e.g., changes on the organization's tax code or internal regulations.

Enhancement Maintenance : It deals with enhancing or improving the performance of the system either by adding new features or by changing existing ones. An example of this type of maintenance is the conversion of text-based systems to GUI (Graphical User Interface).

Preventive Maintenance : This type of maintenance may be one of the most cost effective, since if performed timely and properly, it can avoid major problems with the system. An example of this maintenance is the correction for the year 2000.

8.8 SUMMARY

Testing is the process of evaluating a system or its component(s) with the intent to find that whether it satisfies the specified requirements or not. This activity results in the actual, expected and difference between their results. In simple words testing is executing a system in order to identify any gaps, errors or missing requirements in contrary to the actual desire or requirements. After the systems implementa-

tion phase, the maintenance phase takes over. Systems maintenance is the on-going maintenance of a system after it has been placed into operation. When developing information strategy plans, organizations cannot afford to neglect the fact that systems maintenance is the longest and costliest phase of the systems life cycle

8.9 KEY WORDS

1. Testing Types
2. Debugging
3. Automate
4. Selenium
5. Protability Testing
6. Traceability Matrix

8.10 SELF ASSESSMENT QUESTIONS

1. What are the various types of testing in system development?
2. Why testing stage is very crucial in systems development?
3. Why maintanenance is required in systems development?

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UNIT -9: INTRODUCTION TO DATABASE DEVELOPMENT

STRUCTURE

9.0 OBJECTIVES

After studying this unit, you should be able to:

* Explain the Concept of Information System;
* Design an information system, the various methods of developing the information system;
* Analyse the life cycle of a system and
* Develop the database of a typical system for a typical application.

9.1 INTRODUCTION

Information systems are crucial to the success of modern business organizations, and new systems are constantly being evolved and developed to make businesses more competitive. The key to a successful system development is through systems analysis and design to understand what the business requires from the information system. System analysis and design is used to analyze, design and implement improvements in the functioning of businesses that can be accomplished through the use of computerized information systems.

9.2 DESIGN OF INFORMATION SYSTEM

Designing aspect needs to be looked into very carefully and understood properly before one starts developing a system. There are various methods that are available.

9.2.1 Local Design

The logical design of a system pertains to an abstract representation of the data flows, inputs and outputs of the system. This is often conducted via modelling, which involves a simplistic (and sometimes graphical) representation of an actual system. In the context of systems design, modelling can undertake the following forms, including:

- Data Flow Diagrams (DFD)
- Entity Life Histories (EFH)
- Entity Relationship (ER) diagrams

9.2.2 Physical Design:

The physical design relates to the actual input and output processes of the system. This is laid down in terms of how data is inputted into a system, how it is verified/authenticated, how it is processed, and how it is displayed as output.

Physical design, in this context, does not refer to the tangible physical design of an information system. To use an analogy, a personal computer's physical design involves input via a keyboard, processing within the CPU, and output via a monitor, printer, etc. It would not concern the actual layout of the

tangible hardware, which for a PC would be a monitor, CPU, motherboard, hard drive, modems, video/ graphics cards, USB slots, etc

9.2.3 Alternative Design Method :

Apart from the logical and physical designing methodologies, various other methods are also available in designing a system development.

9.2.2.1 Rapid Application Development (RAD) :

Rapid Application Development (RAD) is a methodology in which a systems' designer produces prototypes for an end-user. The end-user reviews the prototype, and offers feedback on its suitability. This process is repeated until the end-user is satisfied with the final system.

9.2.2.2 Joint Application Development (JAD) :

JAD is a methodology which has been evolved from RAD, in which a systems designer consults with a group consisting of the following parties before the designer develops the actual system. They are;

- Executive sponsor
- Systems Designer
- Managers of the system

Each of them play a vital role in the overall development of a robust system which looks into all the aspects which is required.

9.2.3 Embedded System

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs.

Characteristics :

a. Embedded systems are designed to do some specific task, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs.

b. Embedded systems are not always standalone devices. Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. For example, the Gibson Robo Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile

provides a specific function as a subsystem of the car itself.

c. The program instructions written for embedded systems are referred to as firmware, and are stored in read-only memory or Flash memory chips. They run with limited computer hardware resources: little memory, small or non-existent keyboard and/or screen.

9.2.4 Design Phase Activities

The Systems Development Life Cycle (SDLC), or Software Development Life Cycle in systems engineering, information systems and software engineering, is the process of creating or altering systems, and the models and methodologies that people use to develop these systems. The concept generally refers to computer or information systems.

Work breakdown structure organization: The upper section of the Work Breakdown Structure (WBS) should identify the major phases and milestones of the project in a summary fashion. In addition, the upper section should provide an overview of the full scope and timeline of the project and will be part of the initial project description effort leading to project approval.

9.3 DEVELOPMENT OF INFORMATION SYSTEM

The Information Systems Development is designed to provide a consistent, repeatable process for developing systems. By referencing, utilizing and applying the techniques within this methodology, development teams have a standard framework necessary to efficiently and effectively scope a project, conduct analysis, define and design the solution, create the system modules and evaluate the system after its implementation. The three distinct approaches to the development of information systems **:**

(a) Systems Development Life Cycle Method

(b) Structured Analysis Development Method

(c) Systems Prototype Method

9.4 SYSTEMS DEVELOPMENT LIFE CYCLE

System Development Life Cycle (SDLC) method is classically the set of activities that analysts, designers and users carry out to develop and implement an information system. SDLC method consists of the following activities:

a) Preliminary Investigation : When a request is made, the first systems activity, the preliminary investigation begins. This activity has three parts **:**

- Request Clarification
- Feasibility Study(Technical, Economic, Operation)
- Request Approval

b) **Determination of System Requirements :** Analysts working closely with employees and managers must study the business process to answer these key questions:

- What is being done?
- How is it being done?
- How well is the task being performed?

c) **Design of System :** Design of an information system produces the details that state how a system will meet the requirements identified during system analysis. System analysts begin the design process by identifying reports and other outputs the system will produce. The specific data on each are pinpointed. Designers sketch the form or display on paper or on computer display. System design describes the data to be input, calculated, or stored. Individual data items and calculation procedures are written in detail. Procedures tell how to process the data and produce the output. The documents containing the design specifications portray the design in many different ways-charts, tables and special symbols. Designers are responsible for providing programmers with complete and clearly outlined software specifications

d) **Development of Software :** Software developers may install purchased software or they may write new, custom-designed programs. Choice depends on the cost of each option, the time available to write software and the availability of programmers. Programmers are also responsible for documenting the program, providing an explanation of how and why certain procedures are coded in specific ways. Documentation is essential to test the program and carry on maintenance once the application has been installed.

e) **Systems Testing :** During system testing, the system is used experimentally to ensure that the software does not fail i.e. that it will run according to its specifications and in the way users expect. Special test data are input for processing and the results examined.In many organizations, testing is performed by persons other than those who wrote the original programs to ensure more complete and unbiased testing and more reliable software.

f) **Implementation and Evaluation :** Implementation is the process of having systems personnel check out and put new equipment into use, train users, install the new application and construct any files of data needed to use it. Evaluation of the system is performed to identify its strengths and weaknesses. Actual evaluation can occur along any of the following dimensions:

- Operational Evaluation (Ease of use, response time, reliability)
- Organizational Impact (Benefit to organization)
- User Manager Assessment (Evaluation)
- Development Performance

9.4.1 Structured Analysis Development Method

Structured Analysis Development Method is aimed to overcome the difficulty of understanding large, complex systems through:

- Partitioning the system into components
- Constructing a model of the system

Structured Analysis focuses on specifying what the system or application is required to do. It does not state how the requirements should be accomplished or how the application should be implemented. Elements of Structured Analysis include: Graphic Symbols, Data Flow Diagrams, and Centralized Data Dictionary. Structured Design, another element of structured analysis that utilizes graphic description focuses on the development of software specifications. Goal of Structured Design is to create programs consisting of functionally independent modules that perform relatively independently of one another. The fundamental tool of structured design is the structure chart. Structure chart describes the interaction between independent modules and the data passing between modules that interact with one another.

9.4.2 Systems Prototype Method

This method involves the user more directly in the analysis and design. Prototyped is a working system that is developed to test ideas and assumptions about the new system. Like any computer-based system, it consists of working software that accepts input, performs calculations, produces printed or displayed information or performs other meaningful activities. System analysts find prototypes to be more useful under following conditions:

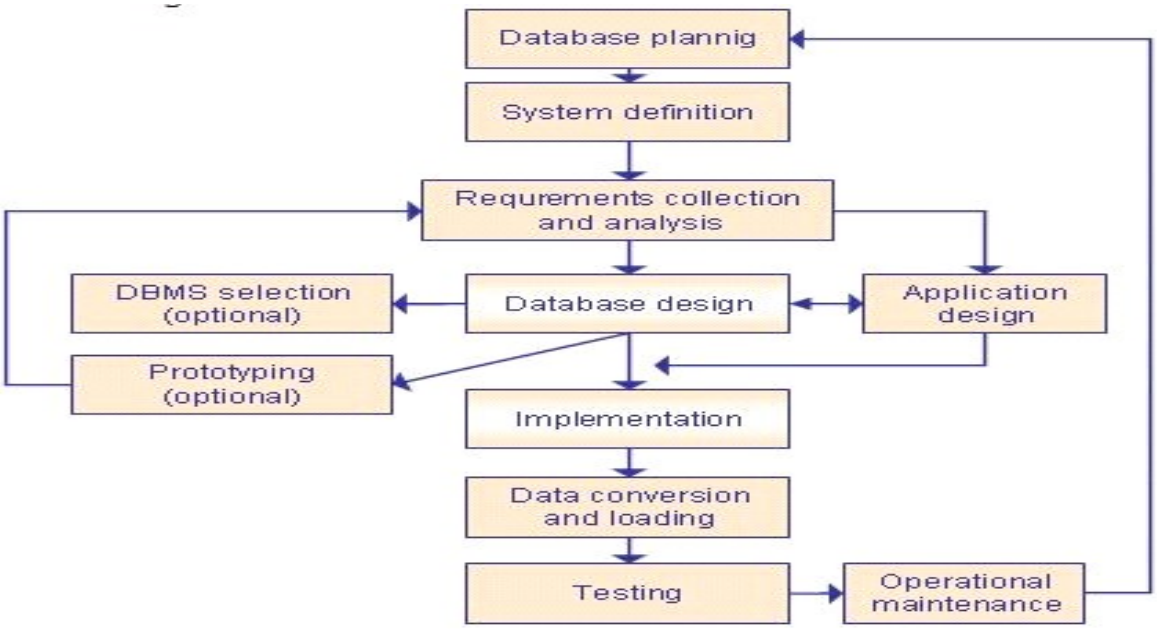
- No system with the characteristics of the one proposed has yet been constructed by the developers.
- The essential features of the system are only partially known; others are not identifiable even through careful analysis of requirements.
- Experience in using the system will significantly add to the list of requirements the system should meet.
- Alternate versions of the system will evolve through experience and additional development and refinement of its features.
- The system users will participate in the development process.

9.5 DESIGN AND DEVELOPMENT OF DATABASE

Databases store and keep track of information in a structured manner with each individual piece of information stored as a record. They allow large quantities of information to be more easily searched, compared, retrieved or manipulated. Databases are essential for multi-user applications to enterprise-wide systems, where coordinating between many users is required. Designing a database is the process of identifying information needing to be stored by an application, determining a logical data structure and

creating an information storage plan. Database design can help evaluate existing databases and create new relational databases to manage important business data.

A database is usually a fundamental component of the information system, especially in business oriented systems. Thus database design is part of system development. The following picture shows how database design is involved in the system development lifecycle.



The various stages in the designing principles

9.5.1 Database Planning

The database planning includes the activities that allow the stages of the database system development lifecycle to be realized as efficiently and effectively as possible. This phase must be integrated with the overall Information System strategy of the organization. The very first step in database planning is to define the mission statement and objectives for the database system. They are:

- The major aims of the database system
- The purpose of the database system
- The supported tasks of the database system
- The resources of the database system

9.5.2 Systems Definition

In the systems definition phase, the scope and boundaries of the database application are described. This includes the links with the other information systems of the organization. What the planned system is

going to do now and in the future who the users are now and in the future. The major user views are also described, i.e., what is required of a database system from the perspectives of particular job roles or enterprise application areas.

9.5.3 Requirements Collection and Analysis

During the requirements collection and analysis phase, the collection and analysis of the information about the part of the enterprise to be served by the database are completed. E.g.

- The description of the data used or generated
- The details how the data is to be used or generated
- Any additional requirements for the new database system

9.5.4 Database Design

The database design phase is divided into three steps **:**

1. Conceptual database design
2. Logical database design
3. Physical database design

1. **Conceptual database design :** In the conceptual database design phase, the model of the data to be used independent of all physical considerations is to be constructed. The model is based on the requirements specification of the system.
2. **Logical database design :** In the logical database design phase, the model of the data to be used is based on a specific data model, but independent of a particular database management system is constructed. This is based on the target data model for the database e.g. relational data model.
3. **Physical database design :** In the physical database design phase, the description of the implementation of the database on secondary storage is created. The base relations, indexes, integrity constraints, security, etc. are defined using the SQL language.

9.5.5 Database Management System Selection

This is an optional phase. When there is a need for a new database management system (DBMS), this phase is done. DBMS means a database system like Access, SQL Server, MySQL, and Oracle. In this phase the criteria for the new DBMS are defined. Then several products are evaluated according to the criteria. Finally the recommendation for the selection is decided.

9.5.6 Application Design and Prototyping

In the application design phase, the design of the user interface and the application programs that use and process the database are defined and designed.

The purpose of a prototype is to allow the users to use the prototype to identify the features of the system using the computer. There are horizontal and vertical prototypes. A horizontal prototype has many features (e.g. user interfaces) but they are not working. A vertical prototype has very few features but they are working.

9.5.7 Implementation

During the implementation phase, the physical realization of the database and application designs is to be done. This is the programming phase of the systems development. One can use a particular platform for the development of the required system.

9.5.8 Data Conversion and Loading

This phase is needed when a new database is replacing an old system. During this phase the existing data will be transferred into the new database.

9.5.9 Testing and Operational Maintenance

Before the new system is going to live, it should be thoroughly tested. The goal of testing is to find errors. The goal is not to prove the software is working well.

The operational maintenance is the process of monitoring and maintaining the database system. Monitoring means that the performance of the system is observed. If the performance of the system falls below an acceptable level, tuning or reorganization of the database may be required. Maintaining and upgrading the database system means that, when new requirements arise, the new development lifecycle will be done.

9.6 SUMMARY

As a whole, we have learned about the designing principles of a system of our choice and also the various approaches used in the designing process. Also the different models of a system is looked into during the process. The importance of a database and its designing aspects also play a vital role in the designing process.

9.7 KEYWORDS

System, Design, Development of a system, Database, Models, SDLC, Prototype

9.8 SELF ASSESSMENT QUESTIONS

1. What is a system?
2. What are the steps involved in the design of a system?
3. Discuss the various methods of developing a designed system.

4. Explain SDLC method.
5. How does a prototype method work?
6. What is a database?
7. How does one develop and design a database?
8. What is the importance of testing in the design and development of a system?
9. How are the systems maintained?

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UNIT 10: INPUT AND OUTPUT DESIGN

STRUCTURE

10.0 OBJECTIVES

After studying this unit, you should be able to:

* Design an input to a system;
* Design an output to a system;
* Explain the design the user's interface with the system and
* Describe the design the front end and back end softwares for the system.

10.1 INTRODUCTION

Inputs and outputs to and from a system are very important in the designing of a system as the system development depends on the input for the required output. Hence, in this unit, we will look into how a system designer takes care of all the aspects of designing the input in such a way that the system works for the desired output. Also, in a system, which softwares should be made as front end softwares and which should work as back end softwares and also the importance and advantages of developing front end and back end softwares.

10.2 OUTPUT DESIGN

Output is the most important task of any system. These guidelines apply for the most part to both paper and screen outputs. Output design is often discussed before other feature of design because, from the customer's point of view, the output is the system. Output is what the customer is buying when he or she pay for a development of project. Inputs, databases, and processes are present to provide output. Problems often associated with business information output are information hold-up, information (data) overload, paper domination, extreme distribution, and no tailoring.

For example: Mainframe printers: high volume, high speed, located in the data center Remote site printers: medium speed, close to end user.

COM is Computer Output Microfilm. It is more compressed than traditional output and may be produced as fast as non-impact printer output.

Turnaround documents trim down the cost of internal information processing by reducing both data entry and associated errors. Periodic reports have set frequencies such as daily or weekly; ad hoc reports are produced at irregular intervals. Detail and summary reports differ in the former support day-to-day operation of the business while the latter include statistics and ratios used by managers to consider the health of operations.

Page breaks and control breaks allow for abstract totals on key fields. Report requirements documents include general report information and field specifications; print layout sheets present a picture of what the report will actually look like. Page decoupling is the separation of pages into cohesive groups.

Two ways to create output for strategic purposes are :

I. Make it compatible with processes outside the immediate scope of the system

II. Turn action documents into turnaround documents.

People often receive reports they do not require because the number of reports received is perceived as a measure of power. Fields on a report should be selected carefully to provide organized reports, facilitate 80-column remote printing, and reduce information (data) overload.

The types of fields which should be considered for business output are: key fields for access to information, fields for control breaks, fields that change, and exception fields.

Output may be designed to aid future change by stressing formless reports, defining field size for future growth, making field constants into variables, and leaving room on review reports for added ratios and statistics.

Output can now be more easily tailored to the needs of individual users because inquiry-based systems allow users themselves to generate ad hoc reports. An output intermediary can restrict access to key information and avoid illegal access. An information clearinghouse (or information center) is a service center that provides consultation, assistance, and documentation to encourage end-user development and use of applications. The specifications essential to describe the output of a system are: data flow diagrams, data flow specifications, data structure specifications, and data element specifications.

- Output Documents
- Printed Reports
- External Reports: for use or distribution outside the organization; often on pre-printed forms.
- Internal Reports: for use within the organization; not as "pretty", stock paper, greenbar, etc.
- Periodic Reports: produced with a set frequency (daily, weekly, monthly, every fifth Tuesday, etc.)
- Ad-Hoc (On Demand) Reports: unbalanced interval; produced upon user demand.
- Detail Reports: one line per transaction. Review Reports: an overview.
- Exception Reports: only shows errors, problems, out-of- range values, or unexpected conditions or events.

10.3 INPUT DESIGN

A source document differs from a turnaround document in that the former holds data that revolutionize the status of a resource while the latter is a machine readable document. Transaction throughput is the number of error-free transactions entered during a specified time period. A document should be concise because longer documents contain more data and so take longer to enter and have a greater chance of data entry errors.

Numeric coding substitutes numbers for character data (e.g., 1=male, 2=female); mnemonic coding represents data in a form that is easier for the user to understand and remember. (e.g., M=male, F=female). The more quickly an error is detected, the nearer the error is to the person who generated it and so the error is more easily corrected. An example of an illogical combination in a payroll system would be an option to eliminate federal tax withholding.

By "multiple levels" of messages, I mean allowing the user to obtain more detailed explanations of an error by using a help option, but not forcing a long-lasting message on a user who does not want it. An error suspense record would include the following fields: data entry operator identification, transaction entry date, transaction entry time, transaction type, transaction image, fields in error, error codes, date transaction re-entered successfully.

- A data input specification is a detailed description of the individual fields (data elements) on an input document together with their characteristics (i.e., type and length).
- Be specific and precise, not general, ambiguous, or vague. (BAD: Syntax error, Invalid entry, General Failure).
- Don't JUST say what's wrong be constructive; propose what needs to be done to correct the error condition.
- Be positive; Avoid condemnation. Possibly even to the point of avoiding pejorative terms such as "invalid" "illegal" or "bad."
- Be user-centric and attempt to convey to the user that he or she is in control by replacing imperatives such as "Enter date" with wording such as "Ready for date." ? Consider multiple message levels: the initial or default error message can be brief but allow the user some mechanism to request additional information.
- Consistency in terminology and wording. i. Place error messages in the same place on the screen ii. Use consistent display characteristics (blinking, color, beeping, etc.

10.4 USER INTERFACE

The primary differences between an inter active and batch environment are:

Interactive processing is done during the organization's prime work hours. Interactive systems usually have multiple, simultaneous users. The experience level of users runs from novice to highly experience. Developers must be good communicators because of the need to design systems with error messages, help text, and requests for user responses.

