MBA-DE(Second Year)

Semester-III

Lesson No. 1

MISDSS 302

MANAGEMENT INFORMATION SYSTEM &

DECISION SUPPORT SYSTEM

AUTHOR: SAHIL RAJ

STRUCTURE

1.0 OBJECTIVES

After reading this lesson, students would be able to answer:

- Concept of information system
- Structure of MIS
- Characteristics of MIS
- Importance of MIS

1.1 INTRODUCTION

The system provides information on the past, present and project future and on relevant events inside and outside the organization. It may be defined as a planned and integrated system for gathering relevant data, converting it in to right information and supplying the same to the concerned executives.

The information system provides procedures to record and make available information, concerning part of an organization, to assist organization related activities. Before moving ahead with further elaboration of IS it is very important to define information and system.

Information is a necessary and vital input in any decision making process in an organization. Davis & Olson have defined information as data that has been processed into a form that is meaningful to the recipient and is of real & perceived value in current or prospective actions or decisions.

So information is processed form of data and it reduces uncertainty and triggers action.

TYPE OF INFORMATION

The types of information are directly related to the activities that use the information.

1. Functional information is used by functional activities. Many functional activities contain information processing activities which may record information in and receive information from an information system. Examples of information activities are

— Processing a shipment order
— Paying employee wages
— Processing a sale order

2. The second type of information is MANAGEMENT INFORMATION deals with management activities which are less detailed but of longer duration as compared to functional information. The management activities are scheduling jobs, hiring and firing staff, managing departmental budgets, organizational performance against objectives, deciding new strategies.

The other part of IS is the system. System may be defined as set of elements which are joined together to achieve a common objective. The set of elements of a system are input, process, and output. A system has one or multiple input(s), these inputs are processed through a transformation process to convert inputs into outputs, but when we attach feedback and control elements to any system it is known as CYBERNATIC SYSTEM.

1.2 TYPES OF SYSTEM

- Abstract and Physical system
- Deterministic and Probabilistic system
- Open and Closed system
- User machine system

An Abstract System is an orderly arrangement of interdependent ideas or constructs, which may or may not have any counterpart in the real world. For example, a system of theology which is an orderly arrangement of ideas of god and relationship of humans with god

— The Physical System is generally concrete operational system made of people, materials, energy, and other physical things. E.g. transportation system, computer system,

Deterministic System is one in which the occurrence of all events is known with certainty. E.g. correct computer program which performs exactly according to a set of instructions.

— While Probabilistic System is one in which the occurrence of events cannot be perfectly predicted. E.g. warehouse and its contents. Given a description of the contents at a given point, the contents at the next point in time could not be perfectly predicted.

— An Open System interacts with environment and thus exchanges information, material, energy with environment including random and undefined inputs. Open systems are adaptive in nature as they tend to react with environment in such a way so as to favor their existence. All living systems are open systems

— Closed System is one which does not interact with environment; such systems are isolated from environment. E.g. the computer program is relatively closed system.

In User Machine system both humans and machines perform some activities in the accomplishment of objective. The machine elements are closed and deterministic whereas the human elements are open and probabilistic.

The systems approach provides a model based on system concepts which is claimed to be applicable to an unrestricted stet of situations. We may define a model as an abstract representation of reality. There are three types of models:

1. **Predictive models** are used for predicting the future and therefore are used for

planning

2. **Normative models** suggest the best action to be taken in a given situation
3. **Descriptive models** are useful for deeper understanding of a situation under investigation. This model is based in "DIVIDE AND CONQUER" principle where a situation is divided into smaller parts using the concepts of inputs/outputs and partitioned from other systems using the concepts of boundary and environment. The model further provides a typology of systems from open to close depending on the degree of interaction with the environment.

1.3 SELF CHECK EXERCISE

1.3.1 What are the different types of system?

1.3.2 What are the different types of models?

1.4 ADVANTAGES OF SYSTEM APPROACH

The system approach provides an informal start to understand and describe a situation using intuitively familiar notions of input, output and process. The decomposition of processes is useful method of analyzing complex processes. The notion of the importance of a control system often highlights the fact that one is missing or ineffective.

A system description is often simple enough for it to be used as £ too for communication between individuals accompanied by a suitable explanation. Thus IS provides a mean for processing information to improve the efficiently and effectiveness of the organization. There are two parts in definition

- Structure and functioning of IS
- Organizational context of IS

  i.e. the information is recorded this information concerns a part of organization as it relates to sales department, recording information such as items sc-ld , their quantities and the prices. There are procedures to record and make available the information then there is close relationship between information system and the organization. The IS satisfies the information needs of required activities Secondly it provides automated procedures which assist activities.

Thirdly the system is useable and acceptable to organization.

1.5 TYPOLOGY

IS can be categorized into various types:

1. **Transaction Processing System (TPS):** TPS processes transactions i.e. just automation of day to day activities of the organization. The TPS does not provide any information to the managers which can be used for decision making. TPS takes input as data and gives output as data. Now a day as competition is increasing so organizations need that type of information system which can be used to felicitate decision making process. So organization are moving forward to develop a refined model of TPS and the solution came in the form of MIS
2. **Management Information System (MIS)**: MIS is one step ahead of typical TPS. Whereas TPS only provides data the MIS provides information which facilitate the decision making process for the managers. The objective of MIS is to provide right information to right person at right time. The information provided by MIS can be used for short range as well as for long range planning but mainly the domain of

MIS is at management control level.

MIS the term is generally understood as user machine system for generating and providing information to support operations, management and decision making functions in an organization by utilizing computer hardware and software, manual procedures, models for analysis,planning, control and decision making and strong well developed database. Again in spite of all he merits of MIS there is limitation of that MIS is primarily for the management control level but in this era of competitive world the managers at the strategic planning level have to take quick and important decision and these decisions have far reaching implications for the organization. So organizations need a dedicated IS for the top management level and answer is DSS

3. **Decision Support System (DSS):** If MIS is considered as refined model of TPS then DSS is the refined model of MIS. Again DSS provides information which can be used for decision making process but DSS is made specifically for the strategic planning level managers. Also DSS is interactive in nature i.e. the top level managers can ask what if analysis. This is one of the important application of DSS the managers can vie different prospective of the problem and know the possible implication of the decision on various important attributes. So with help of DSS, an organization can do sensitivity analysis.
4. **Executive Support System (ESS)**: The ESS is the special kind of DSS. DSS is for all the top level managers but sometimes organization needs specific type of DSS considering the requirements as well as the personality of managers. For this ESS is developed but ESS has got limited usage because it is tailored made for managers and for particular requirements.
5. **Business Expert System**: Since the invention of computers every possible effortis made that computers should display human like intelligence. With the advancements that are made in the field of Artificial Intelligence this dream can be fulfilled. In the terms of IS we term it as KNOWLADGE BASED IS. Business Expert System is Knowledge Based Information Systems that uses the knowledge of specific area and act as expert.

1.6 SELF CHECK EXERCISE

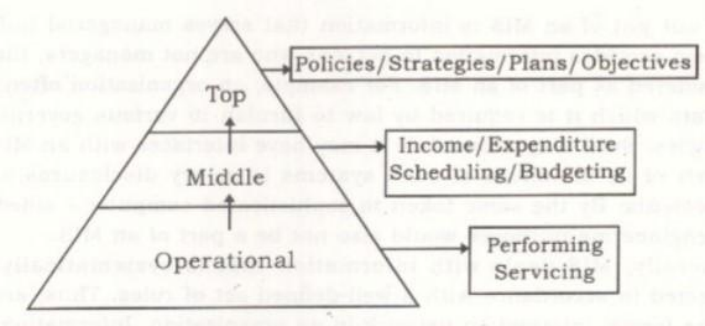
1. What are different types of Information System?

1.7 STRUCTURE OF MIS

Structure based on the management Activities There are three levels of management i.e.

- Strategic Management
- Management Control
- Operational Control

The strategic planning deals with the broad levels of plan or strategies of the organization. The next level deals with the planning, scheduling and controlling of the system activities and the last levels deals with the day to day activities such as general transactions. At the strategic level the top management deals with the formation of policies, plans and objectives whereas at the middle level the job is to make specific income, expenditure, scheduling and budgeting goals. The operational level deals with the producing services and goods required to meet the revenue and cost goals.



For the Top level there is Strategic information system

For the Middle level there is Management information system

For the Operational level there is Transaction Processing system

The structure of MIS can be identified into different sub groups

Structure based on the physical components- The physical components of an organization can be hardware, software, database and operating persons. Every organization is unique and the structure can be different in the form of the components the organization.

Lastly the structure of MIS can also be described on the basis of the decision. For the structured decision is well defined and can be easily programmable. Management Information systems can easily support these types of the decisions whereas for the unstructured decisions there are other types of information systems that can be used according to the need.

1.8 CONCEPT OF MIS

The Concept of management information systems originated in the 1960s and become the byword of almost all attempts to relate computer technology and systems to data processing in business. During the early 1960s, it became evident that the computer was being applied to the solution of business problem in a piecemeal fashion, focusing almost entirely on the computerization of clerical and record - keeping tasks. The concepts of management information systems were developed to counteract such in efficient development and in effective use of the computer. The MIS concepts are vital to efficient and effective computer use in business of two major reasons:

1. It serves as a systems framework for organizing business computer applications. Business applications of computers should be viewed as interrelated and integrated computer - based information systems and not as independent data processing job.
2. It emphasizes the management orientation of electronics information processing in business. The primary goal of computer based information systems should be the processing of data generated by business operations.

1.9 CHARACTERISTICS OF MIS

A management information system is an integrated man - machine systems that provides information to support the planning and control function of manager in an organization.

The output of an MIS is information that serves managerial functions. When a system provides information to persons who are not managers, then it will not be considered as part of an MIS. For example, an organization often processes a lot of data which it is required by law to furnish to various government regulatory agencies. Such a system, while it may have interfaces with an MIS: would not be a part of it, Instances of such systems is salary disclosures and excise duty statements. By the same token to sophisticated computer - aided design system for engineering purposes would also not be a part of an MIS.

Generally, MIS deals with information that is systematically and routinely collected in accordance with a well-defined set of rules. Thus, and MIS is a part of the formal information network in an organization. Information that has major managerial planning significance is sometimes collected at golf courses. Such information is not part of MIS, however; one- shot market research data collected to gauge the potential of a new product does not come within the scope of an MIS by our definition because although such information may be very systematically collected it is not collected on a regular basis.

Normally, the information provided by an MIS helps the managers to make planning and control decisions. Now, we will see, what is planning and control. Every organization in order to function must perform certain operations. For Example, a car manufacturer has to perform certain manufacturing activities, a wholesaler has to provide water to its area of jurisdiction. All these are operations that need to be done. Besides, these operations, an organization must make plans for them. In other words, it must decide on how many and what type of cars to make next month or what commissions to offer retailers or what pumping stations to install in the next five years.

Also an organization must control the operations in the light of: he plans and targets developed in the planning process. The car manufacturer must know if manufacturing operations are in line with the targets and if not, he must make decisions to correct the deviation or revise his plans. Similarly, the wholesaler will want to know the impacts that his commissions have had on sales and make decisions to correct adverse trends. The municipal corporation will need to control the tendering process and contractors who will execute the pumping station plans.

Generally, MIS is concerned with planning and control. Often there are elaborate systems for information that assists operations. For example, the car manufacturer will have a system for providing information to the workers on the shop floor about the job that needs to be done on a particular batch of material. There may be route sheets, which accompany the rate materials and components in their movement through various machines. This system per se provides only information to support operation. It has managerial decision-making significance. If, however, the system does provide information on productivity, machine utilization or rejection rates, then we would say that the system is part of an MIS.

Generally, MIS has all the ingredients that are employed in providing information support to manager to making planning and control decisions. Managers often use historical data on an organization's activities as well as current status data

make planning and control decisions. Such data comes from a data base which is contained in files maintained by the organization. This data base is an essential component of an MIS. Manual procedures that are used to collect and process information and computer hardware are obvious ingredients of an MIS. These also form part of the MIS. In summary, when we say that an MIS is an integrated man

— Machine systems that provided information to supports the planning and control function of managers in an origination. It does the following function.
— Sub serves managerial function
— Collects stores, evaluates information systematically and routinely
— Supports planning and control decisions
— Includes files, hardware, software, software and operations research models. Effective management information systems are needed by all business organization

because of the increased complexity and rate of change of today's business environment. For Example, Marketing manager need information about sales performance and trends, financial manger returns, production managers need information analyzing resources requirement and worker productivity and personnel manager require information concerning employee compensation and professional development. Thus, effective management information systems must be developed to provide modern managers with the specific marketing, financial, production and personnel information products they required to support their decision making responsibilities.

1.10 NEED OF MIS

An MIS provides the following advantages.

1. It Facilitates Planning

MIS improves the quality of plants' by providing relevant information for sound decision - making. Due to increase in the size and complexity of organizations, managers have lost personal contact with the scene of operations.

2. In Minimizes Information Overload

MIS change the larger amount of data in to summarize form and there by avoids the confusion which may arise when managers are flooded with detailed facts.

3. MIS Encourages Decentralization

Decentralization of authority is possibly when there is a system for monitoring operations at lower levels. MIS is successfully used for measuring performance and making necessary change in the organizational plans and procedures.

4. It Brings Coordination

MIS facilities integration of specialized activities by keeping each department aware of the problem and requirements of other departments. It connects all decision centers in the organization.

5. It Makes Control Easier

MIS serves as a link between managerial planning and control. It improves the ability of management to evaluate and improve performance. The used computers have increased the data processing and storage capabilities and reduced the cost

6. MIS assembles, process, stores, Retrieves, evaluates and disseminates the information.

Thus Management Information Systems (MIS) is the term given to the discipline focused on the integration of computer systems with the aims and objectives on an organization.

The development and management of information technology tools assists executives and the general workforce in performing any tasks related to the processing of information. MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.

Applications of MIS

With computers being as ubiquitous as they are today, there's hardly any large business that does not rely extensively on their IT systems.

However, there are several specific fields in which MIS has become invaluable.

1. Strategy Support

While computers cannot create business strategies by themselves they can assist management in understanding the effects of their strategies, and help enable effective decision-making.

MIS systems can be used to transform data into information useful for decision making. Computers can provide financial statements and performance reports to assist in the planning, monitoring and implementation of strategy.

MIS systems provide a valuable function in that they can collate into coherent reports unmanageable volumes of data that would otherwise be broadly useless to decision makers. By studying these reports decision-makers can identify patterns and trends that would have remained unseen if the raw data were consulted manually.

MIS systems can also use these raw data to run simulations - hypothetical scenarios that answer a range of 'what if questions regarding alterations in strategy. For instance, MIS systems can provide predictions about the effect on sales that an alteration in price would have on a product. These Decision Support Systems (DSS) enable more informed decision making within an enterprise, which would not be possible without MIS systems.

2. Data Processing

Not only do MIS systems allow for the collation of vast amounts of business data, but they also provide a valuable time saving benefit to the workforce. Where in the past business information had to be manually processed for filing and analysis it can now be entered quickly and easily onto a computer by a data processor, allowing for faster decision making and quicker reflexes for the enterprise as a whole.

3. Management by Objectives

While MIS systems are extremely useful in generating statistical reports and data analysis they can also be of use as a Management by Objectives (MBO) tool.

MBO is a management process by which managers and subordinates agree upon a series of objectives for the subordinate to attempt to achieve within a set time frame. Objectives are set using the SMART ratio: that is, objectives should be Specific, Measurable, Agreed, Realistic and Time-Specific.

The aim of these objectives is to provide a set of key performance indicators by which an enterprise can judge the performance of an employee or project. The success of any MBO objective depends upon the continuous tracking of progress.

In tracking this performance, it can be extremely useful to make use of an MIS system. Since all SMART objectives are by definition measurable they can be tracked through the generation of management reports to be analyzed by decision-makers.

Benefits of MIS

The field of MIS can deliver a great many benefits to enterprises :n every industry. Expert organizations such as the Institute of MIS along with peer reviewed journals such as MIS Quarterly continue to find and report new ways to use MIS to achieve business objectives.

Core Competencies

Every market leading enterprise will have at least one core competency - that is, a function they perform better than their competition. By building an exceptional management information system into the enterprise it is possible to push out ahead of the competition. MIS systems provide the tools necessary to gain a better understanding of the market as well as a better understanding of the enterprise itself.

Enhance Supply Chain Management

Improved reporting of business processes leads inevitably to a more streamlined production process. With better information on the production process comes the ability to improve the management of the supply chain, including everything from the sourcing of materials to the manufacturing and distribution of the finished product.

1.11SELF CHECK EXERCISE-3

1.11.1. What is the need of MIS?

1.12 ANSWERS TO SELF CHECK EXERCISES

Self Check Exercise-1

1.3.1 Different types of Systems are:

- Abstract and Physical system
- Deterministic and Probabilistic system
- Open and Closed system
- User machine system

1.3.2 There are three types of models

- Predictive models
- Normative models
- Descriptive models

Self Check Exercise-2

1.6.1 IS can be categorized into various types:

- Transaction Processing System (TPS)
- Management Information System (MIS)
- Decision Support System(DSS)
- Executive Support System (ESS)
- Business Expert System

Self Check Exercise-3

1.11.1 An MIS provides the following advantages.

- It Facilitates Planning
- In Minimizes Information Overload
- MIS Encourages Decentralization etc.

1.13 Review Questions

Short Questions

1. What is functional information?
2. Explain Management information in detail.

Long Questions

1. What is abstract and physical system?
2. Explain the structure of MIS.

1.14RECOMMENDED READINGS

1. Gordon B. Davis, Margrethe H. Olson: Management Information System
2. Robert G. Murdock, Joel E. Ross: Management Information System
3. D. P. Goal: Management Information System

STRUCTURE

2.0 OBJECTIVES

After reading this lesson, students would be able to answer:

- Importance of Planning
- System Development models
- Design of Management Information System

2.1 INTRODUCTION

All businesses share one common asset, regardless of the type of business. It does not matter if they manufacture goods or provide services. It is a vital part of any business entity, whether a sole proprietorship or a multinational corporation. That common asset is information. Information enables us to determine the need to create new products and services. Information tells us to move into new markets or to withdraw from other markets. Without information, the goods do not get made, the orders are not placed, the materials are not procured, the shipments are not delivered, the customers are not billed, and the business cannot survive.

But information has far lesser impact when presented as raw data. In order to maximize the value of information, it must be captured, analyzed, quantified, compiled, manipulated, made accessible, and shared. In order to accomplish those tasks, an information system (IS) must be designed, developed, administered, and maintained.

2.2 INFORMATION SYSTEMS

An information system is a computer system that provides management and other personnel within an organization with up-to-date information regarding the organization s performance for example, current inventory and sales. It usually is linked to a computer network, which is created by joining different computers together in order to share data and resources. It is designed to capture, transmit, store, retrieve-, manipulate, and or display information used in one or more business processes. These systems output information in a form that is useable at all levels of the organization: strategic, tactical, and operational.

Systems that are specifically geared toward serving general, predictable management functions are sometimes called management information systems (MIS). A good example of an MIS report is the information that goes into an annual report created for the stockholders of a corporation (a scheduled report). The administration of an information system is typically the province of the MIS or information technology (IT) department within an organization.

Some applications have infringed on the familiar MIS landscape. Enterprise resource planning (ERP) software and executive information systems (EIS) both provide packaged modules and programs that perform the same functions as traditional MIS, but with greater functionality, flexibility, and integration capabilities.

2.3 SYSTEM DEVELOPMENT APPROACHES

The IS for the organizations are very complex in nature so it is very much necessary to break the complete system in various parts and then develop a system. This breaking of complex system into smaller manageable parts helps in proper development of system.

System development process contains following steps:

- • Investigation
- Analysis
- Design
- Construction
- Implementation
- Maintenance

Now there are various MODELS which help in the system development process.

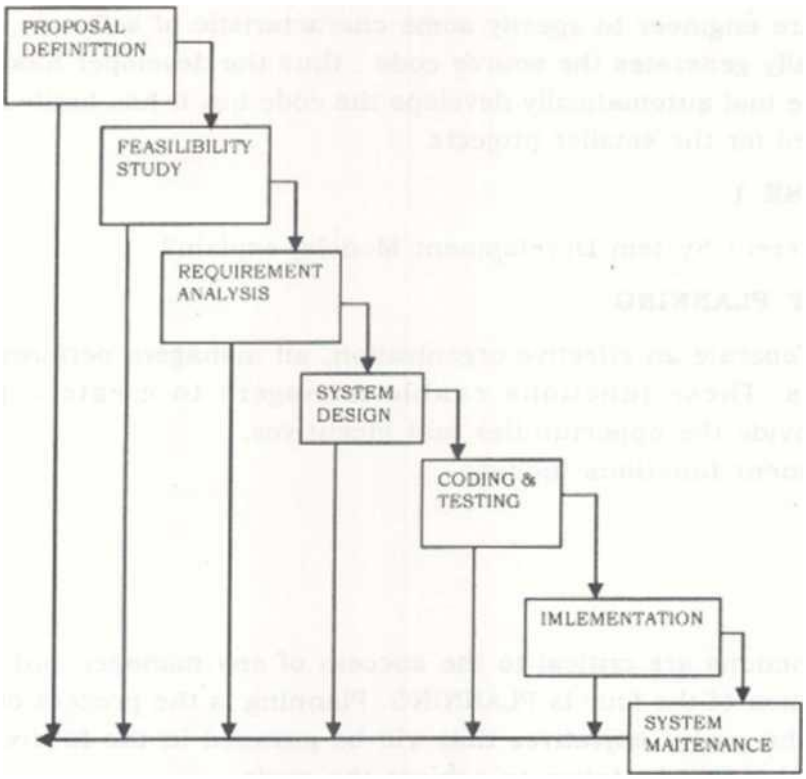
A system development model tells how the activities are joined for development of the complete system

2.4 SYSTEM DEVELOPMENT MODELS

Waterfall Model

Waterfall model works on the principle of System Development LIFE Cycle. In other words, it means are phases are integrated and output of one phase becomes output for the next stage. The various phases are form

A. Proposal Definition
B. Feasibility Study
C. Requirement Analysis
D. System Design
E. Coding & Testing
F. Implementation
G. System Maintenance



Prototyping Models

In prototyping approach, a prototype is developed instead of complete model. Prototype does not include all functions that a system has to perform but a general model which can display the capabilities of the system e.g. in automobile shows various companies show their prototype models if new cars then they get the response from various experts and from public. Out of ten prototypes that a company displays it might go on to produce only one model based on the response. In general prototype has four stages

A. Knowing the basic requirements of the user
B. Develop the basic prototype
C. Get the user response
D. Revise and Enhance the system

Integrative Enhancement Model

In this approach the system is developed in increments and each enhancement adds some more functional capabilities to the system. Initially a basic model is developed which performs some basic functions then it is tested then some more additions are done to add more functional capabilities to it. It is more useful approach because instead of making complete system it works on the principle of increments and if there is any fault it can detect very easily and can be rectified very easily.

Spiral Model

This model was proposed by Boehm. This model works on the notion that various activities are organized like a spiral. This model is cyclic in nature. Each cycle of the spiral consists of four stages represented by one quadrant each. The angular dimension represents the progress of the development and the radius of the spiral represents the cost involved. **Fourth Generation Technique**

The 4GT includes a broad array of software tools that has one special application that

is it enables the software engineer to specify some characteristic of software at a high level then the too automatically generates the source code. thus the developer has to just specify some attributes then the tool automatically develops the code but it has limited use. However, the model can be applied for the smaller projects.

2.5 SELF CHECK EXERCISE

2.5.1 What are different System Development Models?

2.6 IMPORTANCE OF PLANNING

To establish and operate an effective organization, all managers perform several major functions or activities. These functions enable managers to create a positive work environment and to provide the opportunities and incentives.

The key management functions include

— planning
— organizing
— directing
— controlling.

Each of these functions are critical to the success of any manager and organizations. The primary function of the four is PLANNING. Planning is the process of analyzing the situation, determining the goals/ objectives that will be pursued in the future, and deciding in advance the actions that will be taken to achieve the goals.

The following are the steps involved in Planning Process

1. Reviewing the current operation situation.
2. Conducting the current operation strengths/ weaknesses.
3. Studying the External environmental factors affecting the operation.
4. Studying the expectations of the operations.
5. Determine the opportunities for improvements/growth and negatives constraints.
6. Based on the above analyses, determine the:
   — goals
   — objectives

   for the operation for the future period.
7. Based on the objectives, determine your strategy
   — how you are going to achieve the objectives.
8. Based on the strategy, determine the action plan
   — that has to be implemented.
9. Your action plan will determine the resources required
   — manpower
   — finance materials
10. Finally, a system to monitor the plan/its progress.

• The PLANNING is the most challenging, because FUNCTIONALLY, it provides

— opportunity to determine the environmental impact on the organization / business.
— opportunity to assess the organization's strengths/ weaknesses.
— opportunity to determine the business opportunities/ threats to business.
— opportunity to develop strategic plans for the company.

- opportunity to develop long term/short term plans.
- opportunity to develop a vision for the organization.
- opportunity to develop a mission statement for the organization.
- opportunity to develop business objectives for the organization.
- opportunity to develop business strategies for the organization.
- opportunity to develop the action/ implementation planning guidelines, which provides the platform for

The PLANNING is the most challenging, because SKILLWISE, it provides opportunity to use various skills/ knowledge levels

- analytical
- problem solving
- making judgment
- decision making
- lateral thinking
- communication
- presentation
- negotiation
- goal setting
- evaluation

PLANNING IS THE PREMIER FUNCTION, BECAUSE

Without planning

- you cannot organize
- without organization, you cannot direct
- without direction, you cannot control.
- without control, you cannot get results.

For success/ results, you need PLANNING.

Thus PLANNING IS THE PRIMARY FUNCTION.

Planning plays a vital part in many aspects of business management. As planning helps in determining project's

- objectives
- deliverables
- schedules
- external interfacing
- internal structuring
- roles
- responsibility
- risk management
- implementation
- resources allocation
- control system

Apart from business management, planning is also used in various other activities like

- planning for national emergencies
- planning for national disasters
- planning for national economy
- planning for national security

— in household budgeting, to allocate resources.

In all the above cases, the planning provides

— sense of purpose
— sense of direction
— strategic outlook
— mean for action
— sense of timing
— mean to allocate resources.

2.7 SELF CHECK EXERCISE

2.7.1 What is the importance of planning?

2.8 PLANNING OF INFORMATION SYSTEM

PROPER planning is very important for the success of IS. Organizations that plan their activities tend to achieve better results. The organizations today are dynamic and exist in ever changing competition. So organizations have to develop and update there IS in a systematic way. This requires an overall plan for IS in organization. The IS plan is comprehensive one which is derived from organization strategic plan. The IS plan includes goals, objectives and structures of IS. Thus a plan acts as basic for action. One of most important model for planning is NOLAN MODEL. It is a 4 stage model starting from *

Richard Nolan has provided a framework for the planning of information systems which is known as NOLAN STAG'E MODEL. The Nolan stage has identified initially four stages but in year 1979 Nolan enhanced his four stage model to six stage model.

- **STAGE** 1 **- INITIATION STAGE:** In this the technology is just introduced in the organization. It is also known as stage with minimum planning.
- **STAGE 2** - **EXPANSION STAGE:** In this stage there is rapid expansion of the technology that was introduced in first stage. In the initiation stage very few applications arc computerized but in this stage many more applications are computerized.
- **STAGE 3 - CONTROL STAGE:** In the first two stages the technology is introduced and there is growth of the technology but there are no controls. Without proper controls organization will not able to achieve the cost advantages of IS. So in this stage proper standards are maintained for controlling of the technology.
- **STAGE 4 - INTEGRATION STAGE:** Over the period of time the organization gains experience in the application part, so the technology which was introduced earlier in various parts are integrated and controls are adjusted accordingly.
- **STAGE 5 - DATA ADMINISTRATION:** In this stage the controls are relaxed so that system can be developed for the strategic advantage of the organization.
- **STAGE 6 - MATURITY STAGE:** This is the last part of the planning that is the objective of the application is in consonance with overall objective of the organization.

2.9 SELF CHECK EXERCISE 3

2.9.1 How planning of information system is done?

3 MANAGEMENT INFORMATION SYSTEM DESIGN

The design of an information system is based on various factors. Cost is a major consideration, but there certainly are others to be taken into account, such as the number of users; the modularity of the system, or the ease with which new components can be integrated into the system, and the ease with which outdated or failed components can be replaced; the amount of information to be processed; the type of information to be processed; the computing power required to meet the varied needs of the organization; the anticipated functional life of the system and/or components; the ease of use for the people who will be using the system; and the requirements and compatibility of the applications that are to be run on the system.

There are different ways to construct an information system, based upon organizational requirements, both in the function aspect and the financial sense. Of course, the company needs to take into consideration that hardware that is purchased and assembled into a network will become outdated rather quickly. It is almost axiomatic that the technologies used in information systems steadily increase in power and versatility on a rapid time scale. Perhaps the trickiest part of designing an information system from a hardware standpoint is straddling the fine line between too much and not enough, while keeping an eyes on the requirements that the future may impose.

Applying foresight when designing a system can bring substantial rewards in the future, when system components are easy to repair, replace, remove, or update without having to bring the whole information system to its knees. When an information system is rendered inaccessible or inoperative, the system is considered to be "down."

A primary function of the maintaining an information system is to minimize downtime; or hopefully, to eradicate downtime altogether. The costs created by a department; facility, organization, or workforce being idled by an inoperative system can become staggering in a short amount of time. The inconvenience to customers can cost the firm even more if sales are lost as a result, in addition to any added costs the customers might incur.

Another vital consideration regarding the design and creation of a/I information system is to determine which users have access to which information. The system should be configured lo grant access to the different partitions of data and information by granting user- level permissions for access. A common method of administering system access rights is to create unique profiles for each user, with the appropriate user-level permissions that: provide proper clearances.

Individual passwords can be used to delineate each user and their level of access rights, as well as identify the tasks performed by each user. Data regarding the performance of any user unit, whether individual, departmental, or organizational can also be collected, measured, and assessed through the user identification process.

The OSI seven-layer model attempts to provide a way of partitioning any computer network into independent modules from the lowest (physical/hardware) layer to the highest (application/program) layer. Many different specifications can exist at each of these layers.

A crucial aspect of administering information systems is maintaining communication between the IS staff, who have a technical perspective on situations, and the system users, who usually communicate their concerns or needs in more prosaic terminology. Getting the two sides to negotiate the language barriers can be difficult, but the burden of translation should fall upon the IS staff. A little patience and understanding can go a long way toward

avoiding frustration on the part of both parties.

There is more to maintaining an information system than applying technical knowledge to hardware or software. Information System professionals have to bridge the gap between technical issues and practicality for the users. The information system should also have a centralized body that functions to provide information, assistance, and services to the users of the system. These services will typically include telephone and electronic mail "help desk" type services for users, as well as direct contact between the users and IS personnel. Designing is done in two steps. The first step is the

- Conceptual Design
- Detailed Design

1. **Conceptual Design:** This is the base of designing. In this stage the foundation of designing is done. This is also known as OVERALL DESIGN. In this stage alternative designs are made and the system analyst in consultation with the management selects the best one. There are various steps with the help of which the system analyst makes the design of the information system. The important steps are-
   a. The first step is that the system analyst should clearly understand the problem or need of the organization for which he is going to design the system. It is very important step as the information system should address all the problems of the organization. The system analyst should carefully note down the information flow in the organization and how many channels are there for the flow of the information. Then the next important step is the carefully note down the end users of the system. It is also vital that the system analyst should plan the system not for the present but also for the future also. For that the system analyst should carefully consult senior management the possible future expansion plans and future information needs of the organization.
   b. After knowing the problem, the system analyst's next job is to set standards for the information systems that he is going to design. Although it is difficult to set the standards but it is very essential to do so. Setting standards would help in measuring the performance of the information system. Also the standards should be set in quantitative terms rather than qualitative terms so that the performance can be accurately judged.
   c. Every system works in certain constraints. System analyst should take into account all possible limitations of the systems. Knowledge of the limitations helps in the designing of the information system. These constraints can be internal or external. Internal limitations are posed from the within the organization for example organizational policy whereas the external limitations are external to the organization for example government policies.
   d. In the end the information system is going to serve managers and it is vital to know the information need of the end users in a precise manner. System analyst should also know various hierarchal levels in the organization so that he can design information system according to the requirement of each level of hierarchy for example Management information system is for the middle level managers. For this purpose, the system analyst can use various tools for example interviewing the managers, questionnaires, reviewing the records of the organization etc.
   e. In addition to knowing the needs of managers it is also important to know the

source of information. Source can be internal i.e. within the organization and it can be from records, files, books etc. or it can be external for example government records or trade publications etc.

f. After completing all above mentioned step the system analyst will develop a conceptual design of the information system. Conceptual design would take into considering all above mentioned parameters. Conceptual design provides a platform for detailed design. It is also pertinent to mention that the system analyst should make more than one conceptual design so that after detailed consultation with the top management the best design can be selected.

g. After selecting the best design, the final design is documented. The documentation involves
   1. Overall systems flow
   2. System inputs
   3. System outputs

h. After documentation the last step in the conceptual design is to get the approval of the top management. This is done by presetting a report in the form of proposal to the top management. The proposal giving cost to be incurred and includes all important findings. It starts with the mentioning of the problem, objectives, constraints, and various needs of users. It also focuses on the benefits that an organization is going to get after implementing the information system.

2. Detailed Design: After the conceptual design is made the next step is the detailed design pf the information system. Detailed design involves following steps

1. The detailed design should be considered as project in itself so all the fundamentals of projects are applied in the detailed design. So the detailed design starts from defining the project objectives. Then a network diagram is made for all the events and activities of the detailed design.
2. After the panning the next stage is the controlling, so a proper feedback of the actual performance can measure and compared with the scheduled performance.
3. For the successful implementation of the detailed design the acceptance of the users is very essential. So proper involvement of the users is important and for this the users should be told about the future benefits of the information system.
4. The detailed design for any organization has got numerous activities so the overall project (detailed design is considered as project in the first step) should be broken into sub activities. These sub activities are more manageable and with the help of breaking whole project into sub activities one can ascertain all the activities.
5. After making all the important sub activities the next step is to make specifications for the input and output for each sub system. As the main job of management information system is delivery of information so it is very essential to know the input and output requirements of the all the sub activities because integration all these input and output for all sub activities would result in overall input and output requirements of the system.
6. After knowing the input and output for the sub activities the next step is get the feedback from the end users. The system analyst at this point give demonstration to the users to knowtheir response.

7. The next step is the database design. The database is collection of all records related to each other. For the best results from the information system, it is vital that the information system to fast and accurate retrieval of data from the database so proper database designing is very essential for the information system design.
8. In the last step various rules and regulations are made to increase the effectiveness of the system. It includes-

   a. Data entry procedures
   b. Error handling procedures
   c. Documentation procedures

After implementing all above mentioned steps the system analyst transfers all the outputs of the information system to the programmers so that programmers can be write the code and can physically make the system. Hence the system analyst should carefully document the detailed design. In the documentation of detailed design all minute details are included. Documentation also includes the user manual and operator manual. User manuals are made to guide the users for proper understanding and working of the system. Operator manual includes various procedures which guide the operators for smooth functioning of the system.

2.10SELF CHECK EXERCISE 4

2.13.1 What are the different types of designing?

2.10.2 What are important factors that are taken into consideration while designing an information system?

2.11 ANSWERS TO SELF CHECK EXERCISES

Self Check Exercise 2.5

2.5.1 different System Development Models are:

- Waterfall Model
- Prototyping Models
- Integrative Enhancement Model
- Spiral Model
- Fourth generation technique

Self Check Exercise 2.7

2.7.1 Planning is important because without planning

you cannot organize

without organization, you cannot direct

without direction, you cannot control.

without control, you cannot get results.

For success/ results, you need PLANNING.

Self Check Exercise 2.9

2.9.1 Planning of Information system can be done with the help of Nolan model which is a six stage model:

- STAGE 1- INITIATION STAGE
- STAGE 2-EXPANSION STAGE
- STAGE 3- CONTROL STAGE
- STAGE 4- INTEGRATION STAGE
- STAGE 5- DATA ADMINISTRATION
- STAGE 6- MATURITY STAGE

Self Check Exercise 2.10

2.10.1 The two types of designing are:

- Conceptual Design
- Detailed Design

2.10.2 The design of an information system is based on various factors. Cost is a major consideration, but there certainly are others to be taken into account, such as the number of users; the modularity of the system, or the ease with which new components can be integrated into the system, and the ease with which outdated or failed components can be replaced; the amount of information to be processed; the type of information to be processed; the computing power required to meet the varied needs of the organization; the anticipated functional life of the system and/or components; the ease of use for the people who will be using the system; and the requirements and compatibility of the applications that are to be run on the system.

2.12 Review Questions

Short Questions

1. Explain Waterfall model in detail.
2. Explain Spiral model.

Long Questions

1. Explain the process of planning of information system given by Nolan.
2. Explain the conceptual and detailed design of MIS.

2.13 RECOMMENDED READINGS: -

1. D. P. Goyal : Management Information System
2. Gordon B. Davis, Margrethe H. Olson: Management Information System
3. Robert G. Murdick, Joel E. Ross : Management Information System

STRUCTURE

3.0 OBJECTIVES

After reading this lesson, students would be able to answer:

- System implementation
- Importance of Implementation
- System Evaluation
- System Maintenance

3.1 INTRODUCTION

After the successful development of MIS, the next important step is the implementation of the Information System. Implementation can be installing the completely new system in an organization or it can be up gradation of existing system. In brief, implementation means putting the new or modified system into operation. Implementation needs careful attention because it involves various steps. One cannot go for directly implementation the system without proper planning. Planning helps to tell us where we are and where we want to be. With the help of planning various activities can be identified and also it is possible to know the sequence of those activities. With help of various tools of implementation, it is also possible to know the time and cost for each activity. Time and cost analysis is very important for successful implementation of MIS. As time and cost is always limited in any organization, so it is very important to know these constraints before implementation of the MIS. With the help of planning one can know the critical activities and most attention can be given to the critical activities. Critical activities are those activities which can be delayed at any cost so for proper implementation it is very much important to know the critical activities and non-critical activities. Now in case for the very high scale projects it is not possible to plan activities manually so there are various techniques that a MIS manager can use for planning the activities. The most widely used techniques are Network Analysis and Gantt Charts. Both these techniques provide great help in planning of the activities. With the help of Gantt charts various activities can be depicted accurately. Network analysis uses the concept of PERT and CPM for planning of activities and also for estimating the time and cost related to each of the activities. Network analysis is widely used for large scale

OBJECTIVES OF NETWORK ANALYSIS

1. **Helpful in Planning:**Network analysis is powerful tool for planning, scheduling and controlling.
2. **Inter-Relationship** Network analysis creates interrelationship and interdependence of various activities of project. This relationship helps in bringing out the technological interdependencies of the various activities.
3. **Cost Control: -**In certain case we can measure cost of delay in the completion of the project. This cost can be compared to the cost of the resources required to carry out the activities at various speeds.
4. **Minimization** Network analysis helps the management to minimize the total maintenance time.
5. **Control: -**Network analysis also helps to control the idle resources we should not allow large fluctuations in the use of limited resources. We should adhere to our scheduled cost and time.
6. **Avoiding** Network analysis develops discipline and systematic approach in planning scheduling. This is not the case in traditional methods. Network analysis helps the managers to avoid delays, interruptions and control large complex situations where implementation is required.