The seven step path that grades the structure of an interactive system is

- Greeting screen (e.g., company logo)
- Password screen : to prevent unauthorized use

- Main menu : allow choice of several available applications
- Intermediate menus : further delineate choice of functions
- Function screens : updating or deleting records
- Help screens : how to perform a task
- Escape options : from a particular screen or the application

An intermediate menu and a function screen differ in that the former provides choices from a set of related operations while the latter provides the ability to perform tasks such as updates or deletes.

The difference between inquiry and command language dialogue modes is that the former asks the user to provide a response to a simple question (e.g., "Do you really want to delete this file?") where the latter requires that the user know what he or she wants to do next (e.g., MS-DOS C:> prompt; VAX/VMS $ prompt; Unix shell prompt). GUI Interface (Windows, Macintosh) provide Dialog Boxes to prompt user to input required information/parameters.

Directions for designing form-filling screens :

- Fields on the screen should be in the same sequence as on the source document.
- Use cuing to provide the user with information such as field formats (e.g., dates)
- Provide default values.
- Edit all entered fields for transaction errors.
- Move the cursor automatically to the next entry field
- Allow entry to be free-form (e.g., do not make the user enter leading zeroes)

Consider having all entries made at the same position on the screen. A default value is a value automatically supplied by the application when the user leaves a field blank. For example, at SXU the screen on which student names and addresses are entered has a default value of "IL" for State since the majority of students have addresses in Illinois. At one time "312" was a default value for Area Code, but with the additional Area Codes now in use (312, 773, 708, 630, and 847) providing a default value for this field is no longer as useful.

The eight parts of an interactive screen menu are :

- Locator — what application the user is currently in.
- Menu ID — allows the more experienced user access without going through the entire menu tree.
- Title
- User instructions
- Menu list

- Escape option
- User response area
- System messages (e.g., error messages)

Highlighting should be used for gaining attention and so should be limited to critical information, unusual values, high priority messages, or items that must be changed. Potential problems associated with the overuse of color are that colors have different meanings to different people and in different cultures. A certain percentage of the population is known to have color vision deficiency. Some color combinations may be disruptive.

Information density is important because density that is too high makes it more difficult to discern the information presented on a screen, especially for novice users. Rules for defining message content include:

- Use active voice.
- Use short, simple sentences.
- Use affirmative statements.
- Avoid hyphenation and unnecessary punctuation.
- Separate text paragraphs with at least one blank line.
- Keep field width within 40 characters for easy reading.
- Avoid word contractions and abbreviations.
- Use non-threatening language.
- Avoid godlike language.
- Do not patronize.
- Use mixed case (upper and lower case) letters.
- Use humor carefully.

Symmetry is important to screen design because it is aesthetically pleasing and thus more comforting. Input verification is asking the user to confirm his or her most recent input (e.g., "Are you sure you want to delete this file?")

Adaptive models are useful because they adapt to the user's experience level as he or she moves from novice to experience over time as experience with the system grows. "Within User" sources of variation include: warm up, fatigue, boredom, environmental conditions, and extraneous events. The elements of the adaptive model are triggering question to determine user experience level. Differentiation among user experience. Alternative processing paths based on user level. Transition of casual user to experienced processing path. Transition of novice user to experienced processing path and allowing the user to move to an easier processing path. Interactive tasks can be designed for closure by providing the user with feedback indicating that a task has been completed. Internal locus of control is making users

feel that they are in control of the system, rather than that the system is in control of them. Examples of distracting use of surprise are: Highlighting, Input verification, Flashing messages and Auditory messages. Losing the interactive user can be avoided by using short menu paths and "You are here" prompts. Some common user shortcuts are: direct menu access, function keys, and shortened response time.

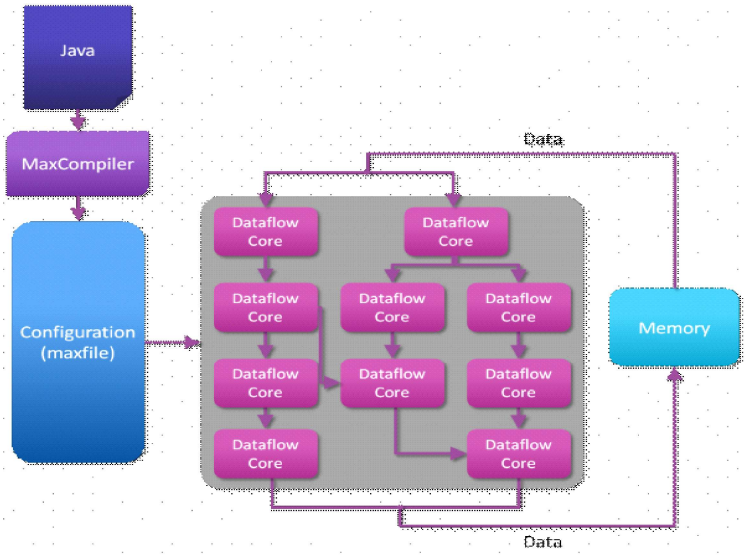
10.5 GOLDEN RULES OF INTERFACE DESIGN

- Strive for consistency.
- Enable frequent users to use shortcuts.
- Offer informative feedback.
- Design dialogs to yield closure.
- Offer error prevention and simple error handling.
- Permit easy reversal of actions.
- Support internal locus of control. 8. Reduce short-term memory load.

10.6 DATA FLOW

Dataflow is a software architecture based on the idea that changing the value of a variable should automatically force recalculation of the values of variables which depend on its value. Dataflow embodies these principles, with spreadsheets perhaps the most widespread embodiment of dataflow. For example, in a spreadsheet you can specify a cell formula which depends on other cells; then when any of those cells is updated the first cell's value is automatically recalculated. It's possible for one change to initiate a whole sequence of changes, if one cell depends on another cell which depends on yet another cell, and so on.

The dataflow technique is not restricted to recalculating numeric values, as done in spreadsheets. For example, dataflow can be used to redraw a picture in response to mouse movements, or to make a robot turn in response to a change in light level. One benefit of dataflow is that it can reduce the amount of coupling-related code in a program. For example, without dataflow, if a variable Y depends on a variable X, then whenever X is changed Y must be explicitly recalculated. This means that Y is coupled to X. This means that the update operation must be explicitly contained in the program and eventually checking must be added to avoid cyclical dependencies. Dataflow improves this situation by making the recalculation of Y automatic, thereby eliminating the coupling from X to Y. Dataflow makes implicit a significant amount of computation that must be expressed explicitly in other programming paradigms. Dataflow is also sometimes referred to as reactive programming.

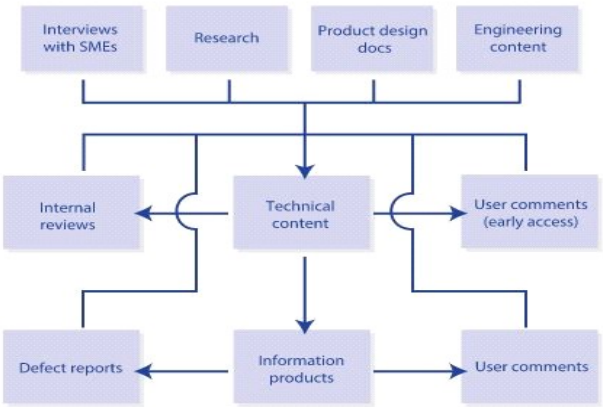


A sample Data Flow Diagram (DFD)

There have been a few programming languages created specifically to support dataflow. In particular, many (if not most) visual programming languages have been based on the idea of dataflow. Distributed data flows have also been proposed as a programming abstraction that captures the dynamics of distributed multi-protocols. The data-centric perspective characteristic of data flow programming promotes high-level functional style of specifications, and simplifies formal reasoning about system components.

10.7 INFORMATION FLOW

To determine how raw information becomes technical content, you need to understand and map the flow of information. Typically, you work backward from the final information product (perhaps a book or a web page) to determine the original data sources for text and graphics.



A Sample depiction of information flow (typical for high-tech)

The information sources are the items at the top of the flowchart. You can further refine this information by specifying who is responsible for each step in the process and when responsibility is handed off from one group to another. For example, in some organizations, engineers write content drafts and give those drafts to the technical publications group so that they can "make it pretty." In other organizations, technical communicators write content independently with minimal input from the engineering team. Some organizations use a hybrid approach: perhaps the technical communicators write user documentation and the engineers write systems documentation. It is important to understand how information flow is currently working and where the problem areas lie.

The distinction between technical content and information products is not always present. In many web-based tools, for example, content is stored in its final form. In most publishing workflows, however, there is a transition between a source content format (maybe XML) and a delivery content format (HTML or PDF).

As you examine the information flow, the goal is to identify bottlenecks and inefficiencies so that a new process can improve upon the current workflow. For example, one common recommendation is to eliminate any content duplication via copy-and-paste and instead carefully manage reusable information. Speeding up the update process so that published information products are current is a priority for many organizations. And often, the integration of a localization workflow into a previously monolingual process is a challenge.

Other considerations may include existing tools, skills, and corporate culture. There's a big difference between Microsoft Word and wiki authoring. Staff who have lots of experience with print production may find a transition to automated document creation annoying—they like having the ability to tweak page breaks. If your corporate culture glorifies last-minute heroics rather than careful planning, you cannot implement a workflow that requires multiple formal signatures on reviews.

The analysis goal is to develop a solution that :

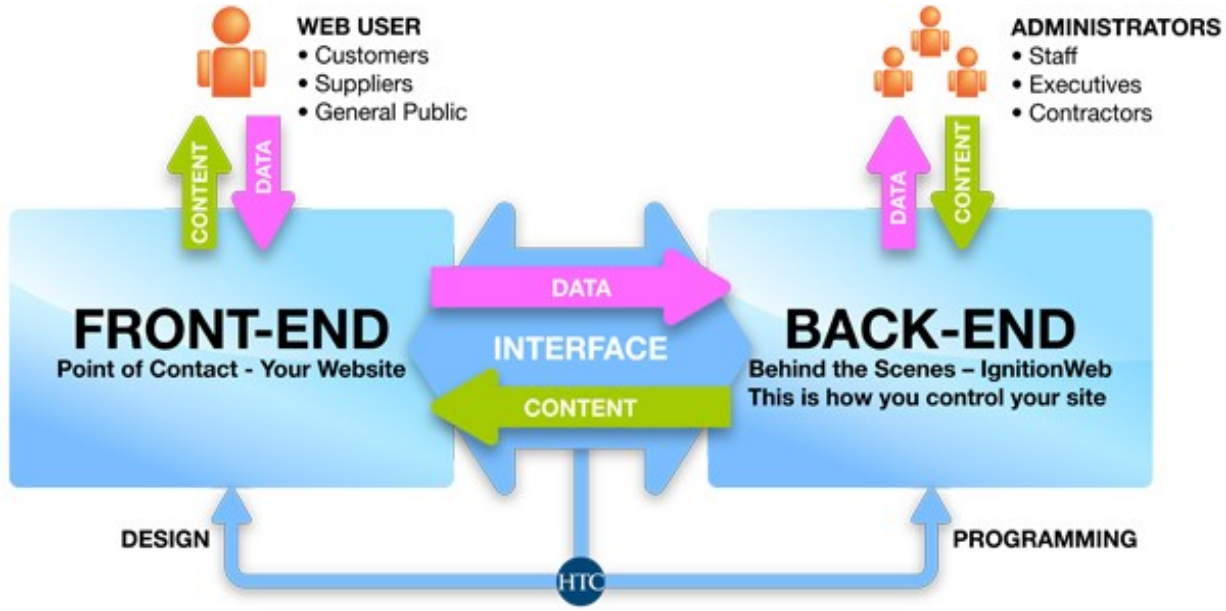
- Streamlines the flow of information throughout the organization
- Supports efficient content creation and delivery (which reduces costs)
- Maintains or improves the quality of the information delivered to customers
- Provides an authoring environment that is appropriate for content creators

10.8 FRONT END AND BACK END SOFTWARE

The front end is responsible for collecting input in various forms from the user and processing it to conform to a specification the back end can use. The front end is an interface between the user and the back end. The front and back ends may be distributed amongst one or more systems. In software architecture there may be many layers between the hardware and end user. Each can be spoken of as

having a front end and a back end. The front is an abstraction, simplifying the underlying component by providing a user-friendly interface.

In software design, for example, the model-view-controller architecture, provides front and back ends for the database, the user, and the data processing components. The separation of software systems into front and back ends simplifies development and separates maintenance. A rule of thumb is that the front (or "client") side is any component manipulated by the user. The server-side (or "back end") code resides on the server. The confusion arises when one must make front-end edits to server-side files. Most HTML designers, for instance, don't need to be on the server when they are developing the HTML; conversely, the server-side engineers are, by definition, never on anything but a server. It takes both to ultimately make a functioning, interactive website.



For major computer subsystems, a graphical file manager is a front end to the computer's file system, and a shell interfaces with the operating system. The front end faces the user, and the back end launches the programs of the operating system in response. Using the command-line interface (CLI) requires the acquisition of special terminology and memorization of commands, so a graphical user interface (GUI) acts as a front end desktop environment instead. In the UNIX environment, ncurses is a simpler, semi-graphical front end to the CLI. At the level of the Unix CLI itself, most byte stream-oriented (that is, using stdin/stdout/stderr as their interface) programs act as filters—standalone programs that can also serve as front ends and back ends to other programs. (They function by piping data between themselves, mostly for text processing; for example: $ grep word ~user/dir/infile | sort | tee ~user/dir/outfile).

In network computing, front end can refer to any hardware that optimizes or protects network traffic. It is called application front-end hardware because it is placed on the network's outward-facing front end or boundary. Network traffic passes through the front-end hardware before entering the network. In content management systems the terms front end and back end may refer to the end-user facing views of the CMS and the administrative views respectively.

In compilers, the front end translates a computer programming source code into an intermediate representation, and the back end works with the intermediate representation to produce code in a computer output language. The back end usually optimizes to produce code that runs faster. The front-end/back-end distinction can separate the parser section that deals with source code and the back end that generates code and optimizes. Some designs, such as GCC, offer choices between multiple front ends (parsing different source languages) or back ends (generating code for different target processors).

In speech synthesis, the front end refers to the part of the synthesis system that converts the input text into a symbolic phonetic representation, and the back end converts the symbolic phonetic representation into actual sounds. In the context of WWW applications, a mediator is a service that functions simultaneously as a server on its front end and as a client on its back end.

10.9 SUMMARY

This unit lets us understand the importance of input and output design. In the same way, this also lets us understand the way a user interfaces with the various parts of the system. Also, one can understand the interactions between the various parts of the system. Among the different modules of a system, some modules work as front end while some work in the background knows as back end.

10.10 KEYWORDS

Input, Output, Interface, Information Flow, Front End Software, Back End Software

10.11 SELF ASSESSMENT QUESTIONS

1. What do you mean by Input design?
2. What are the factors for an output design?
3. How does a user interact with the system?
4. What are the various factors for an interface design?
5. How does the information flow from an input to an output?
6. How does one distinguish between front end and back end softwares?
7. What are the advantages of design front end and back end softwares?

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UNIT 11: DATA MINING AND WAREHOUSING

STRUCTURE

11.0 OBJECTIVES

After studying this unit, you should be able to:

* Explain and differentiate between data and information;
* Describe the concept of data warehousing and its importance and applications;
* Discuss what knowledge is and how to manage it and
* Elaborate on data and its security measures.

11.1 INTRODUCTION

Data are any facts, numbers, or text that can be processed by a computer. Today, organizations are accumulating vast and growing amounts of data in different formats and different databases. This initiates the importance of data acquiring, its maintenance, data mining for some application purpose and data ware housing for future usage. Also, with the data collected as such, how the information is generated and how knowledge is derived and how that knowledge is managed is what we are enriching us with this knowledge.

11.2 DATA MINING

Generally, data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

11.2.1 Data, Information, Knowledge:

Data : Data are any facts, numbers, or text that can be processed by a computer. Today, organizations are accumulating vast and growing amounts of data in different formats and different databases. This includes:

- operational or transactional data such as, sales, cost, inventory, payroll, and accounting
- nonoperational data, such as industry sales, forecast data, and macro economic data
- meta data - data about the data itself, such as logical database design or data dictionary definitions

Information : The processed data is called Information. The patterns, associations, or relationships among all the *data* can provide *information*. For example, analysis of retail point of sale transaction data can yield information on which products are selling and when.

Knowledge : Information can be converted into *knowledge* about historical patterns and future trends. For example, summary information on retail supermarket sales can be analyzed in light of promotional efforts to provide knowledge of consumer buying behaviour. Thus, a manufacturer or retailer could determine which items are most susceptible to promotional efforts.

11.2.2 What Can Data Mining Do?

Data mining is primarily used today by companies with a strong consumer focus - retail, financial, communication, and marketing organizations. It enables these companies to determine relationships among "internal" factors such as price, product positioning, or staff skills, and "external" factors such as economic indicators, competition, and customer demographics. And, it enables them to determine the impact on sales, customer satisfaction, and corporate profits. Finally, it enables them to "drill down" into summary information to view detail transactional data.

With data mining, a retailer could use point-of-sale records of customer purchases to send targeted promotions based on an individual's purchase history. By mining demographic data from comment or warranty cards, the retailer could develop products and promotions to appeal to specific customer segments.

For example, Blockbuster Entertainment mines its video rental history database to recommend rentals to individual customers. American Express can suggest products to its cardholders based on analysis of their monthly expenditures.

WalMart is pioneering massive data mining to transform its supplier relationships. WalMart captures point-of-sale transactions from over 2,900 stores in 6 countries and continuously transmits this data to its massive 7.5 terabyte teradata data warehouse. WalMart allows more than 3,500 suppliers, to access data on their products and perform data analyses. These suppliers use this data to identify customer buying patterns at the store display level. They use this information to manage local store inventory and identify new merchandising opportunities. In 1995, WalMart computers processed over 1 million complex data queries.

The National Basketball Association (NBA) is exploring a data mining application that can be used in conjunction with image recordings of basketball games. The Advanced Scout software analyzes the movements of players to help coaches orchestrate plays and strategies. For example, an analysis of the play-by-play sheet of the game played between the New York Knicks and the Cleveland Cavaliers on January 6, 1995 reveals that when Mark Price played the Guard position, John Williams attempted four jump shots and made each one! Advance Scout not only finds this pattern, but explains that it is interesting because it differs considerably from the average shooting percentage of 49.30% for the Cavaliers during that game.

By using the NBA universal clock, a coach can automatically bring up the video clips showing each of the jump shots attempted by Williams with Price on the floor, without needing to comb through hours of video footage. Those clips show a very successful pick-and-roll play in which Price draws the Knick's defense and then finds Williams for an open jump shot.

How does data mining work?

While large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining software analyzes relationships and patterns in stored transaction data based on open-ended user queries. Several types of analytical software are available: statistical, machine learning, and neural networks. Generally, any of four types of relationships are sought:

- **Classes :** Stored data is used to locate data in predetermined groups. For example, a restaurant chain could mine customer purchase data to determine when customers visit and what they typically order. This information could be used to increase traffic by having daily specials.
- **Clusters :** Data items are grouped according to logical relationships or consumer preferences. For example, data can be mined to identify market segments or consumer affinities.
- **Associations :** Data can be mined to identify associations. The beer-diaper example is an example of associative mining.
- **Sequential patterns :** Data is mined to anticipate behavior patterns and trends. For example, an outdoor equipment retailer could predict the likelihood of a backpack being purchased based on a consumer's purchase of sleeping bags and hiking shoes.

Data mining consists of five major elements :

- Extract, transform, and load transaction data onto the data warehouse system.
- Store and manage the data in a multidimensional database system.
- Provide data access to business analysts and information technology professionals.
- Analyze the data by application software.
- Present the data in a useful format, such as a graph or table.

Different levels of analysis are available :

- **Artificial neural networks :** Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- **Genetic algorithms :** Optimization techniques that use processes such as genetic combination, mutation, and natural selection in a design based on the concepts of natural evolution.
- **Decision trees :** Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi Square Automatic Interaction Detection (CHAID). CART and CHAID are decision tree techniques used for classification of a dataset. They provide a set of rules that you can apply to a new (unclassified) dataset to predict which records will have a given outcome. CART segments a dataset by creating 2-way splits while CHAID segments using chi square tests to

create multi-way splits. CART typically requires less data preparation than CHAID.

- **Nearest Neighbour method :** A technique that classifies each record in a dataset based on a combination of the classes of the *k* record(s) most similar to it in a historical dataset (where *k* 1). Sometimes called the *k*-nearest neighbour technique.
- **Rule induction :** The extraction of useful if-then rules from data based on statistical significance.
- **Data visualization :** The visual interpretation of complex relationships in multidimensional data. Graphics tools are used to illustrate data relationships.

11.2.3 What Technological Infrastructure is Required?

Today, data mining applications are available on all size systems for mainframe, client/server, and PC platforms. System prices range from several thousand dollars for the smallest applications up to $1 million a terabyte for the largest. Enterprise-wide applications generally range in size from 10 gigabytes to over 11 terabytes. NCR has the capacity to deliver applications exceeding 100 terabytes. There are two critical technological drivers:

- **Size of the database :** the more data being processed and maintained, the more powerful the system required.
- **Query complexity :** the more complex the queries and the greater the number of queries being processed, the more powerful the system required.

Relational database storage and management technology is adequate for many data mining applications less than 50 gigabytes. However, this infrastructure needs to be significantly enhanced to support larger applications. Some vendors have added extensive indexing capabilities to improve query performance. Others use new hardware architectures such as Massively Parallel Processors (MPP) to achieve order-of-magnitude improvements in query time. For example, MPP systems from NCR link hundreds of high-speed Pentium processors to achieve performance levels exceeding those of the largest supercomputers.

11.3 DATA WAREHOUSING

The term Data Warehouse is defined by Bill Inmon in the following way: "A warehouse is a subject-oriented, integrated, time-variant and non-volatile collection of data in support of management's decision making process". Data can be described in very many different ways.

Subject Oriented : Data, that gives the information about a particular subject instead of about companies' ongoing operations.

Integrated : Data that is gathered is transformed into a data warehouse from a variety of sources and merged into a coherent whole.

Time-variant & Non-volatile : All data in the data warehouse is identified with a particular time

period. Data is stable in a data warehouse. More data is added but data is never removed. This enables management to gain a consistent picture of the business. According to Stanford University, a data warehouse is a repository of integrated information, available for queries and analysis. Data and information are extracted from heterogeneous sources as they are generated. This makes it much easier & more efficient to run queries over data that originally from different sources.

Data sources that have been constructed independently are likely to have different schemas. In fact, they may even use different data models. Part of the task of a warehouse is to perform schema integration and to convert data to the integrated schema before they are stored.

11.3.1 History of Data Warehousing and Importance

Data warehousing is not new. Data warehousing reminds us of an old mainframe concept from the mid-1970s: take data out of production databases, clean it up a bit, and load the data into an end-user database. International Business Machines (IBM) Corporation was first to coin the phrase "information warehouse" in late 1991. IBM's original concept met with scepticism because accessing non-relational data stores (such as IDMS(TM) IMS(TM) or SAM(TM)) was too complex and degraded operational system performance. Based on these experiences, experts now agree that a warehouse needs to be a separate data store built with an RDBMS. While names such as "information factory" or "information refinery" surfaced and went, "data warehouse" is now the generally accepted term.

Since the early 1990s, data warehouses have been at the forefront of information technology applications as a way for organizations to effectively use digital information for business planning and decision-making. Data Warehousing is not a new phenomenon. All large organizations already have data warehouses, but they are just not managing them. Over the next few years, the growth of data warehousing is going to be enormous with new products and technologies coming out frequently.

Prior to data warehousing organizations wrestled to get information out of transaction processing systems. While some of these systems are sufficient for getting limited information into users' hands, they leave much to be desired when it comes to extracting data. In particular, transaction processing systems fail to provide two key elements:

Integrated information : Each application has its own unique understanding of data and no two applications are the same. That means using application information to look across the corporation is not a viable option.

Historical information : Transaction processing system applications focus on very current information. But when it comes to gathering and assimilating historical information, the applications pay little or no attention.

As information professionals, we no doubt will encounter the data warehouse phenomenon if we

have not already been exposed to it in our work. Hence, an understanding of data warehouse system architecture is or will be important in our roles and responsibilities in information management. After all, customers are creatures of habit and history is a great indicator of future behaviour. Aside from the shortcomings of transaction processing systems, there are other very good reasons for the growth of data warehousing.

One of the most exciting phenomena is the data warehouse's ability to shelter information that fosters new data uses within the corporation. Data warehousing makes it possible to take advantage of entirely new styles of applications – analytical, business intelligence and exploration, to name a few. Using these applications, corporations are finally able to leverage their information throughout the system and better cope with business mergers, globalization, product introductions and business changes. Another advantage is that data warehouses store data at an atomic level, which can be endlessly reshaped to supply ever-changing informational needs throughout the corporation. The savvy organization can achieve a new level of competitiveness based on information available in the warehouse. It is no surprise that this effect on corporations planning to grow and remain strong find data warehouses at the heart of the new wave of applications.

11.3.2 Data Warehouse Scope

The scope of a data warehouse may be as broad as all the informational data for the entire enterprise from the beginning of time, or it may be as narrow as a personal data warehouse for a single manager for a single year. There is nothing that makes one of these more of a data warehouse than another.

In practice, the broader the scope, the more value the data warehouse is to the enterprise and the more expensive and time consuming it is to create and maintain. As a consequence, most organizations seem to start out with functional, departmental or divisional data warehouses and then expand them as users provide feedback.

11.4 KNOWLEDGE MANAGEMENT

Knowledge Management (KM) is the process of capturing, developing, sharing and effectively using organisational knowledge. It refers to a multi-disciplined approach to achieving organisational objectives by making the best use of knowledge.

An established discipline since 1991, KM includes courses taught in the fields of business administration, information systems, management, and library and information sciences. More recently, other fields have started contributing to KM research; these include information and media, computer science, public health, and public policy. Columbia University and Kent State University offer

dedicated Master of Science degrees in Knowledge Management.

Many large companies, public institutions and non-profit organisations have resources dedicated to internal KM efforts, often as a part of their business strategy, information technology, or human resource management departments. Several consulting companies provide strategy and advice regarding KM to these organisations.

Knowledge management efforts typically focus on organisational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organisation. KM efforts overlap with organisational learning and may be distinguished from that by a greater focus on the management of knowledge as a strategic asset and a focus on encouraging the sharing of knowledge. It is seen as an enabler of organisational learning and a more concrete mechanism than the previous abstract research.

11.4.1 History

Knowledge management efforts have a long history, to include on-the-job discussions, formal apprenticeship, discussion forums, corporate libraries, professional training and mentoring programs. With increased use of computers in the second half of the 20th century, specific adaptations of technologies such as knowledge bases, expert systems, knowledge repositories, group decision support systems, intranets, and computer-supported cooperative work have been introduced to further enhance such efforts.[2]

In 1999, the term personal knowledge management was introduced; it refers to the management of knowledge at the individual level.[14]

In the enterprise, early collections of case studies recognized the importance of knowledge management dimensions of strategy, process, and measurement.[15][16] Key lessons learned include people and the cultural norms which influence their behaviours are the most critical resources for successful knowledge creation, dissemination, and application; cognitive, social, and organizational learning processes are essential to the success of a knowledge management strategy; and measurement, benchmarking, and incentives are essential to accelerate the learning process and to drive cultural change.[16] In short, knowledge management programs can yield impressive benefits to individuals and organizations if they are purposeful, concrete, and action-oriented.

11.4.2 Research

KM emerged as a scientific discipline in the earlier 1990s. It was initially supported solely by practitioners, when Skandia hired Leif Edvinsson of Sweden as the world's first Chief Knowledge Officer (CKO). The objective of CKOs is to manage and maximize the intangible assets of their organisations. Gradually, CKOs became interested in practical and theoretical aspects of KM, and the

new research field was formed. Discussion of the KM idea has been taken up by academics, such as Ikujiro Nonaka (Hitotsubashi University), Hirotaka Takeuchi (Hitotsubashi University), Thomas H. Davenport (Babson College) and Baruch Lev (New York University). In 2001, Thomas A. Stewart, former editor at *Fortune* magazine and subsequently the editor of *Harvard Business Review*, published a cover story highlighting the importance of intellectual capital in organisations. Since its establishment, the KM discipline has been gradually moving towards academic maturity. First, there is a trend toward higher cooperation among academics; particularly, there has been a drop in single-authored publications. Second, the role of practitioners has changed. Their contribution to academic research has been dramatically declining from 30% of overall contributions up to 2002, to only 10% by 2009 (Serenko et al. 2010).

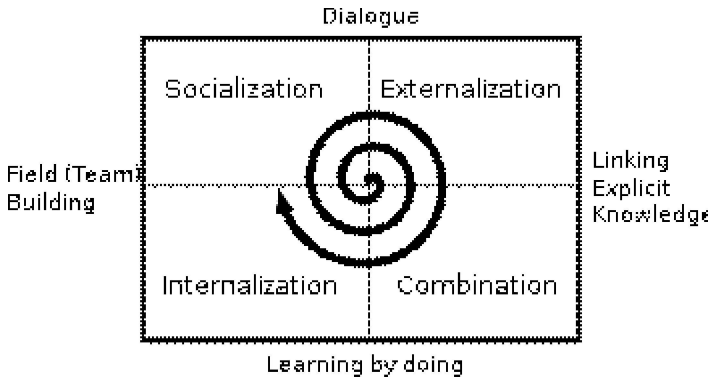
A broad range of thoughts on the KM discipline exist; approaches vary by author and school. As the discipline matures, academic debates have increased regarding both the theory and practice of KM, to include **Techno-centric, Organisational**, and **Ecological**.

Regardless of the school of thought, core components of KM include people, processes, technology (or) culture, structure, technology, depending on the specific perspective (Spender & Scherer 2007). Different KM schools of thought include lenses through which KM can be viewed and explained, to include community of practice, social network analysis, intellectual capital, information theory, complexity science, constructivism. The practical relevance of academic research in KM has been questioned with action research suggested as having more relevance and the need to translate the findings presented in academic journals to a practice.

11.4.3 Dimensions

Different frameworks for distinguishing between different 'types of' knowledge' exist. One proposed framework for categorizing the dimensions of knowledge distinguishes between tacit knowledge and explicit knowledge.[30] Tacit knowledge represents internalized knowledge that an individual may not be consciously aware of, such as how he or she accomplishes particular tasks. At the opposite end of the spectrum, explicit knowledge represents knowledge that the individual holds consciously in mental focus, in a form that can easily be communicated to others. Similarly, Hayes and Walsham describe content and relational perspectives of knowledge and knowledge management as two fundamentally different epistemological perspectives. The content perspective suggest that knowledge is easily stored because it may be codified, while the relational perspective recognizes the contextual and relational aspects of knowledge which can make knowledge difficult to share outside of the specific location where the knowledge is developed.

Early research suggested that a successful KM effort needs to convert internalized tacit knowledge into explicit knowledge to share it, and the same effort must permit individuals to internalize and make



The Knowledge Spiral as described by Nonaka & Takeuchi

personally meaningful any codified knowledge retrieved from the KM effort. Subsequent research into KM suggested that a distinction between tacit knowledge and explicit knowledge represented an oversimplification and that the notion of explicit knowledge is self-contradictory. Specifically, for knowledge to be made explicit, it must be translated into information (i.e., symbols outside of our heads). Later on, Ikujiro Nonaka proposed a model called SECI for Socialization, Externalization, Combination, Internalization, which considers a spiralling knowledge process interaction between explicit knowledge and tacit knowledge. In this model, knowledge follows a cycle in which implicit knowledge is 'extracted' to become explicit knowledge, and explicit knowledge is 're-internalized' into implicit knowledge. More recently, together with Georg von Krogh and Sven Voelpel, Nonaka returned to his earlier work in an attempt to move the debate about knowledge conversion forwards. A second proposed framework for categorizing the dimensions of knowledge distinguishes between embedded knowledge of a system outside of a human individual (e.g., an information system may have knowledge embedded into its design) and embodied knowledge representing a learned capability of a human body's nervous and endocrine systems.

A third proposed framework for categorizing the dimensions of knowledge distinguishes between the exploratory creation of "new knowledge" (i.e., innovation) vs. the transfer or exploitation of "established knowledge" within a group, organisation, or community. Collaborative environments such as communities of practice or the use of social computing tools can be used for both knowledge creation and transfer.

11.4.4 Strategies

Knowledge may be accessed at three stages: before, during, or after KM-related activities Organisations have tried knowledge capture incentives, including making content submission mandatory and incorporating rewards into performance measurement plans. Considerable controversy exists over whether incentives work or not in this field and no consensus has emerged.

One strategy to KM involves actively managing knowledge (push strategy). In such an instance, individuals strive to explicitly encode their knowledge into a shared knowledge repository, such as

a database, as well as retrieving knowledge they need that other individuals have provided to the repository. This is commonly known as the Codification approach to KM. Another strategy to KM involves individuals making knowledge requests of experts associated with a particular subject on an adhoc basis (pull strategy). In such an instance, expert individual(s) can provide their insights to the particular person or people needing this. This is commonly known as the Personalisation approach to KM.

Information technology plays a less important role, as it is only supposed to facilitate communication and knowledge sharing among members of an organisation. Other knowledge management strategies and instruments for companies include Rewards (as a means of motivating for knowledge sharing), Storytelling (as a means of transferring tacit knowledge), Cross-project learning, After action reviews, Knowledge mapping (a map of knowledge repositories within a company accessible by all), Communities of practice, Expert directories (to enable knowledge seeker to reach to the experts), Best practice transfer, Knowledge fairs, Competence management (systematic evaluation and planning of competences of individual organisation members), Proximity & Architecture (the physical situation of employees can be either conducive or obstructive to knowledge sharing), Master-apprentice relationship, Collaborative technologies (groupware, etc.), Knowledge repositories (databases, bookmarking engines, etc.), Measuring and reporting intellectual capital (a way of making explicit knowledge for companies), Knowledge brokers (some organisational members take on responsibility for a specific "field" and act as first reference on whom to talk about a specific subject), Social software (wikis, social bookmarking, blogs, etc.), Inter-project knowledge transfer.

11.4.5 Motivations

There are a number of claims as to the motivation leading organisations to undertake a KM effort. Typical considerations driving a KM effort include Making available increased knowledge content in the development and provision of products and services, Achieving shorter new product development cycles, Facilitating and managing innovation and organisational learning, Leveraging the expertise of people across the organisation, Increasing network connectivity between internal and external individuals, Managing business environments and allowing employees to obtain relevant insights and ideas appropriate to their work, Solving intractable or wicked problems, Managing intellectual capital and intellectual assets in the workforce (such as the expertise and know-how possessed by key individuals),

Debate exists whether KM is more than a passing fad, though increasing amount of research in this field may help to answer this question, as well as create consensus on what elements of KM help determine the success or failure of such efforts. Knowledge sharing remains a challenging issue for knowledge management, while there is no clear agreement barriers may include time issues for knowledge works, the level of trust, lack of effective support technologies and culture.

11.4.6 TECHNOLOGIES

Early KM technologies included online corporate yellow pages as expertise locators and document management systems. Combined with the early development of collaborative technologies, KM technologies expanded in the mid-1990s. Subsequent KM efforts leveraged semantic technologies for search and retrieval and the development of e-learning tools for communities of practice. Knowledge management systems can thus be categorized as falling into one or more of the following groups: Groupware, document management systems, expert systems, semantic networks, relational and object oriented databases, simulation tools, and artificial intelligence.

More recently, development of social computing tools have allowed more unstructured, self-governing or ecosystem approaches to the transfer, capture and creation of knowledge, including the development of new forms of communities, networks, or matrixed organisations. However such tools for the most part are still based on text and code, and thus represent explicit knowledge transfer. These tools face challenges in distilling meaningful re-usable knowledge and ensuring that their content is transmissible through diverse channels.

11.5 DATA SECURITY

Data security means protecting data, such as a database, from destructive forces and the unwanted actions of unauthorized users.

11.5.1 Data Security Technologies

Disk Encryption : Disk encryption refers to encryption technology that encrypts data on a hard disk drive. Disk encryption typically takes form in either software (see disk encryption software) or hardware (see disk encryption hardware). Disk encryption is often referred to as on-the-fly encryption (OTFE) or transparent encryption.

Hardware-based mechanisms for protecting data : Software-based security solutions encrypt the data to prevent it from theft. However, a malicious program or a hacker could corrupt the data in order to make it unrecoverable, making the system unusable. Hardware-based security solutions can prevent read and write access to data and hence offer very strong protection against tampering and unauthorized access.

Hardware-based or assisted computer security offers an alternative to software-only computer security. Security tokens such as those using PKCS#11 may be more secure due to the physical access required in order to be compromised. Access is enabled only when the token is connected and correct PIN is entered (see two-factor authentication). However, dongles can be used by anyone who can gain physical access to it. Newer technologies in hardware-based security solves this problem offering fool proof security for data.

Working of hardware-based security: A hardware device allows a user to log in, log out and set different privilege levels by doing manual actions. The device uses biometric technology to prevent malicious users from logging in, logging out, and changing privilege levels. The current state of a user of the device is read by controllers in peripheral devices such as hard disks. Illegal access by a malicious user or a malicious program is interrupted based on the current state of a user by hard disk and DVD controllers making illegal access to data impossible. Hardware-based access control is more secure than protection provided by the operating systems as operating systems are vulnerable to malicious attacks by viruses and hackers. The data on hard disks can be corrupted after a malicious access is obtained. With hardware-based protection, software cannot manipulate the user privilege levels. It is impossible for a hacker or a malicious program to gain access to secure data protected by hardware or perform unauthorized privileged operations. This assumption is broken only if the hardware itself is malicious or contains a backdoor.[2] The hardware protects the operating system image and file system privileges from being tampered. Therefore, a completely secure system can be created using a combination of hardware-based security and secure system administration policies.

Backups : Backups are used to ensure data which is lost can be recovered and nowadays it's very important to keep a backup of any data.

11.5.2 Data Masking And Erasure

Data Masking : Data Masking of structured data is the process of obscuring (masking) specific data within a database table or cell to ensure that data security is maintained and sensitive information is not exposed to unauthorized personnel. This may include masking the data from users (for example, so banking customer representatives can only see the last 4 digits of a customer's national identity number), developers (who need real production data to test new software releases but should not be able to see sensitive financial data), outsourcing vendors, etc.

Data Erasure : Data erasure is a method of software-based overwriting that completely destroys all electronic data residing on a hard drive or other digital media to ensure that no sensitive data is leaked when an asset is retired or reused.

11.5.3 International Laws and Standards

International Laws : In the UK, the Data Protection Act is used to ensure that personal data is accessible to those whom it concerns, and provides redress to individuals if there are inaccuracies. This is particularly important to ensure individuals are treated fairly, for example for credit checking purposes. The Data Protection Act states that only individuals and companies with legitimate and lawful reasons can process personal information and cannot be shared. Data Privacy Day is an international holiday started by the Council of Europe that occurs every January 28.

International standards : The international standard ISO / IEC 17799 covers data security under the topic of information security, and one of its cardinal principles is that all stored information, i.e.,

data should be owned so that it is clear whose responsibility it is to protect and control access to that data. The Trusted Computing Group is an organization that helps standardize computing security technologies. The Payment Card Industry Data Security Standard is a proprietary international information security standard for organizations that handle cardholder information for the major debit, credit, prepaid, e-purse, ATM and POS cards.

11.6 SUMMARY

In this unit, data mining, data warehousing concepts have been discussed elaborately. Also the concepts that lead the data to information, information to knowledge and how knowledge need to be management, the different ways that is done is also discussed. Apart from that, the various measures taken to secure the different forms of data collected have also been elucidated.

11.7 KEYWORDS

Data Mining, Data Warehousing, Information, Knowledge, Management, Data Security

11.8 SELF ASSESSMENT QUESTIONS

1. What is Data and Information?
2. How are information and knowledge differentiated?
3. What do you mean by data mining?
4. Describe the various infrastructures needed for data mining.
5. Discuss the concept of data warehousing.
6. How does one secure data?
7. What are the security measures taken in order to secure data?

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UNIT 12: CYBER CRIME AND PRIVACY ISSUES

STRUCTURE

12.0 OBJECTIVES

After studying this unit you should be able to:

* Define the meaning of the cyber crime and right to privacy;
* Identify the various kinds of Cyber Crime and punishment there on and
* Discuss the role of Ethical issues for IT Managers.