PERT

PERT is Program Evaluation and Review Technique is important network analysis tool for accurately knowing all the activities for successfully implementing the Management Information system. With the help of PERT, the analyst can make a network diagram and can easily manage various sub activities that are important for the implementation.

MERITS OF PERT

1. It enables a manager to understand easily the relationship that exists between the activities in a project.
2. It enables the manager to know' the in advance, where the trouble may occur, where more supervision may be needed, and w[h]ere resources may be transferred to keep the project on schedule.
3. It enables the manager to plan carefully and study how the activities fit in a project.
4. It draws attention of the management to the critical activities of the project.
5. It suggests areas of increasing efficiency, decreasing the cost and maximizing profits.
6. It enables the use of statistical analysis.
7. It makes possible a forward looking type of control.
8. It compels the management for taking the necessary action at the right time without any let up.
9. It provides up to date information through frequent reporting, data processing and program analysis.
10. It helps in formulating a new schedule when the existing ones cannot meet the situation.
11. It helps in minimizing delays and disruptions by scheduling the time and

budgeting the resources.

12. It helps in coordinating the various parts of the project and expediting the time and budgeting of resources.
13. It permits more effective planning and control.

DEMERITS OF PERT

1. It does not lay any emphasis on the cost of a project except on the time only.
2. It does not help in routine planning of the recurring events.
3. Errors in time estimates under the PERT make the network diagram and the critical path.
4. In the calculation of the probabilities under the PERT it is assumed that a large number of the independent activities operate on the critical path.
5. For the effective control, the PERT, requires frequent up to date information which may be costly for the management.
6. It does not consider the matter of resources required for the various types of activities.

CRITICAL PATH METHOD

CPM was developed in 1957 by J.E. WALKER to help to schedule maintenance of chemical plant. With the CPM scheduling of activities is done in such a way that the most critical activity is never delayed because if the most important activity is delayed then whole implementation will be delayed.

But CPM has certain limitations of CPM

1. It operates on the assumptions of precise known time for each activity which may not be true in real situation.
2. It does not make use of the statistical analysis in the determination of the time estimates for each activity.
3. It requires repetition of the evaluation of the entire project each time a change is introduced to the network. This is very difficult and cumbersome process.
4. It cannot serve as a dynamic controlling device as it was introduced as static planning model. ^

After identifying various activities in planning the next step for implementation is proper layout for installation of system. Layout is the method of allocating machines and equipment, various processes and other necessary services involved in process of implementation so as to perform various operations in the most efficient and convenient manner providing output of high quantity and minimum cost.

OBJECTIVES OF LAYOUT

1. Economies in proper implementation of system.
2. Proper and efficient utilization of available space.
3. To ensure that work proceeds without any delay.
4. Provision of better supervision and control of operations.
5. Careful planning to avoid frequent changes in layout which may result in undue increase in cost of implementation.

6. To meet quality and capacity requirement in the most economic manner.

It also includes number and types of:

- Exits
- storage areas
- air-conditioning
- safety factors
- Location of computer room.

After proper layout the next step is acclimatize the users of the system to the new system. They should think that the system their own and there should be no resistance to the implementation of the system. This is especially very much important in case of public sector organizations. Generally, there is myth that with the implementation of information system there will be retrenchment which results in lot of resistance but if there is proper participation of the users in the implementation then there would be no resistance an employee can also observe that information system is the need of the hour and these systems are for their own help. After acclimatizing the users, it is also important for the MIS manager to recruiting the new staff so that there can be smooth transition of the system to the users. The next important step in the implementation of the information system is the training of the employees who are going to us the system. Information system can be used by different types of employees so it is very important for the MIS manager to segregate the employees into various non overlapping groups and then design a training program according to needs of the particular category of employee. But before starting the training program it is very much important that proper hardware and software should be purchased so that the users can learn the system in the practical way. So a careful survey is done by the MIS manager about the requirements of information system and then proper hardware and software is purchased accordingly. This acquisition includes all he important things such as

- Computers
- Printers
- Air-conditioning
- Ribbons
- Papers
- Floppies
- Tapes
- Compact Disk -

After the purchase of all important hard and software the next step is to make forms. The Management Information System should generate forms so that information can be used by managers to reach to a decision. So proper emphasis should be given that proper forms are generated by the information system. Forms are the key user interface and there should be no error while system is generating the output.

As this is the most important part of management information system it very important to test the management information system. Rather testing is done at every stage to know the error and accordingly it can be rectified. Testing is usually done with the help of factual data because MIS manager is only interested in knowing the efficiency of the system. The most rational approach of testing is that the testing of should be done in different at various levels starting from elements to sub-systems and then finally to the system as a whole. The

elements include equipment, forms, programs, work procedures, and formats. These tests are basically done to check the accuracy, range, frequency of inputs, operating conditions and reliability. Now days testing can even be done with the help of advanced tools like CASE

i. e. Computer Aided Software engineering tool. These advanced tools help online debugging for correcting the programs and the errors.

3.2 SELF CHECK EXERCISE 1

1. Explain implementation process in detail.
2. What are the merits and demerits of PERT?

3.3 IMPLEMENTATION STRATEGIES AND PROCESS

After testing the management information system, it is time for implementation of management information system. This implementation can be changeover from old system to new system or just implementation of new system where there is old system does not exist. In case there is implementation of information system where there is no old system then the strategy is directly install the new system but the MIS manager has to follow all the implementation stages that are mentioned above i.e.

- Proper layout
- Users involvement
- Training
- Purchasing of hardware and software
- Creation of forms
- Testing

But in case the information system is implemented where an old system is then there are various strategies that can be adopted according to the situation

1. Direct
2. Parallel
3. Modular
4. Phase-in

1. DIRECT APPROACH

In this approach the new system is installed and the old system is discontinued immediately. This approach effective in the case of

1. The system is not replacing any other system
2. The old system is judged redundant
3. The new system is simple and easy to implement
4. The new system is improvement over the old system and there is no need of comparisons.

This type of strategy is more used in case of seasonal industries like sugarcane industry where the operation is closed for considerable period of time. Also this strategy is inexpensive as directly MIS manger is going to implement the new advanced system. But the main disadvantage of this strategy is the high risk of failure. As the old system is discontinued immediately thinking that new system is improvement over the old system but in case the new system has some flaw that can be have far reaching implications on the organizations as it can result in lot of losses to the organization.

2. PARALLEL APPROACH

In this approach the new system is installed and operated in parallel with the old system until the new system is thoroughly tested after checking the results the decision is taken whether the old system is continued or discontinued immediately. This approach is just opposite to the direct approach. This is more rational approach where outputs at each step are compared with the present results. This is more expensive and time consuming but give accurate results. This approach is more widely used in case of making payrolls, examination and defense systems.

3. MODULAR APPROACH

In this approach the new system is implemented in modular basis i.e. piecemeal approach. This approach is more widely used in case of

1. the risk of system is localized
2. the problem identified in the system can be corrected before further implementation
3. other operating personnel can be trained in a live environment before the system is implemented at their location

4. PHASE- IN APPROACH

This approach is similar to the modular approach the only difference is that the system itself is segmented and not the organization. Thus in this approach the system is divided into parts instead of the organization and then it is implemented. This approach is more useful for the systems that require up gradation of the old system. The disadvantage is the

- Cost incurred to develop the temporary interfaces with old systems
- Limited applicability
- Feeling if pendency' in the organization

After it becomes operational, the job of system analyst is not over rather his focus now shifts from implementation to maintenance.

3.4 SELF CHECK EXERCISE 2

1. What are the different types of implementation strategies?

3.5 SYSTEM EVALUATION

Evaluation of MIS is the essential part of controlling the process i.e. organizations with the help of evaluation can know the quality or worth of the information system. In other words, we can evaluation is the process of measuring the performance of the system. It provides the feedback which is very helpful in making necessary adjustment if necessary in the information system.

There are two dimensions of Evaluation is measured in terms of

1. Effectiveness
2. Efficiency

1. **Effectiveness** Effectiveness is the quality of the output. The information systems are designed to give appropriate output in the form of information now it is very important that the output generated by the information system should be of right quality because in the end the managers are going to use this information to reach to a particular decision. In other words, we can say that the information system should be

giving right information to the right person.

2. **Efficiency** to get the results from the information system it is important that we should use some resources. So to be efficient it is essential that the information system should use optimum number of resources to give the right output.

Thus the effectiveness is the quality of the output that an information system is giving whereas the efficiency is the amount of resources spent so that his information system is effective.

3.6 SYSTEM EVALUATION TECHNIQUES

The evaluation can be done on the basis of various attributes it possesses or it can be evaluated on the financial basis using various rating techniques.

1. In the first technique various attributes are identified in the information system which is essential in the system. These attributes depend on the particular type of information system and particular type of organization for which it is made. After listing the important attributes, the users of the system are asked to rate the various outputs on the basis of each of the attribute identified. Here we have to use certain concepts of research methodology to reach to a conclusion. While asking the question from the managers the MIS manager can use 5-point Liker scale. It starts from strongly disagree, disagree, can't say, agree, strongly agree. Accordingly, we can assign weights to all options. In the end all responses are tabulated to find the end result.

   For example

   Report generated by the present information system is 'ADEQUATE'

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
(1)	**(2)**	**(3)**	**(4)**	**(5)**

2. Financial Evaluation: It takes into account the expected costs and the benefit to be expected from the system. In other words it is cost effectiveness of the system. To apply this type of evaluation it is essential to jot down all important types of costs a that are incurred and the important benefits from the system. For example the important types of costs are

   1. Initial Development Cost- Initial development cost is the cost incurred in developing the system. It includes project
      - planning cost
      - feasibility cost
      - design cost
      - testing cost

   a. Capital Cost - It is one time cost, it is incurred in facilities and providing the various equipments. It includes cost of
      - Wiring
      - Flooring
      - Lighting
      - Acoustics
      - Air-conditioning

      b. Annual operating cost- It is ongoing cost that is incurred for operating the

system in a smooth manner. It includes

- Computer maintenance cost
- Personnel cost
- Overheads and Supplies

Similarly, the benefits are identified and monetary value is assigned to them. The benefits can be tangible or intangible.

There are two major benefits

1. Performance improvement'
2. Cost reduction

The performance improvement means that now with the help of information system there is improvement in the accuracy, timeliness, adequacy and usefulness in the information that means now manages have more time for the planning and they can accurately use information for better results. Similarly, the cost reduction means reduced salary, labor cost reduction, reduced inventory etc.

In the end all cost and benefits are matched so see the net savings from the new system

3.7 SELF CHECK EXERCISE 3

1. On what parameters evaluation is measured?
2. What are the different techniques of evaluation?

3.8 SYSTEM MAINTENANCE

On the basis of the feedback provided by the evaluation of the system, the organization can take the necessary action. Because discussed earlier the information system should be effective as well as efficient. On the basis of evaluation, the organization can see whether the system is effective and efficient. As the organizations are working in the highly dynamic environment it is very essential for the organizations to go on continuous evaluation of the system as a system which is effective today can be redundant tomorrow. But the process does not stop on evaluation, evaluation provides feedback and it is necessary to take action on that feedback even if the feedback is positive it is important that organizations should go for continuous monitoring. Thus the process of monitoring, evaluation and modifying of the existing information system is known as System maintenance.

System maintenance is ongoing activity which covers entire gamut of other important activities including design programs, documentation, test data, updating user support. Maintenance can have groupedinto:

1. Corrective
2. Adaptive
3. Perfective

1. **Corrective** This type of maintenance deals with the removal of the errors that are there in the system due to faulty design. In this type of maintenance, the failures are repaired.

2. **Adaptive Maintenance** as the organizations are constantly working in the highly dynamic environment some changes are necessary after due course of time. The adaptive maintenance is done to constantly upgrade the system according to the changing environment. These changes can arise from

a. change in the objectives, goals of the organization
b. change in the needs of the managers
c. change in the procedures of the organization
d. change in the external environment
e. change in the internal environment

3. **Perfective Maintenance** This implies addition of new facilities to the system or modifying the system to enhance the information system. As no system is perfect, various modifications are needed at various stages to make the system more reliable. Also the needs and the requirement of the user go on increasing from the system with time so it is important to enhance the system accordingly.

Also there can be new advancement in the technology that can be beneficial to the users so it is essential to enhance the present system using perfective maintenance.

3.9 SELF CHECK EXERCISE 4

1. What is the need of maintenance?
2. What are the different types of maintenance?

3.10 ANSWERS TO SELF CHECK EXERCISES

Self Check Exercise 1

1. Implementation process consist of the following steps:
   - Proper layout
   - Users involvement
   - Training
   - Purchasing of hardware and software
   - Creation of forms
   - Testing

2. Merits of PERT:
   - It enables the manager to plan carefully and study how the activities fit in a project.
   - It draws attention of the management to the critical activities of the project.
   - It suggests areas of increasing efficiency, decreasing the cost and maximizing profits.
   - It enables the use of statistical analysis.

   Demerits of PERT:
   - It does not lay any emphasis on the cost of a project except on the time only.
   - It does not help in routine planning of the recurring events.

Self Check Exercise 2

1. Different types of Implementation strategies are:
   1. Direct
   2. Parallel
   3. Modular
   4. Phase-in

Self Check Exercise 3

1. There are two dimensions of Evaluation is measured in terms of
   - Effectiveness
   - Efficiency

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2. The evaluation can be done on the basis of various attributes it possesses or it can be evaluated on the financial basis using various rating techniques.

Self Check Exercise 4

1. System maintenance is ongoing activity which covers entire gamut of other important activities including design programs, documentation, test data, updating user support.
2. Maintenance can have groupedinto:
    - Corrective
    - Adaptive
    - Perfective

3.11 Review Questions

Short Questions

1. what is CPM? Explain in detail.

2. what are the objectives of network analysis.

Long Questions

1. Explain the different types of System Maintenance in detail

2. Do the critical analysis of PERT.

3.12RECOMMENDED READINGS: -

1. D. P. Goyal : Management Information System
2. Gordon B. Davis, Margrethe H. Olson: Management Information System
3. Robert G. Murdick, Joel E. Ross : Management Information System

ENTERPRISE RESOURCE PLANNING (ERP)

STRUCTURE

4.0 DEFINITION

ERP (enterprise resource planning) is an industry term for the broad set of activities supported by multi-module application software that help a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. ERP can also include application modules for the finance and human resources aspects of a business. Typically, an ERP system uses or is integrated with a relational database system.

4.1 History of ERP

In the past decade the business environment has changed dramatically. The world has become a small and very dynamic marketplace. Organizations today confront new markets, new competition and increasing customer expectations. This has put a tremendous demand on manufacturers to:

1) Lower total costs in the complete supply chain
2) Shorten throughput times
3) Reduce stock to a minimum
4) Enlarge product assortment
5) Improve Product quality
6) Provide more reliable delivery dates and higher service to the customer

4.2 Evolution of ERP Systems

The focus of manufacturing systems in the 1960 s was on Inventory control. Most of the software packages then (usually customized) were designed to handle inventory based on traditional inventory concepts. In the 1970's the focus shifted to MRP (Material Requirement Planning) systems which translated the Master Schedule built for the end items into time- phased net requirements for the sub-assemblies, components and raw materials planning and procurement.

In the 1980's the concept of MRP-II (Manufacturing Resources Planning) evolved which was an extension of MRP to shop floor and Distribution management activities. In the early 1990 s, MRP-II was further extended to cover areas like Engineering, Finance, Human Resources, Projects Management etc. i.e. the complete gamut of activities within any business enterprise. Hence, the term ERP (Enterprise Resource Planning) was coined, [n addition to system requirements, ERP addresses technology aspects like client/server distributed architecture, RDBMS, object oriented programming etc. ERP Systems - Bandwidth ERP solutions address broad areas within any business like Manufacturing, Distribution, Finance, Project Management, Service and Maintenance, Transportation etc. A seamless integration is essential to provide visibility and consistency across the enterprise.

Evaluation Criteria

Some important points to be kept in mind while evaluating ERP software include:

1) Functional fit with the Company's business processes
2) Degree of integration between the various components of the ERP system
3) Flexibility and scalability
4) Complexity; user friendliness
5) Quick implementation; shortened ROI period
6) Ability to support multi-site planning and control
7) Technology; client/server capabilities, database independence, security
8) Availability of regular upgrades
9) Amount of customization required
10) Local support infrastructure
11) Availability of reference sites
12) Total costs, including cost of license, training, implementation, maintenance, customization and hardware requirements.

ERP Systems - Implementation

The success of an ERP solution depends on how quick the benefits can be reaped from it. This necessitates rapid implementations which lead to shortened ROI periods. Traditional approach to implementation has been to carry out a Business Process Re-engineering exercise and define a "TO BE'[1] model before the ERP system implementation. This led to mismatches between the proposed model and the ERP functionality, the consequence of which was customizations, extended implementation time frames, higher costs and loss of user confidence.

The BAAN approach is to conduct a concurrent Business Process Re-engineering during the ERP implementation and aim to shorten the total implementation time frame. Two scenarios' can be distinguished:

1. Comprehensive Implementation Scenario

Here the focus is more on business improvement than on technical improvement

during the implementation. This approach is suitable when: Improvements in business processes are required. Customizations are necessary Different alternative strategies need to be evaluated High level of integration with other systems are required Multiple Sites have to be implemented.

2. Compact Implementation Scenario

Here the focus is on technical migration during the implementation with enhanced business improvements coming at a later stage. This approach is suitable when; Improvements in business processes are not required immediately Change-minded organization with firm decision making process Company operating according to common business practices. Single site has to be implemented.

4.3 Self Check Exercise

4.3.1 write some important points to be kept in mind while evaluating ERP software?

4.3.2 On which factor the success of ERP system depends on?

4.4 ERP PROCESSING MODELS

ERP systems are often deployed in either two-tier (client/server) or three-tier (client/ application server/database server) implementations.

Two-Tier Model

In a two-tier model the server holds the database and database software. The business processes, the programs, are downloaded to the client and executed on the client s system and the client system fetches the data from the database server. Access control is maintained by the business logic executing on the client system.

Some advantages of the two-tier model:

- The cost savings on server hardware.
- Expansion of the number of clients does not create a server bottleneck because the business process code is executing on the client systems.

Some disadvantages of the two-tier model:

- Increased network load.
- Data may be transferred to the client system that the user may not be authorized to view. Though the business logic will not allow the data to be displayed, the data is available on the client system and could be compromised.
- The database server must be visible to the client systems exposing it to additional vulnerabilities.
- Security auditing is difficult.

Three-Tier Model

In a three-tier model the client uses a browser or thick client (graphical user interface) to access the application server. The business processes, the programs, are executed on the application server and fetch the data from the database server. Access control is maintained by the business process logic executing on the application server.

Some advantages of the three-tier model:

- Decreased network load.
- Scalable.
- No data is transferred to the client system that the user is not authorized to access.
- The database server needs to be visible only to the application server decreasing its exposure to Vulnerabilities.
- Security auditing is centralized and simpler.

Some disadvantages of the three-tier model:

- Increased server cost (additional server need for the application server).

- Increase in usage can create a server bottleneck at the application server. This may require additional hardware to be purchased for additional application servers and load balancing hardware/software to balance the load between the multiple parallel application servers.

4.5 Self Check Exercise

4.5.1 explain two tier model?

4.5.2 explain three tier model?

4.6 HIDDEN COSTS AND THE MAJOR ISSUES INVOLVED WITH IMPLEMENTING AN ERP PROJECT

Here are several key areas where problems can arise:

Planning and Project Management

It takes time and effort to properly prepare for an ERP deployment. The company's **IT** staff and the appropriate business managers must be given the time and clear **responsibility** to conceive and evaluate the project's scope, costs, and timeline. It's important to assign **the** planning responsibilities to staff members who not only have a good grasp of the technology, but who also understand the company's business requirements and processes. Also make sure that whoever leads the planning sees the project through--from the initial deployment to some extended period after deployment to work out the inevitable kinks.

Integration

Companies almost always underestimate the time and cost necessary for enterprise software integration. ERP systems rarely exist in a vacuum and they usually need to be tied into software and complex business processes that predate the ERP system. In addition to software from a primary ERP vendor, the enterprise may also want to use applications provided by other software vendors. For example, a company may want to tie its core ERP suite from SAP into a CRM application from Siebel and global trading management software from vast era. Mergers and acquisitions also create difficult integration challenges because the merged companies may use different ERP packages and other different applications with which they've already integrated. Dick Kuiper, a vice president with Meta Group, says that a large enterprise typically operates five or more ERP systems and some companies are known to have more than 20 ERP systems.

Dirty Data

A number of problems and hidden costs crop up when handling real-world data. When an enterprise converts its legacy systems to ERP, it must convert large amounts of data for use in the new system. Much of the old data is difficult--if not impossible--to convert, which means a lot of time and money will be spent re-entering it into the system or putting it through complex conversion processes. Even after a system is fully deployed, you can't take the data for granted because it ages. For instance, every month some of the company's customers, employees, and business partners change their address or other parts of their profile. Gartner Group analyst Beth Eisenfeld estimates that 2 percent of a company's customer data goes bad every month. She recommends an ongoing effort to clean up obsolete data. Finally, when data is combined from multiple systems for analysis or as a result of integration projects, more work can be involved to clean it up and convert it.

Testing

Given the mission-critical nature of a company's ERP system, it should be thoroughly tested before it's fully deployed. Don't just test the system with dummy data. Use actual data from different real-world scenarios. For example, a manufacturing company should pull up historic orders from customers and route the orders through the entire process of creating

the product, shipping it, and billing for it. Ideally, employees who actually operate the specific business processes on a day-to-day basis should perform these tests. Of course, all of this costs money, but the investment will significantly reduce other costs that result from the downtime and poor implementations that occur when systems aren't properly tested.

Documentation

ERP systems take a long time to deploy}' and are used for many years within a company. That means they usually outlast the IT employees and business-process managers who conceptualize, deploy, and modify the systems. Documenting the system is crucial so that future employees can make sense of the software and business-process logic the system encompasses. Documentation is also needed to help future workers deal with the inevitable updates, extensions, and integration projects that occur as a company evolves. In addition, documentation can save consultants time and help them map out the scope of projects properly to improve cost accountability.

Training

One of the biggest mistakes enterprises make is forgetting that employees must adapt to a new ERP system. Employees must be trained on how to operate the system and how to apply it to familiar business tasks such as looking up and entering data, Furthermore, a new ERP system almost always means changes to business processes. That requires change management to teach employees about new business practices and manage staff reorganization. Employees often resent change and resist it when it means they have to let go of established work habits and take up new reporting relationships. Despite all the money a company spends, an ERP deployment can fall flat on its face or simply operate at vastly- reduced efficiency if the company fails to adequately train the staff and manage the change effectively.

Consulting Fees

Since few IT departments are staffed to handle the extra work required to implement each phase of a big ERP project, many of the items mentioned earlier require consultants. Without proper management, though, consulting fees can eat through your budget faster than a pack of mice through a chunk of cheese. It's important to make sure that in-house staff is capable of managing consultants. Consulting contracts should carefully define key deliverables, schedules, skill levels of available staff, and objectives for training internal staff. The contract should also be accompanied by a detailed specification that clearly points out the desired business objective and technical requirements. Proper planning and project management (as mentioned earlier) arc important for managing consultants and holding them accountable.

The Bottom Line on ERP

Although ERP projects are complex and expensive, properly implemented, they are nonetheless worthwhile. Meta Group found that once fully dcplo3'ed, the median annual savings from a new ERP system was $1.6 million per year.

But every ERP system must be continually maintained and upgraded to take advantage of new applications, technologies, and features. ERP software is hardly static, and there are major new developments as the software grows to embrace the Internet and as companies open up their data and business processes to partners.

4.7 Self Check Exercise

4.7.1 what are the major issues involved with implementing an ERP project?

4.8 CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Definition

CRM is a strategy by which companies optimize profitability through enhanced customer satisfaction. CRM is about automating and enhancing the customer-centric business processes of Sales, Marketing, and Service. CRM not only deals with automating these processes, but also focuses on ensuring that- the front-office applications improve customer satisfaction, resulting in added customer loyalty that directly affects the organization's bottom line. It is important to emphasize that managing the front office alone independent of the back-office is insufficient. It is the integration of customer-centric applications with the internal back-end systems that provides the customer experience that will in turn give the desired ROI for the entire enterprise operation. CRM is, therefore, actually a concept that requires a new customer-centric business model that must be supported by a set of applications integrating the front and back office processes. These coordinated applications ensure a more satisfactory customer experience, which is believed to have a direct link to a more profitable organization.

4.9 BENEFITS OF CRM

The popularity of CRM is fed by the fact that better customer relationship management is advantageous for both the customer and the enterprise. The end-user clearly enjoys great advantage from increased CRM. Better service is not only pleasant but has tremendous value in its own right. The total value of a product with customer service is significantly higher than of the product alone. On the other hand, the enterprise implementing CRM is not doing it for altruistic reasons. Companies have come to realize that their customers are their real assets. The benefits when CRM is adopted are very significant. Industry statistics show that 68% of customers who walk away from a relationship with a vendor do so because of poor customer service. Statistics also show that 80% of a company’s income is from its repeat customers.

A company that has both knowledge and the applications to leverage this information has the advantages to:

- Increase customer retention by enhancing satisfaction as a result of higher responsiveness.
- Identify the most profitable customers and treat them accordingly.
- Reduce marketing costs by developing effective targeted campaigns.
- Direct qualified leads to appropriate sales channel.
- Increase sales by offering the correct products (cross-sell/up-sell).
- Achieve higher ROI by increasing profits per sale.
- Streamline the sales cycle managed by interdepartmental workflow.
- Eliminate redundant functions by centralizing common activities.
- Save costs by reducing errors that occur from multiple uncoordinated interaction points.
- Improve understanding of customer needs by using their preferred channel of communication.
- Leverage on previous contacts with other customers for the current interaction.
- Estimate future sales, marketing, and service activities based on analysis of past performance.

  From CRM to have a significant impact on the organization, enterprise-wide

communication and commitment are required. There is no question that to stay competitive, businesses must invest in CRM technology as well as in a new business mode. It is the pooling of all customer information that is the core of a successful CRM implementation. This powerful strategy will increase sales, customer loyalty, and competitive advantage.

4.10 CRM Functionalities

Before we understand the technologies behind the CRM, we need to know the CRM functionalities. Dr. Ivan Roche from Lagan Technologies comes out with common functionalities of CRM components:

- **Customer Care and support functionality**
  e.g. incident assignment/escalation/tracking/reporting, problem management/ resolution, order management/promising, warranty/contract management.
- **Marketing functionality**
  e.g., campaign management, opportunity management, web-based encyclopedia, configuration, market segmentation, lead generations/enhancement/tracking
- **Executive information functionality** e.g.,
  extensive and easy-to-use reporting
- **ERP integration functionality**
  e.g., legacy systems, the web, third-party external information
- **Excellent data synchronization functionality**
  e.g., mobile synchronization with multiple field devices, enterprise synchronization with multiple databases/application servers
- **Sales functionality**
  e.g., contact management profiles and history, account management including activities, order entry, proposal generation
- **Sales management functionality**
  e.g., pipeline analysis (forecasting, sales cycle analysis, territory alignment and assignment, roll-up and drill-down reporting
- **Telemarketing/telesales functionality**
  e.g., call list assembly, auto dialing, scripting, order taking
- **Time management functionality**
  e.g., single user and group calendar/scheduling (this is likely to be Microsoft Outlook), e-mail
- **E-commerce functionality**
  e. g., manages procurement through EDI link and web-server, and includes business- to-business as well as business-to-consumer applications
- **Field service support functionality**
  e. g., work orders, dispatching, real time information transfer to field personnel via mobile technologies

4.11 Self Check Exercise

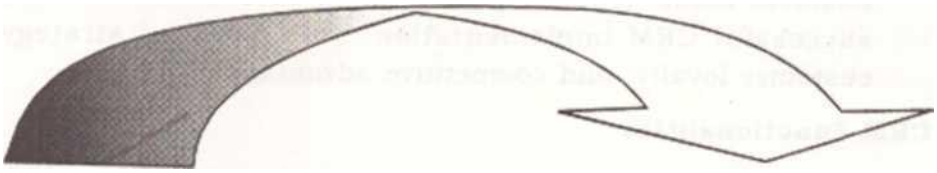
4.11.1 Explain CRM

4.11.2 write some CRM functionalities?

4.12CRM COMPONENTS

CRM involve the three big functions in the organization. There is almost uniform agreement among industry analysts that Sales, Marketing, and Service are the three pillars of functionality that must be addressed when putting together a CRM offering. These are the primary areas where the customer makes contact with the enterprise, either in a pre-sale, sale, or post sale situation, or as part of an ongoing relationship that requires service and

information as well as the option of additional purchases. These inter-linked areas of functionality are portrayed in Figure 1.



	Prospect ID Through Qualified Lead Generation	s Opportunity Through Sale Close	/ Order / Entry Through \ / Fulfillment Delivery \	
Process				
Function:Appli	Marketing	Sales	(Fulfillment j	Service/ Support
cation:	CRM	CRM	\ ERP J	CRM

Business Intelligence

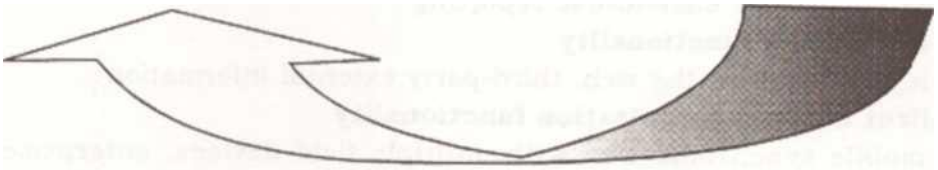


Figure 1 : The closed-looped customer life cycle

Service

The area of service is probably the most crucial when it comes to customer relationship management. The customer service that an enterprise provides is key to its ability to maintain satisfied loyal customers. The service that is expected today goes beyond traditional telephone call centers. Today's call centers are evolving into contact centers handling an assortment of communication media. Telephone interaction must be coordinated with email, fax, web, and any other communication media that the customer prefers to use. Self-service is a fast growing requirement, as more customers are making their way to the web and want to look up their order status or make queries via their browser. Customer service clearly reaches beyond the traditional help desk. The term 'Customer Care is being used today to broaden the enterprise's responsibility toward the customer. Proactive relations with the customer are an important part of what customer service is about. Customer service handles all types of customer queries, including product concerns, information needs, order requests, and fulfillment inquiries, as well as providing quality field service.

Sales

According to Meta Group, Sales Force Automation (SFA) is the fastest growing component of CRM. The interaction of the sales force with the prospect, turning the prospect into a customer and then maintaining a loyal relationship, is a core business concern for the enterprise's success. The sales process must be managed across many domains interfacing with other business units. Sales Force Automation is frequently expanded to include forecasting, contact and quote management, proposal generation, and win/loss analysis. Sales personnel are an essential source of information for the enterprise and must have the

tools both to access up-to-date field information and to provide this information to others.

Marketing

Marketing Automation includes lead generation, lead capture and management, campaign management, and telemarketing. Today, initial mass marketing activities are often used for the first contact, and are then followed up by more focused campaigns with specific target audiences in mind. Personalization is quickly becoming the expected norm of interaction, where the customer's preferences and buying habits are taken into account. Content management and one to one marketing have emerged as trends with a mission of better addressing customers with the relevant information for their specific needs. Marketing activities are quickly evolving from traditional telemarketing to web and e-mail campaigns. These web-based marketing activities give prospects a better customer experience, allowing the relevant information to be retrieved by the prospects on their own terms and in their own time. For maximum value, follow-up of these campaigns must be done in collaboration with the sales force to enable qualified leads and success /failure analysis. Management of marketing campaign costs as well as marketing events (trade shows and seminars) has significant value for future planning and ROI analysis.

Consistent Shared Customer Repository

It is insufficient for a CRM offering to independently include Sales, Marketing, and Service. These three major areas as discussed above are the primary contact points of the enterprise to its community. However, the lack of a unified approach, combining and integrating these functions, leads to less than optimal results. Integrating customer interactions across the entire enterprise shifts organizations from departmentalized silos of customer contact to an environment where all customer interactions are coordinated and consistent. Gartner Group calls the integrated approach of Sales, Marketing, and Service ApplicationsTechnology}' Enabled Relationship Management (TERM). This approach modifies the way the organization interacts with its customers. In this new paradigm, the enterprise conforms to the customer's needs and ensures integration of the traditionally independent activities of Sales, Marketing, and Service. Conceptually, it is absolutely critical and essential for a CRM solution to have the customer repository at the center of the Sales, Marketing, and Service efforts. An enterprise that functions with independent sources of information has duplicate, conflicting, and out-of-date information. This adversely influences the effectiveness of the enterprise as a whole. Each of the point solutions is a step in the overall prices and must communicate via a common shared repository with the other steps in the process. **Analytic Capabilities**

An important dimension of CRM is the area of analysis capabilities, which focuses on optimizing customer value. Real-time analysis, both quantitative, is now being provided in addition to standard reports that have long been an important component of CRM solutions. Intelligent in-depth analysis requires consistent customer data as a starting point, with all enterprise applications participating in the analytic environment. Added value is achieved by feeding the analysis results back to management and throughout the organization. The enterprise decision-makers must leverage this knowledge to make more informed and timely business decisions. A thorough analysis is required of the customers to gauge the value that they bring the enterprise as well as to measure their satisfaction. Relevant data should be readily available and enable intelligent insight to the underpinnings of the organization. The gathered information reveals, for example, customer ranking, service-level, and critical

bottlenecks. It is the basis for management reports and an assortment of enterprise tasks such as prioritizing leads, monitoring time spent on certain phases of the sale cycle, or the types of problems that are being dealt with. Analysis should allow strategic planning, enabling the appropriate allocation of resources to where opportunity lies and the re-evaluation or restructuring of problematic areas. Collected demographic information should be provided as input for more focused campaigns to more specific target markets. More informed business decisions can thus be carried out with the aid of analytic tools that consolidate and manage the vast amount of customer knowledge within the organization.

Third-Party CRM Software Vendors

There are a lot of software vendors offering CRM solution in the market. Based on the survey conducted by CRM Community, top 15 CRM Software vendors have been identified:

1. Siebel
2: Oracle
3. Goldmine
4. Clarify
5. Onyx
6. SalesLogix
7. antive/Peoplesoft
8. Pivotal
9. Remedy
10. Epiphany/Octane
11. Quintus
12. SAP
13. Apply
14. Saragota
15. Epicor

However, before a company selects CRM software, the company must consider about the software architecture. The CRM software must have an open architecture when there is a need for the business to expand. Therefore the CRM software must be able to integrate all the business functionalities.

4.13 SUPPLY CHAIN MANAGEMENT

Definition

A supply chain is a network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the production, delivery, and sale of a product to the consumer. The supply chain is typically made up of multiple companies who coordinate activities to set themselves apart from the competition.

A supply chain has three key parts :

- Supply focuses on the raw materials supplied to manufacturing, including how, .when, and from what location.
- Manufacturing focuses on converting these raw materials into finished products.
- Distribution focuses on ensuring these products reach

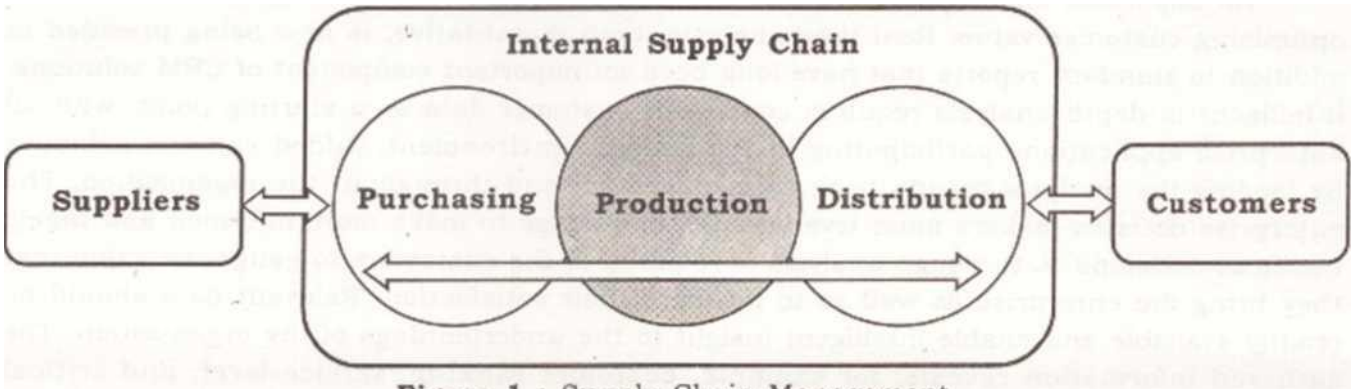


Figure 1 : Supply Chain Management

Supply chain management, then, is the active management of supply chain activities to maximize customer value and achieve a sustainable competitive advantage. It represents a conscious effort by the supply chain firms to develop and run supply chains in the most effective & efficient ways possible. Supply chain activities cover everything from product development, sourcing, production, and logistics, as well as the information systems needed to coordinate these activities.

The organizations that make up the supply chain are "linked" together through physical flows and information flows.

- Physical flows involve the transformation, movement, and storage of goods and materials. They are the most visible piece of the supply chain.
- Information flows. Information flows allow the various supply chain partners to coordinate their long-term plans, and to control the day-to-day flow of goods and material up and down the supply chain.

4.14 THEORIES OF SUPPLY CHAIN MANAGEMENT

Currently there exists a gap in the literature available in the area of supply chain management studies, on providing theoretical support for explaining the existence and the boundaries of supply chain management. Few authors such as Halldorsson, et al. (2003), Ketchen and Hult (2006) and Lavassani, et al. (2008) had tried to provide theoretical foundations for different areas related to supply chain with employing organizational theories. These theories include : '

- Resource-based view (RBV)
- Transaction Cost Analysis (TCA)
- Knowledge-based view (KBV)
- Strategic Choice Theory (SCT)
- Agency theory (AT)
- Institutional theory (InT)
- Systems Theory (ST)
- Network Perspective (NP)

4.15 COMPONENTS OF SUPPLY CHAIN MANAGEMENT INTEGRATION The

Management Components of SCM

The SCM components are the third element of the four-square circulation framework. The level of integration and management of a business process link is a function of the number and level, ranging from low to high, of components added to the link (Ellram and Cooper, 1990; Houlihan, 1985). Consequently, adding more management components or increasing the level of each component can increase the level of integration of the business process link. The literature on business process reengineering, buyer-supplier relationships and SCM suggests various possible components that must receive managerial attention when managing supply relationships. Lambert and Cooper (2000) identified the following components which are:

Planning and Control

- Work structure
- Organization structure
- Product flow facility structure
- Information flow facility structure

- Management methods
- Power and leadership structure
- Risk and reward structure
- Culture and attitude

Baziotopoulos (2004) suggests the following supply chain components:

1. **For customer service management:**Includes the primary level component of customer relationship management, and secondary level components such as benchmarking and order fulfillment.
2. **For product development and commercialization:**Includes the primary' level component of Product Data Management (PDM), and secondary level components such as market share, customer satisfaction, profit margins, and returns to stakeholders.
3. **For physical distribution, manufacturing support and procurement:**Includes the primary' level component of enterprise resource planning (ERP), with secondary level components such as warehouse management, material management, manufacturing planning, personnel management, and postponement (order management).
4. **For performance measurement:**Includes the primary level component of logistics performance measurement, which is correlated with the information flow facility structure within the organization. Secondary level components may include four types of measurement such as: variation, direction, decision and policy measurements. More specifically, in accordance with these secondary level components, total cost analysis (TCA), customer profitability analysis (CPA), and asset management could be concerned as well.
5. **For outsourcing:**Includes the primary level component of management methods, and the strategic objectives for particular initiatives in key areas of information technology,

4.16 Self Check Exercise

4.16.1 Explain the parts of supply chain management.

4.16.2 Name some theories of supply chain management.

4.17 Answers to Self Check Exercise

4.3.1It includes-

a- Functional fit with the Company's business processes

b- Degree of integration between the various components of the ERP system

c- Flexibility and scalability

d- Complexity; user friendliness

e- Quick implementation; shortened ROI period etc.

4.3.2 The success of an ERP solution depends on how quick the benefits can be reaped from it.

4.5.1 - In a two-tier model the server holds the database and database software. The business processes, the programs, are downloaded to the client and executed on the client s system and the client system fetches the data from the database server.

4.5.2 In a three-tier model the client uses a browser or thick client (graphical user interface) to access the application server. The business processes, the programs, are executed on the application server and fetch the data from the database server.

4.7.1 Some major issues involved with implementing an ERP project are:

- Dirty Data
- Testing
- Documentation
- Training
- Consulting Fees

4.11.1 CRM is a strategy by which companies optimize profitability through enhanced customer satisfaction. CRM is about automating and enhancing the customer-centric business processes of Sales, Marketing, and Service.

4.11.2 some common CRM functionalities are:

- Customer Care and support functionality
- Marketing functionality
- Executive information functionality
- ERP integration functionality
- Sales functionality
- Sales management functionality

4.16.1 A supply chain has three key parts:

a- Supply focuses on the raw materials supplied to manufacturing, including how, when, and from what location.

b- Manufacturing focuses on converting these raw materials into finished products.

c- Distribution focuses on ensuring these products reach.

4.16.2 name some theories of supply chain management.

- Resource-based view (RBV)
- Transation Cost Analysis (TCA)
- Knowledge-based view (KBV)
- Strategic Choice Theory (SCT)
- Agency theory (AT)
- Institutional theory (Into)
- Systems Theory (ST)
- Network Perspective (NP)

4.18 Review Questions

Short Questions

1. Critically examine the three tier model of ERP.
2. Explain the major issues involved in implementing an ERP project.

Long Questions

1. Give a detailed analysis on the components of CRM.
2. Define SCM and explain its different theories.

4.19 Suggested Readings

1. D. P. Goal : Management Information System
2. Gordon B. Davis, Margrethe H. Olson: Management Information System
3. Robert G. Murdock, Joel E. Ross : Management Information System

DATA WAREHOUSING

STRUCTURE

5.0 DEFINITION

Data warehouse is a large collection of an organization's electronically stored data. Data warehouses are designed to facilitate reporting and analysis. It provides a means to retrieve and analyze data, to extract, transform and load data, and to manage the data dictionary.

Data warehousing includes business intelligence tools, tools to extract, transform, and load data into the repository, and tools to manage and retrieve metadata. Simply stating data warehouses are operational databases that support transaction processing on day to day basis.

In a broader view data warehousing is the design and implementation of processes, tools, and facilities to manage and deliver complete, timely, accurate, and understandable information for decision making. It includes all the activities that make it possible for an organization to create, manage, and maintain a data warehouse or data mart.

5.1 HISTORY OF DATA WAREHOUSE

Data Warehouses became a distinct type of computer database during the late 1980s and early 1990s. They were developed to meet a growing demand for management information and analysis that could not be met by operational systems. Operational systems were unable to meet this need for a range of reasons such as The processing load of reporting reduced the response time of the operational systems and Development of reports in operational systems often required writing specific computer programs which was slow and expensive.

As a result, separate computer databases began to be built that were specifically designed to support management information and analysis purposes. These data warehouses were able to bring in data from a range of different data sources, such as mainframe computers, minicomputers, as well as personal computers and office automation software such as spreadsheet, and integrate this information in a single place. This capability, coupled with user-friendly reporting tools and freedom from operational impacts, has led to a growth of this type of computer system.

As technology improved (lower cost for more performance) and user requirements increased (faster data load cycle times and more features), data warehouses have evolved through several fundamental stages:

- **Offline Operational Databases:** Data warehouses in this initial stage are developed by simply copying the database of an operational sister. to an off-line server where the processing load of reporting does not impact on the operational system's performance.
- **Offline Data Warehouse:** Data warehouses in this stage of evolution are updated on a regular time cycle (usually daily, weekly or monthly) from the operational systems and the data is stored in an integrated reporting-oriented data structure.
- **Real Time Data Warehouse:** Data warehouses at this stage are updated on a transaction or event basis, every time an operational system performs a transaction (e.g. an order or a delivery or a booking etc.)
- **Integrated Data Warehouse:** Data warehouses at this stage are used to generate activity or transactions that arc passed back into the operational systems for use in the daily activity of the organization.

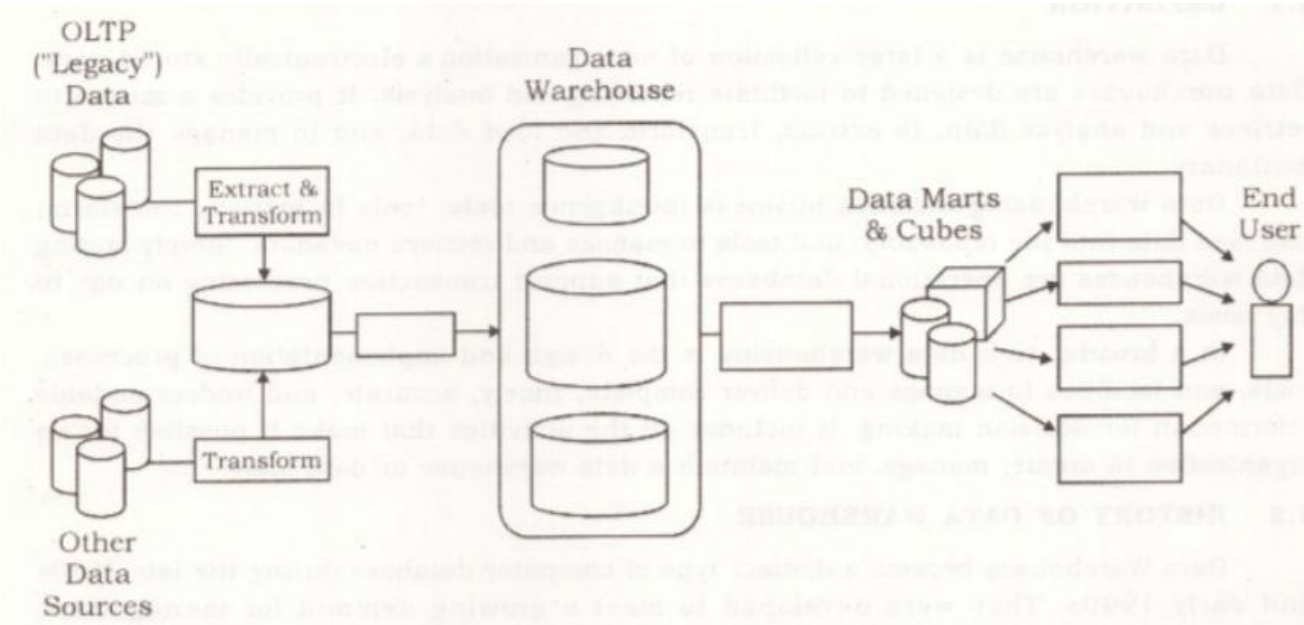


Figure1 : Data Warehousing Environment

5.2 IMPORTANCE OF DATA WAREHOUSING APPROACH

The concept of data warehousing has evolved out of the need for easy access to a structured store of quality data that can be used for decision making. Information is a very powerful asset that can provide significant benefits to any organization and a competitive advantage in the business world. Organizations have vast amounts of data but have found it increasingly difficult to access it and make use of it. This is because it is in many different formats, exists on many different platforms, and resides in many different file and database structures developed by different vendors. Thus organizations have had to write and maintain perhaps hundreds of programs that are used to extract, prepare, and consolidate data for use by many different applications for analysis ankle reporting. Also, decision makers often want to dig deeper into the data once initial findings are made. This

would typically require modification of the extract programs or development of new ones. This process is costly, inefficient, and very time consuming. Data warehousing offers a better approach. Data warehousing implements the process to access heterogeneous data sources. Here data is cleaned, filtered, and transformed and then stored in a structure that is easy to access, understand, and use. The data is then used for query, reporting, and data analysis.

Some of the applications data warehousing can be used for are:

- Credit card churn analysis
- Insurance fraud analysis
- Call record analysis
- Logistics management.

5.3 DATA ANALYSIS TECHNIQUES

There are several techniques for data analysis that are in common use today.

They are:

1. Query and reporting
2. Multidimensional analysis
3. Data Mining.

They are used to formulate and display query results, to analyze data content by viewing it from different perspectives, and to discover patterns and clustering attributes in the data that will provide further insight into the data.

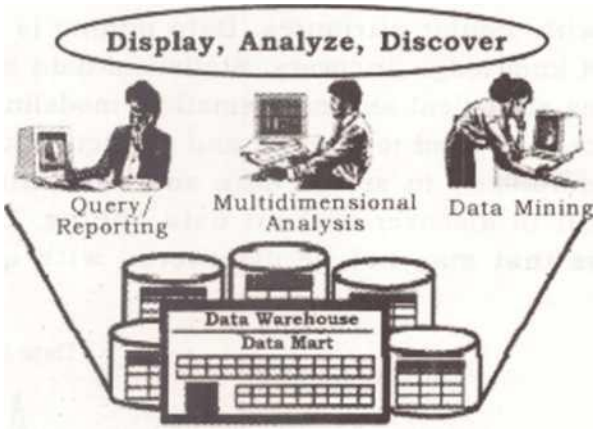


Figure 2: Data Analysis Techniques

1. Query and Reporting

Query and reporting analysis is the process of posing a question to be answered, retrieving relevant data from the data warehouse, transforming it into the appropriate context, and displaying it in a readable format. It is driven by analysts who must pose those questions to receive an answer.

2. Multidimensional Analysis

Multidimensional analysis has become a popular way to extend the capabilities of query and reporting. That is, rather than submitting multiple queries, data is structured to enable fast and easy access to answers to the questions that are typically asked. For example, the data would be structured to include answers to the question. How much of

each of our products was sold on a particular day, by a particular sales person, in a particular store? Each separate part of that query is called a dimension. By pre calculating answers to each sub query within the larger context, many answers can be readily available because the results are not recalculated with each query; they are simply accessed and displayed. For example, by having the results to the above query, one would automatically have the answer to any of the sub queries. That is, we would already know the answer to the sub query. How much of a particular product was sold by a particular salesperson? Having the data categorized by these different factors, or dimensions, makes it easier to understand, particularly by business-oriented users of the data. Dimensions can have individual entities or a hierarchy of entities, such as region, store, and department.

3. Data Mining

Data mining is a relatively new data analysis technique. It is very different from query and reporting and multidimensional analysis in that is uses what, is called a discovery technique. That is, you do not ask a particular question of the data but rather use specific algorithms that analyze the data and report what they have discovered. Unlike query and reporting and multidimensional analysis where the user has to create and execute queries based on hypotheses, data mining searches for answers to questions that may have not been previously asked. This discovery could take the form of finding significance in relationships between certain data elements, a clustering together of specific data elemis, or other patterns in the usage of specific sets of data elements. After finding these patterns, the algorithms can infer rules. These rules can then be used to generate a model that can predict a desired behavior, identify relationships among the data, discover patterns, and group clusters of records with similar attributes. Data mining is most typically used for statistical data analysis and knowledge discovery. Statistical data analysis detects unusual patterns in data and applies statistical and mathematical modeling techniques to explain the patterns. The models are then used to forecast and predict. Data mining is data driven. There is a high level of complexity in stored data and data interrelations in the data warehouse that are difficult to discover without data mining. Data mining offers new insights into the business that may not be discovered with query and reporting or multidimensional analysis.

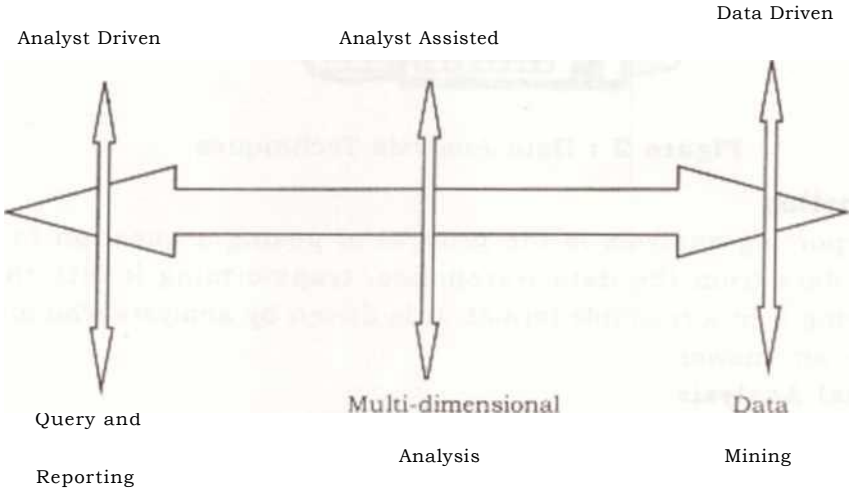


Figure 3: Comparing Data Analysis Models

5.4 Self Check Questions

5.4.1 What is data warehouse?

5.4.2 Name some data analysis techniques.

5.4.3 Explain data mining

5.5 DATA WARE HOUSE ARCHITECTURE

Data Warehouse architecture involves the efforts of building a data warehouse. The business analysis frame work must be understood in order to create an efficient data warehouse. Four different views of the data warehouse must be considered: the top-down view, the data source view, the data warehouse view and the business query view.

- The top-down view allows the selection of relevant information necessary for the data warehouse. The data information matches the current and the forthcoming needs of the business.
- The data source view exposes the way in which data is captured, stored and managed by a data warehouse system. From individual source tables to integrated source tables information may be detailed at various levels of accuracy.
- The data warehouse view includes fact tables and dimension tables. It represents the information that is stored within the data warehouse as well as information regarding the date, time of origin of the source data to provide the historical context.
- The business query view is the perspective of data in the data warehouse from the point of view of the end user.

5.6 ARCHITECTURE CHOICES

Selection of an architecture will determine, or be determined by, where the data warehouses and/or data marts (Data marts are smaller data warehouses that can function independently or can be interconnected to form a global integrated data warehouse) themselves will reside and where the control resides. For example, the data can reside in a central location that is managed centrally. Or, the data can reside in distributed local and/ or remote locations that are either managed centrally or independently. The architecture choices are global, independent, interconnected, or some combination of all three.

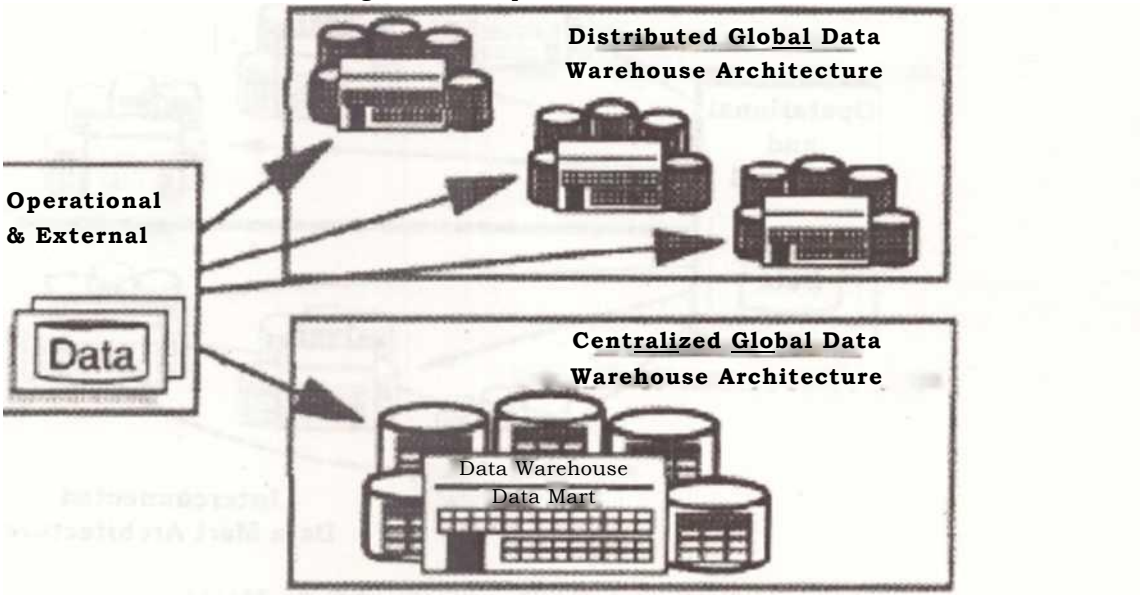


Figure 4: Global Warehouse Architecture: comparing the Two architecture approaches

5.6.1 Global Warehouse Architecture

A global data warehouse supports all, or a large part, of the corporation that has the requirement for a more fully integrated data warehouse with a high degree of data access and usage across departments or lines-of-business. That is, it is designed and constructed based on the needs of the enterprise as a whole. It could be considered to be a common repository for decision support data that is available across the entire organization, or a large subset thereof.

Figure 4 shows the two ways that a global warehouse can be implemented. In the top part of the figure, you see that the data warehouse is distributed across three physical locations. In the bottom part, of the figure, the data warehouse resides in a single, centralized location. A global warehouse architecture enables end users to have more of an enterprise wide or corporate wide view of the data. It should be certain that this is a requirement, however, because this type of environment can be very time consuming and costly to implement.

5.6.2 Independent Data Mart Architecture

An independent data mart architecture implies stand-alone data marts that are controlled by a particular workgroup, department, or line of business and are built solely to meet their needs. There may, in fact, not even be any connectivity with data marts in other workgroups, departments, or lines of business. For example, data for these data marts may be generated internally. The data may be extracted from operational systems but would then require the support of Information systems (IS). IS would not control the implementation but would simply help manage the environment. Data could also be extracted from sources of data external to the organization.

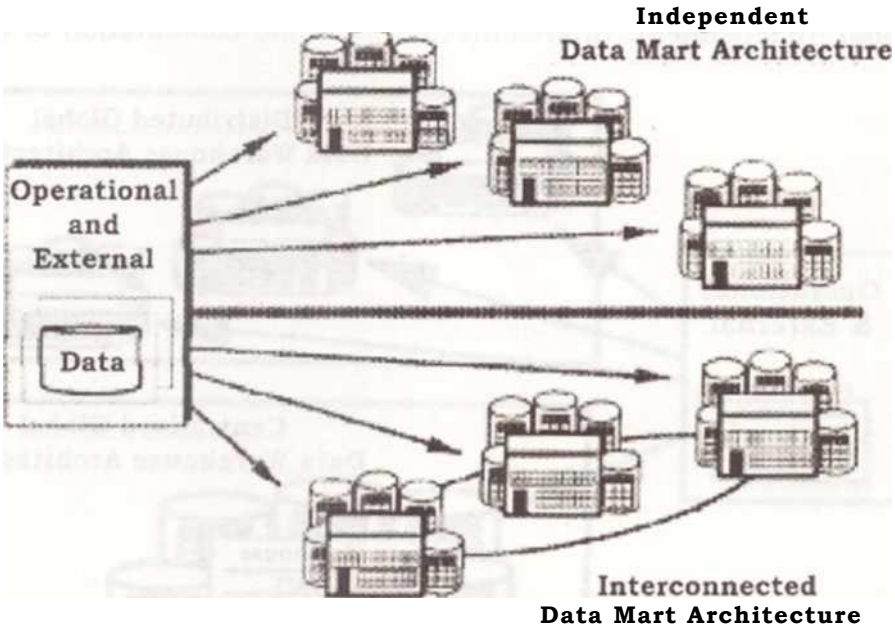


Figure 5: Two types of Data Marts The top part of Figure 5 depicts the independent data mart structure. Although the figure depicts the data coming from operational or external data sources, it could also come

from a global data warehouse if one exists. The independent data mart architecture requires some technical skills to implement, but the resources and personnel could be owned and managed by the workgroup, department, or line of business.

5.6.3 Interconnected Data Mart Architecture

Interconnected data mart architecture is basically a distributed implementation. Although separate data marts are implemented in a particular workgroup, department, or line of business, they can be integrated, or interconnected, to provide a more enterprise wide or corporate wide view of the data. In fact, at the highest level of integration, they can become the global data warehouse. Therefore, end users in one department can access and use the data on a data mart in another department. This architecture is depicted in the bottom of Figure5. Although the figure depicts the data coming from operational or external data sources, it could also come from a global data warehouse if one exists. This architecture brings with it many other functions and capabilities that can be selected. These additional choices can bring with them additional integration requirements and complexity as compared to the independent data mart architecture. For example, you will now need to consider who controls and manages the environment.

5.7 Self Check Questions

5.7.1 Explain the basic relationship between data, information, knowledge in data mining?
5.7.2 Describe the steps of data mining process

5.8 BASIC CONSTRUCTION STEPS OF DATA WAREHOUSING

In general data warehousing comes in all shapes and sizes, which bear a direct relationship to cost and time involved. The approach to construct a data warehousing project will vary and the steps listed below are summary of some of the points to consider.

1. Choose the business process to model, for example orders, invoices, shipments etc. if the business is multiple and involves many parts of the organization a data warehouse model should be followed. On the other hand, if the business process involves only one kind of process a data mart should be made.
2. Choose the grain of the business process. The grain is the fundamental atomic level at which a fact in a fact table is to be represented.
3. Choose the dimensions that will apply to each fact table record. Typical dimensions are time, item, customer, supplier, warehouse transaction type and status.
4. Choose the measures that will populate each fact table record. Typical measures are numerical additive quantities like units sold and 'units purchased'.
5. Choose the best method of integrating the data warehouse to external applications. Most data warehousing projects sink or swim by their ability to extract data from external applications. Enterprises have a slew of applications either developed in-house or obtain from a vendor. Conceptually, data warehouse will act as the heart to diverse applications running in the enterprise.

5.9 BASIC RELTIONSHIP BETWEEN DATA, INFORMATION, KNOWLEDGE IN DATA MINING

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
- **Non-Operational 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 patterns, associations, or relationships among all this 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 behavior. Thus, a manufacturer or retailer could 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.

Example 1

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

Example 2

Wal-Mart 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. Wall- Mart allows more than 3,500 suppliers, to access data on their products and performs 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, Wal-Mart computers processed over 1 million complex data queries.

Example 3

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! Advanced 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.

5.9.1 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 arc sought:

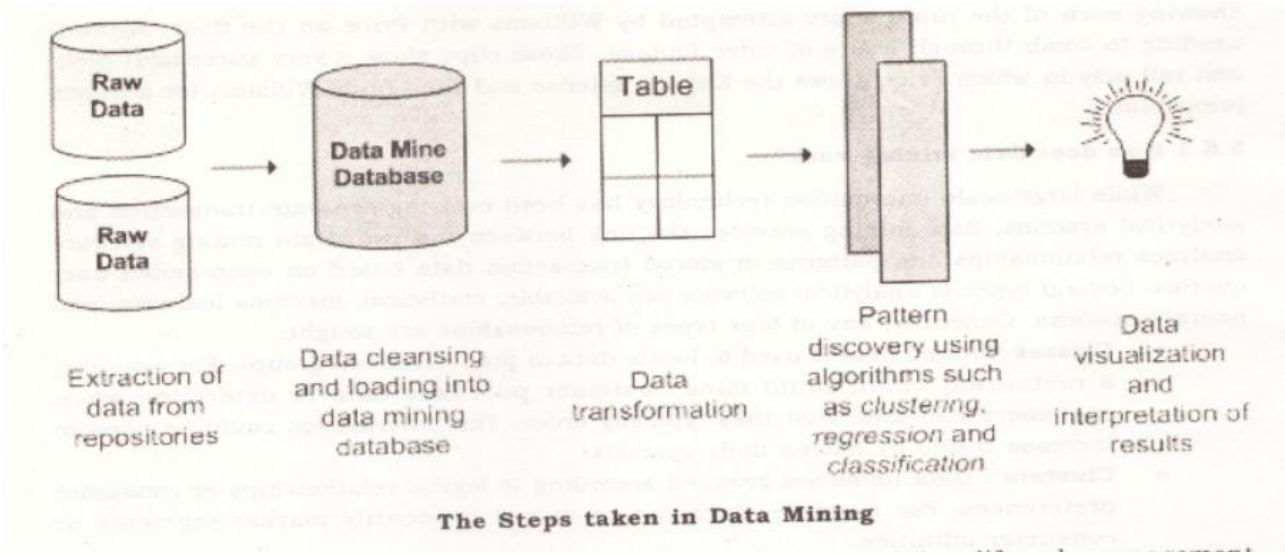
- **Classes:** Stored data is used to locate data in predetermined groups. For example, a restaurant chain could mine customer purchase data to determine when customers visit and what they typically order. This information could be used to increase traffic by having daily specials.
- **Clusters:** Data 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.

5.9.2 The steps for data mining follow the following pattern:

- Data extraction
- Data cleansing
- Modeling data
- Applying data mining algorithm
- Pattern discovery
- Data visualization



The Steps taken in Data Mining

Data extraction and data cleansing can be eased with good data lifecycle management policies. Very often a data warehousing project will ensure that data extraction and metadata standards are pre-defined in an organization.

Data models for operational and archived data are different from data mining models. Data stored referentially in operational systems are designed for transactional speed.

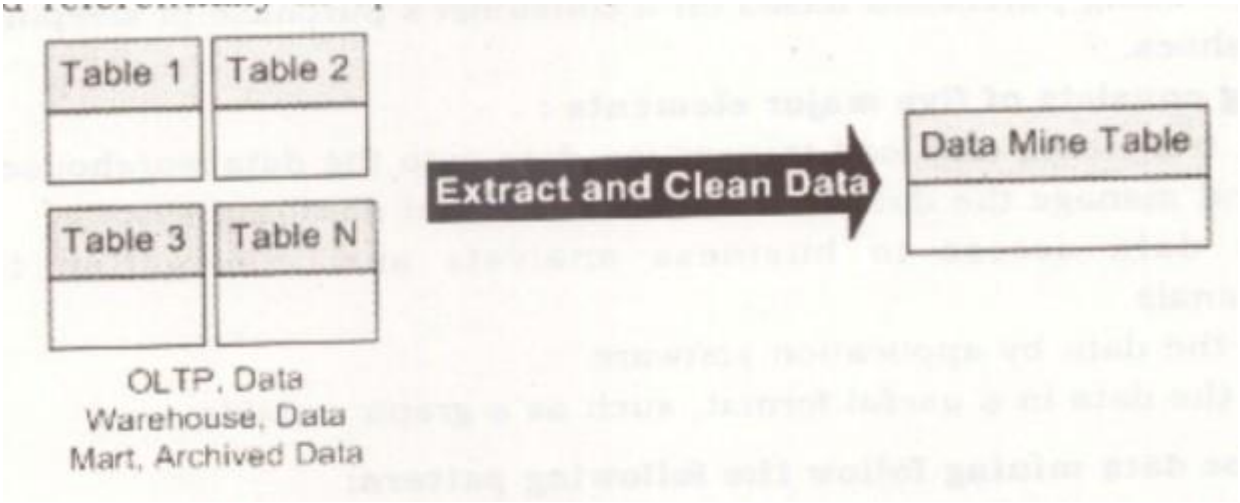


Figure: Data Extraction for Data Mining

In data mining a unified table view is created where data of interest is stored. Most data mining vendors offer the ability to extract data from repositories and transfer to the data mining database. The table view below shows an example for a retailer s data mining database.

Table 1: Table View of Data Mining Database

Unique Identifier	Customer Name	Telephone Number	Address Purchased SKU	Item Purchased	Date
456	A. Robertson	212-555-2222	6th St. Pierre, NY 20100	1181-3	11-11-02
457	B. Meyers	202-555-1212	77th Ave, Uptown, CA 90211	0201-9	12-05-03
458	A. Robertson	212-555-2222	6th St. Pierre, NY 20100	5512-8	06-22-02
459	G. Sanchez	604-555-1111	41st Gore Ave, TN 30101	4122-7	01-06-99
460	L. Downing	708-555-3333	22nd Dec., CA 95121	001 1-7	07-05-03

Not all of the data found in the data mining table view will have relevance. An example is the first column in Table 1, which has identifier values.

Other data may hold hidden patterns that can be discovered after relevancy is captured, often with external data sources. An example from Table 1 is the telephone number column. At first glance it would seem this data set would be insignificant to the data mining process.

However, useful information can be obtained from telephone numbers, such as telephone exchange location ‘or cell phone usage. This can be obtained from external data sources which will grade and score the telephone number data set in Table 1.

5.10 DIFFERENT LEVELS OF ANALYSIS

- **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 neighbor 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 neighbor 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.

DATA MINING TECHNOLOGICAL INFRASTRUCTURE

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.

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.

5.11 Self Check Exercise

5.11.1 Explain the two technological drivers of Data Mining Infrastructure.

5.12 Answers to Self Check Exercise

5.4.1 Data warehouse is a large collection of an organization's electronically stored data. Data warehouses are designed to facilitate reporting and analysis. It provides a means to retrieve and analyze data, to extract, transform and load data, and to manage the data dictionary.

5.4.2 There are several techniques for data analysis that are in common use today.

They are:

1. Query and reporting
2. Multidimensional analysis
3. Data Mining.

5.4.3 3Data mining is a relatively new data analysis technique. It is very different from query and reporting and multidimensional analysis in that is uses what, is called a discovery technique. That is, you do not ask a particular question of the data but rather use specific algorithms that analyze the data and report what they have discovered.

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5.13 Review Questions

Short Questions

1. Give a detailed analysis on Global Warehouse Architecture.
2. How does Data Mining work? Also explain its elements.

Long Questions

1. Explain in detail Query and Reporting and Multidimensional analysis techniques of Data Analysis.
2. What are the different views of data warehouse that must be considered while designing its architecture.

5.14Suggested Readings

1. D. P. Goal : Management Information System
2. Gordon B. Davis, Margrethe H. Olson: Management Information System
3. Robert G. Murdock, Joel E. Ross : Management Information System

MBA-DE(Second Year)
Semester-Ill

MISDSS 302
MANAGEMENT INFORMATION SYSTEM &
DECISION SUPPORT SYSTEM

Lesson No. 6

AUTHOR : NEERAJ SHARMA

DECISION SUPPORT SYSTEMS (DSS)

STRUCTURE

6.0 OBJECTIVES

After going through this lesson, you will be able to understand:

- Characteristics of a Decision Support System
- DSS and MIS
- DSS and ES
- Types of DSS
- Role and Applications of DSS

6.1 INTRODUCTION

Decision Support Systems (DSS) are a specific class of computerized information systems that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. The more information you have, based on internal experiences or from external sources, the better your decisions. Business executives are faced with the same dilemmas when they make decisions. They need the best tools available to help them. Decision makers to make quality decisions should, -to the best of their abilities:

1. Thoroughly check a wide range of alternatives
2. Gather full range of goals and implications of choices
3. Weigh costs and risks of both positive and negative consequences
4. all new information into account, even when it doesn't support initial course of action
6. Re-examine positive and negative consequences of all alternatives, including initially rejected ones
7. Make detailed provisions for implementation, including contingency plans for

known risks

Decision Support Systems (DSS) help executives make better decisions by using historical and current data from internal Information Systems and external sources. By combining massive amounts of data with sophisticated analytical models and tools, and by making the system easy to use, they provide a much better source of information to use in the decision-making process. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to successfully complete decision process tasks.

6.2 CHARACTERISTICS OF A DECISION SUPPORT SYSTEM

Decision Support Systems (DSS) are a specific class of computerized information system that supports decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems and make decisions. Alter (1980) identified three major characteristics of DSS:

1. DSS are designed specifically to facilitate decision processes,
2. DSS should support rather than automate decision making, and
3. DSS should be able to respond quickly to the changing needs of decision makers. Clyde Hollsopple and Andrew Whinston (1996) identified four characteristics one

should expect to observe in a DSS. Their list is very general and provides an even broader perspective on the DSS concept. Holsapple and Whinston specify that a DSS must: have a body of knowledge, a record-keeping capability that can present knowledge on an ad hoc basis in various customized ways as well as in standardized reports, a capability for selecting a desired subset of stored knowledge for either presentation or for deriving new knowledge, and must be designed to interact directly with a decision maker in such a way that the user has a flexible choice and sequence of knowledge-management activities.

The following are the major characteristics of a DSS:

1. **Facilitation**

DSS facilitate and support specific decision-making activities and/or decision processes.

2. **Interaction**

DSS are computer-based systems designed for interactive use by decision makers or staff users who control the sequence of interaction and the operations performed.

3. **Ancillary**

DSS can support decision makers at any level in an organization. They are NOT intended to replace decision makers.

4. **Repeated Use**

DSS are intended for repeated use. A specific DSS may be used routinely or used as needed for ad hoc decision support tasks.

5. **Task-oriented**

DSS provide specific capabilities that support one or more tasks related to decision-making, including: intelligence and data analysis; identification and design o' alternatives; choice among alternatives; and decision implementation.

6. **Identifiable**

DSS may be independent systems that collect or replicate data from other information

systems OR subsystems of a larger, more integrated information system.

7. **Decision Impact**

DSS are intended to improve the accuracy, timeliness, quality and overall effectiveness of a specific decision or a set of related decisions.

6.3 DSS AND MIS

MIS	DSS
Structured decisions	Semi structured, unstructured decisions
Reports based on routine flows of data	Focused on specific decisions / classes of decisions
General control of organization	End-user control of data, tools, and sessions
Structured information flows	Emphasizes change, flexibility, quick responses
Presentation in form of reports	Presentation in form of graphics
	Greater emphasis on models, assumptions, ad hoc queries
Traditional systems development	Develop through prototyping; iterative process

Decision Support Systems (DSS) should be developed based on the dominant technology components or drivers of decision support, the targeted users, the specific purpose of the system and the primary deployment technology. Five categories of DSS based on the dominant technology components are, Communications-Driven, Data-Driven, Document-Driven, Knowledge-Driven, and Model-Driven Decision Support Systems. Each generic DSS can be targeted to internal or external stakeholders. DSS can have specific or very general purposes. The DSS deployment technology may be a mainframe computer, a client/server LAN, or a Web-Based architecture. Because of the limitations of hardware and software, early DSS systems provided executives only limited help. With the increased power of computer hardware, and the sophisticated software available today, DSS can crunch lots more data, in less time, in greater detail, with easy to use interfaces. The more detailed data and information executives have to work with, the better their decisions can be.

6.4 Self Check Exercise

6.4.1 Describe Decision Support Systems(DSS).

6.4.2 Write major characteristics of DSS according to Alter.

6.5 DSS and ES

Expert Systems (ES) come under the area of Artificially Intelligence. Artificially Intelligent decision support systems exist for **two** main reasons. First, advances in AI technology have made it practical to build **systems** whose behaviors resembles some aspects of human intelligence. We can expect such advances to continue, leading to new dimensions for DSSs. Second, decision makers **can** benefit from DSSs that exhibit more, rather than less, intelligence. As does human **intelligence,** artificial intelligence has many aspects. One of the most significant is the ability to reason. The Al quest for reasoning systems has matured to the point where computers are **able** to display expert behavior. To assist, in the construction of these expert systems, numerous software tools are now commercially available. These include both shells and integrated environments.

first involves extracting the relevant knowledge from the human expert. Such knowledge is often heuristic in nature, based on useful rules of thumb rather than absolute certainties. Extracting it from the expert in a way that can be used by a computer is generally a difficult task, requiring its own expertise. A knowledge engineer has the job of extracting this knowledge and building the expert system knowledge base. Since the Expert System behaves like an expert so in order to build it the person responsible should extract the knowledge from an expert and use it to make an Expert System.

A first attempt at building an expert system may not be successful. This is partly because the expert generally finds it very difficult to express exactly what knowledge and rules they use to solve a problem. Much of it is almost subconscious, or appears so obvious they do not even bother mentioning it. Knowledge acquisition for expert systems is a big area of research, with a wide variety of techniques developed. However, generally it is important to develop an initial prototype based on information extracted by interviewing the expert, and then iteratively refine it based on feedback both from the expert and from potential users of the expert system.

In order to do such iterative development from a prototype it is important that the expert system is written in a way that it can easily be inspected and modified. The system should be able to explain its reasoning (to expert, user and knowledge engineer) and answer questions about the solution process. Updating the system should not involve rewriting a lot of code. After extracting knowledge from the expert we will convert that knowledge in the form of certain rules to solve that problem. The most widely used knowledge representation scheme for expert systems is rules. Typically, the rules will not have certain conclusions - there will just be some degree of certainty that the conclusion will hold if the conditions hold. Statistical techniques are used to determine these certainties. Rule-based systems, with or without certainties, are generally easily modifiable and make it easy to provide reasonably helpful traces of the system s reasoning. These traces can be used in providing explanations of what it is doing.

Although expert systems are the most prominent kind of artificially intelligent DSSs, there are other branches of Al that contribute to the realization of artificially intelligent decision support systems. These include natural language processing, which effectively allows a DSS user to specify the LS, knowledge representation, which offers alternative kinds of KS contents, machine learning, which provides mechanisms that can be incorporated in PPS to allow a DSS to learn, automatic programming, which has potential to aid in the construction of DSS solvers and user interfaces, and pattern recognition, which can yield DSSs with nontraditional modes of interaction.