12.1 INTRODUCTION

Perhaps the most prominent form of cybercrime is identity theft, in which criminals use the Internet to steal personal information from other users. Two of the most common ways this is done is through phishing and harming. Both of these methods lure users to fake websites (that appear to be legitimate), where they are asked to enter personal information. This includes login information, such as usernames and passwords, phone numbers, addresses, credit card numbers, bank account numbers, and other information criminals can use to "steal" another person's identity. For this reason, it is smart to always check the URL or Web address of a site to make sure it is legitimate before entering your personal information.

Because cybercrime covers such a broad scope of criminal activity, the examples above are only a few of the thousands of crimes that are considered cybercrimes. While computers and the Internet have made our lives easier in many ways, it is unfortunate that people also use these technologies to take advantage of others. Therefore, it is smart to protect yourself by using antivirus and spyware blocking software and being careful where you enter your personal information.

12.2 MEANING OF CYBER CRIME

Generally it is a crime that has some kind of computer or cyber aspect to it. To go into more detail is not as straightforward, as it takes shape in a variety of different formats. We've put together this guide with some interesting and often alarming facts, to make it a little easier to digest.

Cyber crime can be defined as an activity or a crime that involves the Internet, a computer system, or computer technology identity theft, phishing, and other kinds of cyber crime.

Encyclopaedia of Britannica defined the term Cyber Crime as "cybercrime, also called computer crime, the use of a computer as an instrument to further illegal ends, such as committing fraud, trafficking in child pornography and intellectual property, stealing identities, or violating privacy.

Cybercrime has now surpassed illegal drug trafficking as a criminal money maker. Somebody's identity is stolen every 3 seconds as a result of cybercrime. Without a sophisticated security package, your unprotected PC can become infected within four minutes of connecting to the Internet.

12.3 KINDS OF CYBER CRIME

Criminals committing cybercrime use a number of methods, depending on their skill-set and their goal. Few of them are as follows,

1. Theft of personal data
2. Copyright infringement
3. Fraud
4. Child pornography
5. Cyber stalking
6. Bullying

Cybercrime covers a wide range of different attacks, that all deserve their own unique approach when it comes to improving our computer's safety and protecting ourselves. Symantec draws from all the different interpretations of cybercrime and defines it concisely as "any crime that is committed using a computer network or hardware device".

The computer or device may be the agent of the crime, the facilitator of the crime, or the target of the crime. The crime may take place on the computer alone or in addition to other locations.

New technologies create new criminal opportunities but few new types of crime. What distinguishes cybercrime from traditional criminal activity? Obviously, one difference is the use of the digital computer, but technology alone is insufficient for any distinction that might exist between different realms of criminal activity. Criminals do not need a computer to commit fraud, traffic in child pornography and intellectual property, steal an identity, or violate someone's privacy. All those activities existed before the "cyber" prefix became ubiquitous. Cybercrime, especially involving the Internet, represents an extension of existing criminal behaviour alongside some novel illegal activities. Most cybercrime is an attack on information about individuals, corporations, or governments.

Although the attacks do not take place on a physical body, they do take place on the personal or corporate virtual body, which is the set of informational attributes that define people and institutions on the Internet. In other words, in the digital age our virtual identities are essential elements of everyday life: we are a bundle of numbers and identifiers in multiple computer databases owned by governments and corporations. Cybercrime highlights the centrality of networked computers in our lives, as well as the fragility of such seemingly solid facts as individual identity.

12.4 NATURE OF CYBER CRIME

An important aspect of cybercrime is its nonlocal character. Actions can occur in jurisdictions separated by vast distances. This poses severe problems for law enforcement since previously local or even national crimes now require international cooperation. For example, if person accesses child

pornography located on a computer in a country that does not ban child pornography, is that individual committing a crime in a nation where such materials are illegal? Where exactly does cybercrime take place? Cyberspace is simply a richer version of the space where a telephone conversation takes place, somewhere between the two people having the conversation. As a planet-spanning network, the Internet offers criminals multiple hiding places in the real world as well as in the network itself. However, just as individuals walking on the ground leave marks that a skilled tracker can follow, cybercriminals leave clues as to their identity and location, despite their best efforts to cover their tracks. In order to follow such clues across national boundaries, though, international cybercrime treaties must be ratified.

12.5 LAW ON CYBER CRIME

In 1996 the Council of Europe, together with government representatives from the United States, Canada, and Japan, drafted a preliminary international treaty covering computer crime. Around the world, civil libertarian groups immediately protested provisions in the treaty requiring Internet service providers (ISPs) to store information on their customers' transactions and to turn this information over on demand. Work on the treaty proceeded nevertheless, and on November 23, 2001, the Council of Europe Cybercrime Convention was signed by 30 states. Additional protocols, covering terrorist activities and racist and xenophobic cybercrimes were proposed in 2002. In addition, various national laws, such as the USA PATRIOT Act of 2001, have expanded law enforcement's power to monitor and protect computer networks.

Cyber crimes can involve criminal activities that are traditional in nature, such as theft, fraud, forgery, defamation and mischief, all of which are subject to the Indian Penal Code. The abuse of computers has also given birth to a gamut of new age crimes that are addressed by the Information Technology Act, 2000. (it is famously known as IT Act).

The Act totally has 13 chapters and 90 sections (the last four sections namely sections 91 to 94 in the ITA 2000 dealt with the amendments to the four Acts namely the Indian Penal Code 1860, The Indian Evidence Act 1872, The Bankers' Books Evidence Act 1891 and the Reserve Bank of India Act 1934). The Act begins with preliminary and definitions and from there on the chapters that follow deal with authentication of electronic records, digital signatures, electronic signatures etc.

IT Act, 2000 as amended by The IT (Amendment) Act, 2008 is known as the Cyber law. It has a separate chapter XI entitled "Offences" in which various cyber crimes have been declared as penal offences punishable with imprisonment and fine. Cyber Crimes may be categorizing in to two groups.

1. Computer as a Target: Using a computer to attach other computers. I.e. Hacking, Virus/Worm attack, Dos Attack etc.
2. The computer as a weapon:-using a computer to commit real world crimes.

I.e. Cyber Terrorism, Intellectual Property Rights PR violations, Credit card frauds, pornography etc.

The punishment as for the cyber crime mentioned in the IT Act can be seen the following table.

Sl. No.	Nature of the Crime	Meaning	Law	Punishment
1	Hacking	Hacking means unauthorized attempts to bypass the security mechanisms of an information system or network. Also, in simple words Hacking is the unauthorized access to a computer system, programs, data and network resources.	IT Act, 2000 Section 43(a) read with section 66 is applicable and Section 379 & 406 of Indian Penal Code, 1860 also are applicable.	imprisonment, which may extend to three years or with fine, which may extend to five lakh rupees or both
2	Data Theft	without permission of the owner or any other person, who is in charge of a computer, computer system of computer network downloads, copies or extracts any data, computer data base or information from such computer, computer system or computer network including information or data held or stored in any removable storage medium, then it is data theft.	Information Technology (Amendment) Act, 2008, Section 43(b) read with Section 66 is applicable and under section 379, 405 & 420 of Indian Penal Code, 1860	Imprisonment up to three years or a fine of five lakh rupees or both.
3	Spreading Virus or Worms	In most cases, viruses can do any amount of damage; the creator intends them to do. They can send your data to a third party and then delete your data from your computer. They can also ruin/mess up your system and render it unusable without a re-installation of the operating system. Most have not done this much damage in the past, but could easily do this in the future.	Information Technology (Amendment) Act, 2008, Section 43(c) & 43(e) read with Section 66 is applicable and under Section 268 of Indian Penal Code, 1860	imprisonment up to three years or a fine of five lakh rupees or both.

4	Identity Theft	Information Technology (Amendment) Act, 2008, crime of identity theft under Section 66-C, whoever, fraudulently or dishonestly make use of the electronic signature, password or any other unique identification feature of any other person known as identity theft.	Information Technology (Amendment) Act, 2008, Section 66-C and Section 419 of Indian Penal Code, 1860	Three years imprisonment or fine of one lakh rupees or both.
5	E-Mail Spoofing	Email spoofing is a technique used by hackers to fraudulently send email messages in which the sender address and other parts of the email header are altered to appear as though the email originated from a source other than its actual source.	Information Technology (Amendment) Act, 2008, Section 66-D and Section417, 419 & 465of Indian Penal Code, 1860	Imprisonment of either description for a term which extend to three years and shall also be liable to fine which may extend to one lakh rupee.
6	Privacy Violation	Publishing or transmitting private area of any person without his or her consent etc. Punishment is three years imprisonment or two lakh rupees fine or both.	Information Technology (Amendment) Act, 2008, Section 72	Extend to two years or with fine which may extend to one lakh rupees or with both.
7	Cyber terrorism	Intent to threaten the unity, integrity, security or sovereignty of the nation and denying access to any person authorized to access the computer resource or attempting to penetrate or access a computer resource without authorization. Acts of causing a computer contaminant (like virus or Trojan Horse or other spyware or malware) likely to cause death or injuries to persons or damage to or destruction of property etc. come under this Section.	Information Technology (Amendment) Act, 2008, Section 66-E and Indian Penal Code, 1860	Life Imprisonment.

8	Pornography	Screening video graphs and photographs of illegal activities through Internet all come under this category, making pornographic video or MMS clippings or distributing such clippings through mobile or other forms of communication through the Internet fall under this category.	Information Technology (Amendment) Act, 2008, Section 67-A	For the first time imprisonment for a maximum of five years and fine of ten lakh rupees and in the event of subsequent conviction with imprisonment of seven years and fine of ten lakh rupees.

16.6 CYBER CRIME AND RIGHT TO PRIVACY

Privacy refers to the right of an individual/s to determine when, how and to what extent his or her personal data will be shared with others. Breach of privacy means unauthorized use or distribution or disclosure of personal information like medical records, sexual preferences, financial status etc. The right to privacy involves confidentiality. It means whenever person with authority receives the information relating to an individual he should maintain the confidentiality.

The word C**onfidentiality** means non disclosure of information to unauthorized or unwanted persons. In addition to Personal information some other type of information which useful for business and leakage of such information to other persons may cause damage to business or person, such information should be protected. Only with the permission of the individual and with the permission of the court for the protection of the individual rights and public interest the information may be revealed. The law of privacy is the recognition of the individual's right to be let alone and to have his person space inviolate.

The right to privacy as an independent and distinctive concept originated in the field of Tort law, and which a new cause of action for damages resulting from unlawful invasion of privacy was recognised. In recent times, this right is recognised as fundamental right under Article 21 of the Indian Constitution. With the advent of information technology and the traditions concept of right to privacy has taken new dimensions, which require a different legal outlook. The various provisions of Information Technology Act, 200 can be taken. The various provisions of the Act aptly protect the only privacy rights of the citizens.

Generally for protecting secrecy of such information, parties while sharing information forms an agreement about the procedure of handling of information and to not to disclose such information to third parties or use it in such a way that it will be disclosed to third parties. Many times party or their employees leak such valuable information for monitory gains and causes breach of contract of confidentiality. Special techniques such as Social Engineering (Face book etc) are commonly used to obtain confidential information.

12.7 STANDING COMMITTEE RECOMMENDATION

The Standing Committee on Information Technology (Chairperson: Mr. Rao Inderjit Singh) presented its report on Cyber Crime, Cyber Security and Right to Privacy on February 12, 2014. Those are as follows,

1. **Establishment of protection centre :** The Committee noted the existence of 20 types of cyber crimes, worldwide. With India amongst the top five countries with respect to cyber crimes, a growing need to protect its 11 critical sectors (power, atomic energy, space, aviation, transportation, etc.), is arising. The Committee recommended establishing a National Critical Information Infrastructure Protection Centre to field cyber attacks.
2. **Institutions to deal with cyber crime :** The Committee recommended the installation of a single, centralised body to deal with cyber crime. The current setup involves overlapping responsibilities of many departments, agencies and banks. Cyber crime cells should be constituted in each state, district and block, connected to a centralised system.
3. **International Standards Organisation certification :** The Committee identified that government organisations should obtain the appropriate certification for best practices related to information security.
4. **Shortage of manpower :** Pointing out the inadequacy of existing initiatives, it suggested conducting extensive training programmes to overcome shortage of security experts and auditors, and skilled Information Technology (IT) personnel in the country.
5. **Funding for research and development :** The Committee highlighted the need for innovative research and development to enhance security of cyber space. It expressed concern over budgetary cuts in the sector as large funds are needed for the development of key, strategic technologies.
6. **External hosting and new technology :** The Committee recommended that despite the cost advantages of hosting websites outside India, internet servers for critical sectors should be hosted within the country to ensure security. Upcoming technologies like cloud computing under the National e-Governance Programme (NeGP) could be risky. The Committee, acknowledging the possibility of cyber security breaches in NeGP, recommended conducting surveys to collect data on the matter and reducing such instances.
7. **Information Technology Act, 2000 and National Cyber Security Policy, 2013 :** The Committee opined that although the IT Act, 2000 may appear adequate, there is a need for periodic review of its provisions. It also recommended that a more detailed plan of action (deadlines and targets) be constructed with respect to the National Cyber Security Policy, 2013.
8. **Miscellaneous legal recommendations :** The Committee's other recommendations relating to the legal aspect of the subject included, (i) signing of MoU's and international treaties to address cross border challenges in cyber security (ii) instituting a legal framework on privacy, which is secure and people friendly, and (iii) setting up of a grievance redressal mechanism by means of Cyber Appellate Tribunal and help line for common public to deal with cyber crime.

12.8 ETHICAL ISSUES FOR IT MANAGERS

Meaning of Ethics : the word Ethics denotes "moral principles that govern a person's behaviour or the conducting of an activity. Ethic principles differ depending upon the activity. The medical ethics may be different of internet ethics, lawyer's ethics.

Ethical issues for IT Managers : Ethics is defined as moral principles that govern a person's behaviour or the conducting of an activity. "Medical ethics also enter into the question". Ethics can also be defined as moral code, morals and rules of conduct or dictates of conscience. In IT field ethics means Principles which govern the IT managers".

The Word Information Ethics was used by the Robert Hauptman in the Journal of Information Ethics in 1992 and Rafael Capurro in his article published in German in 'Information Ethos and Information Ethics'. Later Mr. Barbara J. Kostrewski and Charles Oppenheim wrote an article, "Ethics in Information Science" for the *Journal of information science* where they discussed such issues as the confidentiality of information, bias in information provided to clients or consumers, the quality of data supplied by online vendors, the use of work facilities, etc. As the years have progressed, the term *information ethics* was also adopted by faculty in schools of computer science. Depending on the academic institution in the United States, many departments of Computer Science focused on theoretical dimensions of computer science.

The Code of Ethics is a comprehensive guide to professional conduct. The Code is designed to help IT practitioners maintain the highest level of ethical conduct, standards of practice and integrity with respect to their professional activities. IT practitioners are strongly encouraged to use the Code of Ethics in their professional dealings with colleagues, employers, employees, clients and students. The following five ethical principles are derived from the CIPS Code of Ethics and Professional Code of Conduct.

1. **Protecting the Public Interest and Maintaining Integrity :** IT Managers should protect the public interest and discharge with integrity all duties and services owed to the public, Information Technology (IT) professionals, clients or employers.
2. **Demonstrating Competence and Quality of Service :** IT Managers owe their client or employer a duty to be competent to perform any IT service undertaken on such a party's behalf. Managers serve their client or employer in a conscientious, diligent and efficient manner by providing a high quality of service and by not undertaking a matter without honestly feeling competent to handle it.
3. **Maintaining Confidential Information and Privacy :** IT Managers should hold in strict confidence all information concerning the business and affairs of the client or employer without exception.
4. **Avoiding Conflict of Interest :** IT Managers do not place personal or professional interests, or those of colleagues, above interests of the public and/or client or employer, and avoid situations

where there is a significant risk that the interests of the member may conflict with the public and/or client or employer.

5. **Upholding Responsibility to the IT Profession :** IT Managers shall assist in maintaining the integrity of IT profession. They should support and advance the interests the IT profession, and respect the rights and professional aspirations of their colleagues.

12.9 SUMMARY

In this Unit, the concept of Cyber Crime, Right to Privacy and Ethics for IT Mangers were emphasized. We are able see briefly about Cyber Crime, nature of the Cyber Crime, kinds of Cyber Crimes and Ethics for IT Managers. Information Technology was used to the commit crimes are called Cyber Crime. The Information Technology Act, 2000 prohibits different kinds of Cyber Crimes. It gives provisions for punishment for the all types of Cyber Crimes. In spite of the IT Act, 2000 there some ethical issues for the IT Managers to follow. The violation of Ethical code is not possible to punish under IT Act but Ethical code is acting as a self restriction imposed by oneself to not to do act which prohibited under law or once consciousness.

12.10 KEYWORDS

Computer : A computer is a programmable device that receives input, stores and manipulates data, communicates data and provides output in a suitable format.

Crime : It is an Act prohibited under the Law An explicit command given to a computer.

Ethics : Moral Principles that govern a person's behaviors or the conduction of an activity.

Standing Committee : It is committee appointed by the Parliament to conduct investigation on the particular law or subject and to submit the report to the Parliament.

12.11 SELF ASSESSMENT QUESTIONS

1. What is Cyber Crime?
2. What is Ethics?
3. What is Right to Privacy? What provision of the Indian Constitution protects Right to Privacy?
4. What are the laws gives punishment for Cyber Crime in India?
5. Explain the nature of Cyber Crime.
6. Examine the recommendation of the Standing Committee on Cyber Crime.
7. Explain the Nature of the Information Technology Act, 2000.
8. Explain the punishment for Cyber Crimes.

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UNIT -13 : INTRODUCTION TO INFORMATION SYSTEM

STRUCTURE

13.0 OBJECTIVES

After studying this unit, you should be able to:

* Asses the applications of Information systems;
* Identify need for Human Resource Information system;
* Explain the significance of financial and accounting information system;
* Elucidate the uses of marketing information system and
* Design the project information management system.

13.1 INTRODUCTION

The information systems have been an integral part of the management of today's organizations. Information system has a huge potential in the present scenario. Irrespective of size and the complexity computer based information systems are being used in the business world. In the previous modules you have already seen the need and significance of MIS, the process of implementation of MIS and so on. Now we can see how large organization have made successful use of information system in the various functions of the organization.

Information systems are rapidly transforming themselves from past three decades. The complexity of business is also growing parallelly in the present day competitive world. The span of business now sees the world as one market to do business. Invariably a business requires a full fledged information system that keeps the business on track and be informed about the activities of the organization as well as competitors. The data should be collected and processed immediately and all the records should be maintained up to date. Further the records must be precise, clear and accessible to the managers concerned to take appropriate decision at the right time.

Lot of theories have been developed about management seeking to impart right kind of theoretical understanding to the future managers to grapple with daunting problems. Hence the a proper information system is extremely needed to achieve the organization objective as a whole.

13.2 INFORMATION SYSTEM

The concept of information system is clear from the below figure which shows the various components of a typical information system. The information system consists of input, processing and out put at the outset. All information systems use people, hardware, software, data and network resources to perform various activities.