Each cycle picks up where the last ended, building on the prior rule set. For a developer, the spiral represents a continuing education process in which more and more of an expert's reasoning knowledge is discovered and formalized in the rule set. Here, each development cycle is presented in terms of consecutive stages. Many aspects of traditional systems analysis and project management can be applied to the development of expert systems. Rule set development is a process of discovery and documentation. Research continues in search of ways of automating various aspects of the process. It would not be surprising to see expert systems assisting in order to build new expert systems in the near future.

6.6 TYPES OF DSS

Decision Support Systems should be defined as a broad category of information systems for informing and supporting decision-makers. DSS are intended to improve and speed-up the processes by which people make and communicate decisions. We need to define Decision Support Systems on both a conceptual level and on a concrete, technical level. Both managers and DSS designers need to understand categories of decision support so they can better communicate about what needs to be accomplished in informing and supporting decision makers. The DSS literature includes a number of frameworks for categorizing systems. Steven Alter (1980) developed the broadest and most comprehensive one more than 20 years ago. Alter concluded from his research that decision support systems could be categorized in terms of the generic operations that can be performed by such systems. These generic operations extend along a single dimension, ranging from extremely data-oriented to extremely model-oriented. Alter conducted a field study of 56 DSS that he categorized into seven distinct types of DSS. His seven types arc as below:

1. File drawer systems that provide access to data items.
2. Data analysis systems that support the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators.
3. Analysis information systems that provide access to a series of decision-oriented databases and small models.
4. Accounting and financial models that calculate the consequences of possible actions.
5. Representational models that estimate the consequences of actions on the basis of simulation models.
6. Optimization models that provide guidelines for action by generating an optimal solution consistent with a series of constraints.
7. Suggestion models that perform the logical processing leading to a specific suggested decision for a fairly structured or well-understood task.

However, today a new, broader framework than Alter's (1980) is needed because Decision Support Systems arc much more common and more diverse than when he conducted his research and proposed his framework.

Decision Support Systems do vary in many ways. Some DSS focus on data, some on models and some on communications. DSS also differ in scope, some DSS are intended for one primary user and used stand-alone for analysis and others are intended for many users in an organization. Let us categorize the most common Decision Support Systems currently in use.

1. **Data-Driven DSS**

The first generic type of Decision Support System is a Data-Driven DSS. Data-Driven DSS take the massive amounts of data available through the company's TPS and MIS systems and extract useful information which executives can use to make more informed decisions. They do not have to have a theory or model but can free-flow the data. These systems include file drawer and management reporting systems, data warehousing and analysis systems, Executive Information Systems (EIS) and Spatial Decision Support Systems. Business Intelligence Systems are also examples of Data-Driven DSS. Data- Driven DSS emphasize access to and manipulation of large databases of structured data and especially a time-

series of internal company data and sometimes external data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. Data-Driven DSS with Online Analytical Processing (OLAP; provide the highest level of functionality and decision support that is linked to analysis of large collections of historical data.

2. **Model-Driven DSS**

A second category, Model-Driven DSS, includes systems that use accounting and financial models, representational models, and optimization models. Model-Driven DSS emphasize access to and manipulation of a model. Simple statistical and analytical tools provide the most elementary level of functionality. Some OLAP systems that allow complex analysis of data may be classified as hybrid DSS systems providing modeling, data retrieval and data summarization functionality. Model-Driven DSS use data and parameters provided by decision-makers to aid them in analyzing a situation, but they are not usually data intensive. Very large databases are usually not needed for Model-Driven DSS.

Model-Driven DSS were isolated from the main Information Systems of the organization and were primarily used for the typical "what-if analysis. That is, what if we increase production of our products and decrease the shipment time?" These systems rely heavily on models to help executives understand the impact of their decisions on the organization, its suppliers, and its customers.

3. **Knowledge-Driven DSS**

The terminology for this third generic type of DSS is still evolving. Currently, the best term seems to be Knowledge- Driven DSS. Adding the modifier "driven" to the word knowledge maintains a parallelism in the framework and focuses on the dominant knowledge base component. Knowledge-Driven DSS can suggest or recommend actions to managers. These DSS are personal computer systems with specialized problem solving expertise. The "expertise consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving some of these problems. A related concept is Data Mining. It refers to a class of analytical applications that search for hidden patterns in a database. Data mining is the process of sifting through large amounts of data to produce data content relationships.

4. **Document-Driven DSS**

A new type of DSS, a Document-Driven DSS or Knowledge Management System, is evolving to help managers retrieve and manage unstructured documents and Web pages. A Document-Driven DSS integrates a variety of storage and processing technologies to provide complete document retrieval and analysis. The Web provides access to large document databases including databases of hypertext documents, images, sounds and video. Examples of documents that would be accessed by a Document-Based DSS are policies and procedures, product specifications, catalogs, and corporate historical documents, including minutes of meetings, corporate records, and important correspondence. A search engine is a powerful decision aiding tool associated with a Document-Driven DSS.

5. **Communications-Driven and Group Decision Support Systems (GDSS)**

Group Decision Support Systems (GDSS) came first, but now a broader category of

Communications-Driven DSS or groupware can be identified. (Group Decision Support Systems (GDSS) has been explained in detail later in this chapter.) This fifth generic type of Decision Support System includes communication, collaboration and decision support technologies that do not fit within those DSS types identified. Therefore, we need to identify these systems as a specific category of DSS. A Group DSS is a hybrid Decision Support System that emphasizes both the use of communications and decision models. A Group Decision Support System is an interactive computer-based system intended to facilitate the solution of problems by decision-makers working together as a group. Groupware supports electronic communication, scheduling, document sharing, and other group productivity and decision support enhancing activities We have a number of technologies and capabilities in this category in the framework - Group DSS, two-way interactive video, White Boards, Bulletin Boards, and Email.

6. **Inter-Organizational or Intra-Organizational DSS**

A relatively new targeted user group for DSS made possible by new technologies and the rapid growth of the Internet is customers and suppliers. We can call DSS targeted for external users an Inter-organizational DSS. The public Internet is creating communication links for many types of inter-organizational systems, including DSS. An Inter-Organizational DSS provides stakeholders with access to a company's intranet and authority or privileges to use specific DSS capabilities. Companies can make a Data-Driven DSS available to suppliers or a Model-Driven DSS available to customers to design a product or choose a product. Most DSS are Intra-Organizational DSS that are designed for use by individuals in a company as standalone DSS or for use by a group of managers in a company as a Group or Enterprise-Wide DSS.

7. **Function-Specific or General Purpose DSS**

DSS are designed to support specific business functions or types of businesses and industries. Wk. can call such a Decision Support System a function-specific or industry- specific DSS. A Function-Specific DSS like a budgeting system may be purchased from a vendor or customized in-house using a more general-purpose development package. Vendor developed or "off-the-shelf" DSS support functional areas of a business like marketing or finance; some DSS products are designed to support decision tasks in a specific industry like a crew scheduling DSS for an airline. A task-specific DSS has an important purpose in solving a routine or recurring decision task. Function or task-specific DSS can be further classified and understood in terms of the dominant DSS component that is as a Model-Driven, Data-Driven or Suggestion DSS. A function or task- specific DSS holds and derives knowledge relevant for a decision about some function that an organization performs (e.g., a marketing function or a production function). This type of DSS is categorized by purpose; function-specific DSS help a person or group accomplish a specific decision task. General-purpose DSS software helps support broad tasks like project management, decision analysis, or business planning.

6.7 ROLE AND APPLICATIONS OF DSS

Managers and executives make semi-structured and unstructured decisions based on historical and current data, from both internal and external sources. Well-built Decision- Support Systems help them make better decisions by making more of these kinds of data

available in the decision-making process. Data mining is one of the most effective tools for gathering useful information provided it's used properly. In addition to data, the components of a DSS include effective software tools, and a user interface that is easy to use.

The Generic DSS framework can be studied in terms of four interrelated elements: a language system (LS), a presentation system (PS), a knowledge system (KS), and a problem processing system (PPS). The first three of these are systems of representation: the set of all requests a user can make, the set of all responses the DSS can present, and the knowledge representations presently stored in the DSS. The problem processor is a dynamic system that can accept any request in the LS and react with a corresponding response from the PS. Which response corresponds to which request is determined by the PPS, often in light of the knowledge available to it in the KS. That is, a change in the KS could very well yield a different response for the same request. Some DSSs can even produce responses without having received a corresponding request. In addition to reacting to users, they take initiative in the processing of knowledge. There are many special cases of the generic DSS framework, each characterizing a distinct class of decision support systems. They differ in terms of their emphasis on one or another popular knowledge management technique.

Traditionally, academics have discussed building Decision Support Systems in terms of four major components:

1. The user interface
2. The database
3. The models and analytical tools and
4. The DSS architecture and network

This traditional list of components remains useful because it identifies similarities and differences between categories or types of DSS. The DSS framework is primarily based on the different emphases placed on DSS components when systems are actually constructed.

Data-Driven, Document-Driven and Knowledge-Driven DSS need specialized database components. A Model- Driven DSS may use a simple flat-file database with fewer than 1,000 records, but the model component is very important. Experience and some empirical evidence indicate that design and implementation issues vary for Data-Driven, Document-Driven, Model-Driven and Knowledge-Driven DSS.

Multi-participant systems like Group and Inter- Organizational DSS also create complex implementation issues. For instance, when implementing a Data-Driven DSS a designer should be especially concerned about the user's interest in applying the DSS in unanticipated or novel situations. Despite the significant differences created by the specific task and scope of a DSS, all Decision Support Systems have similar technical components and share a common purpose, supporting decision- making.

A Data-Driven DSS database is a collection of current and historical structured data from a number of sources that have been organized for easy access and analysis. Now the data components are expanded to include unstructured documents in Document-Driven DSS and knowledge in the form of rules or frames in Knowledge-Driven DSS. Supporting management decision-making means that computerized tools are used to make sense of the structured data or documents in a database.

Mathematical and analytical models arc the major component of a Model-Driven DSS. Each Model-Driven DSS has a specific set of purposes and hence different models are

needed and used. Choosing appropriate models is a key design issue. Also, the software used for creating specific models needs to manage needed data and the user interface. In Model-Driven DSS the values of key variables or parameters are changed, often repeatedly, to reflect potential changes in supply, production, the economy, sales, the marketplace, costs, and/or other environmental and internal factors. Information from the models is then analyzed and evaluated by the decision-maker.

Knowledge-Driven DSS use special models for processing rules or identifying relationships in data. The DSS architecture and networking design component refers to how hardware is organized, how software and data are distributed in the system, and how components of the system are integrated and connected. A major issue today is whether DSS should be available using a Web browser on a company intranet and also available on the Global Internet. Networking is the key driver of Communications- Driven DSS.

Decision-makers receive and analyze information using many different media, including traditional print, group and interpersonal information exchanges, and computer based tools. For more than 30 years, researchers and Information Systems specialists have built and studied a wide variety of systems for supporting and informing decision-makers that they have called Decision Support Systems or Management Decision Systems. In the past few years, sot's additional terms like business intelligence, data mining, on-line analytical processing, groupware, knowledge ware, and knowledge management have been used for systems that are intended to inform and support decision-makers.

6.8 SUMMARY

Decision Support Systems (DSS) are a specific class of computerized information system that supports decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems and make decisions.

Decision Support Systems (DSS) help executives make better decisions by using historical and current data from internal Information Systems and external sources. By combining massive amounts of data with sophisticated analytical models and tools, and by making the system easy to use, they provide a much better source of information to use in the decision-making process. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to successfully complete decision process tasks.

6.9 GLOSSARY

- Data Mining: It refers to a class of analytical applications that search for hidden patterns in a database. Data mining is the process of sifting through large amounts of data to produce data content relationships.
- **Decision Support Systems (DSS):** A specific class of computerized information systems that supports business and organizational decision-making activities.
- **Data Analysis Systems:** The systems that support the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators.

6.10 SELF CHECK EXERCISE

6.10.1 What is Expert system and why it is important?
6.10.2 What are the different types of DSS.

6.11 Review Questions

Short Questions

1. Are there decision support tools for Business Intelligence tasks?
2. What are some examples of a DSS?

Long Questions

1. How is MIS related to DSS?
2. What are examples of decision support systems in global enterprises?
3. What are benefits of a DSS?

6.12 Answers to Self Check Exercise

6.4.1 Decision Support Systems (DSS) are a specific class of computerized information system that supports decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to identify and solve problems and make decisions.

6.4.2 Three major characteristics of DSS:

1. DSS are designed specifically to facilitate decision processes,
2. DSS should support rather than automate decision making, and
3. DSS should be able to respond quickly to the changing needs of decision makers.

6.10.1 Expert Systems (ES) come under the area of Artificially Intelligence. Artificially Intelligent decision support systems exist for *two* main reasons. First, advances in AI technology have made it practical to build *systems* whose behaviors resembles some aspects of human intelligence. We can expect such advances to continue, leading to new dimensions for DSSs. Second, decision makers *can* benefit from DSSs that exhibit more, rather than less, intelligence. As does human *intelligence,* artificial intelligence has many aspects.

6.10.2 DSS can categorized into seven distinct types of DSS. These are:

1. Data-Driven DSS
2. Model-Driven DSS
3. Knowledge-Driven DSS
4. Document-Driven DSS
5. Communications-Driven and Group Decision Support Systems (GDSS)
6. Inter-Organizational or Intra-Organizational DSS
7. Function-Specific or General Purpose DSS

6.13 SUGGESTED READINGS

1. Decision Support and Data Warehouse Systems, Efren G. Mallach, Irwin McGraw- Hill Publishing, 2000.
2. Decision Support Systems and Data Warehouses, B. Ravindranath, New Age International Publishers, 2003.

Lesson No. 7

AUTHOR : NEERAJ SHARMA

COMPONENTS OF DSS

STRUCTURE

7.0 OBJECTIVES

After reading this unit you should be able to:

- Understand the basic components of a DSS;
- Know the architecture and structure of DSS;
- Explain the functions of Data sub-system, Model sub-system; and user-interface Components.

7.1 INTRODUCTION

Managers and executives make semi-structured and unstructured decisions based on historical and current data, from both internal and external sources. Well-built Decision- Support Systems help them make better decisions by making more of these kinds of data available in the decision-making process. Data mining is one of the most effective tools for gathering useful information provided it's used properly. In addition to data, the components of a DSS includc effective software tools, and a user interface that is easy to use.

The Generic DSS framework can be studied in terms of four interrelated elements: a language system (LS), a presentation system (PS), a knowledge system (KS), and a problem processing system (PPS). The first three of these are systems of representation: the set of all requests a user can make, the set of all responses the DSS can present, and the knowledge representations presently stored in the DSS. The problem processor is a dynamic system that can accept any request in the LS and react with a corresponding response from the PS. Which response corresponds to which request is determined by the PPS, often in light of the knowledge available to it in the KS. That is, a change in the KS could very well yield a different response for the same request. Some DSSs can even produce responses without having received a corresponding request. In addition to reacting to users, they take initiative in the processing of knowledge. There are many special cases of the generic DSS framework, each characterizing a distinct class of decision support systems. They differ in terms of their emphasis on one or another popular knowledge management technique.

Traditionally, academics have discussed building Decision Support Systems in terms of four major components :

1. Data management subsystem - database and DBMS
2. Model management subsystem - analytical and modeling software packages and a

3.

The user is also considered a part of the system. Figure 1 shows the schematic of a DSS and explicit the relationships that exist between its various components. This traditional list of components remains useful because it identifies similarities and differences between categories or types of DSS. The DSS framework is primarily based on the different emphases placed on DSS components when systems are actually constructed.

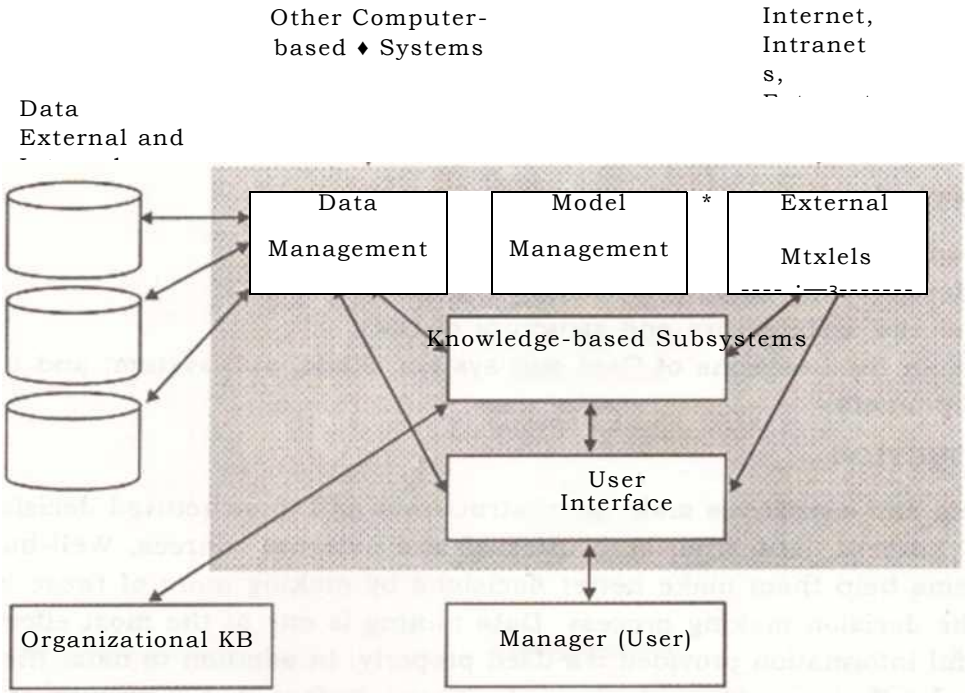


Figure 1: The Schematic of a DSS and its Components

7.2 COMPONENTS OF A DSS

There are three fundamental components of DSS.

Database Management System (DBMS)

A DBMS serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures (as opposed to the physical data structures) with which the users. Interact. A DBMS separates the users from the physical aspects of the database structure and processing. It should also be capable of informing the user of the types of data that are available and how to gain access to them.

Model-base Management System (MBMS)

The role of MBMS is analogous to that of a DBMS. Its primary function is providing independence between specific models that are used in a DSS from the applications that use them. The purpose of an MBMS is to transform data from the DBMS into information that is useful in decision making. Since many problems that the user of a DSS will cope with may be

unstructured, the MBMS should also be capable of assisting the user in model building. **Dialog Generation and Management System (DGMS)**

The main product of an interaction with a DSS is insight. As their users are often managers who are not computer-trained, DSS need to be equipped with intuitive and easy- to-use interfaces. These interfaces aid in model building, but also in interaction with the model, such as gaining insight and recommendations from it. The primary responsibility of a DGMS is to enhance the ability of the system user to utilize and benefit from the DSS.

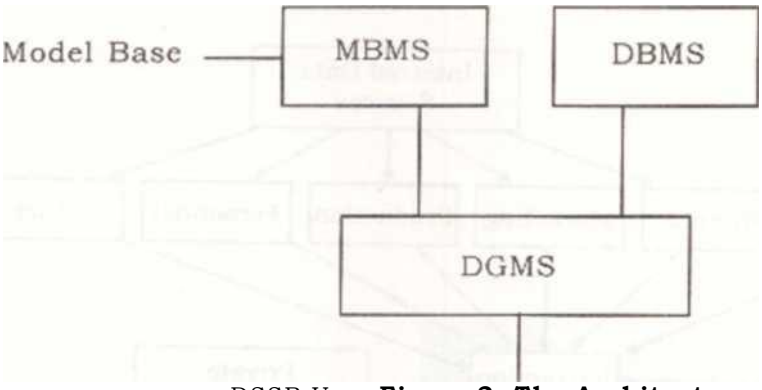


Figure 2: The Architecture of a DSS

While a variety of DSSs exists, the above three components can be found in many DSS architectures and play a prominent role in their structure. Interaction among them is illustrated in Figure 2. Essentially, the user interacts with the DSS through the DGMS. This communicates with the DBMS and MBMS, which screen the user and the user interface from the physical details of the model base and database implementation.

7.3 THE DATA MANAGEMENT SUBSYSTEM

The data management subsystem is further decomposed into the following elements *I*

- DSS database
- DBMS
- Data dictionary
- Query facility

DSS Database

DSS Database is a collection of interrelated data organized to meet the needs and structure of an organization and can be used by more than one person for more than one application. For a larger DSS the database by be part of a larger data warehouse (a collection of databases from throughout the organization)

The data in the database come from three generalized sources:

- internal data
- external data
- private data

Internal data comes mainly from within the organization, from transaction processing system and may be available over an intranet. External data comes mainly from outside the organization and may include industry data, marketing research data, census data, and regional employment data and may be available over the Internet. Private data includes

guideline used by specific decision makers and assessments of specific data and/or situations.

Data-driven, document-driven and knowledge-driven DSS need specialized database components. A model-driven DSS may use a simple flat-file database with fewer than 1,000 records, but the model component is very important. Experience and some empirical evidence indicate that design and implementation issues vary for data-driven, document- driven, model-driven and knowledge-driven DSS. Figure 3 exhibits the parts of the Data sub-system.

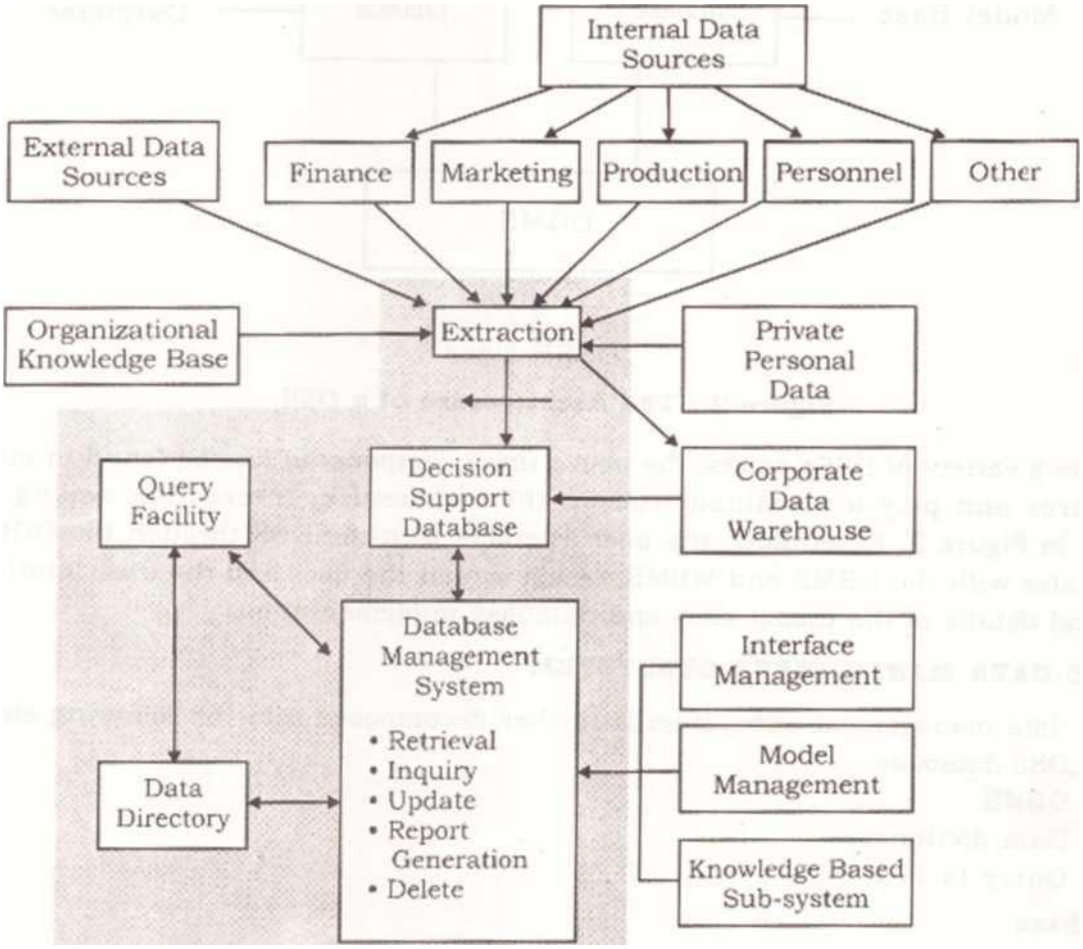


Figure 3: Data Sub-system of a DSS

Multi-participant systems like Group and inter-organizational DSS also create complex implementation issues. For instance, when implementing a data-driven DSS a designer should be especially concerned about the user s interest in applying the DSS in unanticipated or novel situations. Despite the significant differences created by the specific task and scope of a DSS, all decision support systems have similar technical components and share a common purpose, supporting decision- making.

A data-driven DSS database is a collection of current and historical structured data from a number of sources that have been organized for easy access and analysis. Now the data components are expanded to include unstructured documents in document-craven DSS and knowledge in the form of rules or frames in knowledge-driven DSS. Supporting management

decision-making means that computerized tools are used to make sense of the structured data or documents in a database.

Functions of Data Extraction Component

- capturing data from several sources
- involves importing files, summarization, and condensation of data
- creation of reports
- managed by the DBMS

Functions of DBMS

- Captures/extracts data for inclusion in a DSS database
- Updates (adds, deletes, edits, changes) data records and files
- Interrelates data from different sources
- Retrieves data from the database for queries and reports
- Provides comprehensive data security (protection from unauthorized access, recovery capabilities, etc.)
- Handles personal and unofficial data so that users can experiment with alternative solutions based on their own judgment
- Performs complex data manipulation tasks based on queries
- Tracks data use within the DSS
- Manages data through a data dictionary **Query Facility**

The DBMS activities of creation, accessing, and updating is supported by the query facility which accepts requests for data from other DSS components. Most of the DSS typically involves a special query language.

Data Dictionary

Data dictionary is a catalog of all the data in the database and contains data definitions, answers questions about the availability of data, their source, and their exact meaning. In fact, a data dictionary is a database unto itself

The Model Management Subsystem

Mathematical and analytical models are the major component of a model-driven DSS. Each model-driven DSS has a specific set of purposes and hence different models are needed and used. Choosing appropriate models is a key design issue. Also, the software used for creating specific models needs to manage needed data and the user interface. In model- driven DSS the values of key variables or parameters are changed, often repeatedly, to reflect potential changes in supply, production, the economy, sales, the marketplace, costs, and/or other environmental and internal factors. Information from the models is then analyzed and evaluated by the decision-maker.

Knowledge-driven DSS use special models for processing rules or identifying relationships in data. The DSS architecture and networking design component refers to how hardware is organized, how software and data are distributed in the system, and how components of the system are integrated and connected. A major issue today is whether DSS should be available using a Web browser on a company intranet and also available on the Global Internet. Networking is the key driver of communications- driven DSS.

A model management subsystem is composed of the following (See Figure 4)

- model base
- model base management system
- modeling language
- model directory
- model execution, integration, and command processor **Model**

Base

Model base contains routine and special statistical, financial, forecasting, management science, and other quantitative models that provide the analysis capabilities in a DSS. The ability to invoke, run, change, combine, and inspect model is a key DSS capability that differentiates it from other computer-based information systems.

Models can be subdivided into 4 major categories:

1. Strategic
2. Tactical
3. Operational
4. Model-building

Strategic models support top management, and include developing corporate objectives, planning for mergers and acquisitions, plant location selection, environmental impact analysis and non-routine capital budgeting. Strategic models cover long-range planning.

Tactical models are used by middle management and they assist in allocating and controlling the organization's resources. Tactical decisions are applicable to organizational subsystems and their time horizon spans from 1 month to less than 2 years.

Operational models support day-to-day working activities like approving bank loans, production schedule, inventory control, quality control. The span of their decision making is from daily to monthly time horizon.

Apart from these, there are Modeling Building Blocks and Routines, which are smaller processes that support model building. Examples include random number generator, curve fitting, present-value calculations etc.

Modeling Languages

DSS need to deal with semi- and unstructured situations and thus require customization. This is done with high-level languages (4GLs).

Functions of Model Base Management System (MBMS)

- support model creation, generation of reports, model data manipulation
- links with DB **Functions**

of the Model Directory

- catalog of all models and other software in the model base
- answers questions about the availability and capability of the models **Model**

Execution, Integration, and Command

- controlling the actual execution of the model
- combining the operations of several models
- accept and interpret modeling instructions

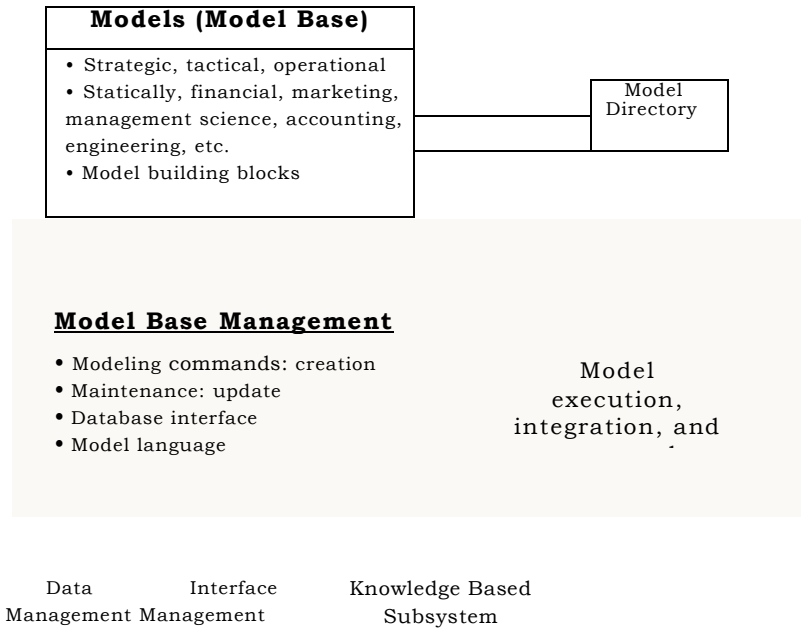


Figure 4: Model Sub-system of a DSS

The User Interface (Dialog) Subsystem

User interface covers all aspects of communication between a user and the DSS. Dialog subsystem is not only software but also ease of use, accessibility, and human-machine interactions and is the most important component of a DSS application. Much of the power, flexibility, and ease-of-user characteristics of DSS are derived from this component. According to some, the user-interface component of the system is what the user sees. Figure 5 shows the various components of the User-interface sub-system.

User interface management system (UIMS), also known as dialog generation and management system, is responsible for the following functions:

- provide GUI
- accommodates a variety of input devices
- presents data in a variety of formats
- helps users through suggestions and prompting
- allows interaction with other subsystems (database and model base)
- provides multimedia and visualization features
- is flexible and adaptive
- captures and stores dialogs

The User

The user is the person faced with the decision and is also known as a manager or decision maker. The user may interact using natural language or by extensive use of objects in a GUI (buttons, menus, icons, etc.). There is considerable heterogeneity among users.

There are two broad classes of users:

1. managers
2. staff specialists

Staff specialists serve as intermediaries between management and DSS and examples

include financial analysts, production planners, marketing researchers etc. These users use technology far more the most managers. An intermediary allows managers to access the DSS without having to use it.

Different types of intermediaries are:

- Staff assistant
- Expert toll user
- Business (system) analyst
- Facilitator in group DSS

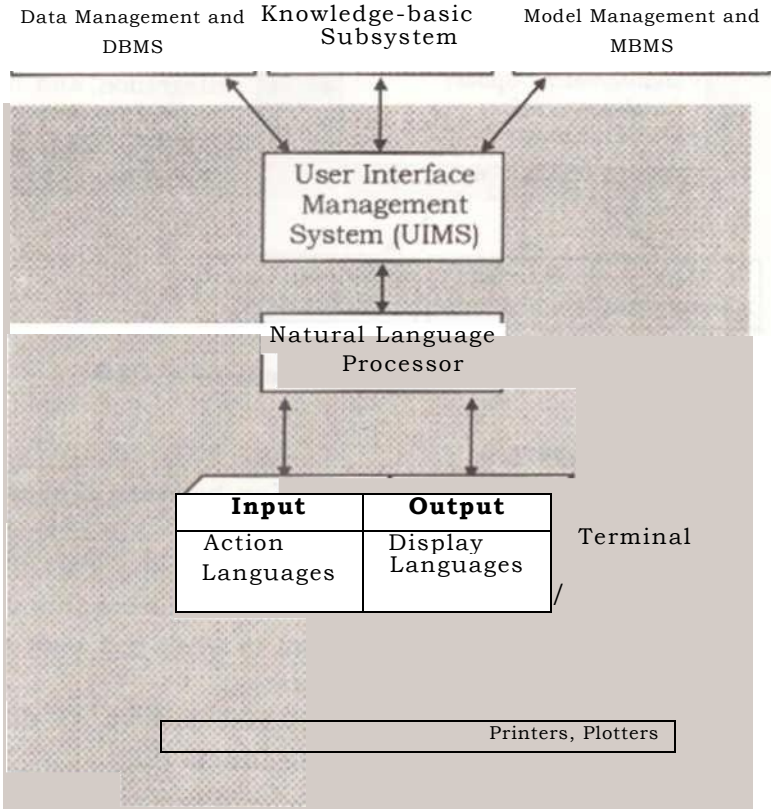


Figure 5: User Interface Sub-system of DSS

Putting the Components Together

Figure 7 shows all the above discussed components of DSS and explains how they fit together in the overall DSS schema. The basic model of a DSS might be a spreadsheet containing the data. The user may make changes in some of the parameters of spreadsheet and observe the impacts on the outcomes. For example, one may create a spreadsheet to support various investment decisions or an individual may create a spreadsheet to model a home loan and see the impact on repayments of changing parameters like interest rates, principal size and the term of the loan. Another example could be from an education institution. A university may create a spreadsheet while entering into a contract with another offshore educational institution to provide its degree programs available in different locations. The spreadsheets then can be used to understand the set of costs, fixed and variable, and to

compare its income in a range of circumstances, like student numbers, the impact of money exchange rates or delivery cost depending on the mode, etc. This allows for sensitivity analysis and risk management. More sophisticated DSSs axe often systems in their own right, although they may be add-ons to some existing transaction processing system.

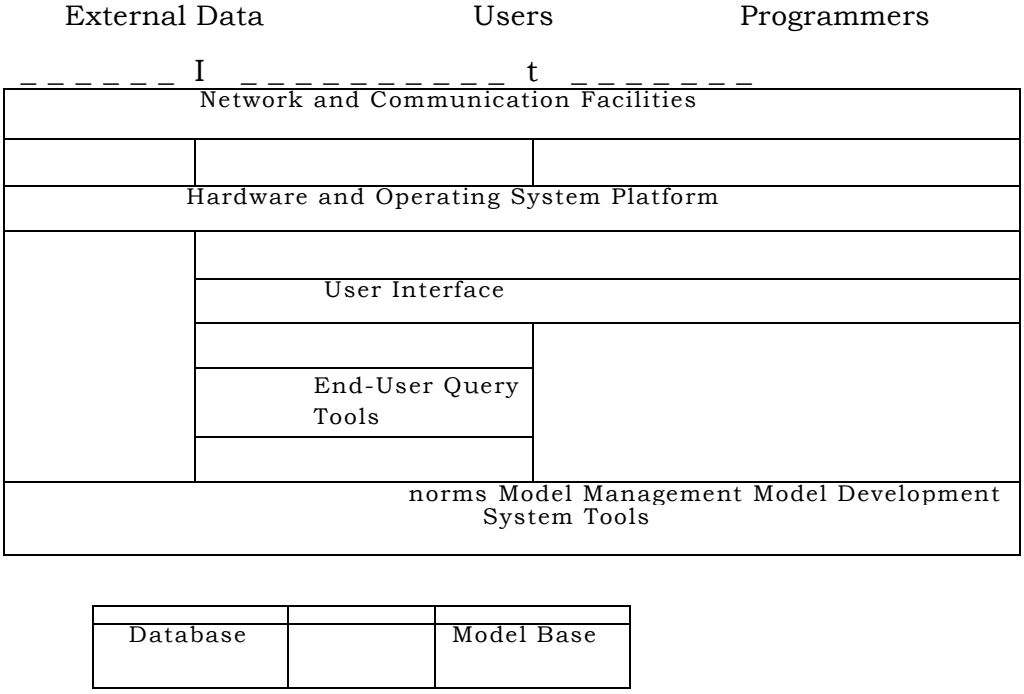


Figure 7: The General Components of DSS

7.4 Self Check Exercise

7.4.1 Name major components of DSS
7.4.2 Explain *Model-base Management System (MBMS)*
7.4.3 What is DSS Database?

7.5 SUMMARY

In this chapter, we have examined the basic components of a DSS model. We have seen that the data likely to be derived from a database underpins the information on which good decisions are made. Hence, the database is the base component of a DSS model. The information or knowledge base contains information about the intricate relationships that may exist between the data. This defines the rules that underpin the various knowledge systems or the relationship among the activities. For example, the relationships could be between costs, demand and profitability in a product costing.

The modeling software enables the user to experiment with various scenarios, i.e. to see the impact of varying parameters when they are changed on the outcomes, or to undertake other mathematical analysis, i.e. sensitivity analysis, linear programming, queuing models and to find out risks involved in each of the scenario.

Based on the database, knowledge base and the relations, the decision interface is created where the user component plays an important role. Here, the users are either senior management or middle management with lower levels of technical expertise. Sometimes the underlying database might be a data warehouse. The real application of a data warehouse thus emerges in DSS though a data warehouse is not an operational business system, but is usually a large database that is updated periodically from a range of sources. The sources of data may be internal transaction processing systems, or may be from external sources and they are sometimes used to bring data together from a range of incompatible or isolated internal systems.

7.6 GLOSSARY

• Data mining	Tools for gathering useful information
• Data Subsystem	Database and DBMS
• MBMS	Analytical and modeling software packages and a model base management system
• DGMS	DSS Component responsible for interacting with the user A
• Data dictionary	catalog of all the data in the database and contains data definitions, answers questions about the availability of data, their source, and their exact meaning Collection of different
• Model base	kinds of models

7.7 Answers to Self Check Exercise

7.4.1 Traditionally, academics have discussed building Decision Support Systems in terms of four major components:

1. Data management subsystem - database and DBMS
2. Model management subsystem - analytical and modeling software packages and a model base management system (MBMS)
3. Knowledge management subsystem - supports other subsystems and provides intelligence
4. User interface subsystem - communicates with user.

7.4.2 The role of MBMS is analogous to that of a DBMS. Its primary function is providing independence between specific models that are used in a DSS from the applications that use them. The purpose of an MBMS is to transform data from the DBMS into information that is useful in decision making.

7.4.3DSS Database is a collection of interrelated data organized to meet the needs and structure of an organization and can be used by more than one person for more than one application. For a larger DSS the database by be part of a larger data warehouse (a collection of databases from throughout the organization)

7.8 Review Questions

Short Questions

1. Elaborate the architecture of a DSS and discuss its components.
2. What is the role of a database system in decision support systems?