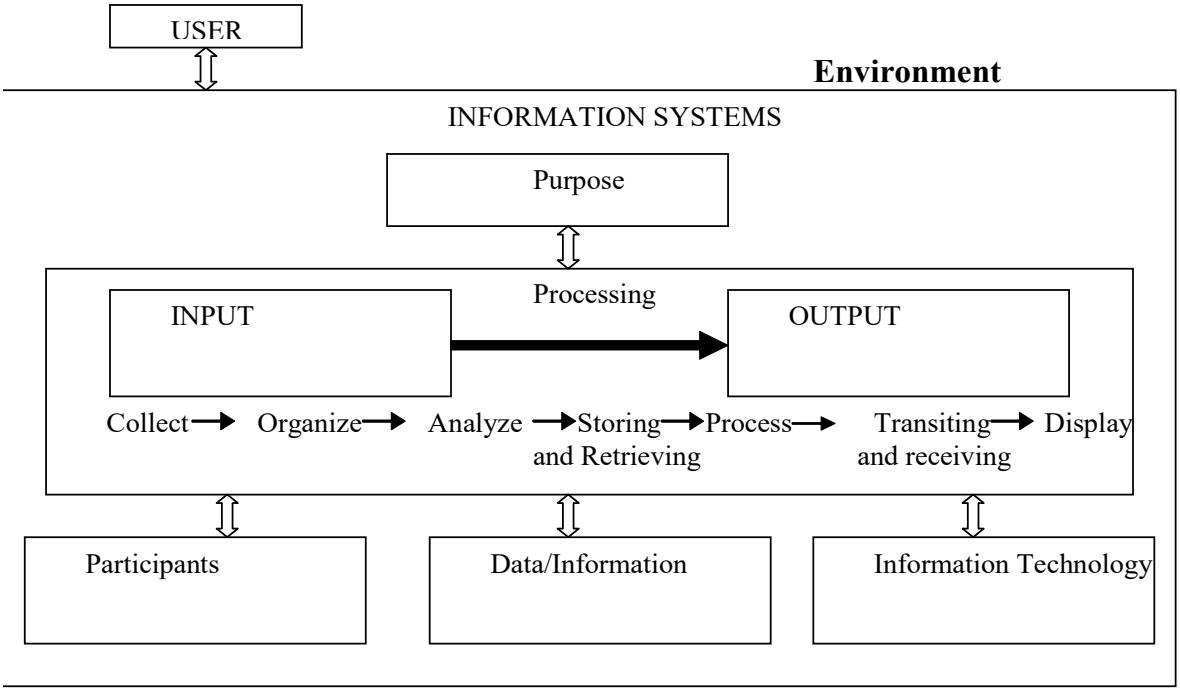
User : Users are the most important components of any information system. They are the customers of the information system. The whole information system has to be designed keeping the user requirements in mind. The information system begins with users and ends with users. The user demands the various

forms of information required based on which the information system should work. In most of the cases the users may not have clear idea about what exactly they want as they may not have awareness about possible uses of an information system.

Purpose : The requirements of users should be stated very clearly. The purposes should be written and objective. Before designing the system and various sub programmes the purpose of developing the system must be clearly stated.

Input : The data has to be input to computer for proper output. In a manufacturing company the data may be on the orders received, the raw material status, the production related information and sales data to name a few. The databases have to be constructed and it has to be made ready before the actual use of information system can take place.

Output : The output of a information system are usually in the form of reports. The reports can either be taken as a printout or can be seen on the monitor depending the requirement. The outputs may total sales of the day, list of raw materials to be ordered, productions stoppages in last six months, materials that are not used from past one year and so on.



The data has to be processed to obtain output. The data can be collected, organized analyzed. The data has to be stored and retrieved whenever it is required. It can be processed. Data can also be transmitted and received among the networked computers. Finally it is displayed may be on the monitor

or on the hard copy through printer.

Participants : The participants of an information system consists of system developer, users which includes top level, middle level and lower level managers. The lower level managers may need routine reports. It is usually past information where the top level people need futuristic information to take decisions. They require complex information.

Information Technology : Information technology play a vital role in the information system. Management information system has seen revolutionary changes in the information is processed and the out put are given. Further the variety and volume of the information has also changed in past two decades. Earlier the use of computers in an organization was limited only for data processing. Some data were stored in the databases like Lotus 123, Ms-Excel etc. Later exclusive programs were written to meet the needs of the organization. Further they were replaced by ERP, SAP.

13.3 APPLICATIONS OF INFORMATION SYSTEM

The information system is the life blood of any organization. Any specific information system aims to support operations, management and decision making. In a broad sense, the term is used to refer not only to the information and communication technology (ICT) that an organization uses, but also to the way in which people interact with this technology in support of business processes.

Some authors make a clear distinction between information systems, computer systems, and business processes. Information systems typically include an ICT component but are not purely concerned with ICT, focusing instead on the end use of information technology. Information systems are also different from business processes. Information systems help to control the performance of business processes.

Alter argues for advantages of viewing an information system as a special type of work system. A work system is a system in which humans and/or machines perform work (processes and activities) using resources to produce specific products and/or services for customers. An information system is a work system whose activities are devoted to processing (capturing, transmitting, storing, retrieving, manipulating and displaying) information.

As such, information systems inter-relate with data systems on the one hand and activity systems on the other. An information system is a form of communication system in which data represent and are processed as a form of social memory. An information system can also be considered a semi-formal language which supports human decision making and action. Information systems are the primary focus of study for organizational informatics.

Today even small scale industries, ancillary units have their own information system. Many organizations are structured based on functional areas. This is often reflected in an organizational chart. Typically, functional areas include finance, human resources, marketing, etc. Many of these functional

areas have their own **Management Information System**, or MIS.

Financial MIS : A financial MIS provides financial information for managers to make daily decisions on operations within the organization. Most systems provide these functions **:**

- Integrate financial information from multiple sources
- Provide easy access to financial information in summarized form
- Enable financial analysis using easy-to-use tools
- Compare historic and current financial activity

A financial MIS often has a number of subsystems, depending on the type of organization. These include systems to analyze revenues, costs and profits, auditing systems for both internal and external purposes and systems to manage funds. A financial MIS can also be used to prepare reports for third parties, such as external auditors or shareholders.

Marketing MIS : A marketing MIS supports activities throughout the many activities of marketing departments. Some of the typical subsystems of a marketing MIS are marketing research, product development and delivery, promotion and advertising, product pricing and sales analysis.

One of the most common uses of a marketing MIS is to produce sales reports. These are typically produced on a regular schedule, such as by week, month and quarter. Reports can be organized by sales representative, product, customer or geographic area. Such reports allow managers to see which aspects of sales are doing well and which ones need attention.

Perhaps one sales representative has suddenly experienced a drop in sales by losing one major customer and needs some support to develop some new leads. If there are only a handful of sales reps sharing one office, a manager might be able to pick up on this just by talking to everyone. However, what if a manager has to oversee more than 100 sales reps in 12 different offices around the nation? A specialized information system that provides regular updates in a meaningful format will make it a lot easier for the manager to make effective decisions.

Manufacturing MIS : Manufacturing is one of the areas where information systems have made a major impact. A typical manufacturing MIS is used to monitor the flow of materials and products throughout the organization. In a manufacturing process, raw materials or parts are transformed to finished products, and a manufacturing MIS is used at every stage. Some of the common subsystems in a manufacturing MIS include : design and engineering, production scheduling, inventory control, process control and quality control.

Consider the example of building an airplane. How many different parts do you think there are in an airplane? One of those commercial jets used by the major airlines easily has over 100,000 parts. Many of those parts come from suppliers and have to be ordered. Others are made at the manufacturing plant

itself. Now think of the process that is needed to get all those parts at the right place at the right time. And all those parts have to be carefully inspected before they can be used in building the plane.

13.4 HUMAN RESOURCE INFORMATION SYSTEM

Human resource constitute major asset in any organization. In a small scale industry human resource information system may not play a significant role. But in large scale industries, public sectors such as banks, government offices HRIS plays a very significant role.

The Government of Karnataka at par with few other states has implemented HRIS for the government officials. According to this all the information relating to the employee attendance, leave, TA/DA would be uploaded to the HRMS website.

A Human Resources Management System (HRMS) or Human Resources Information System (HRIS), refers to the systems and processes at the intersection between human resource management (HRM) and information technology. It merges HRM as a discipline and in particular its basic HR activities and processes with the information technology field. The function of human resources (HR) departments is administrative and common to all organizations. Organizations may have formalized selection, evaluation, and payroll processes. Management of human capital progressed to an imperative and complex process. The HR function consists of tracking existing employee data which traditionally includes personal histories, skills, capabilities, accomplishments and salary. To reduce the manual workload of these administrative activities, organizations began to electronically automate many of these processes by introducing specialized human resource management systems. Currently human resource management systems encompass :

1. Payroll
2. Time and attendance
3. Performance appraisal
4. Benefits administration
5. HR management information system
6. Recruiting
7. Performance record
8. Employee self-service
9. Scheduling
10. Absence management
11. Analytics
12. Competency Mapping
13. Pooling of skills

The payroll module automates the pay process by gathering data on employee time and attendance,

calculating various deductions and taxes, and generating periodic pay cheques and employee tax reports. Data is generally fed from the human resources and time keeping modules to calculate automatic deposit and manual cheque writing capabilities. This module can encompass all employee-related transactions as well as integrate with existing financial management systems.

The time and attendance module gathers standardized time and work related efforts. The most advanced modules provide broad flexibility in data collection methods, labour distribution capabilities and data analysis features. Cost analysis and efficiency metrics are the primary functions.

Many organizations have gone beyond the traditional functions and developed human resource management information systems, which support recruitment, selection, hiring, job placement, performance appraisals, employee benefit analysis, health, safety and security,

13.5 FINANCIAL INFORMATION SYSTEM

Finance is the lifeblood of any organization. Organizations strive to make profit and it is the major objectives of the organization. Hence the top management strives to minimize expenditures and maximise returns. In this context financial information system plays a very important role.

The Government of Karnataka has effectively implemented KHAJANE (Treasury) to address the finance related issues. This project was implemented mainly to eliminate systematic deficiencies in the manual treasury system and for the efficient management of state finance. The government can present a white paper in the session by click of mouse in the computer.

A financial information system (FIS) accumulates and analyzes financial data used for optimal financial planning and forecasting decisions and outcomes. An FIS is used in conjunction with a decision support system, and it helps a firm attain its financial objectives because they use a minimal amount of resources relative to a predetermined margin of safety. An FIS can be thought of as a financial planner for electronic commerce that can also produce large amounts of market and financial data at once obtained from financial databases worldwide.

Financial data analysis may be conducted through trend evaluations, ratio analyses and financial planning modelling. Data outputs that are produced by FIS can include

- Operating and capital budgets
- Working capital reports
- Accounting reports
- Cash flow forecasts

The predictive analytics included in these applications may also narrow down exactly what could be expected from a business interaction or transaction that has yet to take place.

The management of financial information in an e-commerce business is paramount in order to gain maximum operating results in the shortest amount of time. An FIS can also yield huge amounts of data for

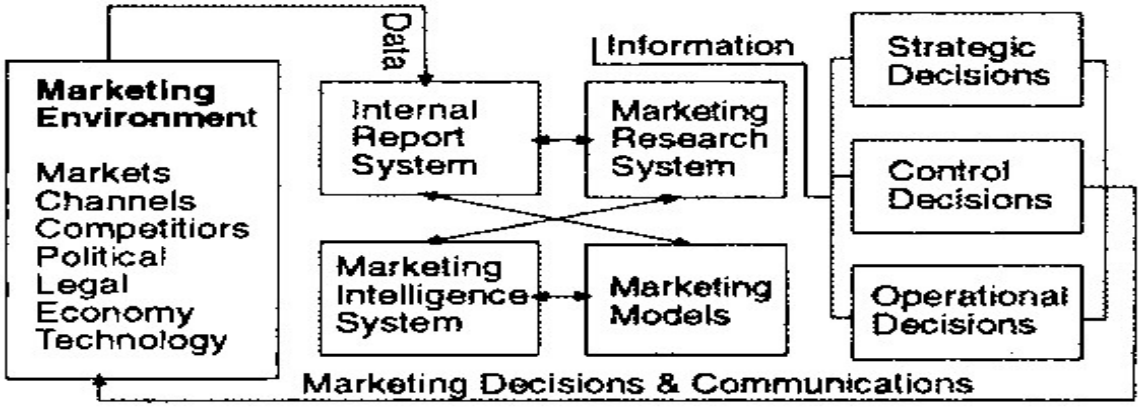
daily business operations. Financial markets traders and salespeople have the greatest demand for FIS because they work in very fast environments and their on-demand computing systems must keep up with real-time activities in order to allow these professionals to operate in real time. Broker investigating, investment and trade data along with fiscal asset classes can be relayed through an FIS. This also works for smaller businesses that need to obtain financial data about local markets. FIS is a form of real-time operating system that works to enhance financial information exchanges.

13.6 MARKETING INFORMATION SYSTEM

Marketing information system also has a vital play in the overall Management information system. Unlike production information system, the marketing information system has to collect data from outside the organization as well. Many of the marketing information system presently used has limited use as they collect data only internally i.e. the application of marketing information system is limited to order booking, order tracking and bill preparation. They also allow queries on the product status so that the customers can get instant feedback on their order status.

The advanced marketing information system makes an attempt to collect information from external sources also. The customer relationship management plays a significant role here.

A marketing information system is a continuing and interacting structure of people, equipment and procedures to gather, sort, analyse, evaluate, and distribute pertinent, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation, and control".



by the

The explanation of this model of an MIS begins with a description of each of its four main constituent parts: the internal reporting systems, marketing research system, marketing intelligence system and marketing

models. It is suggested that whilst the MIS varies in its degree of sophistication - with many in the industrialised countries being computerised and few in the developing countries being so - a fully fledged MIS should have these components, the methods (and technologies) of collection, storing, retrieving and processing data notwithstanding.

Internal Reporting Systems : All enterprises which have been in operation for any period of time nave a wealth of information. However, this information often remains under-utilised because it is compartmentalised, either in the form of an individual entrepreneur or in the functional departments of larger businesses. That is, information is usually categorised according to its nature so that there are, for example, financial, production, manpower, marketing, stockholding and logistical data. Often the entrepreneur, or various personnel working in the functional departments holding these pieces of data, do not see how it could help decision makers in other functional areas. Similarly, decision makers can fail to appreciate how information from other functional areas might help them and therefore do not request it.

The internal records that are of immediate value to marketing decisions are: orders received, stockholdings and sales invoices. These are but a few of the internal records that can be used by marketing managers, but even this small set of records is capable of generating a great deal of information. Below, is a list of some of the information that can be derived from sales invoices

- Product type, size and pack type by territory
- Product type, size and pack type by type of account
- Product type, size and pack type by industry
- Product type, size and pack type by customer
- Average value and/or volume of sale by territory
- Average value and/or volume of sale by type of account
- Average value and/or volume of sale by industry
- Average value and/or volume of sale by sales person

By comparing orders received with invoices an enterprise can establish the extent to which it is providing an acceptable level of customer service. In the same way, comparing stockholding records with orders received helps an enterprise ascertain whether its stocks are in line with current demand patterns.

Marketing Research Systems : The general topic of marketing research has been the prime ‘ subject of the textbook and only a little more needs to be added here. Marketing research is a proactive search for information. That is, the enterprise which commissions these studies does so to solve a perceived marketing problem. In many cases, data is collected in a purposeful way to address a well-defined problem (or a problem which can be defined and solved within the course of the study). The other form

of marketing research centres not around a specific marketing problem but is an attempt to continuously monitor the marketing environment. These monitoring or tracking exercises are continuous marketing research studies, often involving panels of farmers, consumers or distributors from which the same data is collected at regular intervals. Whilst the *ad hoc* study and continuous marketing research differs in the orientation, yet they are both proactive.

Marketing Intelligence Systems: Whereas marketing research is focused, market intelligence is not. A marketing intelligence system is a set of procedures and data sources used by marketing managers to sift information from the environment that they can use in their decision making. This scanning of the economic and business environment can be undertaken in a variety of ways, including.

13.7 PROJECT MANAGEMENT INFORMATION SYSTEM

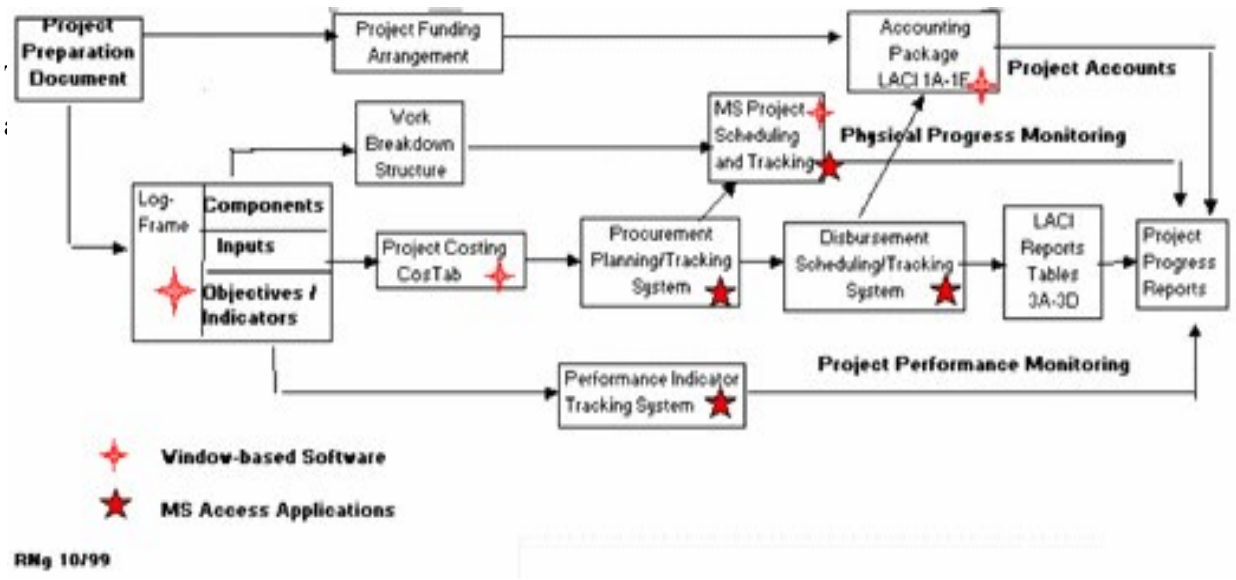


Figure PMIS Flowchart

1. **Project Performance Indicator Tracking System :** The Project Performance Indicator Tracking System (PPITS), stores the indicators in a database format, and codifies the status into five outcomes: Accomplished Successfully, Being Achieved (on course), Experiencing Minor Problems (being addressed), Experiencing Major Problems and Rescheduling of Target Date Required, and Not

Yet Due. With a graphic interface in MS Access, the project manager updates the status of each indicator as events occur, inputs the comments, and records the management actions undertaken. At the end of each reporting period, the required report is produced automatically (an internal feature of the system) with all the up-to-date information.

2. **Procurement Planning and Monitoring System (PPMS) :** Procurement is a major part of the project activities. In many projects, procurement staffs simply follow the process in a step-by-step manner, finishing one step before tackling the next, with neither systematic planning nor tracking. A good estimate of when project goods and services will become available can only be done when a contract is signed. The revised list of dates will be automatically updated if a constituent step for any item slips. Since the different methods of procurement for works, goods and services have different steps the PPMS uses different milestones for each type. It also produces a list of procurement activities for a specified time period, thus providing a calendar of all procurement activities required for the next month. This serves as a reminder of critical procurement tasks that the project staff has to perform on a day-to-day basis.
3. **Disbursement Planning and Tracking System (DPTS) :** The DPTS is a system designed to enable the planning of the payment schedule of each contract for works, goods and services and entering the dates of actual payments against this schedule. The system automatically analyzes the data and produces the reports in the required format. Together with the Procurement Planning and Monitoring System (PPMS), all the required LACI reports can be produced directly from the database.
4. **Procurement Activity Tracking System (PATS) :** Apart from the major contracts for the building of new schools and the major consultancies, each project management unit also undertakes a number of relatively small contracts for furnishing the new schools and for purchasing school supplies. These shopping activities include the following steps: Finalizing the initial specifications; contacting suppliers for price quotations; negotiating specification modifications, discounts and delivery dates; receiving shipments or verifying deliveries in terms of quantities and quality; and authorizing payments by the accountant. Although the process for procuring an individual item is not complicated, when the number of items required for a particular date becomes large, there is a need for a database to keep track of the status of placement of orders and of deliveries so that suppliers can be paid

promptly.

5. **Project Planning and Scheduling System (PP&SS) :** A complete critical path based project plan and schedule was developed using MS project.. The first level of indenture is the Work BS of the project. The schedule for the items of procurement, transferred from the PPMS, is presented on one line in the CPM chart using the rollup technique in MS Project.

13.8 SUMMARY

The management information system is an integral part of any organization. With the advancement of technology, the top management can get information on their fingertips today. The management information system has several applications through its various modules. The financial information system keeps track of accounts; the marketing information system takes care of customer order, feedback and sales, The human resources information system plays role in employee management. The project management information system takes care of one time affairs and can be redesigned as and when required.

13.9 KEY WORDS

* Management information system
* Marketing information system
* Human resource information system
* Project management information system
* Financial information system

13.10 SELF ASSESSMENT QUESTIONS

1. Discuss the applications of Management information system
2. Give an account on marketing information system
3. Describe the role of financial information system in an organization
4. With the help of figure explain the project management information system

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UNIT 14: ENTERPRISE RESOURCE PLANNING (ERP) & E-BUSINESS

STRUCTURE

14.0 OBJECTIVES

After studying this unit, you should be able to:

* Identify the concept of ERP;
* Appreciate the applications of ERP;
* Assess the future of ERP and
* Design an ERP for an enterprise.

14.1 INTRODUCTION

The enterprise resource planning is a comprehensive package that addresses all the information related issues and provides a proper solution. An enterprise system enables a company to integrate data used throughout its entire organization. At the core of the enterprise system is a central database that draws data from and feeds to various departments to ensure a smooth flow of information to facilitate decision making. ERP weaves IT through whole enterprise, and thereby have various resources put together to give a common integrated output.

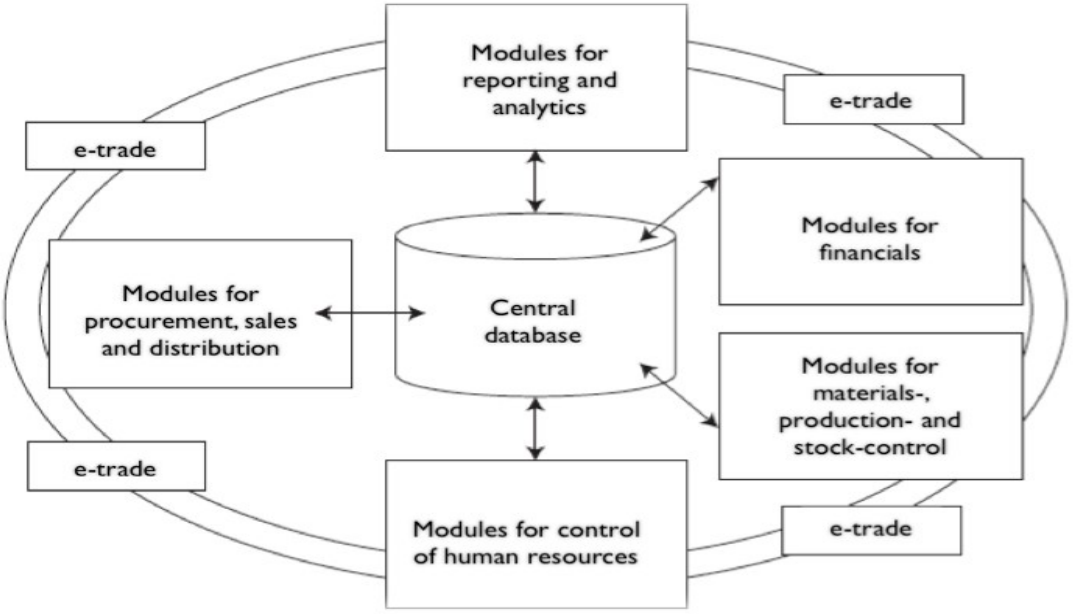
An enterprise consists of the various functional departments, some vertical like product line departments and horizontal like HR, finance, etc. For any financial year or plan period, each departments has its own way of functioning and self defined processes, its own objectives and targets. ERP has moved from being a technology for the manufacturing firms to a technology being used by other industries like finance telecom etc which are into various products and services. This is possible because ERP has various ready made modules that incorporate some of the best business process in world for that module operation. ER P s also able to interoperate certain legacy systems. ERP is used as backbone for various applications that help to give different services offerings to the customer. Hence ERP with increased functions and customizations, can be delivered through an ASP to so many customers, who have till now a desire to use ERP, but could not due to the cost and implantation constraints.

14.2 CONCEPT OF ERP

Enterprise **R**esource **P**lanning (ERP) is software that attempts to integrate all departments and

functions across a company onto a single computer system that can serve all those departments' particular needs. ERP allows a company to automate and integrate the majority of its business processes, including product planning, purchasing, production control, inventory control, interaction with suppliers and customer, delivery of customer service and keeping track of orders, to share common data and practices across the entire enterprise, and to produce and access information in a real-time environment. ERP enables decision-makers to have an enterprise-wide view of the information they need in a timely, reliable and consistent fashion. ERP applications market grew to $25.4 billion in 2005, and reached $29 billion in 2006. Over the next five years, the market will grow at an average of 10%.

In the literature, ERP systems are related to a broader range of information systems that are entitled as Enterprise Systems (ES). These information systems not only process information in an enterprise but also process the human interaction within and outside of the enterprise. ES build on standard software modules and have inscribed knowledge on business practises that has been accumulated by vendors through implementation projects at a broad range of clients. The integrated architecture of Enterprise Systems allows the organisation to share data across the enterprise and to integrate with



The term Enterprise Resource Planning (ERP) is most commonly referenced in the context of commercially available software systems. ERP systems provide an integrated suite of information technology applications that support the operations of an enterprise and are not, as the acronym ERP implies, limited to planning functions. The activities supported by ERP systems include all core functions of an enterprise, including financial management, human resources management, and operations. Increasingly, ERP vendors are offering "bolt-on" products that provide specialized functionality to augment the core, such as Advanced Planning and Scheduling (APS), and Customer Relationship Management (CRM).

Although the term ERP generally refers to a software system, it also encompasses the business processes that drive system requirements and capabilities. ERP systems support and enable the transformation of enterprises through the deployment of best practices and integrated business processes. Transformation of business processes can be achieved using a Continuous Business Process Improvement (CBPI) approach. CBPI refers to both incremental and larger, more radical process changes. Transformation through the use of CBPI frequently leverages the implementation of an ERP solution as a key enabler. In CBPI, business processes, work flows, information, organizational design and position descriptions are changed.

The ERP model took years to emerge and is still evolving today. The concept began in the 1960's with MRP, or Material Requirements Planning systems, that assisted manufacturing companies in planning and scheduling. The first actual ERP system was created in 1972, in Mannheim Germany, by five former IBM employees who founded the company SAP to produce and market standard software for integrated business solutions. In the early 1980's, MRP evolved into Manufacturing Resource Planning, or MRP II, introducing the concept of integrating financials with the manufacturing work-in-process. These early MRP and ERP systems were mainframe based.

In the latter 1980's, the second phase of ERP development occurred when organizations increased the integration of their business and focused more attention on quality measures. In the 1990's, with the Year 2000 computer problem looming and the advent of client/server platforms, businesses decided there were benefits to integrating all the core systems across their internal enterprise.

ERPs soon became known as Commercial Off-The-Shelf (COTS) solutions that specialized in business processes, functions, and industries. This integration focus resulted in a dramatic increase in the widespread use of ERPs. Today, in the world of the Internet and e-commerce, ERP vendors are moving toward integrating businesses with other businesses by building an organization that connects supplier's supplier to customer's customer.

14.3 PURPOSE OF ERP

The main value ERP systems provide is the opportunity to integrate an entire organization. End to end business processes that were traditionally disjointed. The information flow is much more efficient in that there are clear lines of business processes across the enterprise. For example, in a horizontally integrated ERP system, a purchasing department would process a purchase order in a central database with a common General Ledger (GL). Both Accounts Payable and Receiving have access to the same GL so the data would be immediately available to them. There is no time lag, re-entry of information, or dependency on paper documents. By having a single point of entry the risk of inaccuracy in the end-to-end transaction is reduced, resulting in fewer reconciliation points. Additionally, the ERP systems of today provide utilities for vertical integration with suppliers and distributors. When properly implemented as part of a comprehensive transformation effort, ERP solutions can yield the following results :

- Integrated processes and information systems
- Consolidation and/or elimination of current systems
- Reduced complexity of application and technology portfolios
- Reduced reliance on programmers to make software changes
- Authoritative data source
- Reduced data redundancy and duplicative data entry
- More effective and efficient business processes

14.4 MODULES OF ERP

The enterprise resource planning has various modules that cater to specific requirements of each function departments in an enterprise. The details are as follows

Manufacturing : The Manufacturing module defines the production process, calculates and tracks product and job cost, and records all of the activities necessary to manufacture products. Stages of manufacturing are consolidated into a process specification. Actual cost rollups within the process specification are compared to standard job cost for each lot or batch produced. All manufacturing-related activities are tracked and charged to a job, thereby determining actual job cost and variances. General Ledger journal entries are automatically created for all transactions, and lot trace information is recorded from the manufacturing activities.

Sales Order Management : Sales Order Management includes functions for Order Entry, Shipping, Invoicing, Credit Memos, and Sales Analysis. To support these functions, creation and maintenance of the Customer Master, along with Price and Discount functions are also included. Included with Order Entry and Shipping are on-line Credit Checking and Inventory Availability, including 'Available to Promise' and Reservations.

Purchasing : The Purchasing module handles Purchase Requisitions, Purchase Orders, Receiving, and

Vouchering of Invoices for raw materials, MRP purchases, Maintenance, and other MRO and one-time purchases. It can support the purchasing requirements of both multi-site, multi-national corporations and single-site domestic operations in either a centralized or decentralized mode.

Financials : Financials is the central source of financial information that leverages data from across your enterprise and helps manage your critical financial processes – from planning through decision-making. It provides the flexibility and functionality to manage even large, complex, or multi-national enterprises in dynamic business environments.

General Ledger : General Ledger provides a central, integrated data repository for all financial and statistical transactions, with flexible configuration and feature-rich functionality to plan, manage, and analyze your organization's financial performance and operating results.

Accounts Payable : The Accounts Payable module delivers comprehensive functionality for supplier maintenance, online inquiry, and cash management capabilities, handling multi-currency invoices and payments to enable you to conduct your business anywhere in the world.

Accounts Receivable : The Accounts Receivable module delivers comprehensive functionality to streamline routine tasks such as billing, credit management, payment application, and tax calculation – reducing costs and enabling your finance professionals to concentrate on analyzing credit risk and customer performance.

Fixed Assets : ERP enables you to efficiently track and maintain detailed administrative data about your organization's assets, from acquisition to disposal. It allows you to distribute depreciation and expense information to the General Ledger on a monthly basis.

Maintenance Management : ERP enables you to maintain the current and historical data you need to control and effectively manage maintenance; ensure consistently high levels of equipment reliability, regulatory compliance, and cost containment; and extend the life of significant capital assets.

Security, eSignatures, and Audit Trails : Enterprise Security Manager provides advanced, role-based security administration capabilities. Roles are created and users are assigned to one or many roles. In order to use any of the transactions within the software, the user must pass through a number of layers of security.

Technology and Deployment : Beyond business issues, systems become obsolete due to the disconnect between the software vendor and the technology platforms they run on. ERP mitigates these risks by 'future-proofing' the investment. Software has one common software code base for the business logic and provides the middleware to port to all common platforms to ensure evolution without obsolescence.

14.5 APPLICATIONS OF ERP

ERP has been currently implemented in certain industries and creates certain benefits. These benefits are for the organization and the customer. There are so many industry segments and government sectors where this technology of ERP has not been implemented. The basic division of the industry segments and government sectors where we can currently dwell upon with more practically are listed below

1. Corporate Sector
   a. Finance
   b. Manufacturing
   c. Retail
   d. Logistics
   e. Healthcare
   f. Travel and tourism

2. Government Sector
   a. Post and Telecom
   b. Law
   c. Administration
   d. Public works department
   e. Infrastructure
   f. Public Transport
   g. Defence
   h. Industry Analysis

14.6 ERP ARCHITECTURE

ERP applications are most commonly deployed in a distributed and often widely dispersed manner. While the servers may be centralized, the clients are usually spread to multiple locations throughout the enterprise.

Generally there are three functional areas of responsibility that is distributed among the servers and the clients. First, there is the database component - the central repository for all of the data that is transferred to and from the clients. Then, of course, the clients - here raw data gets inputted, requests for information are submitted, and the data satisfying these requests is presented. Lastly, we have the application component that acts as the intermediary between the client and the database. Where these components physically reside and how the processes get distributed will vary somewhat from one implementation to the next. The two most commonly implemented architectures are outlined below.

Two-tier Implementations : In typical two-tier architecture, the server handles both application and database duties. The clients are responsible for presenting the data and passing user input back to the

server. While there may be multiple servers and the clients may be distributed across several types of local and wide area links, this distribution of processing responsibilities remains the same.

Three-tier Client/Server Implementations : In three-tier architectures, the database and application functions are separated. This is very typical of large production ERP deployments. In this scenario, satisfying client requests requires two or more network connections. Initially, the client establishes communications with the application server. The application server then creates a second connection to the database server.

14.7 E-BUSINESS

e business, or **e-business**, is the application of information and communication technologies (ICT) in support of all the activities of business. Commerce constitutes the exchange of products and services between businesses, groups and individuals and can be seen as one of the essential activities of any business. Electronic commerce focuses on the use of ICT to enable the external activities and relationships of the business with individuals, groups and other businesses. The term "e-business" was coined by IBM's marketing and Internet teams in 1996.

eBusiness (electronic business) is using technology to improve business processes. This includes managing internal processes such as human resources, financial and administration systems, as well as external processes such as sales and marketing, supply of goods and services, and customer relationships.

The way in which business relationships are managed has not changed, but the way they are referred to when using eBusiness tools has. They are becoming more often known as:

- business to business (B2B)
- business to consumer (B2C) (also known as eCommerce)
- government to citizen (G2C)
- Government to business (G2B).

B2B (Business to Business) , also known as e-biz, is the exchange of products, services or information (e-commerce) between businesses, rather than between businesses and consumers. Although early interest centered on the growth of retailing on the Internet (sometimes called e-retailing), forecasts have predicted that B2B revenue will soon far exceed business-to-consumers (B2C) revenue.

B2B websites can be sorted into the following categories:

- **Company websites :** The target audience of many company sites is other companies and their employees. These sites can be thought of as round-the-clock mini-trade exhibits. Sometimes, a company website serves as the entrance to an exclusive extranet, available only to customers or registered site users. Some company sites sell directly from the site, effectively e-tailing to other businesses.

- **Product supply and procurement exchanges :** These are exchanges in which a company purchasing agent can shop for supplies from vendors, request proposals and, in some cases, bid to make a purchase at a desired price. Sometimes referred to as e-procurement sites, some serve a range of industries, while others focus on a niche market.
- **Specialized or vertical industry portals :** These portals provide a "sub-web" of information, product listings, discussion groups and other features. Vertical portal sites have a broader purpose than procurement sites (although they may also support buying and selling).
- **Brokering sites :** These sites act as an intermediary between providers and potential customers that need their specific services, such as equipment leasing.
- **Information sites.** Sometimes known as infomediaries, these sites provide information about a particular industry to its companies and their employees. Information sites include specialized search sites and those of trade-and-industry-standards organizations.

Many B2B sites fall into more than one of these groups. Models for B2B sites are still evolving.

Another type of B2B enterprise is software for building B2B websites, including site-building tools and templates, database and methodologies, as well as transaction software.

B2C Business : This is a also part of E-business wherein the customer may directly transact with the companies. The companies shall have websites which provides information about their product portfolio. The customers may visit these website see the products, select the colour, size , shape based on the product and book online. Websites such as Amazon.com, flipcart.com, rediff shopping, ebay and so on are doing huge business in the B2C segment.

Government to Citizen : (G to C) initiatives are introduced to provide one stop, on-line access to information and services to individuals. The service such as payment of property tax, electricity bill, LPG gas bill, telephone bill and motor vehicle taxes can be done on line. It may be noted that US the super power nation in the world expects its citizens to use any service optimally.

Government to Business (G to B) **:** The Federal Government should not continue to make companies to report the same data multiple times to multiple agencies. Government re-uses the data appropriately and takes advantage of commercial electronic transaction protocols. Periodic payment of insurance premiums against risk of life and properties can also be done online. The payment of education cess, the direct tax such as income tax, tax on capital gains, corporate tax, wealth tax, VAT can be done online.

Advantages : The benefits of implementing eBusiness tools is not so much in the use of technology, as in the streamlining of business processes and the ease in finding new markets. Some of the advantages

include:

- Quicker and easier communications
- Strengthened marketing capabilities and reach
- Increased hours of operation (a website provides 24 hour 7 day information to existing and potential customers)
- Access to broader information through research
- Reducing the cost of doing business by lowering transaction costs and increasing efficient methods for payment, such as using online banking and reducing stationery and postage costs
- The opportunities to adopt new business models and develop tailored customer support.

14.8 SUMMARY

ERP systems simply integrate all aspects of a business into one unified database application and interface across the entire business. ERP helps the communication between all aspects of a business including human resource, accounting, manufacturing, supply-chain, distribution, and sales. ERP also allows suppliers to base their inventory on current demand rather then basing inventory on previous demand or forecasting techniques. The use of ERP can also lower lead times because the companies can be integrated with their vendors.

14.9 KEY WORDS

ERP Architecture, E-Business

14.10 SELF ASSESSMENT QUESTIONS

1. Define ERP
2. Explain the applications of ERP
3. Discuss ERP architecture
4. Outline the benefits of ERP

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UNIT -15 : CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

STRUCTURE

15.0 OBJECTIVES

After studying this unit, you should able to:

* Define CRM;
* Evaluate the benefits of CRM;
* Trace the future of CRM;
* Assess the applications of eCRM and
* Implement CRM in an organization.

15.1 INTRODUCTION

Customer relationship management is an information industry term for methodologies, software and usually capabilities that help an enterprise manage customer relationships in an organized way. An enterprise might build a database about its customers that described relationships with sufficient details. It helps an enterprise to enable its marketing department to identify and target their best customers manage marketing campaigns with clear goals and objectives and generate quality leaders for the sales team. It facilitates an organization to improve telesales, account and sales management by optimising information shared by multiple employees and streamlining existing processes.

It allows the formation of individualized relationships with customers with the aim of improving customer satisfaction and maximizing profits, identifying the most profitable customers and providing them the highest level of service. It helps in providing employees information and processes necessary to know their customers, understanding their needs and effectively build relationships between the company, its customer base and channel partners.

It can be identified that CRM is a comprehensive approach that provides seamless coordination between sales, customer service, marketing, field support and customer touching functions. CRM integrates people, process and technology to maximize relationships with all customers including ecustomers, distribution channel members, internal customers and suppliers. CRM increasingly leverages internet.

15.2 CRM – MEANING AND DEFINITIONS

With the growth of the internet and related technologies, customers are concerned over the privacy and safety of their personal information. Therefore, businesses need to ensure that the storage and analysis of the customer data must have the highest levels of protection against cyber criminals, identity theft and other breaches of securities.

CRM is the abbreviation for ***c***ustomer ***r***elationship ***m***anagement. Customer relationship management entails all aspects of interaction that a company has with a customer, whether it is sales or service-related. While the phrase *customer relationship management* is most commonly used to describe a business-customer relationship, CRM systems are also used to manage business contacts, clients, contract wins and sales leads.

The principles, practices, and guidelines that an organization follows when interacting with its customers. From the organization's point of view, this entire relationship not only encompasses the direct interaction aspect, such as sales and/or service related processes, but also in the forecasting and analysis of customer trends and behaviors, which ultimately serve to enhance the customer's overall experience. CRM (customer relationship management) is an information industry term for methodologies, software, and usually Internet capabilities that help an enterprise manage customer relationships in an organized way. For example, an enterprise might build a database about its customers that described relationships in sufficient detail so that management, salespeople, people providing service, and perhaps the customer directly could access information, match customer needs with product plans and offerings, remind customers of service requirements, know what other products a customer had purchased, and so forth.

CRM's core strength is an ability to glean insight from customer feedback to create enhanced, solid and focused marketing and brand awareness. Key motivating drivers for the development of more innovative CRM strategies are Web technologies and a sharpened global focus on customer loyalty.

CRM also:

- Provides a way to directly evaluate customer value. For example, a business that is genuinely interested in its customers is rewarded with customer and brand loyalty. Because CRM is mutually advantageous, market share viability advances at a sound pace.
- Provides cross-selling opportunities, where, based on customer approval, a business may pitch proven marketing or brand strategies to more than one client.

Customer relationship marketing should not be confused with "customer relationship management," a related, but unique concept that shares the acronym of CRM.

Customer **R**elationship **M**anagement an integrated information system that is used to plan, schedule and control the presales and postsales activities in an organization. CRM embraces all aspects of dealing

with prospects and customers, including the call center, sales force, marketing, technical support and field service. The primary goal of CRM is to improve long-term growth and profitability through a better understanding of customer behavior. CRM aims to provide more effective feedback and improved integration to better gauge the return on investment (ROI) in these areas.