Long Questions

1. Why are models used extensively in developing support systems? Discuss the model-subsystem of the DSS.
2. List some examples of internal and external data used in DSS.
3. In what ways are the needs and capabilities of the user taken into account when

7.9 SUGGESTED BOOKS

1. *Decision Support and Data Warehouse Systems,*Efren G. Malachi, Irwin McGraw-Hill Publishing, 2000.
2. *Decision Support Systems and Data Warehouses,* B. Ravindranath, New Age International Publishers, 2003.

MBA-DE(Second Year)
Semester-Ill

MISDSS 302
MANAGEMENT INFORMATION SYSTEM &
DECISION SUPPORT SYSTEM

Lesson No. 8

AUTHOR : NEERAJ SHARMA

GROUP DECISION SUPPORT SYSTEMS

STRUCTURE

8. OBJECTIVES

Following are the major objectives of the present lesson :

1. To know the concept of GDSS and its application in decision making
2. To understand the need of GDSS and its Goals in the organization.
3. To study about the tools used in GDSS
4. To know how GDSS can help managerial decision making better.

8.1 INTRODUCTION

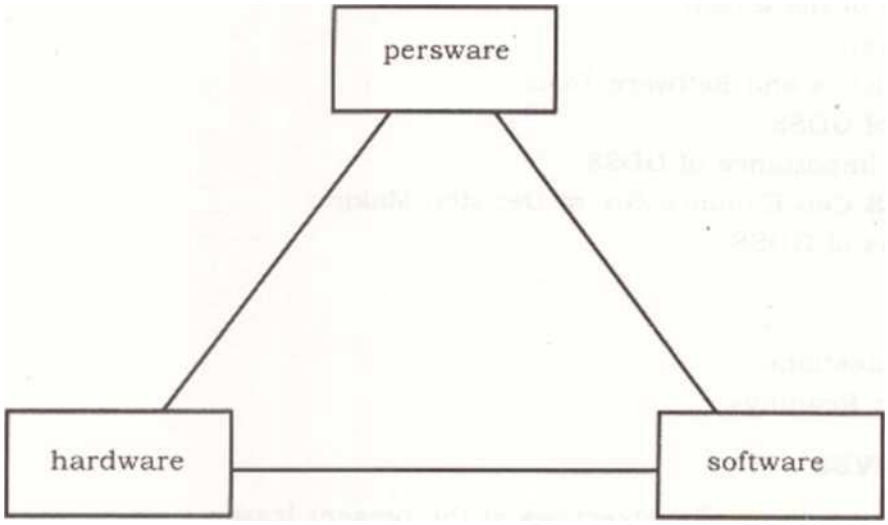
A Group Decision Support System (GDSS) offers a viable and attractive alternative over the traditional, oral meeting environment and in many situations has revolutionized the concept of meetings. Group Decision Support System (GDSS) is a system used by a group of people to solve problems with the use of communication, computing and decision support technologies. A GDSS is designed to help managers reach a consensus during meetings. It has modernized group meetings and has reduced the amount of time spent on them almost by 50%. More and more, companies are turning to groups and teams to get work done. IBM, Boeing, J. P. Morgan and Texaco are some of the large business houses who have implemented GDSS. GDSS has also been used as a research and teaching tool in universities and colleges. Organizations are now using GDSS as a way to increase the efficiency and effectiveness of meetings.

More and more organizations have been using GDSS as a way to increase the efficiency and effectiveness of meetings. Following are the major advantages

- **Preplanning** : A clear-cut agenda of the topics for the meeting.
- **Open, collaborative meeting atmosphere** : Free flow of ideas and communications without any of the attendees feeling shy about contributing
- **Evaluation objectivity** : Reduces "office politics" and the chance that ideas will be dismissed because of who presented them instead of what was presented

- **Documentation** : Clear communication about what took place and what decisions were made by the group
- **Preservation of organizational memory** : Even those unable to attend the meeting will know what took place; great for geographically separated team members.

8.2 CHARACTERISTICS AND SOFTWARE TOOLS



In GDSS the hardware includes more than just computers and peripheral equipment. It also includes the conference facilities, audiovisual equipment, and networking equipment that connect everyone. The per ware extends to the meeting facilitators and the staff that keeps the hardware operating correctly. As the hardware becomes more sophisticated and widely available, many companies are bypassing specially equipped rooms in favor of having the group participants attend the meeting through their individual desktop computers.

Many of the software tools and programs discussed, Groupware, can also be used to support GDSS. Some of these software tools are being reworked to allow people to attend meetings through Intranets or Extranets. Some highlights :

- Electronic questionnaires : Set an agenda and plan ahead for the meeting
- Electronic brainstorming : Allows all users to participate without fear of reprisal or criticism
- Questionnaire tools : Gather information even before the meeting begins, so facts and information are readily available
- Stakeholder identification : Determines the impact of the group's decision
- Group dictionaries : Reduce the problem of different interpretations

Now instead of wasting time in meetings, people will know ahead of time what is on the agenda. All of the information generated during the meeting is maintained for future use and reference. Because input is anonymous, ideas are evaluated on their own merit. And for geographically separated attendees, travel time and dollars arc saved. Electronic meeting systems make these efficiencies possible. The following figure shows the sequence of activities at a typical EMS meeting.

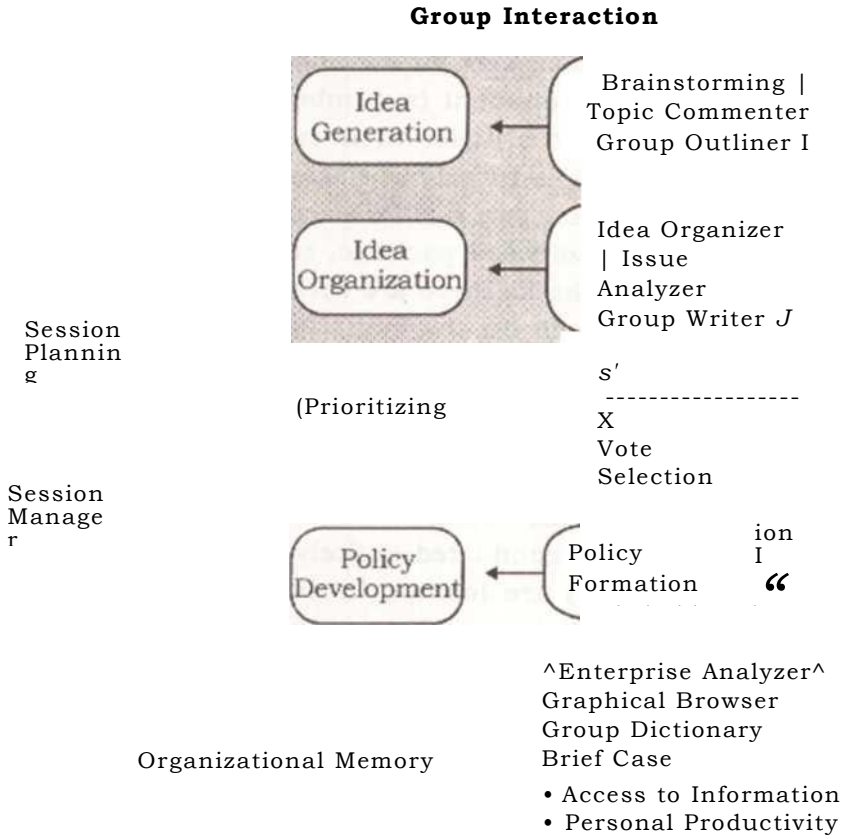


Figure : Group System Tools

All is not perfect wᵀith EMS, how'cver. Face-to-face communications is critical for managers and others to gain insight into how people feel about ideas and topics. Body language can often speak louder than words. Some people still may not contribute freely because they know' that all input is stored on the file server, even though it is anonymous. And the system itself imposes disciplines on the group that members may not like.

Self check exercise 1

1. What is GDSS
2. What is the use of GDSS

8.3 FEATURES OF GDSS

Most versions of GDSS use special meeting rooms where cach participant is seated at a networked computer. A facilitator operates the network and keeps the discussion moving in the right direction. Before the meeting, the primary decision maker meets wᵎith the facilitator to establish the objective of the meeting. They setup sample questions and design the overall strategy.

Typical meetings begin wᵎith a brainstorming session, where participants are asked to think of ideas, problems and potential solutions. They type each of these into categories on their computers. The basic ideas and suggestions are stored in a database and shared with the group through the networked computers.

In terms of discussions and comments, the facilitator can choose individual items and project

person to finish speaking.

Another feature of using the computer for the entry of ideas and comments is that they can be anonymous. Although each comment is numbered, they are not traced back to the original author, so people are free to criticize their supervisor's ideas. Anonymity reduces embarrassment and encourages people to submit riskier ideas.

At various points, the facilitator can call for participants to vote on some of the ideas and concepts. Depending on the software package, there can be several ways to vote. In addition to traditional one-vote methods, there are several schemes where you place weights on your choices. The votes are done on the computer and results appear immediately. Because it is so easy to vote, the GDSS encourages the group to take several votes. This approach makes it easier to drop undesirable alternatives early in the discussion.

One useful feature of conducting the meeting over a computer network is that all of the comments, criticisms, and votes are recorded. They can all be pointed at the end of the session. Managers can review all of the comments and add them to their reports.

In theory, a meeting could be conducted entirely on a computer network, saving costs and travel time if the participants are located in different cities. Also, if it is designed properly, a GDSS can give each participant access to the corporate data while he or she is in the meeting. If a question rises about various facts, the computer can find the answer without waiting for a second meeting.

8.4 NEED AND IMPORTANCE OF GDSS

- Many organizations use group or team structures to organize the work effort.
- Complex decisions often require more co-ordinate efforts and input of multiple individuals.
- Decision making is diffused throughout the organization.
- Information technology is a powerful tool to support the group decision-making processes of an organization.

Self check exercise 2

1. **What is the need of GDSS in an organization**

8.5 HOW GDSS CAN ENHANCE GROUP DECISION MAKING

Go back to the previous list of problems associated with meetings and you can determine how GDSS solve some of these problems.

1. Improved preplanning : Forces an agenda to keep the meeting on track.
2. Increased participation : Increases the number of people who can effectively contribute to the meeting.
3. Open, collaborative meeting atmosphere : Nonjudgmental input by all a:tendees.
4. Criticism-free idea generation: Anonymity can generate more input and better ideas.
5. Evaluation objectivity : The idea itself is evaluated and not the person contributing the idea.
6. Idea organization and evaluation : Organized input makes it easier to comprehend the results of the meeting.
8. Setting priorities and making decisions : All management levels are on equal footing.
8. Documentation of meetings : Results of meeting are available soon after for further use and discussion.
9. Access to external information ; Reduces amount of disagreements by having the

facts.

10. Preservation of "organizational memory" : Information is available to other groups within the organization.

You can see from this list that the potential for efficient and effective meetings is increased by using GDSS to promote open and organized decision making in groups.

More and more, decisions are being made by groups in today's business environment. Most meetings are inefficient. Using Group Decision Support Systems, comprised of hardware, software, and people, helps streamline group meetings and communications by removing obstacles and using technology to increase the effectiveness of the decisions.

SELF CHECK EXERCISE 3

1. How can GDSS enhance group decision making

8.6 LIMITATIONS OF GDSS

Perhaps the greatest drawback to a GDSS is that it requires participants to type in their ideas, comments and criticisms. Most people are used to meeting^ based on oral discussions. Even if they have adequate typing skills, a GDSS can inhibit some managers.

Along the same lines, in a traditional meeting, only one person speaks at a time, and everyone concentrates on the same issue at the same time. With a GDSS your focus is continually drawn to the many different comments and discussions taking place at the same time. People who type rapidly and fit from topic to topic will find that they can dominate the discussions-.

In terms of costs, maintaining a separate meeting room with networked computers can be expensive. Unless the facility is used on a regular basis, the computers will be idle a great '/ deal of then time. When you factor in the costs for network software, the GDSS software, and other utilities, the costs multiply. One way to minimize this problem is to lease the facilities that have been established by a couple of universities and some companies.

The use of GDSS also requires a trained facilitator - someone who can lead discussions, help users, and control the GDSS software on the network. Hiring an in-house specialist can be very expensive of there are only a few meetings a year. Again, using facili;ies are scrupulously honest; there might be some topics that you do not want to discuss with nonemployees.

One way to overcome these limitations is to alter the approach to the meetings. Instead of requiring everyone to get together at the same time in on room, meetings could be held via network discussion groups. Each participant could read the messages, add comments, and vote on issues electronically at any time from any location. Again, the internet offers possibilities to provide these facilities, but it could be a few years before organizations and managers can accept the changes required.

8.8 SUMMARY

The GDSS started originally from the Management Information System at University of Arizona. Some kind of problems has always been observed that are associated more with large meetings than with small meetings. By large meetings we mean meetings with generally more than 15 participants, but can go much beyond that, e.g. 40 or even 50. Some of the identified problems are: Time consuming; Dominance over the meeting; and participation. However, it is important to realize that we are not therefore trying to say that small meetings do not have these above problems; these problems mentioned exist in any kind of meetings, but we are just trying to stress that they are more commonly found in large meetings. Small meetings tend to be more easily controlled than large meetings. In a GDSS environment, there is usually a big room with something like 40 seats, which means that 40 people can be at the meeting at any one time. There are not only 40 seats but also 40

microcomputers. This enables every participant to have the use of one microcomputer during the course of the meeting. The reason why each participant needs a microcomputer depends on how GDSS works.

In the GDSS, with special computer software, the facilitator of each mee:ing will first make the agenda of the meeting, which will be projected onto a big screen that everyone can see. Then the participants will type simultaneously in their ideas of the topic of discussion on the individual microcomputers next to them. Then the computer will sort the ideas, and then the participants will then vote or comment on which ideas they like or they dislike. In the course of the whole meeting, GDSS stores, categorizes and prints out all the ideas, comments and vote tallies, so that each of the meeting participants will get a summary of the meeting when it ends.

8.8 Glossary

- **Group Decision Support System (GDSS)** : A system used by a group of people to solve problems with the use of communication, computing and decision support technologies.
- **Decision Support Systems (DSS)** : A specific class of computerized information systems that supports business and organizational decision-making activities.
- **Software** : A set of instructions for a computer. There are two kinds of software: system software and application software. System software is usually stored on a computer's hard drive until needed by the computer. Application software is more commonly known as programs.

8.9 KEYWORDS; GDSS, DSS, HARDWARE, SOFTWARE

8.10 REVIEW QUESTIONS

SHORT QUESTIONS

1. **What is GDSS?**
2. **What does GDSS hardware includes?**
3. **What are the limitations of GDSS?**

LONG QUESTIONS

1. Explain the concept of GDSS and find out its need in organizations.
2. Briefly describe the features and components of GDSS.
3. Explain the goals and benefits of GDSS.
4. How GDSS can help better decision making?

8.9 SUGGESTED READINGS

1. *Decision Support and Data Warehouse Systems,* Efrem G. Mallach, Irwin McGraw-Hill Publishing, 2000.
2. *Decision Support Systems and Data Warehouses,* B. Ravindranath, New Age International Publishers, 2003.

SOLUTION TO SELF- CHECK EXERCISE

SELF CHECK EXERCISE 1 ANSWERS

1. Group Decision Support System (GDSS) is a system used by a group of people to solve problems with the use of communication, computing and decision support technologies.
2. A GDSS is designed to help managers reach a consensus during meetings. It has modernized group meetings and has reduced the amount of time spent on them almost by 50%.

SELF CHECK EXERCISE 2 ANSWERS

1. Many organizations use group or team structures to organize the work effort.

Complex decisions often require more co-ordinate efforts and input of multiple individuals.

Decision making is diffused throughout the organization.

Information technology is a powerful tool to support the group decision-making processes of an organization.

SELF CHECK EXERCISE 3 ANSWERS

1. Improved preplanning, Increased participation , Open, collaborative meeting atmosphere , Criticism-free idea generation, Evaluation objectivity, Idea organization and evaluation , Setting priorities and making decisions, Documentation of meetings, Access to external information

MBA-DE(Second Year)
Semester-Ill

MISDSS 302
MANAGEMENT INFORMATION SYSTEM &
DECISION SUPPORT SYSTEM

Lesson No. 9

AUTHOR : NEERAJ SHARMA

EXPERT SYSTEMS & ITS INTEGRATION WITH DSS

STRUCTURE

9. OBJECTIVES OF THE LESSON

After reading this unit you should be able to :

- Understand the meaning and characteristic of expert systems;
- Know the structure and design of Expert Systems;
- Explain the efforts made in creation of these systems; and
- Identify and discuss their advantages in business applications.

9.1 INTRODUCTION

Expert Systems (ES) come under the area of Artificially Intelligence. Artificially Intelligent decision support systems exist for two main reasons. First, advances in Al technology have made it practical to build systems whose behaviours resembles some aspects of human intelligence. We can expect such advances to continue, leading to new dimensions for DSSs. Second, decision makers can benefit from DSSs that exhibit more, rather than less, intelligence. As does human intelligence, artificial intelligence has many aspects. One of the most significant is the ability to reason. The Al quest for reasoning systems has matured to the point where computers are able to display expert behavior. To assist in the construction of these expert systems, numerous software tools are now commercially available. These include both shells and integrated environments.

An expert system is software that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used tc simulate the performance of the expert however common to most or all are 1) the creation of a so-called "knowledgebase" which uses some knowledge representation formalism to capture the subject matter experts (SME) knowledge and 2) a process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Expert

systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system.

The basic idea about an Expert system is to develop a machine which can replace any expert to solve some real life problems. Expert systems are meant to solve real problems which normally would require a specialized an expert. Building an expert system therefore first involves extracting the relevant knowledge from the human expert. Such knowledge is often heuristic in nature, based on useful rules of thumb rather than absolute certainties. Extracting it from the expert in a way that can be used by a computer is generally a difficult task, requiring its own expertise. A knowledge engineer has the job of extracting this knowledge and building the expert system knowledge base. Since the Expert System behaves like an expert so in order to build it the person responsible should extract the knowledge from an expert and use it to make an Expert System.

9.2 EXPERT SYSTEM DEFINITION & CHARACTERISTICS

Amongst the most noteworthy developments in the field of Artificial Intelligence (AI) is the advent of expert systems. Joint efforts by human experts yielded systems that can diagnose diseases, fly planes, drive vehicles and configure computer systems at performance levels that can exceed the best human expertise. Question thus arises that what are expert systems? To put it most simply: Expert systems are computer programs that use knowledge to solve problems competently and successfully. They are similar to human experts in the sense that they also use logic and heuristics to solve problems, they also make errors and they also learn from their errors. This expertise is easier to store, retrieve, transfer and is cost-effective and permanent. Johnson (1993) described the term expert" in the most accurate manner as, "An expert is a person who, because of training and experience, is able to do things the rest of s cannot; experts are not only proficient but also smooth and efficient in actions they take. Experts knows a great many things and have tricks and caveats for applying what they know to problems and tasks; they are also good at plowing through irrelevant information in order to get at basic issues, and they are good at recognizing the problems they face as instances of types with which they are familiar. Underlying the behavior of experts is the body of operative knowledge, we have termed expertise...' Thus we can now define expert systems. Patterson (1990) described expert systems as, "An expert system is a set of programs tha: manipulate encoded knowledge to solve problems in a specialized domain that normally requires human expertise. An expert system's knowledge is obtained from expert sources and coded in a form suitable for the system to use in its inference or reasoning process."

Some of the basic properties of an expert system are :

- It tries to simulate human reasoning capabilitj' about a specific domain rather than the domain itself. This feature separates expert systems from some other familiar programs that use mathematical modeling or computer animation. In an expert system the focus is to emulate an expert's knowledge and problem solving capabilities and if possible, at a faster rate than a human expert.
- It performs reasoning over the acquired knowledge, rather than merely performing some calculations or performing data retrieval.
- It can solve problems by using heuristic or approximate models which, unlike other algorithmic solutions are not guaranteed to succeed.

SELF CHECK EXERCISE 1

1. **What is expert system?**
2. **What are the basic properties of expert system?**

9.3 BRIEF HISTORY OF EXPERT SYSTEMS

Expert systems emerged as a consequence of the developments in the artificial intelligence field in early 70's at a few leading US universities like Stanford. They started as problem solvers using specialized domain knowledge. We will discuss a few early successful systems. This is summarized in the table 1 given below :

Table 1 : Brief History of Expert Systems

S. No.	Expert System	Year	Developer	Functions
1.	DENDRAL / Meta-DENDRAL	Late 60s	Stanford University	Determines the structure of chemical compounds using constituent elements and mass spectrometry data. Later adapted inductive learning form
2.	MYCIN/ THEIRESIUS/ GUIDON/MYSIiy	Mid 70's	Stanford University	Diagnoses infectious blood ciseases and determine therapies. Star:ed with 200 rules to build over 600 rules by early 90 s
3.	PROSPECTOR	1974-1993	Stanford Research Institute	Assists geologists in the discovery of mineral deposits. First computer system to assist geologists.
4.	XCON	Late 70s	Digital Equipment Corporation & Carnegie- Mellon University	Select and configure components of complex computer systems. Expert system work in computer systems is typified by XCON.
5.	ACE	Early 90's Early 70‘s	Bell Laboratories	Equipment fault diagnosis and integrated circuit design. AT&T uses it for identify trouble spots in telephone networks
6.	HASP/ SIAP		Stanford University & Systems Control Technology	Identifies ship types by interpreting data from hydrophone arrays that monitors regions of the ocean

These were some of the path setting work in the expert systems. These works provided the base for other systems to build on them. Today one can see a plethora of applications of expert systems in virtually all areas like agriculture, chemistry, computer systems, electronics, engineering, geology, information management, law, manufacturing, mathematics, medicine, meteorology, military science, physics, process control and space technology etc.

Some Existing Expert Systems

Expert System	Area
AQ11	Diagnosis of plant disease
Casnet	Medical consulting
Dipmeter Advisor	Oil Exploration
Mycin	Medical consulting
Prospector	Mineral Exploration
DENDRAL	Chemical Analysis
Xcon	PC Configuration & assembly

9.4 WORKING PRINCIPLES OF EXPERT SYSTEMS

Expert System is a result of the interaction between the system builder (knowledge engineer) and many domain experts. Expert systems are computer systems that are based on knowledge rather than the data. They accumulate this knowledge at the tirr.c of system building. Knowledge is programmed and kept in such a manner so that it can be browsed and appended from time to time. Expert systems possess a very high level of expertise in the area for which they are made for. The best thing about expert systems is that they grow over time and but for the initial expenditure incurred in building them, they work in a cost effective manner. Expert systems have predictive modeling power i.e. they are capable of describing the effects of new situation on the data and the solution. Expert system uses symbolic representations for knowledge (rules, networks or frames). This compilation often becomes a quick reference for best strategies, methods and consensus decisions. This becomes a permanent knowledge base. Thus, one can say that expert systems have a permanent memory. Expert systems give access to the user to understand its reasoning and can be used to provide training. This is possible because of its knowledge base; it can provide trainees with experiences and strategies from which to learn.

9.5 STRUCTURE OF EXPERT SYSTEMS

Expert systems were developed in the 1970's. With advancement in A.I. researchers, the HIPS model of human cognitive system was used to develop the production rule in the form of a programming language called "production system". The production system is based on the basic idea that the database consists of rules called productions in :he form of condition-action pairs: IF this condition arises, THEN take this action". The system consists of two parts: (a) Production rules of IF-THEN statements, and (b) a working memory. In simple language, a production rule is an instruction for recognise act processors. Production rules (or simply productions) are applied to working memory. An expert system is built using the production rule derived from the Human Information Processing System (HIPS) model. It consists of two major parts : (a) The Knowledge Base including the working memory and, (b) The Inference Engine.

Experts solve problems by employing a large number of task-specific facts and heuristics. An expert is an "individual" who is widely recognised as being able to solve a particular type of problem that most other people cannot solve in an effective and efficient manner.

Experts perform well because they have a large amount of compiled task-specific

knowledge stored in LTM. According to one estimate, a Nobel laureate in chemistry has 50,0 to 1, 00,000 chunks of heuristic information about his reality. The human experts arrange the knowledge in his LTM so that he can respond to a problem situation by using heuristics and task specific theories. The knowledge engineer builds a knowledge base by capturing the knowledge of a human expert. This is done through the knowledge engineer talking to experts and asking him to describe various aspects in his/her domain. The knowledge engineer collects elements or objects, identifies the characteristics of each of the object and analyses and establishes relationships linking objects (concrete or conceptual) that constitute knowledge stored in the expert's LTM. The architecture of the knowledge based expert system is given in Figure 1.

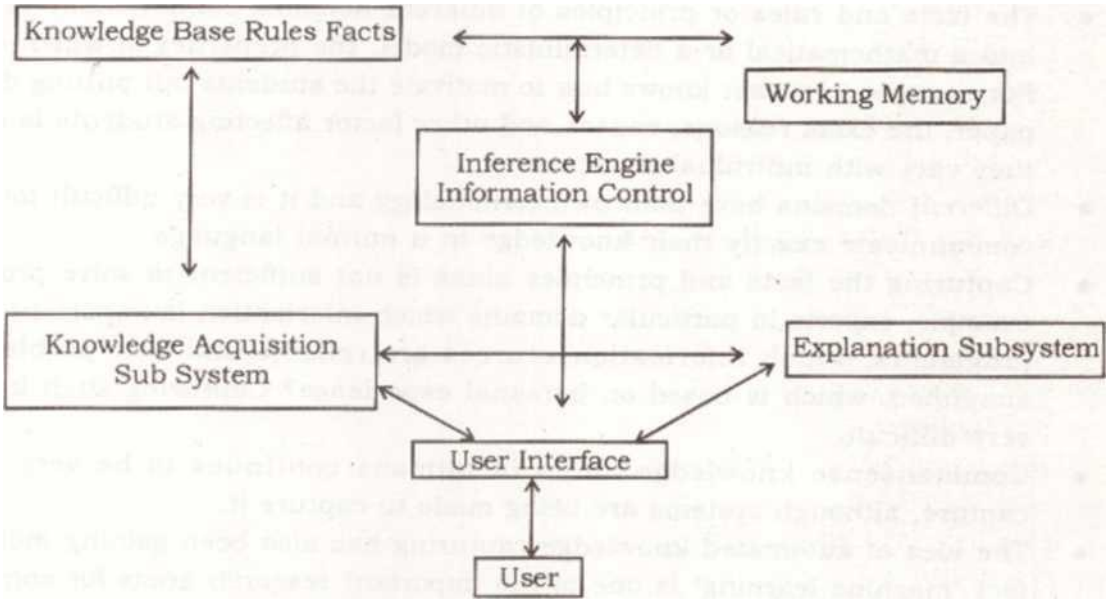


Figure 1 : Architecture of an Expert System

9.6 COMPONENTS OF AN EXPERT SYSTEM

The major components of the expert system are :

i) Knowledge Base
ii) Knowledge acquisition sub-system
iii) Inference Engine
iv) Explanation Subsystem
v) User interface

In a rule based system, the knowledge base consists of: (I) a working memory, (ii) a rule base: A set of IF-THEN rules. Inference Engine is the mechanism by which facts are matched to rules and rules are united together to form a set of conclusions and possible actions. Consequents are proven from antecedents through a principle of logic called modus ponens. Let us now discuss the components of a generic expert system.

Knowledge Base

It contains facts and heuristic knowledge. Developers try to use a uniform representation of knowledge as for as possible. There are many knowledge representation schemes for expressing knowledge about the application domain and some advance expert system shells use both frames (objects) and IF-THEN rules.

Knowledge Acquisition Subsystem

The process of capturing and transformation of potentially useful information for a given problem from any knowledge source (which may be a human expert) to a program in the format required by that program is the job of a knowledge acquisition subsystem. So we can say that these subsystem to help experts build knowledge bases.

As an expert may not be computer literate, so capturing information includes interviewing, preparing questionnaires etc. which is a very slow and time consuming process. So collecting knowledge needed to solve problems and build the knowledge base has always been the biggest bottleneck in developing expert systems.

Some of the reasons behind the difficulty in collecting information are given below :

- The facts and rules or principles of different domains cannot easily be converted into a mathematical or a deterministic model, the properties of which are known. For example a teacher knows how to motivate the students but putting down on the paper, the exact reasons, causes and other factor affecting students is not easy as they vary with individual students.
- Different domains have their own terminology' and it is very difficult for experts to communicate exactly their knowledge in a normal language.
- Capturing the facts and principles alone is not sufficient to solve problems. For example, experts in particular domains which information is important for specific judgments, which information sources are reliable and how problems can be simplified, which is based on personal experience? Capturing such knowledge is very difficult.
- Commonsense knowledge found in humans continues to be very difficult to capture, although systems are being made to capture it.
- The idea of automated knowledge capturing has also been gaining momentum. In fact "machine learning" is one of the important research areas for sometime now. The goal is that, a computing system or machine could be enabled to learn in order to solve problems like the way human do it.

Inference Engine

An inference engine is used to perform reasoning with both the expert knowledge which is extracted from an expert and most commonly a human expert) and data which is specific to the problem being solved. Expert knowledge is mostly in the form of a set of IF-THEN rules. The case specific data includes the data provided by the user and also partial conclusions (along with their certainty factors) based on this data. In a normal forward chaining rule-based system, the case specific data is the elements in the working memory.

Developing expert systems involve knowing how knowledge is accessed and used during the search for a solution. Knowledge about what is known and, when and how to use it is commonly called meta-knowledge. In solving problems, a certain level of planning, scheduling and controlling is required regarding what questions to be asked and when, what is to be checked and so on.

Different strategies for using domain-specific knowledge have great effects on the performance characteristics of programs, and also on the way in which a program finds or searches a solution among possible alternatives. Most knowledge representations schemes are used under a variety of reasoning methods and research is going on in this area.

Explanation Subsystem

An explanation subsystem allows the program to explain its reasoning to the user. The explanation can range from how the final or intermediate solutions were arrived at to justifying the need for additional data.

Explanation subsystems are important from the following points of view :

i) **Proper use of knowledge :** There must be some for the satisfaction of knowledge engineers that the knowledge is applied properly even at the time of development of a prototype.

ii) **Correctness of conclusions :** User's need to satisfy themselves that the conclusions produced by the system are correct.

Hi) Execution trace : In order to judge that the knowledge elicitation is proceeding smoothly and successfully, a complete trace of program execution is required.

iv) **Knowledge of program behavior** : For proper maintenance and debugging, the knowledge of program behavior is necessary for the programmers.

v) **Suitability of reasoning approach** : Explanation subsystems are necessary to ensure that reasoning technique applied is suitable to the particular domain.

Explanation in expert systems deals with the issue of control because the reasoning steps used by the programs will depend on how it searches for a solution.

Explanation subsystems are also related to evaluation as by checking the outputs produced by a system and after examining the trace of its actions performed while reasoning, it can be decided that whether or not a system is producing the right answer for right reasons. Without a good explanation subsystem, an expert will be unable to judge the system's performance or will be unable to find ways to improve it.

To give an idea of how an explanation subsystem works, let us have a simple example:

Example : Suppose there is a simple rule based system to diagnose the problems in a car.

Let the system has following rules :

HI : IF engine-gets-petrol AND engine-turns-over THEN spark-plug-fault

R2 : IF NOT engine-turns-over AND NOT lights-come-on THEN battery-problem

R3 : IF NOT engine-turns-over AND lights-come-on THEN starter-not-working

R4 : IF fuel-tank-has-petrol THEN engine-gets-petrol

We also assume that the system has no initial facts.

Explanation subsystems allow the user to ask why it asked a particular question, and how it reached some conclusion. These questions are answered by referring to the system goals, the rules being used, and any existing problem data.

Now let us focus on the example given above to see the explanation facilities provided, which involve a dialogue involving why and how questions and their explanations.

System : Does the fuel tank have gas?

User : Yes.

System : Does the engine turns over?

User : No

System : Do lights come on?

User : Why?

System : I am trying to prove that there is a battery problem. It has been established that the engine does not turns over. Therefore if it is not the case that the lights come on, then there is a battery problem. Is it true that the lights come on?

User : No.

System : I conclude that there is a battery problem.

User : How?

System : This follows from Rule 2: IF NOT engine-turns-over AND NOT lights-come-on was given by the user.

Providing such an explanation facility involves stating what rules are used in reaching conclusions, and using these records to compose explanations like the ones above. Giving simple explanations like those above is not very difficult, and is quite useful.

Explanation facilities in expert systems are sometimes not used, and sometimes they are not easily accepted by their users. There are a whole lot of reasons for this. One reason is that the explanations just reference the "surface" knowledge encoded in the rules, rather than providing the "deep" knowledge about the domain which originally motiva:ed the rules but which is usually not represented. So, the system will say that it concluded something because of rule 5, but not explain what rule 5 intends to say. In the example given below, maybe the user needs to understand that both the lights and the starter use the battery, which is the underlying purpose of the second rule in this example. Another reason for the frequent failure of explanation facilities is the fact that, if the user fails to understand or accept the explanation, the system can't re-explain in another way (as people can). Explanation generation is a fairly large area of research, concerned with effective communication i.e., how to present things so that people are really satisfied with the explanation, and what implications does this have for how we represent the underlying knowledge.

User interface

It is used to communicate with the user. The user interface is generally not a part of the expert system technology, and was not given much attention in the past. However, it is now widely accepted that the user interface can make a critical difference in the utility of a system regardless of the system's performance.

SELF CHECK EXERCISE 2

1. **What are the components of expert system?**
2. **What is the function of knowledge acquisition system?**
3. **What is the function of explanation subsystem?**

9.7 SOME APPLICATION AREAS OF EXPERT SYSTEMS

The scope of applications of expert systems technology to practical problems is so wide that it is very difficult to characterize them. The applications find their way into most of the areas of knowledge work. Some of the main categories of applications of an expert system are given below.

- **Diagnosis and Troubleshooting** : This class comprises systems that deduce faults and suggest corrective actions for a malfunctioning device or proccss. Medical diagnosis was one of the first knowledge areas to which ES technology was applied, but use of expert systems for solving and diagnosis of engineered systems has become common.
- **Planning and Scheduling** : Systems that fall into this class analyze a set of one or more potentially complex and interacting goals in order to determine a set of actions to achieve those goal. This class of expert systems has grea* commercial potential. Examples include scheduling of flights, personnel, manufacturing process planning etc.
- **Process Monitoring and Control** : Systems falling in this class analyze real-time data from physical devices with the goal of noticing errors, predicting trends, and controlling for both optimality and failure correction. Examples of real-time

systems that actively monitor processes are found in the steel making and oil refining industries.

- **Financial Decision Making** : The financial services industry has also been using expert system techniques. Expert systems belonging to this category act as advisors, risk analyzers etc.
- **Knowledge Publishing** : This is a relatively new, but also potentially explosive area. The primary function of the expert system is to deliver knowledge that is relevant to the user's problem, in the context of the user's problem.
- **Design and Manufacturing** : These systems assist in the design of physical devices and processes, ranging from high-level conceptual design of abstract entities all the way to factory floor configuration of manufacturing processes.

9.9 ADVANTAGES OF AN EXPERT SYSTEM

- Provides consistent answers for repetitive decisions, processes and tasks
- Holds and maintains significant levels of information
- Encourages organizations to clarify the logic of their decision-making
- Never forgets to ask a question, as a human might

9.9 DISADVANTAGES OF AN EXPERT SYSTEM

- Lacks common sense needed in some decision making
- Cannot make creative responses as human expert would in unusual circumstances
- Domain experts not always able to explain their logic and reasoning
- Errors may occur in the knowledge base, and lead to wrong decisions
- Cannot adapt to changing environments, unless knowledge base is changed

SELF CHECK EXERCISE 3

1. List the areas where expert system are used
2. Briefly describe the disadvantages of expert system

9.10 SUMMARY

To overcome the difficulties that were faced in solving many real-life problems, intelligence was put into a computer (essentially based on the knowledge of the then society). The theme of all these efforts was around the concept of making a program intelligent, by providing it with high quality specific knowledge about some problem area. This collaborative and collectivc intelligence led the machine do the tasks better than the humans. AI has taken off from there and what we are getting today is an improved build-up on the older systems. Expert systems emerged as a consequence of the developments in the artificial intelligence field. They started as problem solvers using specialized domain knowledge. As the time passed by these systems kept building on themselves and what we are getting today are much better versions of their predecessors. More and more algorithms and methods were developed to solve problems more efficiently.

-specified input or hypotheses in order to reach a goal or a conclusion. It can be divided into three parts)

KEYWORDS: EXPERT SYSTEM, KNOWLEDGE, SUSBSYSTEM

REVIEW QUESTIONS

SHORT QUESTIONS

1. **Explain the structure of of expert system**
2. **Explain the working principles of expert system**
3. **What is inference engine and briefly explain its purpose?**

Long questions

1. Explain the concept and structure of Expert System.
2. What are expert systems? Mention the working principles of expert systems. Also discuss how knowledge can be represented in expert systems.
3. Identify and describe two good applications areas for expert systems within a university environment.

4. Describe the different methods of knowledge representation.
5. What is the function of Inference Engine?

SUGGESTED BOOKS

1. Buchanan, B. G, and Smith, R. G. (1999), *Fundamentals of Expert Systemsm* In Handbook of Artificial Intelligence. A. Barr, P.R. Cohen and E.A. Feigenbaum, ed. Reading, M. A., *Addison - Wesley,* pp. 149-192.
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CHAPTER 9

SELF CHECK EXERCISE 1

1. An expert system is software that attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence.
2. It tries to simulate human reasoning capabilitj' about a specific domain rather than the domain itself.

   It performs reasoning over the acquired knowledge, rather than merely performing some calculations or performing data retrieval.

   It can solve problems by using heuristic or approximate models which, unlike other algorithmic solutions are not guaranteed to succeed.

SELF CHECK EXERCISE 2

1. The major components of the expert system are :
   Knowledge Base, Knowledge acquisition sub-system, Inference Engine, Explanation Subsystem, User interface.
2. The process of capturing and transformation of potentially useful information for a given problem from any knowledge source (which may be a human expert) to a program in the format required by that program is the job of a knowledge acquisition subsystem.
3. An explanation subsystem allows the program to explain its reasoning to the user. The explanation can range from how the final or intermediate solutions were arrived at to justifying the need for additional data.