Sales force automation (SFA), which became available in the late 1980s, was the first component of CRM. SFA, call center and automated field service operations were on parallel tracks in the 1990s and began to merge with marketing in the late 1990s to become CRM. Like ERP, CRM is a very comprehensive system, and numerous packages provide myriad options.

According to Glen Petersen, author of "ROI: Building the CRM Business Case," the most successful CRM systems are found in organizations that realign their business model for profitability, not just redesign their information systems.

15.3 HISTORY OF CRM

With advent of e-commerce, comes e-customer. The e-customer expects constant access to a company, through e-mails; call centers faxes and web sites. They demand immediate response and a personalized touch. Meeting their needs places new demands on the enterprise. Since traditional enterprise resource planning applications did not include a customer management aspect, CRM was the logical next step. CRM is getting increased importance these days because of increased competition. The product differentiation is also less these days. Hence the customer can easily switch over from one brand to another brand even against a small hike in the price. Obtaining customer loyalty and brand equity is highly challenging task in the present scenario. On the other hand technology has ripened to the point where it is possible to put customer information from all over the enterprise into a single system. Until recently it was difficult to manage the complex information about customers as the information was stored in different systems. But as network and internet technology has matured, CRM software has found its place in the world.

15.4 CHARACTERISTICS OF CRM

The customer relationship management technology employed in any organization should be well designed keeping the specific requirements of the organization in consideration. Well-designed CRM includes the following characteristics:

1. **Relationship management is a customer Oriented** feature with service response based on customer input, one-to-one solutions to customers' requirements, direct online communications with customer and customer service centers that help customers solve their questions.
2. **Sales force automation :** This function can implement sales promotion analysis, automate tracking

of a client's account history for repeated sales or future sales, and also ñoordinate sales, marketing, call centers, and retail outlets in order to realize the sales force automation.

3. **Use of technology :** This feature is about following the technology trend and skills of value delivering using technology to make "up-to-the-second" customer data available. It applies data warehouse technology in order to aggregate transaction information, to merge the information with CRM solutions, and to provide KPI (key performance indicators).
4. **Opportunity management :** This feature helps the company to manage unpredictable growth and demand and implement a good forecasting model to integrate sales history with sales projections

15.5 BENEFITS OF CRM

The biggest benefit most businesses realize when moving to a CRM system comes directly from having all your business data stored and accessed from a single location. Before CRM systems, customer data was spread out over office productivity suite documents, email systems, mobile phone data and even paper note cards and Rolodex entries. Storing all the data from all departments (e.g., sales, marketing, customer service and HR) in a central location gives management and employees immediate access to the most recent data when they need it. Departments can collaborate with ease, and CRM systems help organization to develop efficient automated processes to improve business processes.

Other benefits include a 360-degree view of all customer information, knowledge of what customers and the general market want, and integration with existing applications to consolidate all business information.

Importance of CRM to the B2B sector :

Many of the characteristics in the B2B market suggest that CRM is a factor which influences the business. CRM has special characteristics in the B2B market.

Consider "Critical mass (software engineering)". Due to customer relationship, a network can be established and extended. Extension causes the network not to increase benefits linearly, but in an exponential way. As new members can contact by any existing member the benefit of a network of 200 people is much more effective than one with 100. Hence, these networks can be used to increase the amount of available information for each company. This may lead to more information about a customer which can be used to make the way of handling the customer easier in the future. The history of previous sales from this customer may be a great relief. Moreover it is possible to establish technical cooperation a bigger network is more likely to provide special services.

These services include, among others "systems integration, hosting, financial services such as payment processing, receivables management, credit analysis and logistics services". Services of this kind encourage

companies to join the B2B network by using CRM. Furthermore, B2B hubs have another advantage as they can substitute external personal if members of the network liaise. This may not only avoid extra costs for arrangement of a new contract but is also likely to accelerate the speed of this arrangement as they are in the same network and already possess information about their negotiating partner. Ultimately, special knowledge is required for B2B markets. As B2B customers are generally more rational customers than B2Cs, a person or a team with special knowledge to each customer or industry may enhance the sales in this area.

15.6 E-CRM

Conventional customer relationship marketing done electronically is e-CRM. Companies understood that electronic customer relationship marketing (e-CRM) has significant potential, but they face challenges of building .their required technology infrastructure quickly and cost effectively. A knee jerk reaction is to buy off the shelf applications, cobble together a database of web traffic and online purchase information and launch a e-CRM initiative. Unfortunately many such efforts have met poor results.

A more sound approach is to install a comprehensive software platform of five engines that together enable the e-CRM business process. These five engines are

1. **The customer centric information store :** To consolidate information about millions of customers together with preferences, permissions and information that may be useful to them.
2. **The analysis and segmentation engine :** The leverage this customer information, to build a business campaign strategy and evaluate its success.
3. **The personalization engine :** To personalize the entire customer experience, configuring unique sets of messages offers to each customer
4. **The broadcast engine :** To proactively deliver information and offers to every customer via the media of his or her choice
5. **The transaction Engine :** To facilitate the interactions between and the company, either exchanging information or driving information.

15.7 E-GOVERNANCE

E-governance is the management information system used by government. In India both central and state government have employed E-governance in its various functionaries. Through e-governance the government can obtain vital information in less time which facilitates effective decision making. For example, untill Khajane software was initiated, it used to take months together to consolidate all the accounts under various heads to know the expenditure done and fund unutilized. Now the senior officials with a

click of mouse can know the status. E-governance initiatives aim at cost effectiveness and at providing various facilities to citizens. Innovation in the area of land records, taxation, procurement and such other services have been giving rise to improvement in quality of government transactions.

E–Governance expectations include transparent and corruption free system of online and any where any time service delivery. It should be faster, easier, simpler than the traditional system and facilitate problem solving with ease using electronic systems.

It is through the implementation of electronic media that the government can render its services and disseminate information effectively. Electronic governance (e-governance) can be defined as the use of Information and Communication Technologies (ICT) for the planning, implementation and monitoring of government programmes, projects and activities. In India, e–governance is experiencing a tremendous boom especially in the last twelve years. The Government of India has launched a national e–governance action plan. E-governance is an acronym for the term electronic governance used by government agencies to improve and refine the relations with citizens, businesses and other arms of government. It is an opportunity to transform a public sector organization's commitment, so that it can function as truly citizen centric. It provides an opportunity to provide cost effective services to the private sector contributing to the development of business and promotion of long term economic growth, an opportunity to change governance through improved access to accurate information. E-governance leads to transparent and responsive government machineries.

15.8 BENEFITS OF E-GOVERNANCE

Many projects of e-governance are introduced by the government both at the state and the central level to fetch various benefits, both for end-users and government.

Benefits to the Government

- E-Governance helps to reduce government expenditures.
- Government transactions and problem solving abilities can be faster.
- Government can be transparent in its dealings.
- It can improve tax collection and government revenue.
- It facilitates streamlined, standardized electronic information gathering and access.
- It increases productivity of government employees.

Benefits to the End Users

- Citizens of the nation can have easy access to the government services.
- Corruption can be minimized by implementing e-governance.
- It breaks down the barrier of distance or mobility that some citizens may encounter while commuting from far off and remote villages.

- It can provide round the clock access to government services.
- It eases the business of international trade and commerce.
- It leads to significant improvement in government to citizen (G2C) and government to business (G2B) interface.

E-governance involves use of information technology and especially the internet, to improve the delivery of government services to citizens, businesses and other government agencies.

The Gartner defines **e-governance** as the continuous optimization of service delivery, constituency participation and governance by transforming internal and external relationships through technology, the internet and new media.

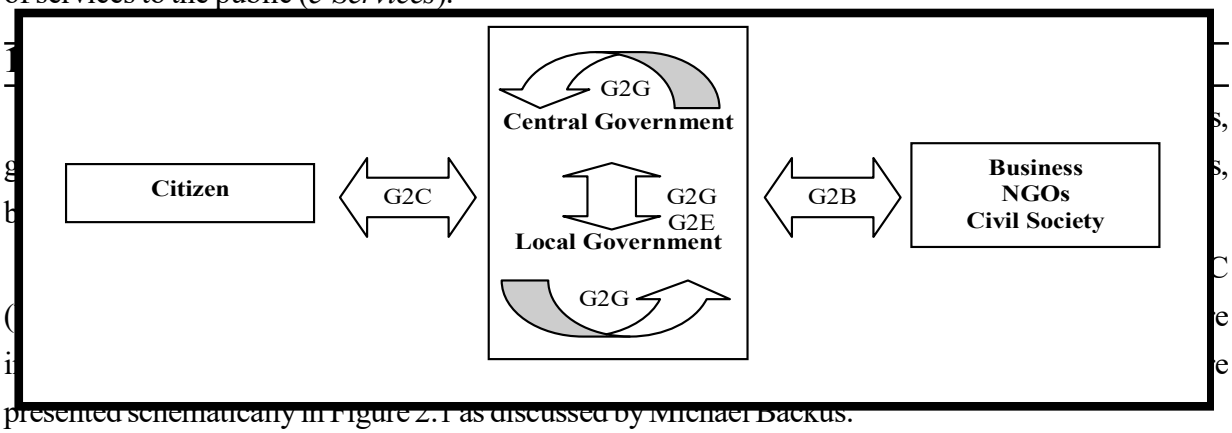
Mark Forman, has defined **e-governance** as the use of Internet technology and protocols to transform agency effectiveness, efficiency and service quality.

INTOSAI gives the definition of **e-governance** as online exchange of government information with, and the delivery of services to, citizens, businesses and other government agencies.

The OECD defines **e-governance** as the use of information and communication technologies, and particularly the internet, as a tool to achieve better government.

According to Michiel backus **E-governance** is defined as the application of electronic means in the interaction between government and citizens and government and businesses, as well as in internal government operations to simplify and improve democratic, government and business aspects of governance.

As per India group for true e-governance **Electronic Governance** *(e-governance)* incorporates all those processes and structures by means of which the new information and communication technologies can be deployed by government to enable administration of government (e-*administration*) and delivery of services to the public (*e-Services*).



presented schematically in Figure 2.1 as discussed by Michael Backus.

Figure 2.1: Interactions among Major Stakeholders in E-governance Source: Michiel Backus

G2C Projects : The e-governance initiatives that are taken up aiming at citizen satisfaction come under the ambit of G2C projects. The governments world over have initiated a number of projects to serve the citizens at large. There exists a mismatch between service providers and services receivers in any country; as such citizens at large are put into hardship while having any transaction with government.

G2B Projects : These projects represent the responsibility of the government towards business. In India, the government exerts greater control on the business and also promotes both domestic as well as international business. Hence the use of e-governance in this area serves the dual aspect of regulating and promoting the business.

G2G Projects : The constitution of India provides for a federal structure having states and central government. The exchange of various resources such as information, finance takes place on continuous basis between these governments. E-governance provides a solution for easy interaction between central and state government and various administrative authorities with in a state.

G2E projects : The government also has to cater to the needs of its own employees in terms of salary, promotion and other human resource related activities. The G2E system facilitates addressing these problems with the help of technology.

The coverage of e-governance in any country spreads out gradually. In the beginning, projects on G2C are initiated, success of these projects inspires projects on G2B, and this in turn leads intra governmental projects like G2G and G2E.

Karnataka is also a forerunner in implementation of E-governance. The projects like Bhoomi initiated in Karnataka have been successfully replicated in many other states. The various projects that are implemented in Karnataka are ;

- Bhoomi

- Kaveri
- Khajane
- KarnatakaOne
- RDS
- E-Procurement
- HRMS
- KSWAN
- E-Sugam
- Online Tax Returns

The projects that are on anvil include

- E-Attendance
- LMS and FMS
- Digital Land Records and Aakar Bandh
- Aadhar Project

Bhoomi :

The Bhoomi program was implemented as first e-governance project in February 2001 in the State of Karnataka. After its launch in five Taluks scattered in various districts as a 'pilot' program, the Government of Karnataka extended it in two phases to cover all 177 Taluks in the state to ensure mainstreaming within broader land management. The land has been allotted to individuals and institutions which may be private, public, government and also foreign companies for the purpose of cultivation. The land being physical property has been grossly manipulated in terms of records. Hence the government finds it very difficult to trace the ownership of the agriculture land, hence levying appropriate taxes on such agriculture land. The e-governance which penetrated into this sector as recipe enabled the government to maintain proper records of agriculture land which invariably covers survey number, RTC, mutation and Khatha. The program has generated a computerized database of 20 million land records belonging to 6.7 million farmers, besides gathering the entire history of cropping pattern for the last 12 seasons. In no other province in a developing country, are land cadastrals being digitized on such a scale. Framing the program demanded technical expertise and implementing it required very committed managerial expertise.

Not surprisingly, Bhoomi has won several awards, and was presented as an instance of best practice by the World Bank leading to the program being showcased nationally and internationally, as no other state had taken up such massive computerization of records. The Bhoomi places in a digital format, the Record of Right, Tenancy and crops and also records the characteristics of the land, the types of soil, rainfall and the crops grown. With eleven columns, spread among nine categories of information, the RTC is vital for a landowner to access bank loans, to buy seeds and fertilizer, for obtaining of documents

like the Small Farmer Certificates and also for evidence in the court. The RTC also records when the land is subdivided or amalgamated, and such mutations as part of land ownership/tenancy and inheritance. An improvement of Bhoomi is the *Bhoomi Plus* where the survey or physical dimension records will also be microfiched and placed online. The computerization is based on a LAN system interconnecting a kiosk and a back office within the Taluk office. Over the time, the original software has been improved by providing various features to reduce corruption, including First in - First Out (FIFO) and biometric authentication. More than 14 lakh RTCs are issued by Mysore Taluk office only in the year 2011. 36 computers are provided throughout the district which are managed by 36 employees. The network Management is done by Wipro limited. The training is provided to employees from District Training Institute. The data security is ensured by taking backups every day.

Kaveri :

The registration procedures in the state of Karnataka, till recently were substantially the same as they were hundred years ago. In spite of the considerable revenues generated by the registration department, registration of properties is a function of the government which was being done on the basis of methods prescribed during the British rule in the country.

In tune with the overall policy of using Information Technology for the benefit of citizens, the Government of Karnataka has computerized the registration department and named it as "KAVERI". Kaveri stands for Karnataka Valuation and e-registration Project which incidentally forms the name of the river Kaveri which takes care of two states Karnataka and Tamilnadu. Kaveri project is Karnataka State's first public-private e-governance initiative taken up for the stamps and registration department. Through this, the State has attempted to incorporate IT in the registration process to offer primarily the twin benefits to the citizens.

Khajane :

KHAJANE is a major e-governance initiative of the Karnataka State Government. Basically, it is a government-to-government (G2G) project. The application software 'KHAJANE' has been developed by CMC Ltd. This has become a support to the government which can inform the financial position of the state, the receipt and payment on daily, weekly, monthly, quarterly, half yearly, annual basis. This project was implemented mainly to eliminate systematic deficiencies in the manual treasury system and for the efficient management of state finance. This project is the first of its kind in the country where the entire treasury activity has been computerized. This is the only project where, from the time of approval of the state budget to the point of rendering accounts to the government, the entire activity can be tracked through the system. The government can present a white paper in the session by click of mouse in the computer. The opposition parties these days are not stressing for white paper in true sense because they are aware that it could be done instantaneously.

Further, once the entry of receipts or payment is made by the case worker concerned and the transmit button is clicked, the software shows this entry in the list of the next higher official, for his approval. Once he approves the entry by physically cross checking with the bill, he can transmit it to the next higher officer. Finally it goes to the officer concerned in the secretriat for final clearance and sanction of payment.

Karnataka One :

The KarnatakaOne project deals with payment facility of a range of utility bills such as electricity bill, telephone bill, water bill and so on. It was launched in 2005. This project is initially implemented in five large cities of Karnataka namely Bangalore, Mysore, Mangalore, Davanagere and Hubi-Dharawad. Then it was extended to Belgaum, Bellary, Shimoga and Tumkur. In Bangalore it is called BangaloreOne, in Hubli it is called HubliOne, in Mysore it is called MysoreOne and so on. This project provides many citizen centric services. This is the second project in India following E-Seva of Andhra Pradesh which provides this facility to the citizens. Andhrapradesh government headed by Sri Chandrababu Naidu, a computer savvy, had launched electronic based service system so as to enable the working class, women and also senior citizens to remit the bills without waiting in long queues. Earlier people used to be in queue for indefinite period to make payment for the bills.

Nemmadi :

The Government of Karnataka could realize the problems encountered by the revenue officers while issuing needful documents to the people of territory concerned. The representatives of general public could transmit their views on red tapism and corruption under the services. For this purpose, the government held a series of meetings with the district magistrates, sub divisional magistrates and Taluk magistrates including the sample of general public and took decision to implement e-services as a solution to aforesaid problem. In a democratic country like India, every citizen is like a king. The political parties which are forming the government have the obligation to render better services to the citizens also. 70 per cent of the people are in rural India, the government accords thrust on such segment by fulfilling their do's and donot's. Under the typical olds method, the stake holders are exploited on various grounds. The Nemmadi Kendra is recipe to such problems as it caters to the diverse needs of stakeholders within the time frame.

E-procurement :

E-procurement refers to the electronic way of purchasing goods and services. It facilitates online inviting and submission of tenders. The bids received are stored, opened after a specific date, compared, right vender is selected electronically. In 2009-10, the Government of Karnataka had sent a circular to all the departments, quasi- government and government aided institutions to follow e-procurement. Many

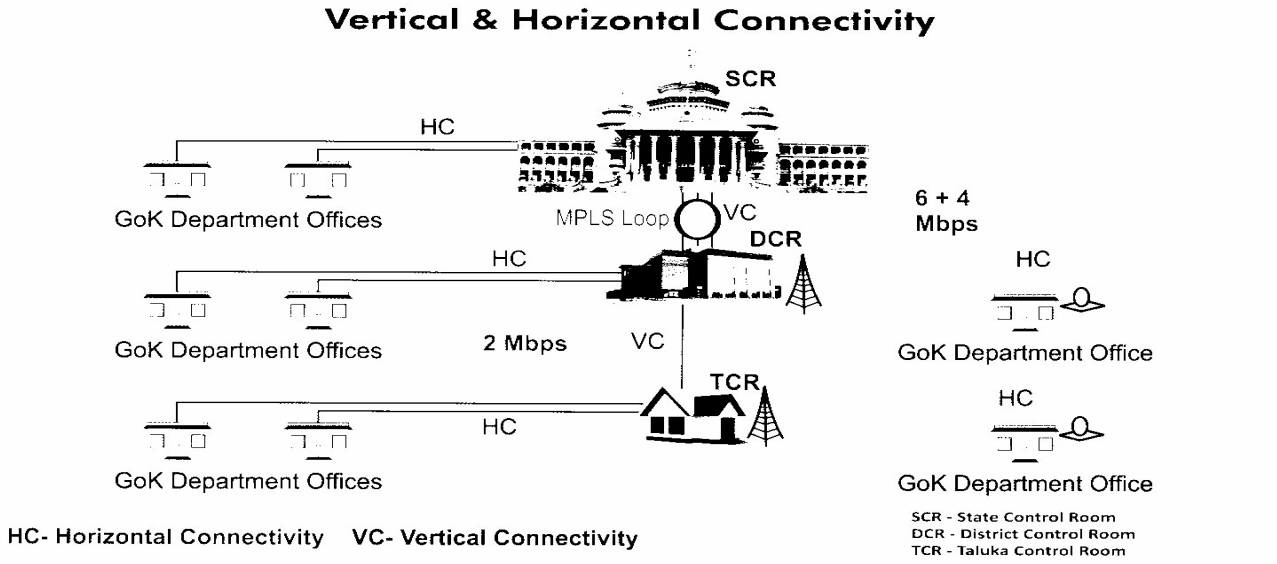
departments including universities gave deaf ear to this issue and expressed their unwillingness to follow the same under the strong pretext that they lacked knowledge. Under consistent pressure, many departments have bowed down and started implementing. The policy not only provides for absolute transparency, but also helps in eliminating the collusion between the department and mafia. The traditional method of manually managing the procurement processes in government departments / agencies resulted in heaps of files, records and documents, often stored in isolation within sections / wings / departments. A simple comparative study or an investigation on procurement activities typically involves physical search and retrieval of relevant files / records / documents and the official concerned had to spend substantial amount of official time and effort to have access to the relevant file / record / document.