SELF CHECK EXERCISE 3

1. Diagonsis and troubleshooting, planning and scheduling, process monitoring and control, financial decision making, knowledge publishing, design and manufacturing.
2. Lacks common sense needed in some decision making
   Cannot make creative responses as human expert would in unusual circumstances
   Domain experts not always able to explain their logic and reasoning
   Errors may occur in the knowledge base, and lead to wrong decisions
   Cannot adapt to changing environments, unless knowledge base is changed

MBA-DE(Second Year)
Semester-Ill

Lesson No. 10

MISDSS 302

MANAGEMENT INFORMATION SYSTEM &

DECISION SUPPORT SYSTEM

AUTHOR : NEERAJ SHARMA

EXECUTIVE INFORMATION SYSTEMS

STRUCTURE

10. OBJECTIVES OF THE LESSON

The objective of this lesson is to have an insight into

- Meaning of Executive Information System (EIS)
- Characteristics of the EIS
- Difference between MIS, DSS and EIS
- Various interfaces available to EIS
- Various applications of EIS

10.1 INTRODUCTION

An executive information system (EIS) is a highly interactive system that provides managers and executives' flexible access to information for monitoring operating results and • general business conditions. These systems are sometimes called executive support systems (ESS). EIS attempts to take over where the traditional MIS approach falls short. Although sometimes acceptable for monitoring the same indicators over time, the traditional MIS approach of providing pre-specified reports on a scheduled basis is too inflexible for many questions executives really care about, such as understanding problems and new situations.

10.2 EIS Model

EIS assists in answering include the following: In what business should we be? What are the competitors doing? What new acquisitions would protect us from cyclical business swings? Which units should we sell to raise cash for acquisitions? Figure 1 illustrates a general model of an EIS.

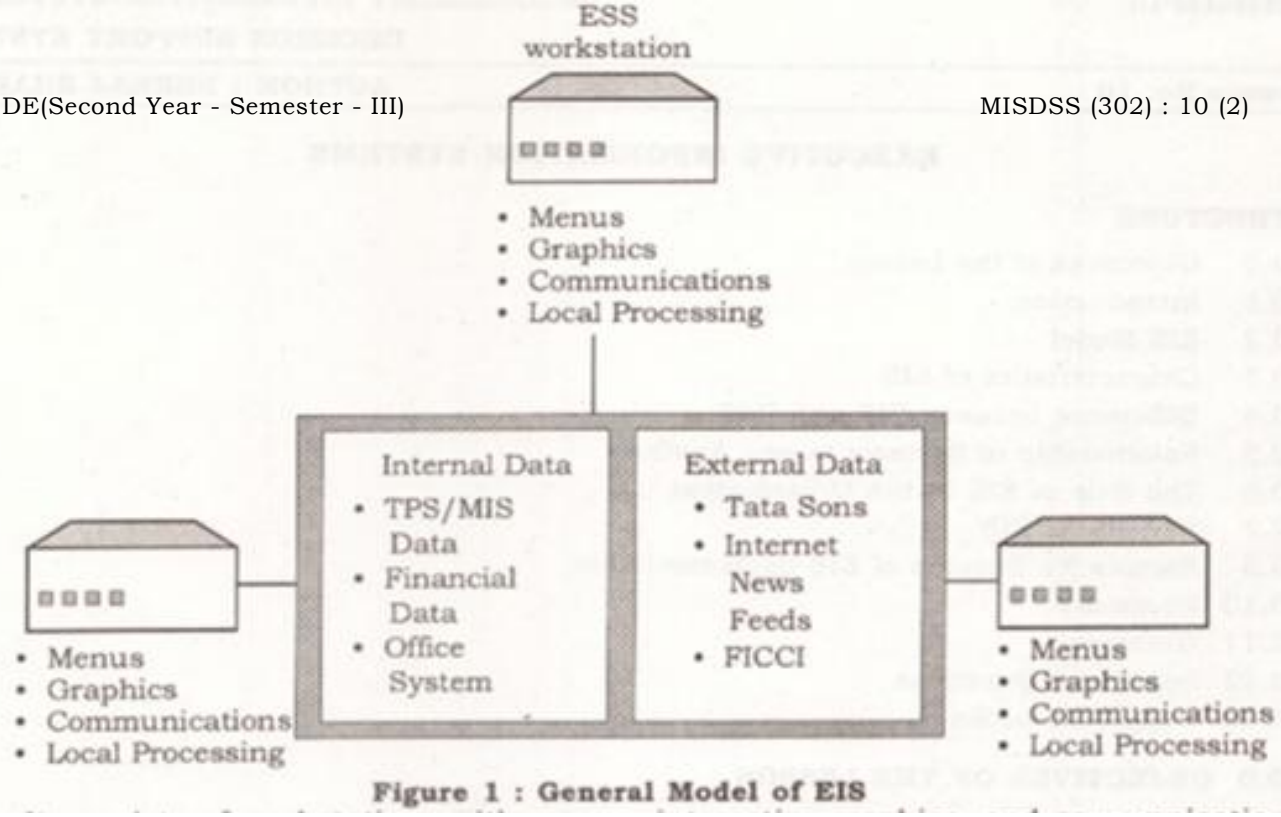


Figure 1 : General Model of EIS

Figure 1 : General Model of EIS

It consists of workstations with menus, interactive graphics, and communications capabilities that can access historical and competitive data from internal corporate systems and external databases. Because EIS are designed to be used by senior managers who often have little, if any, direct contact or experience with computer-based information systems, they incorporate easy-to-use graphic interfaces.

The executive's sole concern with regard to an EIS is to efficiently retrieve relevant data; therefore, the interface is very important. There are several types of interfaces that can be built into the EIS structure which are as follows:

Types of Interfaces available to the EIS

Type	**Description**
Scheduled reports	• Batch-oriented • Predefined, prepared reports • Not flexible • No interaction required
Questions/answers	• Interactive • Ad hoc in nature ("What if?" type of question)
Menu-driven	• User friendly • Step-by-step procedures • Usually consists of common, predefined reports prepared for Users
Command language	Predefined short codes must be learned by users
Natural language	Regular English is used to interact with EIS
Input/output	Predefined data/information relationships are known by the user

Current EIS products incorporate many of these interfaces. It is crucial that the interface fit the executive's decision-making style. If the executive is not comfortable with the information input or output style, the EIS will not be fully utilized. Future interface methods will rely on natural language (command English commands) processing capability to increase the user-friendliness of an EIS. The ideal interface for an EIS would meet the following criteria :

- Simple to use
- Consistent performance
- Reflective of executive's world
- Informative help and error messages
- Highly flexible

The interface is vital because how easily and accurately data are distributed to the user will determine the success of the EIS.

10.3 CHARACTERISTICS OF EIS

An EIS has many distinct characteristics that differentiate it from other applications software. A list of these features is presented in table below. A successful executive information system minimizes hard copy reports while keeping high-level executives up dated. With an EIS, qualitative information is obtained without producing volumes of paper.

Advanced internal control and communication are typical focuses of an EIS. The ability to view exception reporting on the computer screen is an example of an EIS facilitated management control technique. Most Executive Support Systems highlight the areas of the business that are going astray. Color codes are used to display data that are in an acceptable or unacceptable range as defined by the executive. This technique allows the computer to track important project assignments within a company using the executive information system. An EIS allows access to external as well as company internal information.

SELF CHECK EXERCISE 1

1. What is executive information system?
2. What are the criteria foe an ideal EIS interface

Characteristics	**Description**
Degree of use	High, consistent, without need of technical assis:ance
Computer skills required	Very low -must be easy to learn and use
Flexibility	High - must fit executive decision making style
Principle use	Tracking, control
Decisions supported	Upper level management, unstructured
Data supported	Company internal and external
Output capabilities	Text, tabular, graphical, trend toward audio/video in future
Graphic concentration	High, presentation style
Data access speed	Must be high, fast response

10.4 DIFFERENCE BETWEEN EIS AND DSS

Senior managers use executive support systems to make decisions. ESS serves the strategic level of the organisation. They address non-routine decisions requiring judgment, evaluation, and insight because there is no agreed-on procedure for arriving at

a solution. ESS creates a generalised computing and communications environment rather than providing any fixed application or specific capability. ESS is designed to incorporate data about external events such as new tax laws or competitors, but they also draw- summarized information from internal MIS and DSS. They filter, compress, and track critical data, emphasizing the reduction of time and effort required to obtain information useful to executives. ESS employs the most advanced graphics software and can deliver graphs and data from many sources immediately to a senior executive's office or to a boardroom.

Unlike the other types of information systems, EIS is not designed primarily to solve specific problems. Instead, EIS provides a generalised computing and telecommunications capacity that can be applied to a changing array of problems. Whereas many DSS are designed to be highly analytical, EIS tends to make less use of analytical models.

Decision support systems are another type of computer information system designed to support and improve the decision-making process. Many more computer users will be familiar with DSS because these systems were developed as a support tool for middle to lower level managers and system analysts. Like the EIS, DSS are made up of several distinct components. While both types contain a modeling capability and database component, the presentation components are typically not as sophisticated in a DSS. The reason is that DSS were developed to support decisions from the middle level up, while an EIS concentrates on supporting the very top level of management.

Although both EIS and DSS are designed to support and improve the decisionmaking process, the actual type of decision an executive makes differs from that of a middle manager. The EIS can be thought of as a system that provides information to help formulate intelligent queries, which can then be passed on to the DSS. An analyst can then perform a detailed analysis, not an executive. The intention of the EIS is to allow executives to familiarize themselves with the organization as a whole, and not just one particular area. The DSS usually provides very detailed information to assist analysis of problems in one section/department of a business. Another primary difference is the ability of an EIS to incorporate "what if" models in the program. With this ability, the user can perform impact analyses, such as "What is the effect on profits if we close Plant A.' Another important difference is that external data retrieved from on-line databases as well as internal data will be examined when answering a query to the EIS. The DSS typically only places a moderate emphasis on incorporating external data into the decision process.

We also need to discuss the nature of an executives work. This means that which type of work executives normally do or perform for which they require not a DSS but EIS. This is highly required before building an EIS. Without the knowledge of executives work we cannot decide about the system which is suitable for him.

Basically manager's role is divided into 3 categories :

1. Interpersonal Role : Roles like figurehead, leader, and liaison
2. Informational roles : Roles of monitor, disseminator, spokesperson
3. Decisional Roles : Entrepreneur, disturbance handler, resource alligator, negotiator.

Most of the EIS supports all these roles for executive's successful working. If we pay attention then we can see that for interpersonal roles and informational roles with very few advances to DSS the executives can start using EIS. But executives mainly require the EIS for decisional roles. To determine the information needs of executives, it is necessary to specify the activities, which are performed in decisional role.

Functional units like finance, production, accounting, and personnel etc. generate the internal information. The external information comes from the sources such as online databases, newspaper, industry newsletters, government reports, personal contacts etc. We know that the combined information is very important because that is the source needed for successful competition and survival. As the data is large the information is needed to be scanned further. The collected information is then checked and verified for its correction that is it is evaluated for the further use of the organization. Finally the evaluated information is sent for qualitative or quantitative analysis. Then the executive makes a decision whether an opportunity occurs or problem occurs. If there is problem then information is given as an input for the next step else it is again scanned for further evaluation. Finally the executives take the decision.

While each system tracks and reports the status of certain activities, the level of detail provided when a problem occurs is vastly different. An EIS delivers primarily summary information. It allows for details to be given by incorporating the "drilling down'' capability. The DSS will attempt to provide all the details incorporated into the problem analysis the first time.

10.5 RELATIONSHIP OF SYSTEMS TO ONE ANOTHER

Different types of systems exist in organisations. Not all organisations have all of the types of systems described in this unit. Many organisations may not have knowledge work systems, executive support systems or decision support systems. But today most organisations make use of office automation systems and have a portfolio of information system applications based on TPS and MIS (marketing systems, manufacturing systems, human resource systems). Some organisations have hybrid information systems that contain some of the characteristics of different tj'pes of systems.

The field of information systems is moving so quickly that the features of one particular type of system are integrated to other types (e.g., MIS having many of the features of EIS). System characteristics evolve and new types of systems emerge. Yet the classification of information systems into these different types is useful because each type of system has certain features that are relevant in particular situations.

Figure 2 illustrates how the systems serving different levels in the organisation are related to one another. TPS are typically a major source of data for other systems, whereas EIS/is primarily a recipient of data from lower-level systems. The other types of systems may exchange data with each other as well. Data may also be exchanged among systems serving different functional areas. For example, an order captured by a sales system may be transmitted to a manufacturing system as a transaction for producing or delivering the product specified in the order.

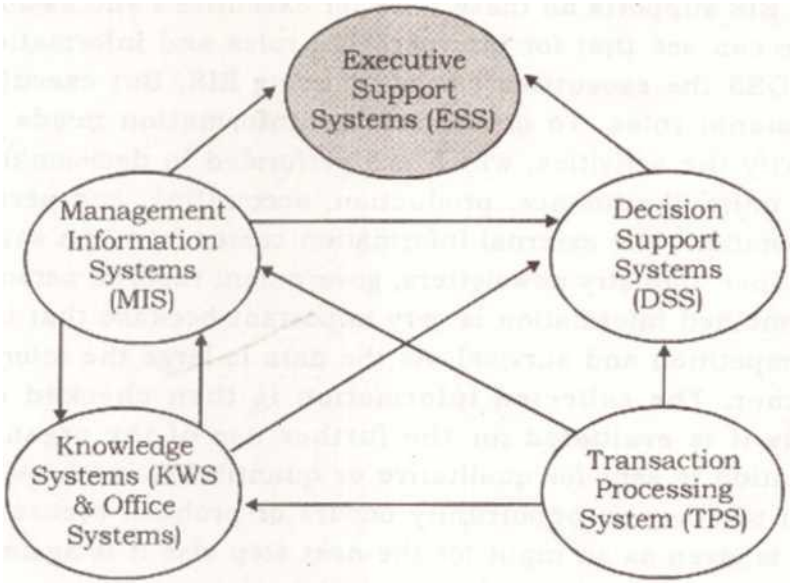


Figure 2 : Relationship of EIS with other systems

It is definitely advantageous to have some measure of integration among these systems so that information can flow easily between different parts of the organisation. Bu: integration costs money, and integrating many different systems is extremely time consuming and complex. Each organisation must weigh its needs for integrating systems against the difficulties of mounting a large-scale systems integration effort.

SELF CHECK EXERCISE 2

1. What is Decision support system?

2. Differentiate between EIS and DSS on the basis of problem solving capabilities.

10.6 THE ROLE OF EIS IN THE ORGANIZATION

Executives often face information overload and must be able to separate the chaff from the wheat in order to make the right decision. On the other hand, if the information they have is not detailed enough they may not be able to make the best decision. An EIS can supply the summarized information executives need and yet provide the opportunity to drill down to more detail if necessary.

As technology advances, EIS are able to link data from various sources both internal and external to provide the amount and kind of information executives fine useful. As common software programs include more options and executives gain experience using these programs, they are turning to them as an easy way to manipulate information. Many executives are also turning to the Web to provide the flexibility they need.

10.7 BENEFITS OF EIS

As more executives come up through the ranks, they are more familiar with and rely more on technology to assist them with their jobs. Executive Support Systems don't provide executives with ready-made decisions. They provide the information that helps them make their decisions. Executives use that information, along with their experience, knowledge, education, and understanding of the corporation and the business environment as a whole, to make their decisions.

Executives are more inclined to want summarized data rather than detailed data (even though the details must be available). EIS relies on graphic presentation of information because it's a much quicker way for busy executives to grasp summarized information.

Because of the trend toward flatter organizations with fewer layers of management, companies are employing EIS at lower levels of the organization.

Advantages of EIS are :

- Simple for high-level executives to use operations; do not require extensive computer experience
- Provides timely delivery of company summary information
- Provides better understanding of information
- Filters data for better time management
- Provides system for improvement in information tracking

Disadvantages of EIS are :

- Computer skills required to obtain results
- Requires preparation and analysis time to get desired information
- Detail oriented; Provides detailed analysis of a situation
- Difficult to quantify benefits of DSS
- Difficult to maintain database integrity
- Provides only moderate support of external data and graphics capabilities

SELF CHECK EXERCISE 3

1. What are the advantages of using EIS in an organisation

10.8 FACTORS FOR SUCCESS OF EIS IMPLEMENTATION

The implementation of EIS is different from implementation of DSS or any other computer based information system since it involves executives. The following factors are critical for successful implementation of EIS :

1. **A committed and informed executive sponsor** : There must be an executive who has both a realistic understanding of the capabilities of EIS, and who really wants the system so badly that he is willing to put considerable time and energy till the system gets developed. He should also be committed to the company and should have complete knowledge about the resources of the company.
2. **An operating sponsor :** As the executive sponsor usually lacks sufficient time to devote to the project, there should be an operating sponsor designated to manage the details of implementation from the user's side.
3. **A clear link to business objectives** : The EIS must help in solving business problems or meet the needs that are addressed most effectively with information systems technology. It should also provide very rapid access to external database, best graphical displays and data with textual annotations.
4. **Appropriate information system resources :** The quality of EIS project manager is very critical. This person should not only have technical knowledge but also business knowledge and the ability to communicate effectively with senior management.
5. **Appropriate technology :** The choice of hardware and software has a major bearing on the acceptance and rejection of any system. The EIS system when implemented should be in such a way that it supports vast variety of hardware and software.
6. **Management of data problems :** The physical and technical ability to provide reliable access to data can be major issue in EIS development.
7. **Management of organizational resistance :** Political resistance to EIS is one of the most common causes of implementation failure of EIS. An EIS alters information flows and this always has the potential to significantly shift power relationships in

a company.

8. **Prototype Development :** A small prototype of the system should be developed, tested and evaluated before making a new EIS.

SELF CHECK EXERCISE 4

1. How can EIS implemented successfully in an organisation

10.10 SUMMARY

Executive Support Systems meet the needs of corporate executives by providing them with vast amounts of information quickly and in graphical form to help them make effective decisions. EIS must be flexible, easy to use, and contain both internal and external sources of information.

EIS provides executives with internal and competitive information through user- friendly interfaces that can be used by someone with little computer-related knowledge. EISs are designed to help executives find the information they need whenever they need it and in whatever form is most useful. Typically, users can choose among numerous tabular or graphical formats. They can also control the level of detail, the triggers for exception conditions, and other aspects of the information displayed. Most EISs focus on providing executives with the background information they need, as well as help in understanding the causes of exceptions and surprises. This leaves executives better prepared to discuss issues with their subordinates.

KEYWORDS: TPS, MIS,DSS, EIS, ESS

10.11 REVIEW QUESTIONS

SHORT QUESTIONS

1. Explain the general model of EIS
2. What are the characteristics of EIS?
3. Differentiate between EIS and DSS

LONG QUESTIONS

1. Explain the role of EIS in organisation and how it supports to managers in decision making?
2. Explain the advantages and disadvantages of EIS?
3. Explain the various characteristics of EIS? ,
4. Briefly write the benefits of EIS with relevant examples
5. Identify the Implementation issues of EIS in any organisation

10.12 SUGGESTED BOOKS

1. *Decision Support Systems,* R. Jayashanker, Tata McGraw-Hill, 110810.
2. *Decision Support and Data Warehouse Systems,* Efrem G. Mallach, Irwin McGraw-Hill Publishing, 2000.
3. *Decision Support Systems and Data Warehouses,* B. Ravindranath, New Age International Publishers, 2003.

SOLUTION TO SELF CHECK EXERCISE (CHAPTER 10)

SELF CHECK EXERCISE 1

1. An executive information system (EIS) is a highly interactive system that provides managers and executives' flexible access to information for monitoring operating results and • general business conditions. These systems are sometimes called executive support systems (ESS).
2. The ideal interface for an EIS would meet the following criteria :
   Simple to use, Consistent performance, Reflective of executive's world, Informative help and error messages, Highly flexible

SELF CHECK EXERCISE 2

1. Decision support systems are another type of computer information system designed to support and improve the decision-making process.
2. EIS is not designed primarily to solve specific problems. Instead, EIS provides a generalised computing and telecommunications capacity that can be applied to a changing array of problems. Whereas many DSS are designed to be highly analytical, EIS tends to make less use of analytical models.

SELF CHECK EXERCISE 3

1. Provides a system for improvement in information tracking
   Provides timely delivery of company summary information
   Provides better understanding of information
   Filters data for better time management

SELF CHECK EXERCISE 4

1. Appropriate technology requirement, a committed and informed executive sponsor, a clear link to business objective, appropriate information system resources.

AUTHOR : NEERAJ SHARMA

DECISION-MAKING

STRUCTURE

11.0 OBJECTIVES

After going through this lesson, you will be able to understand :

- The Concept of Decision Making
- Decision Making Process
- Simon's Model of Decision Making
- Group Decision Making
- Problems and Challenges in Decision Making
- Organizational Levels and Decision Making
- Information System support for Decision Making Phases

11.1 INTRODUCTION

For any organization, decision-making is the most pervasive activity. At every level, information is required for decision-making. Thus, business management is nothing more than the 'information management' and without this an organization cannot, even, operate. Any worker or manager finds himself constantly faced with decision-making challenges. In an increasingly complex environment, the role of the manager is to understand the associated risk of committing resources to business activities. At the start of the new millennium a growing proportion of managerial decisions are supported by a powerful combination of data, models and computers. Information systems have evolved from back-office processors to problem solving and solution applications. The trend is for information systems to assist managers with their most important task: making decisions. When all the resources are available all the time; we tend to take them for granted. But when the cost increases or the supply and quality of the resource deteriorate only then we recognize its importance. The same is the case with management information. Timely and accurate information is needed to support the decisions that must be made for the accomplishment of an organization s objectives. But the question is what type of information does a manager

need for effective management? A manager must be clear about the objectives of the organization, its policies, programmers, plans, strengths, weaknesses etc. The type of information required largely depends upon the type of decisions to be made and the understanding about the organizational levels of management. Therefore, the question of type of information can be answered only in broad terms.

11.2 THE CONCEPT OF DECISION MAKING

In an increasingly complex business environment, the role of the manager is to understand the associated risk of committing resources to business activities. At the start of the new millennium, a growing proportion of managerial decisions are supported by a powerful combination of data, models and computers. Information systems have evolved from back-office processors to problem solving and solution applications. The trend is for information systems to assist managers with their most important task: making decisions.

Decisions are classified according to their importance, frequency and scope. Broadly defined, a manager takes two types of decisions-structured/programmed or unstructured/ non-programmed decisions. The information required depends on whether a manager has to make a structured or unstructured decision. A structured decision is always made using pre-defined procedures or rules. A structured/programmed decision is a routine one that is, made following the completion of a pre-planned series of steps. These steps spell out the information that must be gathered before pre-stated decision rules are applied. They are also known as programmed decision because they are highly structured and can be made by computer programs. Structured decisions can be easily programmed to handle the routine decisions and the people can deal with the exceptions. The information needed to make structured decisions is thus relatively predictable, and steps can be taken in advance to supply it in the reports that decision makers receive.

Decisions that require creativity and intuition are unstructured decisions. An unstructured decision is not routine and it does not follow any pre-defined steps. Hence, these decisions cannot be programmed. They involve the situations where it is not possible to specify in advance about the decision. Unstructured decisions are influenced by internal and external factors that affect the final outcome of the decision. Strategic decisions are unstructured decisions. These decisions lack a structure and the information needed to make unstructured decisions is not completely known in advance.

11.3 DECISION MAKING PROCESS

The right information, available at the right time leads to effective decisions which help in achieving organizational goals. All the decisions usually follow the same process. Different authors have given various decision-making models. Let us discuss how humans take decisions.

Decision-making is a process by which one chooses between two or more alternative course of actions for the purpose of attaining a goal or set of goals. A decision is the conclusion of a decision making process. Herbert A. Simon, Professor of Psychology and Computer Science, Carnegie Mellon University, Pittsburgh, developed a model of decisionmaking. The model consisted of three steps, intelligence, design, and choice. Simon emphasizes the problem solving, thinking and learning aspects of decision-making. As per Simon, problem solving involves :

- Setting a goal
- Detecting the difference between the present state and the goal state
- Finding methods to lessen the difference

Simon says every problem can be broken down into sub-problems. Work in parallel on the sub-parts and then put small solutions together for the big picture. Simon is also responsible for two other decision-making concepts :

Bounded Rationality

This is the notion that a human manager has limits to degree of rationality he/she can bring to a problem. The decision-maker cannot have complete knowledge of all the alternatives to the consequences of choice. Simon suggests that managers often simplify the problem in order to make a decision.

Satisfying

Simon's decision-making model is based on the concept of 'satisfying', which is that people tend to settle for acceptable, rather than optimal solutions, and to attend to problems sequentially, rather than simultaneously. In other words, this refers to the selection of a satisfactory alternative — not the most optimal or the best rather the first one that works in light of the circumstances. It provides a feasible solution which may not be the result of an exhaustive search for the best solution possible.

SELF CHECK EXERCISE 1

1. What is decision making?

11.4 SIMON S MODEL OF DECISION MAKING

Simon's model of Decision Making involves following phases :

- Intelligence phase
- Design phase
- Choice phase

Intelligence Phase

In the intelligence phase, the problem is identified, and information is collected concerning the problem. This can be a long process, as the decision to be made comes from the information. In this phase, the problem situations and opportunities are identified by monitoring the organization and its environment for problems and opportunities. The data about the problems or opportunities are gathered. For example, a finance and investment company monitors the share prices, whenever the prices are changed, the decisions whether to buy or to sell the stocks are taken. The data gathered after identification may be internal or external. Internal data are available within the organization itself. External data involve the data collected from outside environment such as inflation, economic parameters, political news, and government policies.

Design Phase

The design phase develops several possible solutions for the problem. This phase involves finding, developing and evaluating possible courses of actions. Various alternatives are explored through building models and making appropriate calculations to predict the consequences that would arise from the particular alternatives. The mathematical model for the problem is formulated, tested and validated. It is essential to develop the criteria or the standards to compare the alternative courses of actions generated by the specified model. **Choice Phase**

Finally, the choice phase chooses the solution. In this phase, the selection of proper course of action from the alternatives is done. This includes search, evaluation and finding

the appropriate solution to the model. Finally, a best or satisfactory decision is sought, and selected, so* c final verification is undertaken.

In addition to the three stages identified by Simon, a post-decision stage of monitoring and evaluation should be included to follow-up the outcome of a decision. This phase is termed as implementation phase which includes actual implementation of the decision and monitoring the performance of the decision.

Another important decision theory comes from Mintzberg. Mintzberg, was interested in unstructured (non-programmed) decision-making which assists the upper middle management and top level management. Mintzberg in empirical observations and interviews with managers noticed that decision making under ambiguity usually begins with a vague idea which is then matched to an opportunity that happens to be at hand and which then helps to shape the vague idea.

SELF CHECK EXERCISE 2

1. What are the different phases of Simons decision making process
2. Explain the design phase of Simon's decision making model

11.5 GROUP DECISION MAKING

Another model we can discuss here is for group-decision making. Group support systems help groups make decisions. A group makes a better decision, than even the best person in the group. They provide technical support to the group to aid in their decisionmaking. They aid in the brainstorming process; this improves all input and, therefore, the ultimate decision. This can be divided into a three-part process. Part one is the sharing of information and dialogue to shape the body of knowledge relevant to the current decision. Part two is a brief thinking or gestation time. This is for contemplation and thinking in depth. Group members can be sent away to think about the problem for some time say 11 minutes (important decision may require more time). Part three is a sharing of any further ideas and insights through communication, discussing the pros and cons of each alternative and finally, making a decision.

The method of decision making in an individual is as varied as there are individuals making them. There are two types of decision-makers the normative or rational, and the administrative model. The rational decision-maker uses probability and is unbiased. This type of decision cannot always be used; only if the problem is easy to define and the parameters can all be quantified. The administrative model may be used for decisions that are not so defined. Satisfying may be the only available means to pick the solution. To satisfies is to pick the best alternative of all available solutions. It may have both positive and negative aspects, but it is the best at hand.

11.6 PROBLEMS AND CHALLENGES IN DECISION MAKING

Decision-making has never been easy but it has become especially challenging for today's managers. Decision-making in today's business world has become a very complex job.

Today, a decision must satisfy a number of often conflicting criteria representing the interests of different groups like creditors, shareholders, regulatory agencies etc. Factors such as customer's preferences, goodwill, employee morale, corruption, and govt, pclicy etc. are difficult to measure but they often determine decision alternatives. Moreover, every decision brings with it uncertainty and chances of failure.

Decisions have not only short-term impact but they also sometimes involve long-term implications. The complexity of a decision is greatly increased when technical experts such as lawyers, tax advisers, accountants, technicians, and production experts etc. are consulted

before making a decision. This is usually a very time-consuming process.

These days, every important and major decision is taken in groups. But when there are people with differing backgrounds, perceptions, expectations, values etc., the decisionmaking process will be marked by disagreement over what is right or wrong, and ethical or unethical. But for a decision, these have to be neutralized or synchronized.

11.7 ORGANIZATIONAL LEVELS AND DECISION MAKING

The objective of 'organizing' is to make human cooperation effective and the reason for levels of organization is the limitations of the span of management. In other words, organization levels exist because there is a limit to the number of persons a manager can supervise effectively. Moreover, the information a manager needs also depends upon the organizational level of the manager's job. In the small organizations, there are few managerial levels, and the managers tend to be 'all-rounder'. In other words, they are knowledgeable about most of the organization's functions. But as organizations grow in size, people with specialized knowledge are hired and additional managerial levels are created. Information that is satisfactory for generalists is often not acceptable when supplied to specialists. It thus, becomes necessary to supply different types of information to people at different levels.

Top management people must have in-depth understanding of the organization's activities. Their responsibility is to take major strategic decisions and to make major policies and guidelines for the smooth functioning of the organization. They take major decisions such as introduction of a new product, new market exploration, new plant authorizations, and so on. For this, they need the type of information that will support these long-range strategic plans and decisions. These decisions have very long-term implications on the functioning of the organization. Moreover, these decisions, once taken cannot be reversed easily without incurring huge losses.

Middle management people are responsible for making the tactical decisions. A tactical decision is concerned with the allocation of resources and establishing the control standards required to implement the top management's decisions. These decisions have a medium term impact on the functioning of the organization.

Lower management people make the routine and operational decisions. For example, issuing stock, recording sales transactions, pay roll processing etc. These decisions have a very short-term impact on the functioning of the organization.

As we go up higher in the organizational ladder, the decisions also become more unstructured. Lower-level management people requires access to the information systems that process transactions, produce monthly or fortnightly reports etc. But higher-level managers often require that information which is not routine and which cannot be easily anticipated in advance. They, then build decision models that support them in the decisionmaking process.

SELF CHECK EXERCISE 3

1. Explain the role of top management in an organizations decision making

2. What kinds of decision is lower management authorized to take in an organization

11.8 INFORMATION SYSTEM SUPPORT FOR DECISION MAKING PHASES

Information System is a particular discipline or branch of learning which is concerned with the application of information to organizational needs. The scope of information system includes manual, computer-based and other forms of automated procedures and applications of information technology generally.

In order for organizations to use of information technologies effectively, information

systems must be designed, developed, implemented and managed in ways that fit with the specific work processes and organizational contexts. A thorough understanding of information systems development and management concepts together with skills in desktop computing enables the manager to develop end user systems and provide the business perspective to participate in the creation and management of major information systems. Management Information System (MIS) concepts also provide a foundation on which to base expertise in information systems for specialized work processes such as marketing, accounting and international business.

Any system designed to provide Information with above-discussed qualities to the managers in an organization for decision-making is called an 'Information System.' But before formalizing the word 'Information System', we need to understand the meaning of the term 'System' in more detail and then look into the 'Management Information System' which is an important subset of the overall Information System in an organization.

Management Information Systems comprise many subsystems and are influenced by the organization's structure, activities, risk profile, and technological capabilities. Within an organization set up, depending on the level of management the information systems perform various activities and play certain roles. Information systems support top management in setting long-term goals, policies and achieving strategic competitive advantage. For middle management, information systems help in taking tactical decisions. For lower level management, an information system processes daily transactions. The role of Information Systems has developed during the years. The original conception was of automation of existing manual and pre-computer mechanical processes. This was quickly succeeded by the rationalization and integration of systems. In both Of these forms, information system was regarded primarily as an operational support tool, and secondarily as a service to management.

Information is a crucial component of today's IT age. With a smaller world, faster communications, and greater interest, information relevant to a person's life, work and recreation has exploded. However, many believe this is not very good for an organization. Peter Ducker states that although executives have become computer literate, few of them have mastered the questions of what information they need, when they need information and in what form do they need information. Further, Drucker notes, executives will need better information in the future if their companies are to be competitive; more information is not the answer unless it is relevant information. Thus, the success of companies is through the use of appropriate information, and then the future of MIS will be the design of DSS that facilitates astute use of appropriate information. Decision support systems aid in and strengthen some kind of choice process.

SELF CHECK EXERCISE 4

1. Explain the role of information system for different levels of management

11.9 SUMMARY

The right information, available at the right time leads to effective decisions which help in achieving organizational goals. All the decisions usually follow the same process. Different authors have given various decision-making models. Let us discuss how humans take decisions.

Decision-making is a process by which one chooses between two or more alternative course of actions for the purpose of attaining a goal or set of goals. A decision is the conclusion of a decision making process. Herbert A. Simon developed a model of decisionmaking. The model consisted of three steps, intelligence, design, and choice. Simon

emphasizes the problem solving, thinking and learning aspects of decision-making. Simon says every problem can be broken down into sub-problems. Work in parallel on the sub-parts and then put small solutions together for the big picture. Today, a decision must satisfy a number of often conflicting criteria representing the interests of different groups like creditors, shareholders, regulatory agencies etc. Factors such as customer's preferences, goodwill, employee morale, corruption, and govt, policy etc. are difficult to measure but. they often determine decision alte natives. Moreover, every decision brings with it uncertainty and chances of failure.

Decisions have not only short-term impact but they also sometimes involve long-term implications. The complexity of \ decision is greatly increased when technical experts such as lawyers, tax advisers, accountants, technicians, and production experts etc. are consulted before making a decision. This is usually a very time-consuming process.

11.11 GLOSSARY

- **Decision-making** : A process by which one chooses between two or more alternative course of actions for the purpose of attaining a goal or set of goals.
- **Bounded Rationality** : A notion that a human manager has limits to degree of rationality he/she can bring to a problem. The decision-maker cannot have complete knowledge of all the alternatives to the consequences of choice.
- **Information System** : A particular discipline or branch of learning which is concerned with the application of information to organizational needs.

KEYWORDS: decision making, information system

11.11 REVIEW QUESTIONS

SHORT QUESTIONS

1. What are the problems faced while taking decision in an organization?
2. Briefly explain Simon's decision making process
3. Briefly explain the role of different level of management in decision making

LONG QUESTIONS

1. Why is it important to understand the difference between information requirements of different levels of an organization?
2. What are the elements of an Information System that managers must consider?
3. What are some of the factors managers must consider when taking a decision?
4. What are some of the new roles Information Systems are playing in decisionmaking?
5. How GDSS can help better decision making?

11.12 SUGGESTED READINGS

1. *Decision Support and Data Warehouse Systems,* Efrem G. Mallach, Irwin McGraw-Hill Publishing, 2000.
2. *Decision Support Systems and Data Warehouses,* B. Ravindranath, New Age International Publishers, 2003.

SOLUTION TO SELF CHECK EXERCISE (CHAPTER 11)'SELF CHECK EXERCISE 1

1. Decision-making is a process by which one chooses between two or more alternative course of actions for the purpose of attaining a goal or set of goals.

SELF CHECK EXERCISE 2

1. Setting a goal, Detecting the difference between the present state and the goal state, Finding methods to lessen the difference
2. The design phase develops several possible solutions for the problem. This phase involves finding, developing and evaluating possible courses of actions. Various alternatives are explored through building models and making appropriate calculations to predict the consequences that would arise from the particular alternatives.

SELF CHECK EXERCISE 3

1. Top management people must have in-depth understanding of the organization's activities. Their responsibility is to take major strategic decisions and to make major policies and guidelines for the smooth functioning of the organization. They take major decisions such as introduction of a new product, new market exploration, new plant authorizations, and so on. For this, they need the type of information that will support these long-range strategic plans and decisions. These decisions have very long-term implications on the functioning of the organization. Moreover, these decisions, once taken cannot be reversed easily without incurring huge losses.
2. Lower management people make the routine and operational decisions. For example, issuing stock, recording sales transactions, pay roll processing etc. These decisions have a very short-term impact on the functioning of the organization.

SELF CHECK EXERCISE 4

1. Information systems support top management in setting long-term goals, policies and achieving strategic competitive advantage. For middle management, information systems help in taking tactical decisions. For lower level management, an information system processes daily transactions.

DECISION MAKING UNDER CERTAINTY, UNCERTAINTY AND RISK

STRUCTURE

12.0 OBJECTIVES OF THE LESSON

The objective of this lesson is to have an insight into the statistical theory of decision making and classifying the decision making situation into various models on the basis of uncertainty attached with the decision situation. Conditions for each kind of decision situation along with their solutions will be discussed in this lesson.

12.1 INTRODUCTION

Decision theory is primarily concerned with helping people and organizations in making decisions. It provides a meaningful conceptual frame work for important decision making. The decision making refers to the selection of an act from amongst various alternatives, the one which is judged to be the best under given circumstances.

The management has to consider phases like planning, brganization, direction, command and control. While performing so many activities, the management has to face many situations from which the best choice is to be taken. This choice making is technically termed as "decision making" or decision taking. A decision is simply a selection from two or more courses of action. Decision making may be defined as "a process of best selection from a set of alternative courses of action, that course of action which is supposed to meet objectives to the satisfaction of the decision maker".

12.2 STATISTICAL DECISION THEORY

The knowledge of statistical techniques helps to select the best action. The statistical decision theory refers to an optimal choice under condition of uncertainty. In this case probability theory has a vital role, as such, this probability theory will be used more frequently in the decision making theory under uncertainty and risk.

The statistical decision theory tries to reveal the logical structure of the problem into alternative action, states of nature, possible outcomes and likely pay-offs from each such outcome.

Key Terms and Definitions

(i) The decision maker

The decision maker refers to individual or a group of individuals responsible for making the choice of an appropriate course of action amongst the available courses of action.

(ii) Acts (or Courses of Action)

Decision making problems deal with the selection of a single act from a set of alternative acts. If two or more alternative courses of action occur in a problem, then decision making is necessary to select only one coursc of action.

Let the acts or actions be al, a2, a3,... then the totality of all these actions is known as action space denoted by A. For three actions al, a2 a3; A = action space = (al, a2, a3) or A = (Al, A2, A3). Acts may be also represented in the following matrix form i.e., either in row or column form

Acts

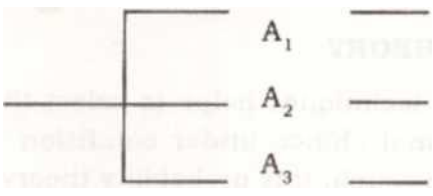
Al

A2

A3

Al	A2		An

In a tree diagram the acts or actions are shown as



(iii) Events (or States of nature)

The events identify the occurrences, which are outside of the decision maker's control and which determine the level of success for a given act. These events are often called 'States of nature' or outcomes. An example of an event or states of nature is the level of market

demand for a particular item during a stipulated time period.

A set of states of nature may be represented in any one of the following ways:

S - !S„ S,...., SJ

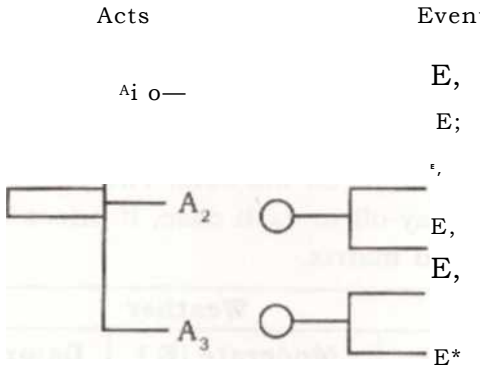
Or E = {E,, E_2, ..., EJ

Or O - { 1, 2, 3}

For example, if a washing powder is marketed, it may be highly liked by customers (outcome 0,) or it may not appeal at all (outcome 0_2) or it may satisfy only a small fraction, say 25% (outcome 0J

Therefore, ii = {0,, 0_2, 0_3}

In a tree diagram the places are next to acts. We may also get another act on the happening of events as follows :



In matrix form, they may be represented as either of the two ways :

States of Nature------ ► Acts |	s,	
A,		
A,		

or

States of Nature ------ ► 1 Acts |	A,	A,	A,
s,			
S_a			

(iv) Pay-off

The result of combinations of an act with each of the states of nature is the outcome and momentary gain or loss of each such outcome is the pay-off. This means that the expression pay-off should be. in quantitative form. Pay-off may also be in terms of cost saving or time saving.

In general, if there are k alternatives and n states of nature, there will be k x n

outcomes or pay-offs. These k x n pay-offs can be very conveniently represented in the form of a k x n pay-off table.

States of nature	Decision alternative			
	A>	A '		v.
E,	a!9			a: k
E,	<!-	. ''		a^k
	.			
E„	a„,			

Where a. = conditional outcome (pay-off) of the i^{lh} event when j'^{h} alternative is chosen. The above pay-off table is called pay-off matrix.

Example 1 :

A farmer can raise any one of three crops on his Field. The yields of each crop depend on weather conditions. We have to show pay-off in each case, if prices of the three products are as indicated in the last column of yield matrix.

Yield in kg. per hectare	**Weather**			
	Dry (BJ	**Moderate (EJ**	**Damp (E_3)**	**Price Rs. per kg.**
Paddy (Al)	500	1700	4500	1.25
Groundnut (A2)	800	1200	1000	4.00
Tobacco (A3)	100	300	200	15.00

Solution :

Pay - off Table

	E.		E»
A!	500 x 1.25 = 625	1700 x 1.25= 2125	4500 x 1.25 - 5625
A_2	800 x 4 = 3200	1200 x 4 = 4800	1000 x 4 » 4000
v	100 x 15 = 1500	300 x 15 = 4500	200 x 15 - 3000

(v) Regret (or Opportunity Loss)

The difference between the highest possible profit for a state of nature and the actual profit obtained for the particular action taken is known as opportunity loss. Opportunity loss is the loss incurred due to failure of not adopting the best possible course of action. Opportunity losses are calculated separately for each state of nature. For a given state of nature the opportunity loss of possible course of action is the difference between the pay-off value for that course of action and the pay-off for the best possible course of action that could
have been selected. Let the pay-off of the outcomes in the l^{51} row be P_{12}, P_{12} .....P.n and similarly for the other rows.

Pay-off table

Acts	States of Nature		
	S,	S_2	s_n
A,	p.»	p., ...	P,„
A,		$p_{„}$ —	P*.
A	p ,	p , ...	P
	m 1	m_2	Mm

SELF CHECK EXERCISE 1

1. What is statistical decision theory?
2. Explain the term opportunity loss
3. Who is a decision maker?

12.3 TYPES OF DECISION MAKING

Decisions are made based upon the information available about the occurrence of events as well as the decision situation. There are three types of decision making situations :

(a) Decision making under certainty

(b) Decision making under uncertainty and

(c) Decision making under risk

These three types of decisions are usually distinguished on the basis of knowledge of outcomes.

12.3.1 Decision Making Under Certainty

Certainty is the condition when the manager has got the perfect information regarding the state of affairs that exist and the conditions that would affect the decision making are known to manager. The decision making would have to be carried out in limited time period and usually the deterministic models would be used for such decision making. Basically the payoff method is used for decision making under certainty. This is equivalent of saying that the effect of choosing any option is known in advance with certainty.

Consider an example; a factory is producing number of products from the same basic ingredients. Each product requires a different mix of ingredients. So for the production of each product, the ingredients are different for all the products. And hence the production cost and the selling cost varies from product to product.

If it is assumed that quantities are known exactly, the profit from given product mix can be determined with certainty. Such a problem is said to be deterministic. For a given condition a product mix can be determined to provide maximum profit. This profit can be considered as the payoff as a result of the decision to choose a particular option. So the effect of choosing any option is known in advance with certainty.

Example 2 :

A canteen prepares a food at a total average cost of Rs. 4 per plate and sells it at a price of Rs 6. The food is prepared in the morning and is sold during the same day. Unsold food during the same day is spoiled and is to be thrown away. According to the past sale, number of plates prepared is not less than 50 or greater than 53. You are to formulate the

(i) action space

(ii) states of nature space

(iii) pay-off table

Solution :

(i) The canteen will not prepare less than 50 plates or more than 53 plates. Thus the acts or courses of action open to him are:

a, = prepare 50 plates a^ = prepare 51 plates a_3 = prepare 52 plates a_4 = prepare 53 plates Thus the action space is A - {a,, a,, a_3, a_4}

(ii) The state of nature is daily demand for food plates. Then there are four possible states of nature, i.e.

S, = demand is 50 plates
52 = demand is 51 plates
53 = demand is 52 plates
54 = demand is 53 plates

Hence the state of nature space, S= {S,, S_2, S_3, S_4}

(iii) The uncertainty element in the given problem is the daily demand. The profit of the canteen is subject to the daily demand.

Let n = quantity demanded m = quantity produced For n £ m, profit = (Cost price - Selling price) x m = (6 - 4) x m = 2m

For m > n, profit = {(Cost price - Selling price) * n} - {Cost price * (m - n){

= 2n - 4 (m-n) = 6n - 4m

Pay-off table

States (m)	**Demand (n)**			
	(S.) 50	(SJ 51	(SJ 52	(S_4) 53
(a,) 50	100	100	100	100
(a i 51	96	102	102	102
(a,) 52	92	98	104	104
(aj 53	88	94	100	106

(iv) To calculate the opportunity loss we first determine the maximum pay-off in each state of nature. In this state

First maximum pay-off =100
Second maximum pay-off =102
Third maximum pay-off = 104
Fourth maximum pay-off =106

Loss table corresponding to the above pay-off table

Supply (m)	Demand (n)			
	(S,) 50	(SJ 51	(s_3) 52	(S_4) 53
(a,) 50	100 -100 = 0	102-100 = 2	104-100 = 4	106 -100 » 6
(a2) 51	100 -96 = 4	102-102 = 0	104-102 = 2	106 -102 = 4
(a3) 52	100 -92 = 8	102 - 98 = 4	104-104 - 0	106 -104 = 2
(a4) 53	100 -88 =12	102 - 94 = 8	104-100 - 4	106 -106 = 0

12.3.2 Decision Making Under Uncertainty

Decisions are said to be made under uncertainty condition when neither the number of possible future states of nature nor the probability of occurrence are known to decision makers. So the conditions under which the decision makers have to take the decisions in this category are :

1. Managers lack the information either about the outcome or relative chances of the outcome.
2. The database is very limited.
3. The reliability of the database is questionable.
4. The various variables and their interdependence are not known.

Under conditions of uncertainty, only pay-offs are known and nothing is known about the likelihood of each state of nature. Such situations arise when a new product is introduced in the market or a new plant is set up.

The number of different decision criteria available under the condition of uncertainty is given below :

(i) Criteria of Optimism or Maxima

The maxima look at the best that could happen under each action and then chooses the action with the largest value. They assume that they will get the most possible state and then they take the action with the best scenario.

The maxima criterion finds the course of action or alternative strategy that maximizes the maximum pay-off. Since this decision criterion locates the alternative with the highest possible gain, it has also been called an optimistic decision criterion. The working method is

(i) Determine the best outcome for each alternative

(ii) Select the alternative associated with the best of these

(ii) Expected Monetary value (EMV)

The expected monetary value is widely used to evaluate the alternative course of action. The EMV for given course of action is just sum of possible pay-off of the alternative each weighted by the probability of that pay-off occurring.

(ill) The Criteria of Pessimism or Maxima

This criterion is the decision to take the course of action which maximizes the minimum possible pay-off. Since this decision criterion locates the alternative strategy that has the least possible loss, it is also known as a pessimistic decision criterion.

The working method is :

(i) Determine the lowest outcome for each alternative

(ii) Choose the alternative associated with the best of these

(iv) Minimax Regret Criterion or Savage Criterion

This criterion is also known as opportunity loss decision criterion because decision maker feels regret after adopting a wrong course of action (or alternative) resulting in an opportunity loss of pay-off. Thus he always intends to minimize this regret. The working method is :

(a) Form the given pay-off matrix, develop an opportunity loss (or regret) matrix.

(i) find the best pay-off corresponding to each state of nature and

(ii) Subtract all other entries (pay-off values) in that row from this value.

(b) Identify the maximum opportunity loss for-each alternative.

(c) Select the alternative associated with the lowest of these.

(v) Equally Likely Decision or Bayes' or Laplace Criterion

Since the probabilities of states of nature are not known, it is assumed that all states of nature will occur with equal probability i.e., each state of nature is assigned an equal probability. As states of nature are mutually exclusive and collectively exhaustive, so the probability of each of these must be 1 / (number of states of nature). The working method
is :

(a) Assign equal probability value to each state of nature by using the formula : 1/(number of states of nature)

(b) Compute the expected (or average) value for each alternative by multiplying each outcome by its probability and then summing.

(c) Select the best expected pay-off value (maximum for profit and minimum for loss) This criterion is also known as the criterion of insufficient reason because, except in a
few cases, some information of the likelihood of occurrence of states of nature is available.

(vi) Criterion of Realism (Hurwicz Criterion)

This criterion is a compromise between an optimistic and pessimistic decision criterion.

To start with, a co-efficient of optimism a (0 < a £ 1) is selected.

When a is close to one, the decision maker is optimistic about the future and when a is close to zero, the decision maker is pessimistic about the future.

According to Hurwicz, select strategy which maximizes H = a (maximum pay-off in row) + (1 - a) minimum pay-off in row.

Example 3

Consider the following pay-off (profit) matrix :

Action	**States**			
	(S,)	(S_3)	(s,)	(S.)
A,	5	10	18	25
A	8	7	8	23
A,	21	18	12 .	21
A,	30	22	19	15

No Probabilities are known for the occurrence of the states of nature. Compare the

solutions obtained by each of the following criteria:

(i) Maxim in (ii) Laplace (iii) Hurwicz (assume that ? = 0.5)

Solution :

(i) Maxim in Criterion :

					Minimum
A,	5	10	18	25	5
A	8	7	8	23	7
A	21	18	12	21	12
A,	30	22	19	15	**15**

Maximum

E (AJ is maximum. So the best action is A4.

(ii) Laplace criterion

E (A,) = 1/4 [5 + 10 18 + 25] - 14.5 E (AJ = 1/4 (8 + 7 + 8 + 23] = 12.5 E (A_3) = 1/4 [21 + 18 + 12 + 21] = 18.0 E (AJ = 1/4 [30 + 22 + 19 + 15] = **21.5**

maximum E (AJ is maximum. So the best action is A_4

(iii) Hurwicz Criterion (with a = 0.5)

	Minimum	Maximum	a (max) + (1 - a) min
A,	5	25	0.5(25) + 0.5(5) = 15
r A..	7	23	0.5(7) + 0.5 (23) = 15
A_3	12	21	0.5(12) + 0.5 (21) = 16.5
A,	15	30	0.5(15) + 0.5 (30) = **22.5 maximum**

Best action is A,,

12.3.3 Decision Making Under Risk

Risk is a degree of uncertainty and an inability to fully control the outcomes of an action. Decisions arc said to be taken under risk when there is more than one possible payoff resulting from the selection of an option and the decision maker is assumed to know the probability of occurrence of each of these payoffs. The variations of payoffs can be considered to be the result of factors occurring outside the control of the decision maker. A simple example of the decision under risk is the decision depending on the roll of two dices. In this the probability of occurrence of any combination can be determined in advance but one can't be sure about the outcome at any particular instance. Risk or the elimination of risk is an effort that managers employ. However, in some cases the elimination of one risk may increase some other risks. Effective handling of risk has great impact on the decision making process. The decision process allows the decision makers to evaluate alternative strategies prior to making any decision. The process is as follows :

- The problem is defined and all feasible alternatives are considered.
- Calculate possible outcomes for each alternative.
- Calculate the monetary payoffs or net gain in reference to assets or time.

- Quantify various uncertainties in terms of probabilities.

Here the decision maker faces many states of nature. As such, he is supposed to believe authentic information, knowledge, past experience or happenings to enable him to assign probability values to the likelihood of occurrence of each state of nature. Sometimes with reference to past records, experience or information, probabilities to future events could be allotted. On the basis of probability distribution of the states of nature, one may select the best course of action having the highest expected pay-off value.

Example 4

The pay-off table for three courses of action (A) with three states of nature (E) (or events) with their respective probabilities (p) is given. Find the best course of action.

Events	E,		E,
Probability ---------- Acts |	0.2	0.5	0.3
A.	2	1	-1
A	3	2	0
A-	4	2	1

The expected value for each act is A, =

2(0.2) + 1(0.5) -1(0.3) = 0.6 A_2 =

3(0.2) + 2(0.5) + 0(0.3) = 1.6 A_3 =

4(0.2) + 2(0.5) + 1(0.3) = 2.1

The expected monetary value for the act 3 is maximum. Therefore the best course of action is A

SELF CHECK EXERCISE 2

1. What is risk? when are decision said to be taken under risk

12.3 SUMMARY

Decision theory is primarily concerned with helping people and organizations in making decisions. It provides a meaningful conceptual frame work for important decision making. The knowledge of statistical techniques helps to select the best action. 'The statistical decision theory refers to an optimal choice under condition of uncertainty. In this case probability theory has a vital role, as such, this probability theory will be used more frequently in the decision making theory under uncertainty and risk.

There are three types of decision making situations :

a) Decision making under certainty

b) Decision making under uncertainty and

c) Decision making under risk

In case of decision making under certainty, the decision maker has the complete knowledge of consequence of every decision choice with certainty. In this decision model, assumed certainty means that only one possible state of nature is assumed to exist.

Under conditions of uncertainty, only pay-offs are known and nothing is known about the likelihood of each state of nature.

Under the conditions of risk, the decision maker faces many states of nature. As such, he is supposed to believe authentic information, knowledge, past experience or happenings to enable him to

nature. Sometimes with reference to past records, experience or information, probabilities to future events could be allotted. On the basis of probability distribution of the states of nature, one may select the best course of action having the highest expected pay-off value.

12.4 **Keywords :** Courses of Action**,** Pay-off, Opportunity loss, Certainty, Uncertainty, Risk

12.5 **Review QUESTIONS**

SHORT QUESTIONS

1. Explain briefly how decisions are taken in case of certainty
2. Explain briefly how decisions are taken in case of uncertainty

LONG QUESTION

3. What is a Pay-off matrix? What is its use in decision making?
4. What is Laplace criterion?
5. What are the various decision making model? Discuss the strategies for dealing with decisions under uncertainty.
6. What is "assumed" certainty? What are the conditions of assumed certainty?
7. The following payoff matrix indicates the costs associated with three decision options (O.) and four states of nature (SJ.

	s,	s	s	
° 1	20	25	30	35
	40	30	40	20
°3	10	60	30	25

Select the decision that should be selected for the maximin rule, the maximax rule, the Laplace rule, the minimax regret rule, and the Hurwicz rule with ? = 0.2. How do the rules applied to the cost matrix differ from those that are applied to a payoff matrix of profits?

8. How do you classify decision problems under risk? What are the strategies to deal with decision making under risk model? Discuss each with relevant examples.

12.6 SUGGESTED BOOKS

1. *Decision Support Systems,* R. Jayashanker, Tata McGraw-Hill, 1989.
2. *Decision Support and Data Warehouse Systems,* Efrem G. Mallach, Irwin McGraw-Hill Publishing, 2000.
3. *Decision Support Systems and Data Warehouses,* B. Ravindranath, New Age International Publishers, 2003.
4. *Applied Decision Support,* Michael W. Davis, Prentice Hall, 1998.

SOLUTION TO SELF CHECK EXERCISE (CHAPTER 12)

SELF CHECK EXERCISE 1

1. The statistical decision theory refers to an optimal choice under condition of uncertainty. In this case probability theory has a vital role, as such, this probability theory will be used more frequently in the decision making theory under uncertainty and risk.The statistical decision theory tries to reveal the logical structure of the problem into alternative action, states of nature, possible outcomes and likely pay-offs from each such outcome.
2. The difference between the highest possible profit for a state of nature and the actual profit obtained for the particular action taken is known as opportunity loss. Opportunity loss is the loss incurred due to failure of not adopting the best possible course of action.
3. The decision maker refers to individual or a group of individuals responsible for making the choice of an appropriate course of action amongst the available courses of action.

SELF CHECK EXERCISE 2

1. Risk is a degree of uncertainty and an inability to fully control the outcomes of an action. Decisions arc said to be taken under risk when there is more than one possible payoff resulting from the selection of an option and the decision maker is assumed to know the probability of occurrence of each of these payoffs.

MBA-DE(Second Year)
Semester-Ill

MISDSS 302
MANAGEMENT INFORMATION SYSTEM &
DECISION SUPPORT SYSTEM

Lesson No. 13

AUTHOR : HARMOHAN SHARMA

DATABASE & MICROSOFT ACCESS

STRUCTURE

13.0 OBJECTIVES

After reading this lesson, students would be able to understand :

- What is Database?
- Concepts of Microsoft Access

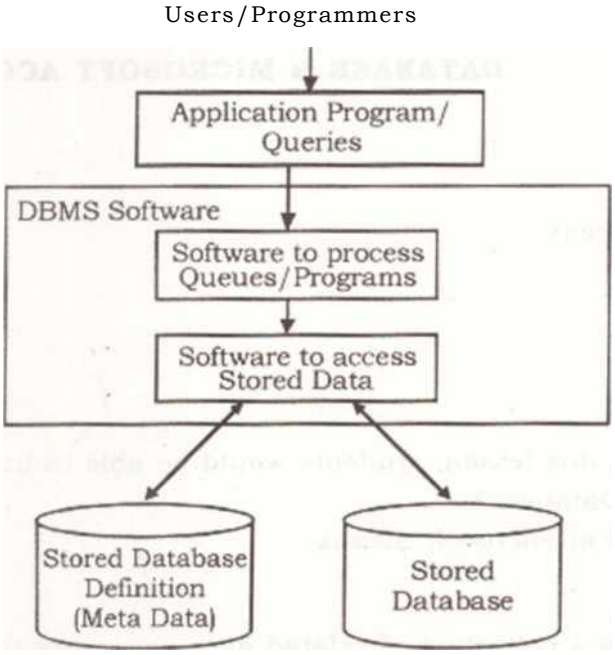
13.1 DATABASE

A database is a collection of related data necessary to manage an organization. It is a collection of interrelated data stored together with controlled redundancy to serve one or more applications in an optimal fashion. The data are stored in such a fashion that they are independent of the program or people using the data. A database is organized in such a way that a computer program can quickly select desired pieces of data. Traditional databases are organized as fields, records, and files. A field is a single piece of information; a record is one complete set of fields; and a file is a collection of records. For example, a telephone book is analogous to a file. It contains a list of records, each of which consists of three fields; name, address, and telephone number. Databases are widely used. Some of the applications are :

- Banking
- Airlines
- Educational Institutions
- Finance
- Sales
- Telecommunications
- Human Resources

To access information from a database, you need a database management system (DBMS). A database-management system (DBMS) is a collection of interrelated data and a set of programs to access those data. The. collection of data, usually referred to as the database, contains information relevant to an organization. The DBMS is hence a general- purpose software system that facilitates the processes of defining, constructing, manipulating, and sharing databases among various users and applications. The important functions provided by the DBMS include protecting the database and maintaining it over a long period of time. Protection includes both system protection against hardware or software malfunction (or crashes), and security protection against unauthorized or malicious access. A typical large database may have a life cycle of many years, sc the

DBMS must be able to maintain the database system by allowing the system to evolve as requirements change over time.



A simplified database system environment

13.1 MICROSOFT ACCESS

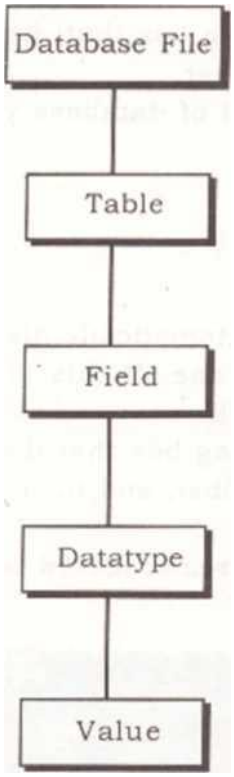
Microsoft Access is a powerful program to create and manage databases. It has many built in features to assist users in constructing and viewing their information. Access is much more involved and is a more genuine database application as compared to others. There are seven main components of a database in Access :

- Tables : Use tables to store database information.
- Forms : Use forms to enter or edit the information in your tables. Farms let you view one record at a time.
- Reports : Use reports to deliver a professional presentation or written report to your class.
- Queries : Filter data so that you retrieve selected records or fields from the database.
- Pages : Create HTML pages from a database quickly and efficiently.
- Macros : Automate tasks that you perform on a regular basis in a database.
- Modules : Automate a group of related procedures in Access.

First of all you need to understand how Microsoft Access breaks down a database. Some keywords involved in this process are:

- Database File
- Table
- Record
- Field
- Data-type.

Here is the Hierarchy that Microsoft Access uses in breaking down a database.



Database File : This is your main file that encompasses the entire database and that is saved to your hard-drive or floppy disk.
Example) StudentDatabase.mdb

Table : A table is a collection of data about a specific topic. There can be multiple tables in a database. Example #1) Students Example #2) Teachers

Field : Fields are the different categories within a Table. Tables usually contain multiple fields. Example #1) Student Last Name Example #2) Student First Name

Datatypes : Datatypes are the properties of each field. A field only has 1 data type.
Fieldname) Student Last Name
Data type) Text

Starting Microsoft Access

There are two ways to start Microsoft Access

1. Double click on the Microsoft Access icon on the desktop.

2. Click on Start --> Programs --> Microsoft Access

Creating New and Opening Existing Databases

This picture gives you the option to:

- Create a New Database from scratch
- Use the wizard to create a New Database
- Open an existing database

The white box gives you the most recent databases you have used. If you do not see the one you had created, choose the More Files option and hit OK. Otherwise choose the database you had previously used and click OK.

Create a database using the Database Wizard

1. When Microsoft Access first starts up, a dialog box is automatically displayed with options to create a new database or open an existing one.

If this dialog box is displayed, click Access Database Wizards, pages, and projects and then click OK.

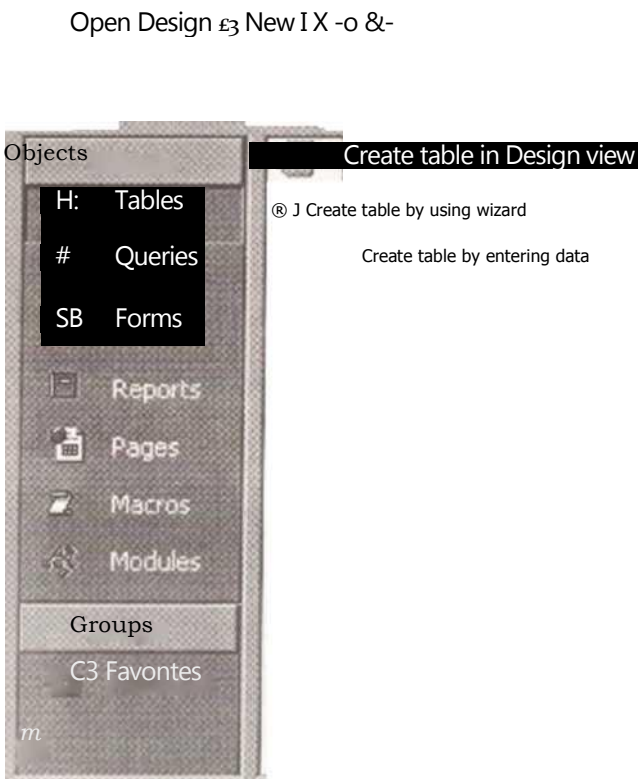
If you have already opened a database or closed the dialog box that displays when Microsoft Access starts up, click New Database on the toolbar.

2. On the Databases tab, double-click the icon for the kind of database you want to create.
3. Specify a name and location for the database.
4. Click Create to start defining your new database

Create a database without using the Database Wizard

1. When Microsoft Access first starts up, a dialog box is automatically displayed with options to create a new database or open an existing one. If this dialog box is displayed, click Blank Access Database, and then click OK.

   If you have already opened a database or closed the dialog box that displays when Microsoft Access starts up, click New Database on the toolbar, and then double-click the Blank Database icon on the General tab.
2. Specify a name and location for the database and click Create. (Below is the screen that shows up following this step)



13.2 TABLES

A table is a collection of data about a specific topic, such as students or contacts. Using a separate table for each topic means that you store that data only once, which makes your database more efficient, and reduces data-entry errors.

Tables organize data into columns (called fields) and rows (called records).

Student Record Table

Roll No.	Name	Class	Address	City
1001	Rohit	MBA	#124, Green View	Jalandhar
1002	Vikas	MCA	#1220, Spectra	Bangalore
10013	Ishaan	MBA	#12213, U/E-II	Patiala

- Each field in the student record contains the same type of information for every student, such as student's Roll No. This is an example of a COLUMN
- Each record in a Student Records table contains all of the information about one student, such as their Name, Class, Address and City, etc... This is an example of a ROW.

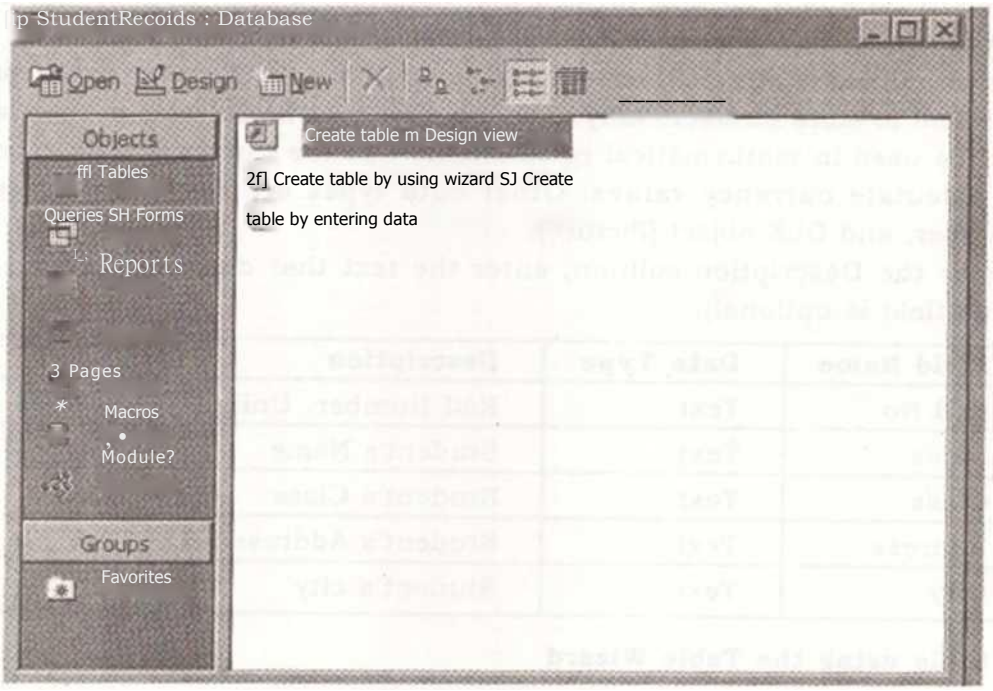
When you open a database, you see three options for creating a table :

- Create table in Design view
- Create table by using wizard
- Create table by entering data

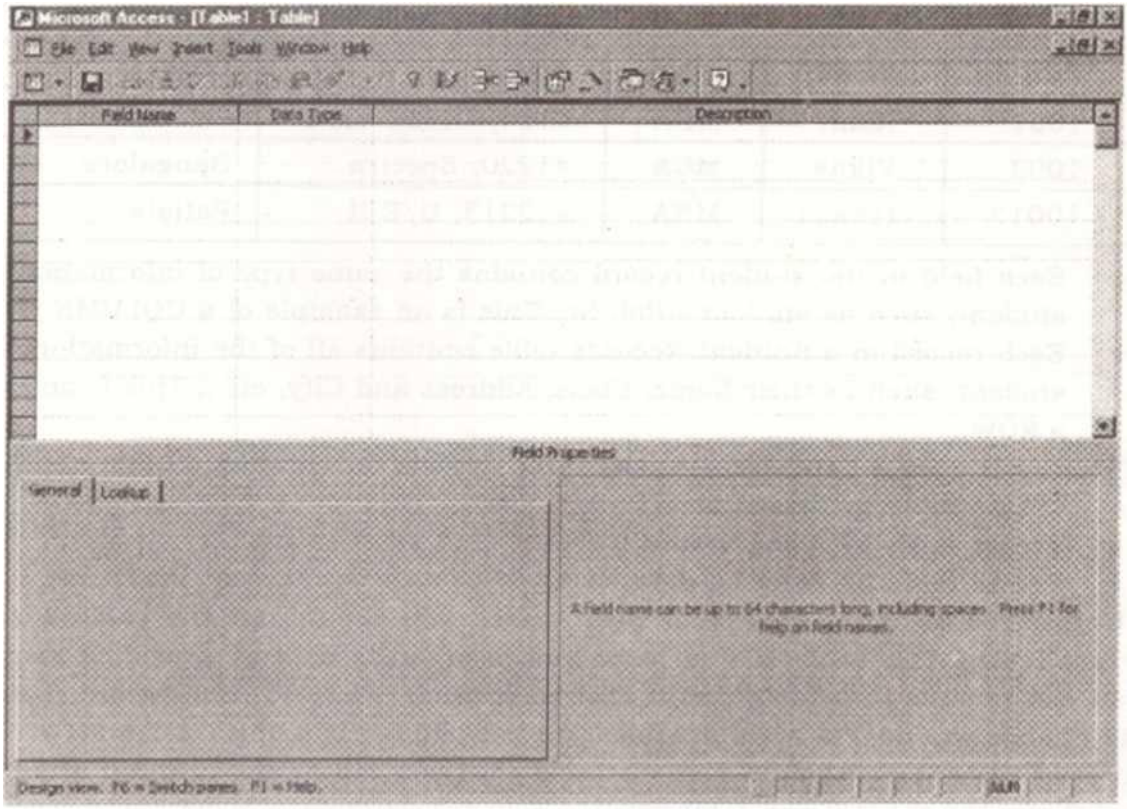
Unless you are already familiar with Access, you should use the Table Wizard when you create tables. The Table Wizard helps you to organize data by providing sample fields that you can include in a table and it assigns a primary key to each record. Later, if you need to change the design of your table, you can modify it using Design view. The Table Wizard even provides a sample student table that you may want to build after you have finished designing the census database.

Create a Table from scratch in Design view

1. If you haven't already done so, switch to the Database Window You can press Fll to switch to the Database window from any other window.



2. Double-Click on "Create table in Design view".
(DESIGN VIEW)



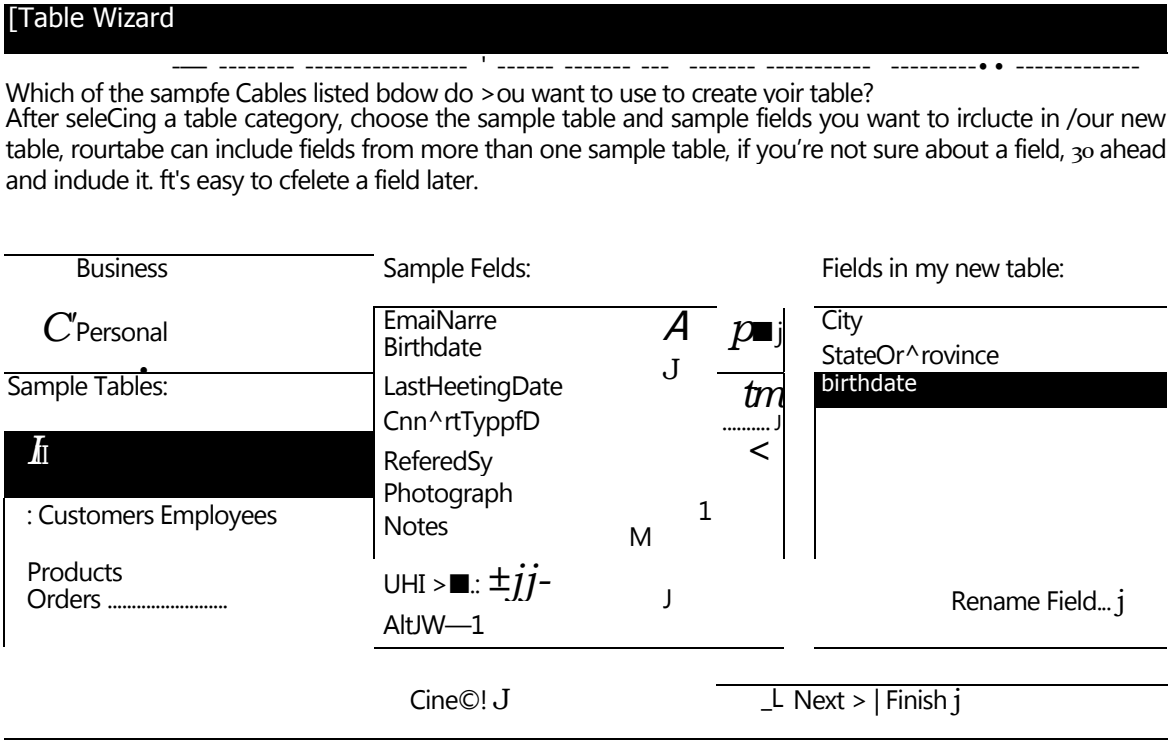
3. Define each of the fields in your table.
   - Under the Field Name column, enter the categories of your table.
   - Under Data Type column, enter the type you want for you categories.
   - The attribute of a variable or field that determines what kind of data it can hold. For example, in a Microsoft Access database, the Text and Memo field data types allow the field to store either text or numbers, but the Number data type will allow the field to store numbers only. Number data type fields store numerical data that will be used in mathematical calculations. Use the Currency data type to display or calculate currency values. Other data types are Date/Time, Yes/No, Auto Number, and OLE object (Picture).
   - Under the Description column, enter the text that describes what you field is. (This field is optional).

Field Name	**Data Type**	**Description**
Roll No	Text	Roll Number, Uniquely identifies a student
Name	Text	Student's Name
Class	Text	Student's Class
Address	Text	Student's Address
City	Text	Student's city

To create a table using the Table Wizard

- From the objects box in the Student Census database window, click Tables.
- Double-click Create table by using wizard. The Table Wizard dialog box opens.

- Click each of the tables in the Sample Tables list and scroll through the Sample Fields list.
- When you see a field that you want to include in your table, click it and then click the single right arrow next to the Sample Fields list. If you want to include all of the Sample Fields in one table, simply click the double right arrow.
- If you accidentally add a field that you don't want or add the same field twice, click it in the Fields in my new table list and then click the single left arrow to remove it.
- When you are satisfied with the fields in the table, click Next. If you need to later, you can modifj' the fields in the table using Design view.
- The Table Wizard provides a name for the table. Replace this name by typing the name desired by you.
- Make sure the option for the Table Wizard to assign a primary key is selected and then click Next.
- Click Finish to exit the Table Wizard.



Navigating in the table

Before you enter data into a table, you need to know how to move around in it. Depending on what you want to do, you can use the TAB key, the navigation buttons at the bottom of the table, the arrow keys, or the HOME, END, PAGE UP, and PAGE DOWN keys.

To move within a record

- To select any field, click it.
- To move one field to the right, press TAB or use the right arrow key.
- To move one field to the left, press SHIFT+TAB or use the left arrow key.

- To move to the first field of the active record, press'HOME.
- To move to the last field of the active record, press END.

To move from record to record

- To move to the next record, click the single right arrow next to Record.
- To move to the previous record, click the single left arrow next to Record.
- To move to the first or last record in the table, click the First Record or Last Record icon next to Record.
- To move one window down, press PAGE DOWN.
- To move one window up, press PAGE UP.

To add a field to a table

- Open the table in Design view.
- Click in the first empty row of the Field Name column.
- Type the field name. Press the DOWN ARROW to move to the next empty row if you want to add another field. A data type will automatically be assigned to the field (which you can change later).
- If the fields are in the wrong order, you can click to select a field and then drag it to where you want it to appear.
- When you have finished adding fields, save and close the table.

To delete a field from the table, select the entire row by clicking the leftmost box and then press the DELETE key.

To rename a field to your table

- Open the table in Design view.
- Select the row containing the field name you want to change by clicking it.
- Type the new field name in the Caption box under Field Properties.
- Save and close your table.

With the new AutoCorrect feature, the field name change is automatically updated in all queries, forms, reports, and pages that draw information from the table you have modified.

SETTING A DATA TYPE

The data type determines the kind of data that can be entered into a field. It. also formats the value you enter for the data type. For example, when you enter numbers in a field with a currency data type, the dollar and decimal signs will be automatically added to the numbers. Some of the more common data types are:

- Text. Any combination of letters and numbers.
- Currency. Numbers and monetary symbols. You can only add numbers to a field with a currency data type.
- Date/Time. The date and the time in 12- hour and 24- hour formats.
- Yes/No. A single value that indicates yes or no, true or false.

For information on the other data types, ask the Office Assistant.

Each field in an MS-Access table must be assigned a data type. The fields you select from the Table Wizard already have a data type assigned to them. Text is the default data type for any fields you add to your table.

Primary Key

The group of one or more columns used to uniquely identify each row of a table/ relation. Also, the constraints used to enforce that these columns are not null-able and are unique

- NOTE : You do not have to define a primary key, but it's usually a good idea. If you don't define a primary key, Microsoft Access asks you if you would like to create one when you save the table.
- For our example, make the Roll No field the primary key, meaning that every student has a roll number and no two students can have the same.

gjUjftljgB

- To do this, simply select the Roll No field and select the primary key button

- After you do this, Save the table

Foreign Key

When a primary key of one table appears as a field in another table, the field is called the foreign key in the second table. The foreign key is used to relate two tables.