HRMS :

Sri Sadananda Gowda, the then Chief Minister of Karnataka, in charge Ministry for Finance, stated categorically in his budget speech 2012-13 that out of every one rupee in the form of revenue, 65 paisa is earmarked to meet various demands of the employees. The implementation of sixth pay commission was a part of budget 2012-13. The DPAR (Department of Personnel and Administrative Reforms) is instrumental behind initiating HRMS. As already stated HRIS invariably covers the complete information about existing employees which is useful for effective utilization of HR, besides addressing the horizontal and vertical mobility and also other benefits. Karnataka Government started implementation of HRMS in March, 2005, which is unique in the entire country. HRMS is rolled out in the entire state. HRMS is the project of generating salary bills of more than seven lakh government employees and also maintaining employee service history. Human Resource Management Systems (HRMS) or Human Resource Information systems (HRIS) or Human Resource Technology shape an intersection between human resource management (HRM) and information technology. It merges HRM as a discipline and in particular it's basic Human Resource activities and processes with information technology.

KSWAN

The project KSWAN (Karnataka State Wide Area Network) has been initiated by Centre for e-Governance in the State of Karnataka to establish a State Information Highway by setting up a cost-effective, secure and reliable State Wide Area Network through Public Private Partnership. Under KSWAN, the Chief Minister or CM secretary can interact with the district magistrate, elected



direct access to interact with the people which help the top officials in reviewing situation which in turn can help in employing strategies to overcome the problems. KSWAN is initiated to connect 209 centres (1 State, 31 Districts, 177 Taluks) and approximately 1700 offices including Chief Minister's Office, Governor's Office, spread across the state of Karnataka.

The Government of Karnataka has set up a State Data Center (SDC), as the infrastructure is required for consolidating state level applications. It is the only State Data Center (SDC) in the country, which has been sanctioned by the Government of India.

E-Sugam

In India, the block marketers, holders, smugglers and tax evaders make constant effort to avoid tax paying for which they instigate vehicles to cross check posts unauthorizedly. E-Sugam system is a measure to plug the loop holes so that revenue from tax will get accelerated. E-Sugam stands for electronic - Simple Uploading of Goods Arrival and Movements. The mechanism of e-Sugam is as given below.

E-Sugam applies to all the buyers and sellers, be a manufacturer, dealer or agent purchasing or selling any goods worth more than Rs 20,000 from or to outside Karnataka. Once the goods are made ready, the seller has to prepare the invoice and e-mail it to the buyer. The buyer in turn uploads the details of goods being transported, vehicle number to the department's website (www.vat.kar.nic.in) and obtain

a unique number as a proof of uploading such transportation details. The unique number thus obtained shall be intimated to the seller who in turn puts this number in the invoice and arranges for transportation. Similarly before dispatching any goods outside Karnataka the seller should take the e-Sugam number and enter it in the invoice. The e-Sugam number must be produced before enforcement officer at the check post. The Commissioner is authorized to notify the goods, the transport of which needs to be entered in the notified website. Thus a trader, before dispatching goods by a truck, first uploads each transaction's details onto the department's website electronically, obtains an acknowledgement called e-SUGAM, for having uploaded and then uses this e-SUGAM as a valid document for transportation of goods.

15.10 SUMMARY

Customer relationship management plays a crucial role in the success of an organization. CRM had its existence even before industrialization here each organization used to cater to only few customers. After industrialization, when companies started having large of customers, it became difficult companies to give a personal touch to individual customer. As a result the customers lost their loyalty towards the organization and stated switching over to other companies. Of late the companies have understood the importance of retaining customers. With the help of technology now it is possible that the companies can record individual customer information and communicate with them individually.

With advent of technology and increased pressure from citizen for better services, even government had initiated use of technology to deliver its service which is better known as e-governance.

15.11 KEY WORDS

CRM,
eCRM,
E-Governance,
B2B, B2C

15.12 SELF ASSESSMENT QUESTIONS

1. Define CRM
2. Discuss the significance of CRM
3. Explain the benefits of CRM
4. Define E-governance, Explain the concept of E-governance
5. Examine various e-governance projects implemented in Karnataka

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UNIT - 16: SUPPLY CHAIN MANAGEMENT (SCM)

STRUCTURE

16.0 OBJECTIVES

After studying this unit, you will be able to :

* Asses the applications of Supply chain management;
* Identify the need for supply chain management;
* Explain the significance IT in supply chain management and
* Elucidate the uses of E- Business.

16.1 INTRODUCTION

Supply chain management is one of the emerging concept in the present scenario of material management. The supply chain management emphasizes on integrating logistics and lowering cost to provide better products and services that produces values in the hand of ultimate customer.

The council for logistics management defines supply chain management as the process of planning, implementing and controlling efficient and cost effective flow of material, in process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of confirming to the customer requirements. It integrates supplier, transporter, manufacturer, wholesaler, retailer and consumer in the form of a chain.

The business in twenty first century throws lot of challenges which the business has to cope such as

a. Managing uncertainty
b. Understanding customer
c. Understanding globalization of business

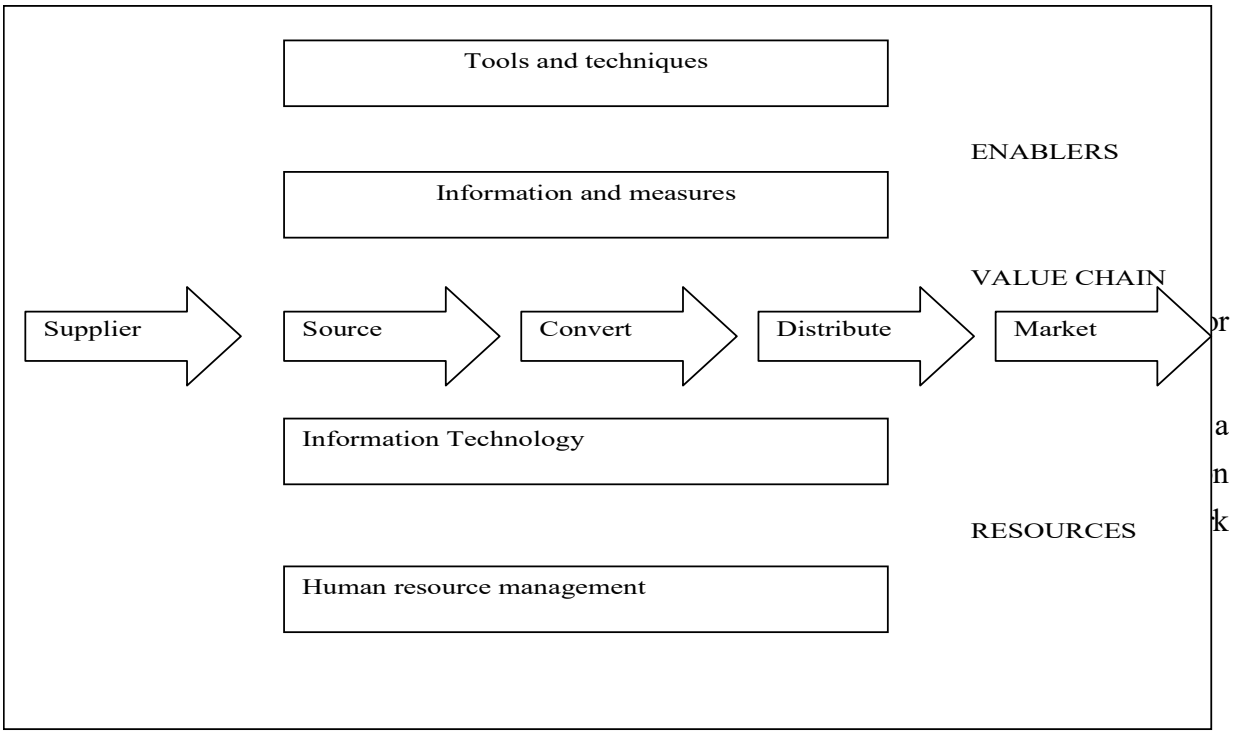
Though the supply chain management is not a new concept it has now became an emerging concept as it has encapsulated information technology with it

Importance of Supply chain management :

1. It integrates supplier, manufacturer, distributor and customer to reduce the cost. A large FMCG company is operating on negative working capital by proper use of SCM.
2. It reduces the total purchase-manufacturing- sales cycle time. One electrical equipment manufacturer has reduced time by 75%. One company has reduced engineering time from 2 months to one day
3. SCM meets the pressure of providing increased level of customer satisfaction.
4. Proper handling of supply chain management results in revenue growth and higher profitability through greater market share and price promotion
5. Without SCM i.e an integrated approach to various aspects of management results in redundancy and loss in the present scenario of globally competitive market.
6. It aims at best and cost effective methods of warehousing
7. It pays tremendous pay off
8. It is source of competitive advantage today.

16.2 CONCEPTS OF SCM

The concept of Supply chain management is illustrated with the help of a diagram. The enablers include tools and techniques and information performance measures where as resources include human



Information measures : Availability of the information to monitor the accomplishment of these success factors becomes crucial judge the success of the exercise. Proper IT support must be taken.

Human Resource Competencies : The ability of the individual involved in the exercise in crucial. Thus the concept of supply chain is more a mater of expanding the thinking and integration beyond the organization boundaries. Rightly implemented the concept will go a long way in saving costs and adding value to the organization

Value Chain : The value of the product or service increases as it passes from one link of the chain to the next link of the chain. The chain starts from supplier who supplies the material which is converted by the organization and it is distributed to the market with the help of intermediaries.

Information Technology : Prior to 1980s the information flow between functional areas with in an organization and between supply chain member organizations were paper based. The paper based transaction and communication is slow. Information was often over looked as a critical competitive resource because its value to supply chain members was not clearly understood. IT infrastructure capabilities provide a competitive positioning of business initiatives like cycle time reduction, implementation, implementing redesigned cross-functional processes.

Human resource management : Humane resource constitutes the integral part of supply chain management. They are decision markers in the supply chain through which value gets added to the chain. They are users and beneficiaries of the system.

16.3 PRINCIPLES OF SUPPLY CHAIN MANAGEMENT

David L. Anderson, Frank F. Britt, And Donavon J. Favre have given seven principles of supply chain management.

Principle 1: Segment customers based on the service needs of distinct groups and adapt the supply chain to serve these segments profitably.

Segmentation has traditionally grouped customers by industry, product, or trade channel and then taken a one-size-fits-all approach to serving them, averaging costs and profitability within and across segments. But segmenting customers by their particular needs equips a company to develop a portfolio of services tailored to various segments. Surveys, interviews, and industry research have been the traditional tools for defining key segmentation criteria.

Today, progressive manufacturers are turning to such advanced analytical techniques as cluster and conjoint analysis to measure customer tradeoffs and predict the marginal profitability of each segment. One manufacturer of home improvement and building products bases segmentation on sales and merchandising needs and order fulfillment requirements. Others are finding that criteria such as technical support and account planning activities drive segmentation.

Principle 2 : Customize the logistics network to the service requirements and profitability of customer segments.

Companies have traditionally taken a monolithic approach to logistics network design in organizing their inventory, warehouse, and transportation activities to meet a single standard. For some, the logistics network has been designed to meet the average service requirements of all customers; for others, to satisfy the toughest requirements of a single customer segment.

Neither approach can achieve superior asset utilization or accommodate the segment-specific logistics necessary for excellent supply chain management. In many industries, especially such commodity industries as fine paper, tailoring distribution assets to meet individual logistics requirements is a greater source of differentiation for a manufacturer than the actual products, which are largely undifferentiated.

Principle 3 : Listen to market signals and align demand planning accordingly across the supply chain, ensuring consistent forecasts and optimal resource allocation.

Forecasting has historically proceeded step by step, with multiple departments independently creating forecasts for the same products—all using their own assumptions, measures, and level of detail. Many consult the marketplace only informally, and few involve their major suppliers in the process. The functional orientation of many companies has just made things worse, allowing sales forecasts to envision growing demand while manufacturing second-guesses how much product the market actually wants.

Principle 4 : Differentiate product closer to the customer and speed conversion across the supply chain.

Manufacturers have traditionally based production goals on projections of the demand for finished

goods and have stockpiled inventory to offset forecasting errors. These manufacturers tend to view lead times in the system as fixed, with only a finite window of time in which to convert materials into products that meet customer requirements.

Principle 5 : Manage sources of supply strategically to reduce the total cost of owning materials and services.

Determined to pay as low a price as possible for materials, manufacturers have not traditionally cultivated warm relationships with suppliers. In the words of one general manager: "The best approach to supply is to have as many players as possible fighting for their piece of the pie—that's when you get the best pricing." Excellent supply chain management requires a more enlightened mindset—recognizing, as a more progressive manufacturer did: "Our supplier's costs are in effect our costs. If we force our supplier to provide 90 days of consigned material when 30 days are sufficient, the cost of that inventory will find its way back into the supplier's price to us since it increases his cost structure."

Principle 6 : Develop a supply chain-wide technology strategy that supports multiple levels of decision making and gives a clear view of the flow of products, services, and information.

To sustain reengineered business processes (that at last abandon the functional orientation of the past), many progressive companies have been replacing inflexible, poorly integrated systems with enterprise-wide systems.

Despite making huge investments in technology, few companies are acquiring this full complement of capabilities. Today's enterprise wide systems remain enterprise-bound, unable to share across the supply chain the information that channel partners must have to achieve mutual success.

Principle 7 : Adopt channel-spanning performance measures to gauge collective success in reaching the end-user effectively and efficiently.

To answer the question, "How are we doing?" most companies look inward and apply any number of functionally oriented measures. But excellent supply chain managers take a broader view, adopting measures that apply to every link in the supply chain and include both service and financial metrics.

First, they measure service in terms of the perfect order—the order that arrives when promised, complete, priced and billed correctly, and undamaged. Second, excellent supply chain managers determine their true profitability of service by identifying the actual costs and revenues of the activities required to serve an account, especially a key account. For many, this amounts to a revelation, since traditional cost measures rely on corporate accounting systems that allocate overheads evenly across accounts. Such measures do not differentiate,

16.4 BENEFITS OF SCM

Supply chain management reduces the investment in current and fixed assets without sacrificing

customer service. It includes

1. Efficient working of capital management- With vendor manager inventory and JIT inventory management very little money is locked up in raw material. SCM assures quick movement of finished goods to the point of consumption.
2. Reduced fixed capital requirement: IT supports increased outsourcing. It requires smaller storage areas, fewer manufacturing facilities less number of warehouse, fewer employees etc
3. Revenue growth: It speeds up the flow of new products, access to new market.
4. Shrink time to market: SCM speeds up time from design to market and tries aim at benefit monopoly i.e. before competitor products enter into market.
5. Customer franchise management: By providing a high level of service and customized programmes at reasonable cost, supply chain managers help companies to build strong and lasting franchise with customers.
6. Competitively superior value: If companies invest its resources in supply chain, the product or service is competitively superior.
7. Economics: Supply chain management involves understanding of cost element of and finds place in changing market
8. New product and service: SCM involves speed innovation and aggressive introduction of new product and service. Involving supplies in the design stage for new products helps in simplification and reduction of cost of companies
9. Channel Management : Growth can be achieved by creatively using alternative distribution channels and even use of multi channel strategies
10. Superior customer service: Customers are looking into more service features than product alone. The value chain must be sensitive to customer needs should be able to meet ad hoc purchases and emerging demands.

16.5 IMPACT OF SCM

SCM has made impact on many factors such as **:**

On customer service : Customer service includes a wide set of activities that attempt to keep a customer satisfied with a product or service after sale. With the organization for supply chain management, the gates of customer services are wide open. There are dedicated customer managers who help in promotion and delivery. They provide customer training and technical support 24 hours in a day. The companies include a network of spare parts distribution centre.

On inventory : The SCM has a direct impact on inventory. It is responsible for managing materials

release for suppliers. It contacts directly a supplier concerning changes and monitoring the status of inbound shipment. SCM evaluates and selects source of supply determines order quantity and shipment schedule. Integrating SCM require that the material and inventory control group coordinate their efforts to ensure a smooth and uninterrupted flow to customer.

Transportation : Transportation is considering from two view points. One is inbound transportation i.e. managing physical and informational links between supplier and buyer. The SCM pays close attention to transportation. It controls all inbound material shipment. The outbound transportation is the link between company and its customer

Order processing : Order processing is the vital link in ensuring that a customer receives material when and where it is needed. It involves accepting a customer order and sequencing it internally. Earlier there was no proper coordination between scheduling and production, meeting the delivery date as requested by customer. But now it is has become an important link between producer and customer supply chain

16.6 ROLE OF IT IN SCM

Prior to 1980s the information flow between functional areas with in an organization and between supply chain member organizations were paper based. The paper based transaction and communication is slow. During this period, information was often over looked as a critical competitive resource because its value to supply chain members was not clearly understood. IT infrastructure capabilities provides a competitive positioning of business initiatives like cycle time reduction, implementation, implementing redesigned cross-functional processes. Several well know firms involved in supply chain relationship through information technology. Three factors have strongly impacted this change in the importance of information. First, satisfying in fact pleasing customer has become something of a corporate obsession. Serving the customer in the best, most efficient and effective manner has become critical. Second information is a crucial factor in the managers' abilities to reduce inventory and human resource requirement to a competitive level. Information flows plays a crucial role in strategic planning.

In the development and maintenance of Supply chain's information systems both software and hardware must be addressed. Hardware includes computer's input/output devices and storage media. Software includes the entire system and application programme used for processing transactions management control, decision-making and strategic planning. Recent development in Supply chain management software is **:**

1. Base Rate, Carrier select & match pay (version 2.0) developed by Distribution Sciences Inc. which is useful for computing freight costs, compares transportation mode rates, analyze cost and service effectiveness of carrier.
2. A new software programme developed by Ross systems Inc. called Supply Chain planning which is

used for demand forecasting, replenishment & manufacturing tools for accurate planning and scheduling of activities.

3. P&G distributing company and Saber decision Technologies resulted in a software system called Transportation Network optimization for streamlining the bidding and award process.
4. Logistics planning solution was recently introduced to provide a programme capable managing the entire supply chain.

16.7 ELECTRONIC COMMERCE

It is the term used to describe the wide range of tools and techniques utilized to conduct business in a paperless environment. Electronic commerce therefore includes electronic data interchange, e-mail, electronic fund transfers, electronic publishing, image processing, electronic bulletin boards, shared databases and magnetic/optical data capture. Companies are able to automate the process of moving documents electronically between suppliers and customers.

Electronic Data Interchange : Electronic Data Interchange (EDI) refers to computer-to-computer exchange of business documents in a standard format. EDI describe both the capability and practice of communicating information between two organizations electronically instead of traditional form of mail, courier, & fax. The benefits of EDI are

1. Quick process to information.
2. Better customer service.
3. Reduced paper work.
4. Increased productivity.
5. Improved tracing and expediting.
6. Cost efficiency.
7. Competitive advantage.
8. Improved billing.

Though the use of EDI supply chain partners can overcome the distortions and exaggeration in supply and demand information by improving technologies to facilitate real time sharing of actual demand and supply information.

Bar coding and Scanner : Bar code scanners are most visible in the check out counter of super market. This code specifies name of product and its manufacturer. Other applications are tracking the moving items such as components in PC assembly operations, automobiles in assembly plants.

Data warehouse : Data warehouse is a consolidated database maintained separately from an organization's production system database. Many organizations have multiple databases. A data warehouse is organized around informational subjects rather than specific business processes. Data held in data

warehouses are time dependent, historical data may also be aggregated.

Enterprise Resource planning (ERP) tools: Many companies now view ERP system (eg. Baan, SAP, People soft, etc.) as the core of their IT infrastructure. ERP system have become enterprise wide transaction processing tools which capture the data and reduce the manual activities and task associated with processing financial, inventory and customer order information. ERP system achieve a high level of integration by utilizing a single data model, developing a common understanding of what the shared data represents and establishing a set of rules for accessing data.

16.8 SUMMARY

All companies operating in various fields have the opportunity to enhance both customer satisfaction and profitability by strengthening management of supply chain. While these companies have pursued different initiatives, all have realized the need to integrate activities across the supply chain. Doing so can improve asset utilization, reduce cost and create price advantage that help attract and retain customer

16.9 KEY WORDS

Supply chain management

Customer service

Order placement

Transportation

16.10 SELF ASSESSMENT QUESTIONS

1. Define Supply chain management. Examine the role of SCM in today's business scenario
2. Identity benefits of SCM
3. Examine the role of IT in SCM
4. Explain the principles of SCM

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