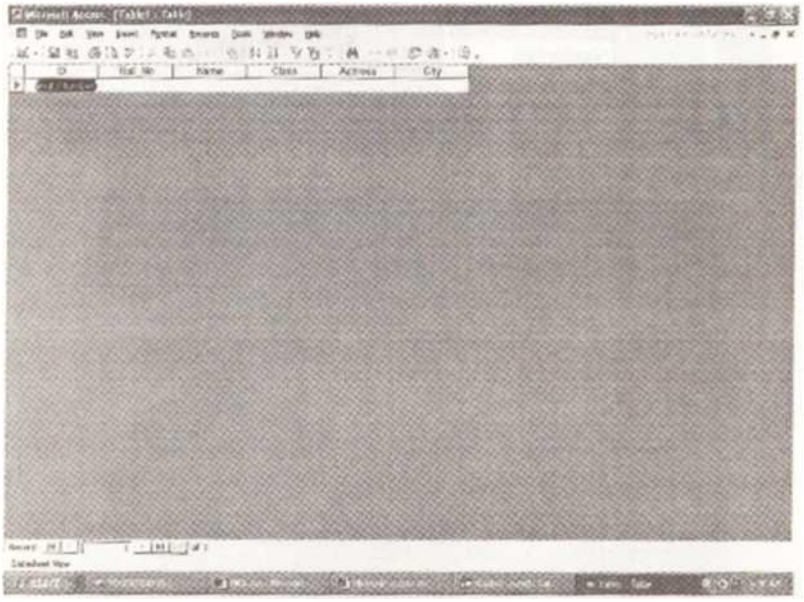
Switching Views

- To switch views form the datasheet (spreadsheet view) and the design view, simply click the button in the top-left hand corner of the Access program.

Datasheet View	Design View
Displays the view, which allows you to enter raw data into your database table.	Displays the view, which allows you to enter fields, data-types, and descriptions into your database table. i

Entering Data

Click on the Datasheet View and simply start "chugging" away by entering the data into each field.



NOTE : Before starting a new record, the Roll No field must have something in it, because it is the Primary Key. If you did not set a Primary Key then it is OK

Manipulating Data

- Adding a new row: Simply drop down to a new line and enter the information
- Updating a record: Simply select the record and field you want to update, and change its data with what you want
- Deleting a record: Simply select the entire row and hit the Delete Key on the keyboard

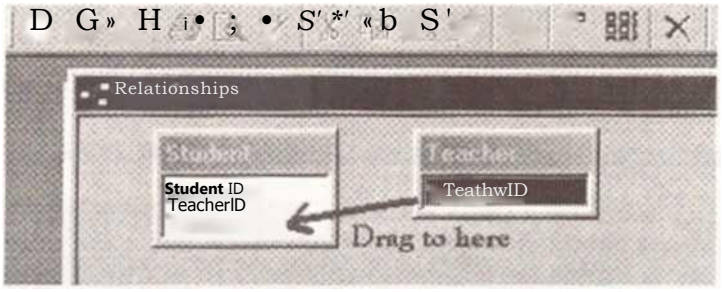
Relationships

After you've set up multiple tables in your Microsoft Access database, you need a way of telling Access how to bring that information back together again. The first step in this process is to define relationships between your tables. After you've done that, you can create queries, forms, and reports to display information from several tables at once.

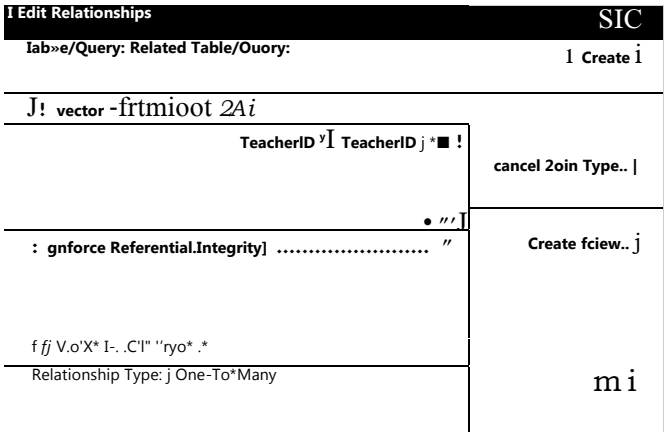
A relationship works by matching data in key fields - usually a field with the same name in both tables. In most cases, these matching fields are the primary key from one table, which provides a unique identifier for each record, and a foreign key in the other table. For example, teachers can be associated with the students they're responsible for by creating a relationship between the teacher's table and the student's table using the Teacher ID fields.

Having met the criteria above, follow these steps for creating relationships between tables.

1. In the database window view, at the top, click on Tools ’ Relationships
2. Select the Tables you want to link together, by clicking on them and selecting the Add Button
3. Drag the primary key of the Parent table (Teacher in this case), and drop it into the same field in the Child table (Student in this case.)



4. Select Enforce Referential Integrity



- When the Cascade Update Related Fields check box is set, changing a primary key value in the primary table automatically updates the matching value in all related records.
- When the Cascade Delete Related Records check box is set, deleting a record in the primary table deletes any related records in the related table

5. Click Create and Save the Relationship

13.3 FORMS

A form is nothing more than a graphical representation of a table. You can add, update, and delete records in your table by using a form. NOTE: Although a form can be named different, from a table, they both still manipulate the same information and the same exact data. Hcnce, if you change a record in a form, it will be changed in :he table also.

A form is very good to use when you have numerous fields in a table. This way you can see all the fields in one screen, whereas if you were in the table view (datasheet) you would have to keep scrolling to get the field you desire.

Creating forms

The easiest way to build a form is by using the Form Wizard. The Form Wizard lets you choose the layout of records in the form and also the background, color, and format of the display. The Form Wizard lets you preview the layout and style options when you create a form.

To create a form

1. Switch to the Database Window. You can do this by pressing FI 1 on the keyboard.
2. Click on the Forms button under Objects on the left side of screen
3. Double click on Create Form Using Wizard
4. On the next screen select the fields you want to view on your form. Most of the time you would select all of them.
5. Click Next
6. Select the layout you wish
7. Click Next
8. Select the style you desire...HINT: if you plan on printing your form, I suggest you use a light background to save on printer toner and ink
9. Click Next
10. Give you form a name, and select Open the Form and enter information 1 1. Select Finish

12. You should see your form. To adjust the design of your form, simply hit the design button (same as with the tables), and adjust your form accordingly To open a form stored in the database, double-click it in the main database window.

Navigating a form

Many of the techniques you used for moving around in tables also apply to forms :

- To add data to a record, click in the box in which you want to add data and then type.

- To delete information, double-click in a box to select the text and then press the DELETE key.
- To move from record to record, press the arrow keys next to Record at the bottom of the window.
- To add a record to a form, click the New Record icon on the Form View toolbar.
- To delete a record from a form, select it by clicking the bar on the left (indicating the whole record is selected) and then press the DELETE key Click Yes to delete.

Any changes you make to a record in a form automatically appear in the table that the form draws information from.

Finding records in a form

At times, you may want to make changes to a record in a database, but the rccord isn't visible when you open your form. You can quickly find a record, or information within a record, by using Find on the Standard toolbar.

To find a record

1. On a form, activate the field for which you plan to enter a value. For example, if you want to find the record for a person with the name "Rohit," click in the Name box of the visible record.
2. Click Find on the Standard toolbar.
3. In the Find What box, type what you are looking for.
4. Click Find Next to begin the search, and continue until all matches have been displayed.
5. Click Close to stop the search and close the window.

13.4 QUERIES

Queries are great for getting information from a database. With a query, you can filter the data that you view in a table. You establish a set of criteria when you create the query. Then when you run the query, Access returns only those fields or records that are of interest to you. The results appear in a table in Datasheet view.

The resulting collection of records, called a dynaset (short for dynamic subset), is saved as a database object and can therefore be easily used in the future. The query will be updated whenever the original tables are updated. Types of queries are select queries that extract data from tables based on specified values, find duplicate queries that display records with duplicate values for one or more of the specified fields, and find unmatched queries display records from one table that do not have corresponding values in a second table.

Create a Query in Design View

Follow these steps to create a new query in Design View :

- From the Queries page on the Database Window, click the New button.

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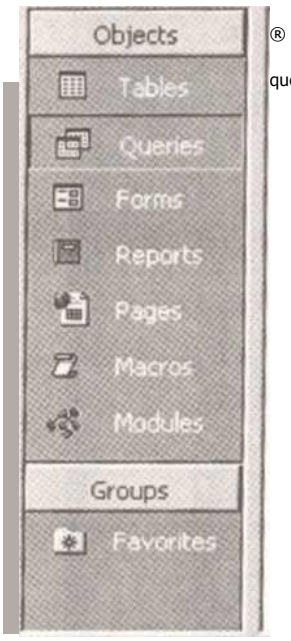
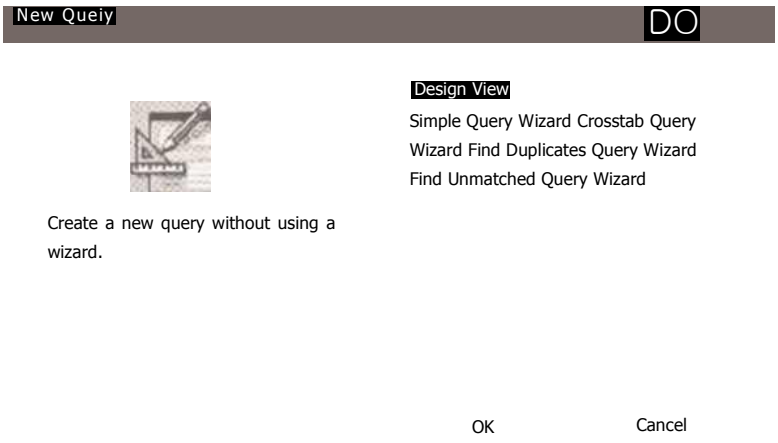


® j Create query in Design view @J Create query by using wizard



Select Design View and click OK.

Select tables and existing queries from the Tables and Queries tabs and click the Add button to add each one to the new query.

Click Close when all of the tables and queries have been selected.

Liu

Field:
Table:
Sort:
Show:
Criteria:
or:

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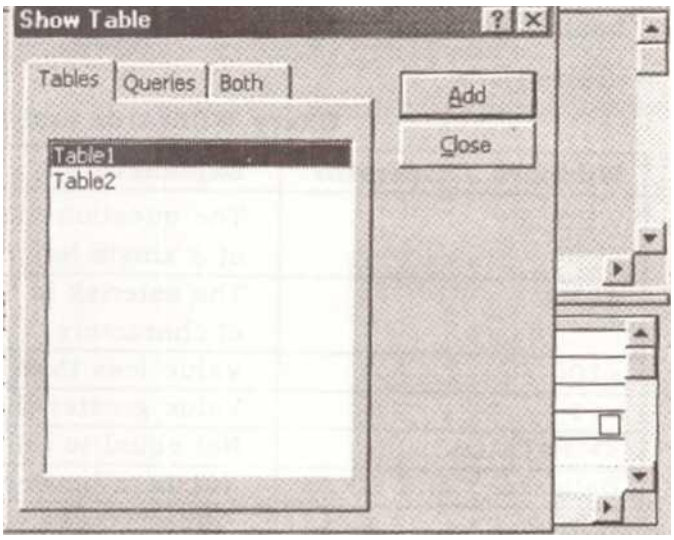
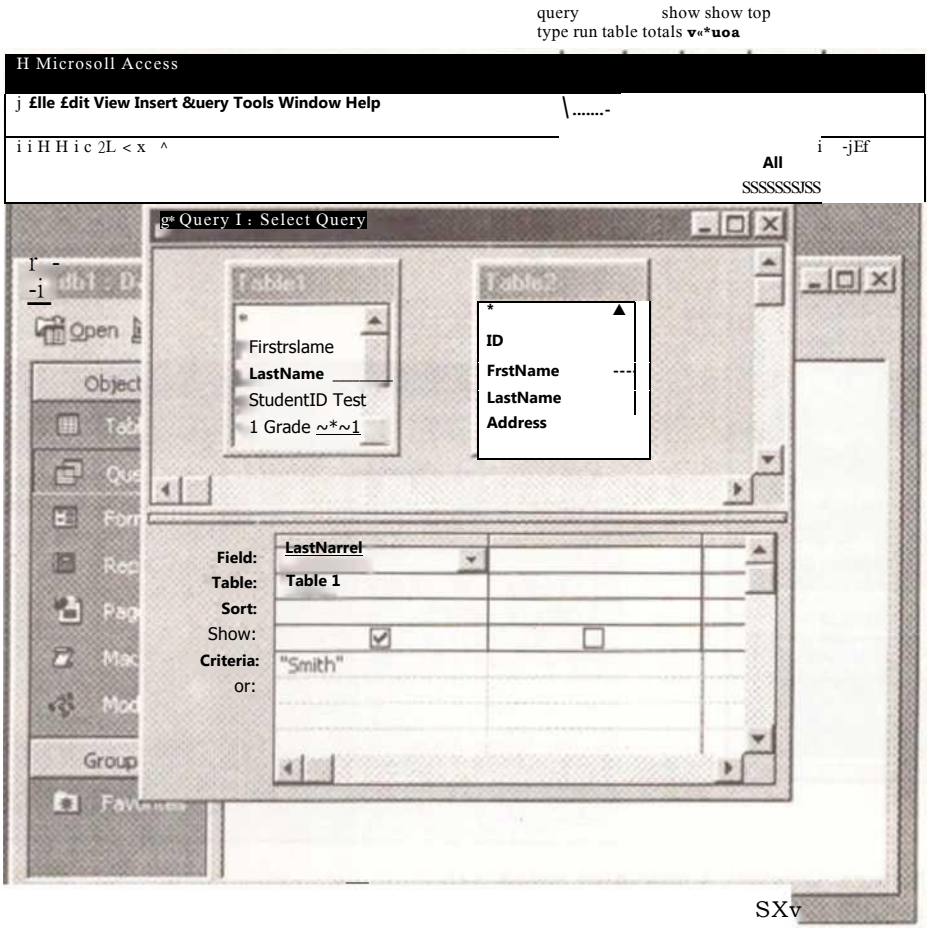


- Add fields from the tables to the new query by double-clicking the field name in the table boxes or selecting the field from the Field: and Table: drop-down menus on the query form. Spccify sort orders if necessary.



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- Enter the criteria for the query- in the Criteria: field. The following table provides examples for some of the wildcard symbols and arithmetic operators that may be used. The Expression Builder can also be used to assist in writing the expressions.

Query Wildcards and Expression Operators

Wildcard / Operator	Explanation
? Street	The question mark is a wildcard that takes the place of a single letter.
413th *	The asterisk is the wildcard that represents a number of characters.
<100	Value less than 100
>=1	Value greater than or equal to 1
<> "PATIALA"	Not equal to (all CITIES besides PATIALA)
Between 1 and 10	Numbers between 1 and 10
Is Null Is Not Null	Finds records with no value or all records that have a value
Like "a*"	All words beginning with ”a"
>0 And <=10	All numbers greater than 0 and less than or equal to 10

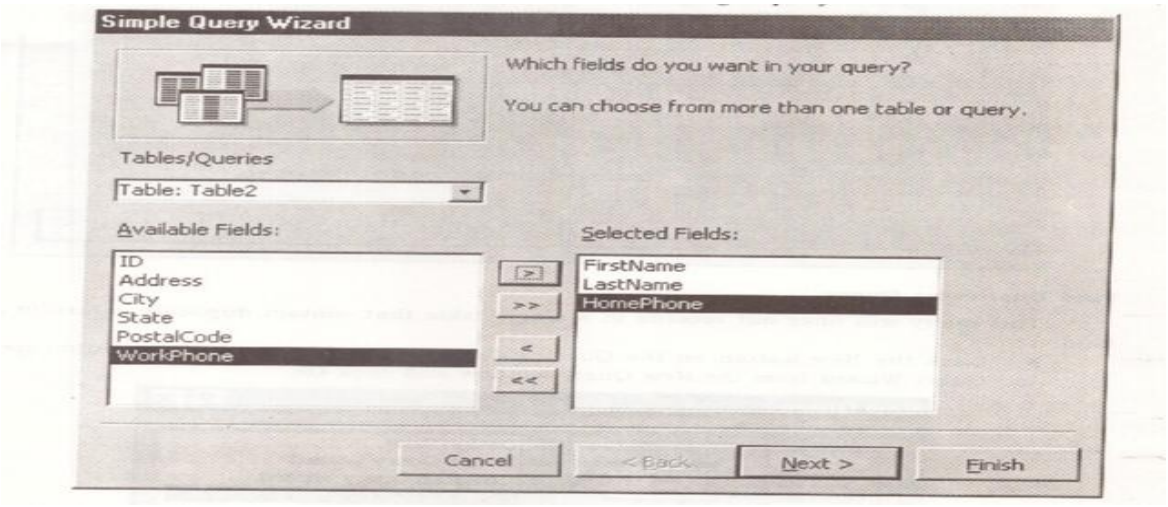
- After you have selected all of the fields and tables, click the Run button on the toolbar.
- Save the query by clicking the Save button.

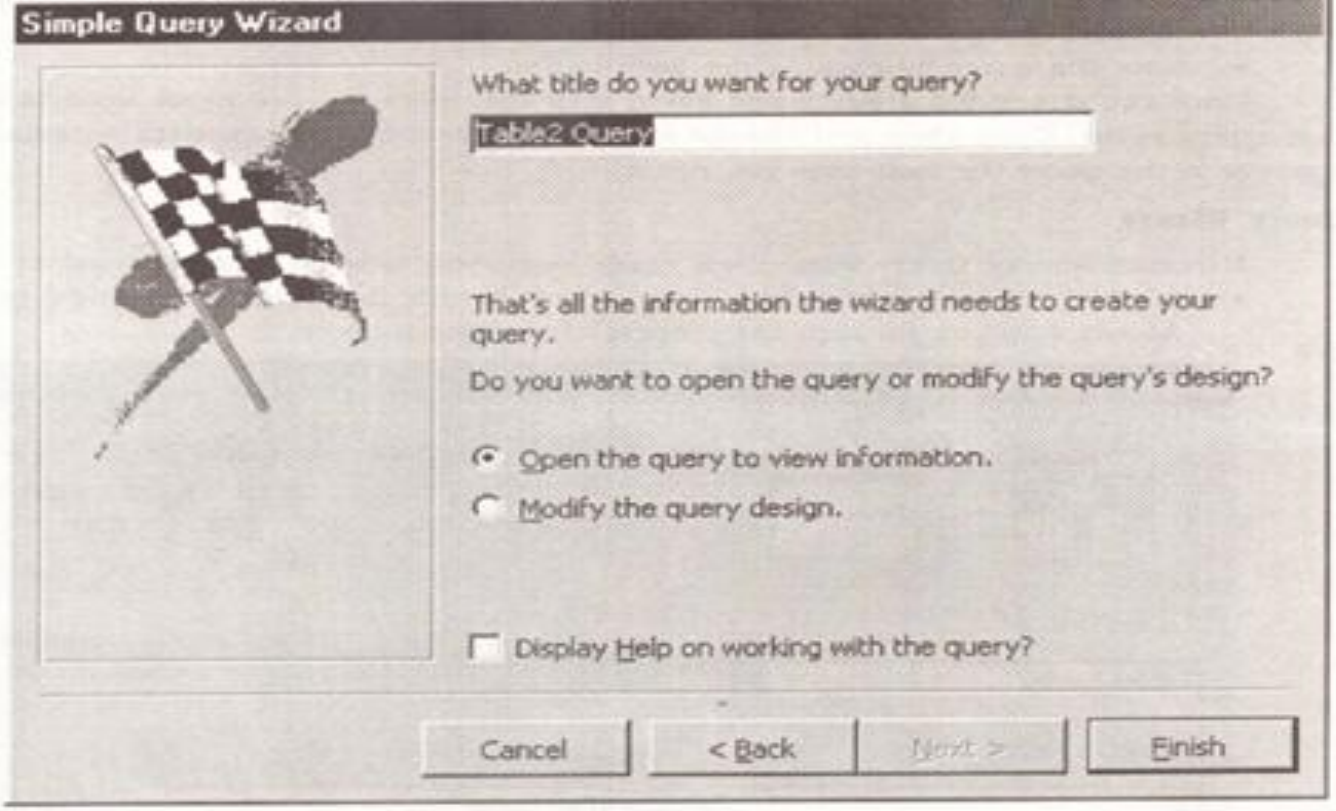
Once you've created a query and saved it in the database, you never need to create that query again. Even when you change or add new records, the new data automatically appears in the query the next time you run it.

Query Wizard

Microsoft Access' Query Wizard will easily assist you to begin creating a select query.

- Click the Create query by using wizard icon in the database window to have Access step you through the process of creating a query.

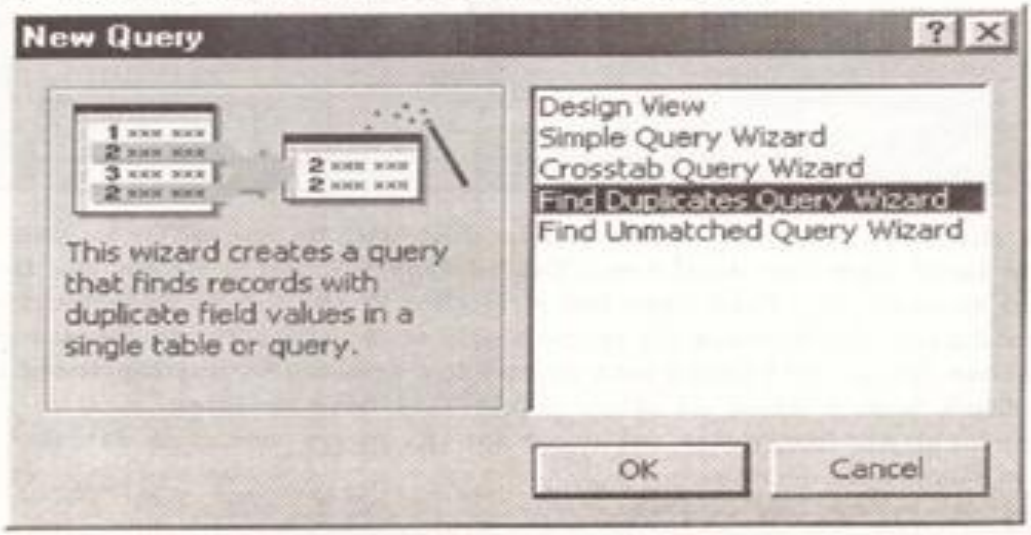


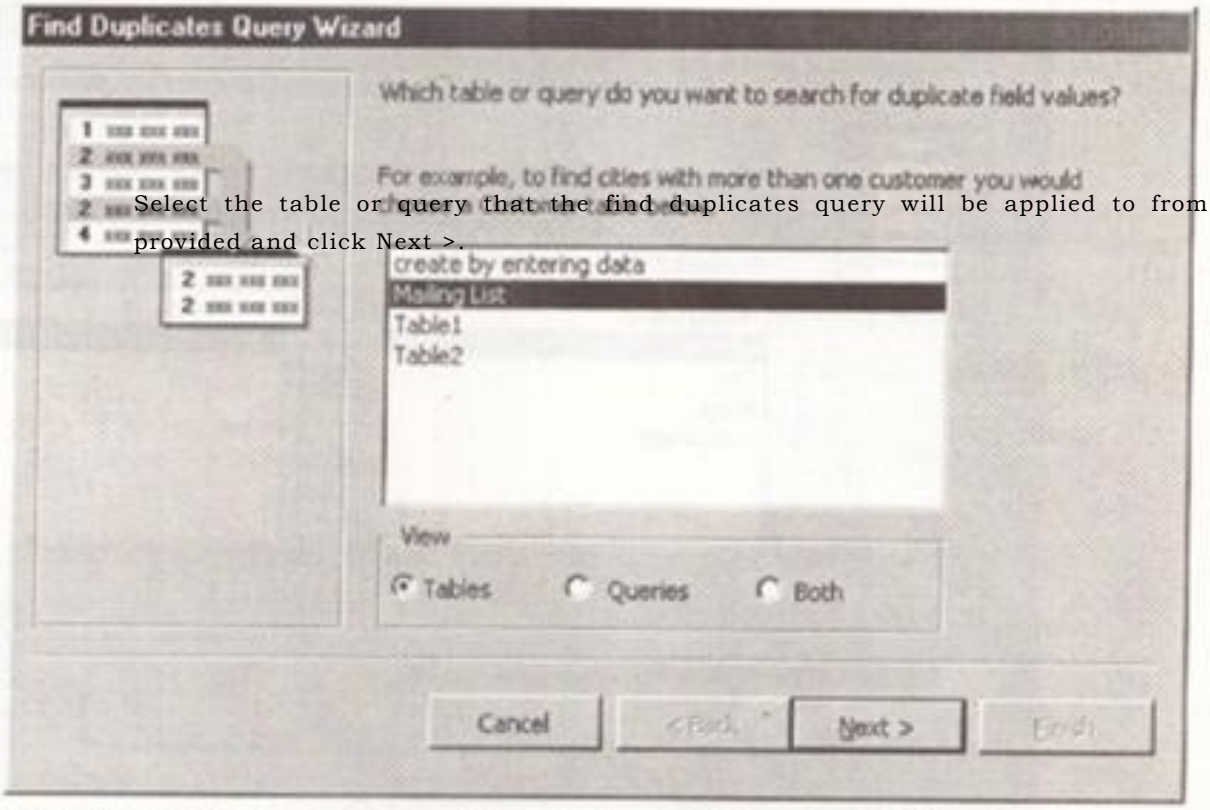


Find Duplicates Query

This query will filter out records in a single table that contain duplicate values in a field.

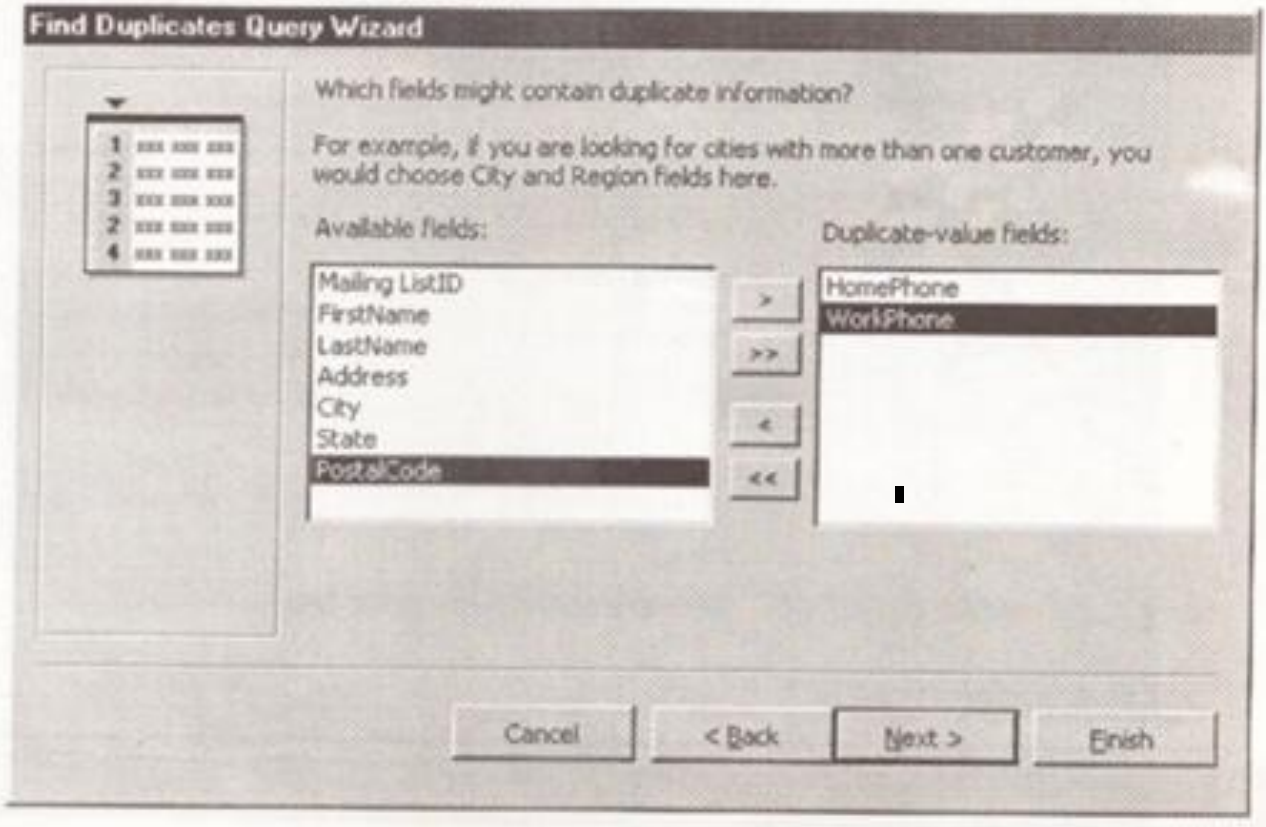
- Click the New button on the Queries database window, select Find Duplicates Query Wizard from the New Query window and click OK.





Select the table or query that the find duplicates query will be applied to from the list provided and click Next >.

- Select the fields that may contain duplicate values by highlighting the names in the Available fields list and clicking the > button to individually move the fields to the Duplicate-value fields list or >> to move all of the fields. Click Next > when all fields have been selected.



Cancel < Back I Next > Finish

Select the fields that should appear in the new query along with the fields selected on the previous screen and click Next >.

Find Duplicates Queiy Wizard

Do you want the query to show fields in addition to those with duplicate values?

1	XXX	XXX	XXX
2	XXX	XXX	XHX
3	XXX	XXX	XKK
2	XXX	XXX	XKH
4	XXX	XXX	XXX

For example, if you chose to look for duplicate City values, you could choose CustomerName and Address here.

Available fields;.

Additional query fields:

I'FirstName

LastName

City

State

PostalCode

Cancel <gack Next > Finish

Name the new query and click Finish.

Find Duplicates Query Wizard

What do you want to name your query?

imHMBMflBHH----------

Do you want to view the query results, or modify the query design?

*• View the results,

r Modify the design.

r Display Help on working with the query,

Cancel <gack . j Finish

Delete a **Query**

To Create a Delete Records Query :

1) Select the Create tab.
2) Click the Query Design icon.
3) Double click on the table(s) you wish to include in the query
4) Close the Show Table Dialog box
5) Select the fields that you would like to include in the query
6) Click the Delete Records Query icon.
7) In the Delete Where row, enter the criteria
8) Click the Run Query icon
9) Click yes to delete the records
10) Close and do not save the query
1 1) Open the table to see if the records where removed

13.5 REPORTS

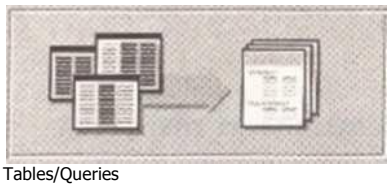
Reports will organize and group the information in a table or query and provide a way to print the data in a database. Reports let you customize the display of information from the database. You can select the data you want to include and then select the report layout from a variety of design and format options. You can insert pictures, add headers, footers, and page numbers, group the information, and change the background colors, among other things. When you design your first report, use the Report Wizard. The Report Wizard asks you a series of questions to help you design the data exactly as you want. After you have created the report, you can open it in Design view to modify its structure.

Using **the** Wizard

Create a report using Access' wizard by following these steps:

- Double-click the "Create report by using wizard" option on the Reports Database Window.
- Select the information source for the report by selecting a table or query from the Tables/Queries drop-down menu. Then, select the fields that should be displayed in the report by transferring them from the Available Fields menu to the Selected Fields window using the single right arrow button > to move fields one at a time or the double arrow button >> to move all of the fields at once. Click the Next > button to move to the next screen.

Report Wizard



Which fields do you want on your report?

You can choose Prom more than one table or query.

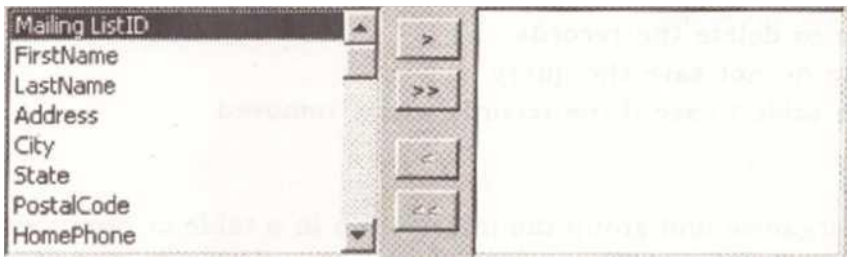
Tables/Queries

(Table: Mailing List

13

Available Fields:

Selected Fields:



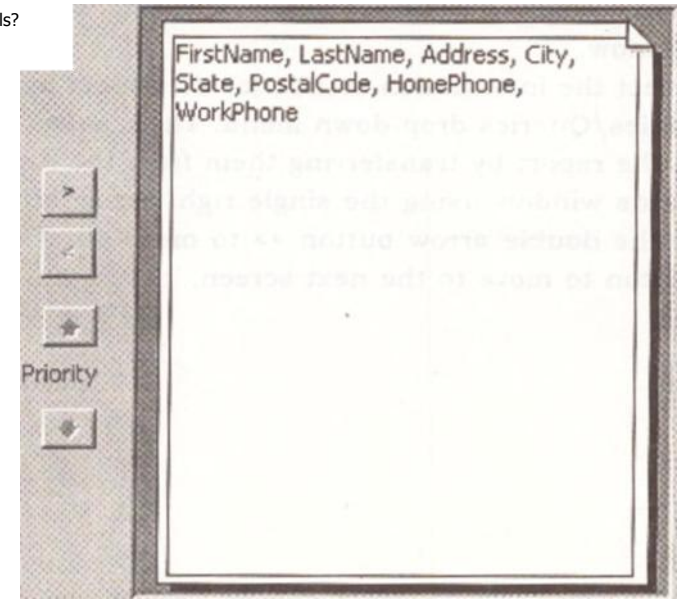
Cancel Next > Finish

Select fields from the list that the records should be grouped by and click the right arrow button > to add those fields to the diagram. Use the Priority buttons to change the order of the grouped fields if more than one field is selected. Click Next > to continue.

Report Wizard

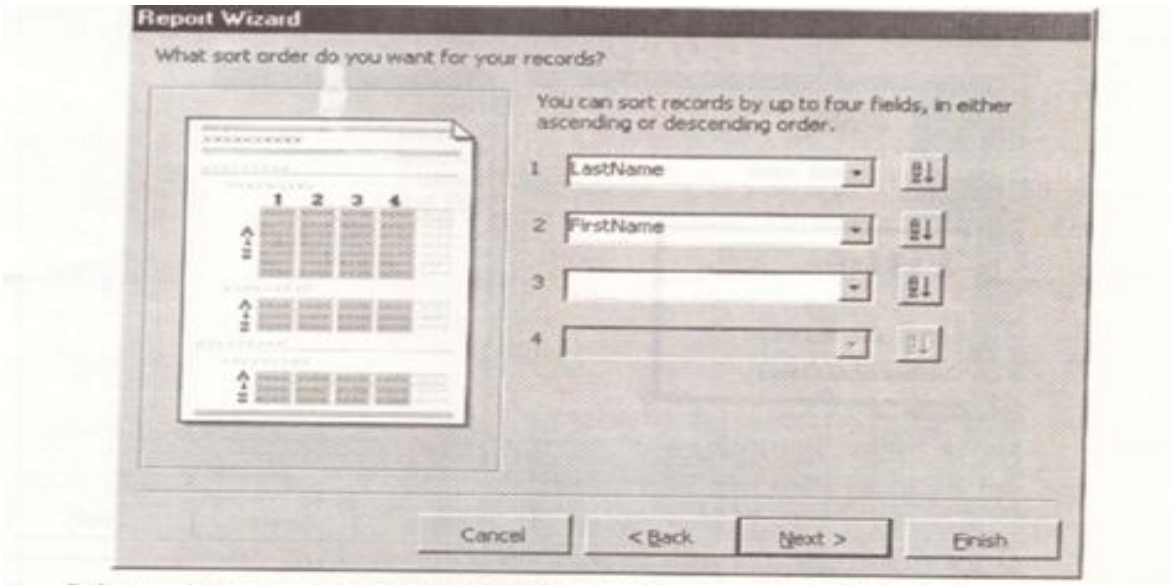
Do you want to add any grouping levels?

IFirstName
LastName
Address
City
State
PostalCode
HomePhone
WorkPhone

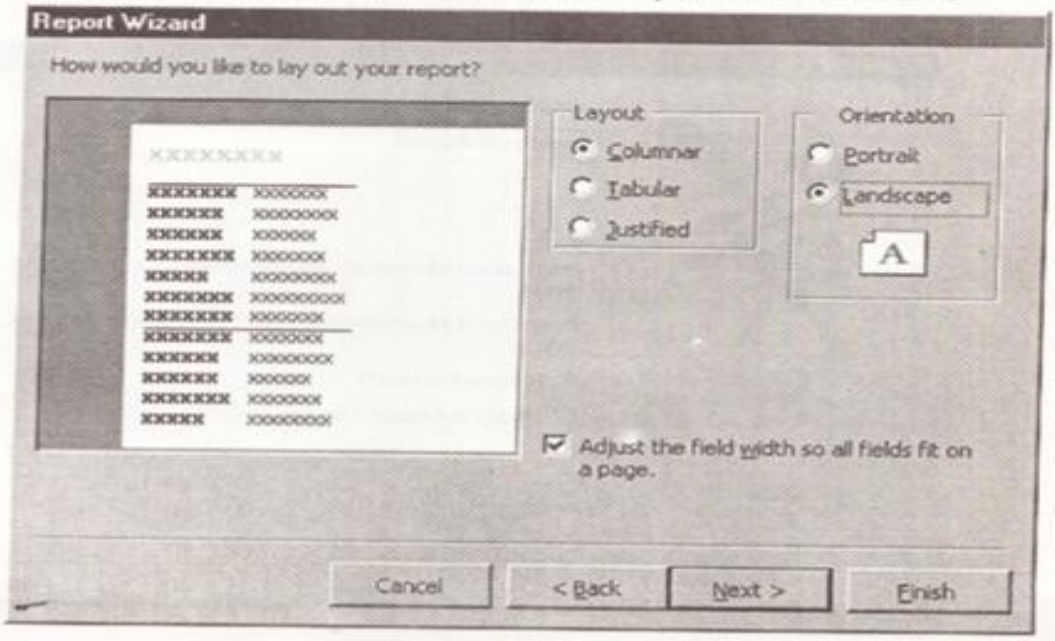


<£ack Next > Finish J

- If the records should be sorted, identify a sort order here. Select the firsi field that records should be sorted by and click the A-Z sort button to choose from ascending or descending order. Click Next > to continue.



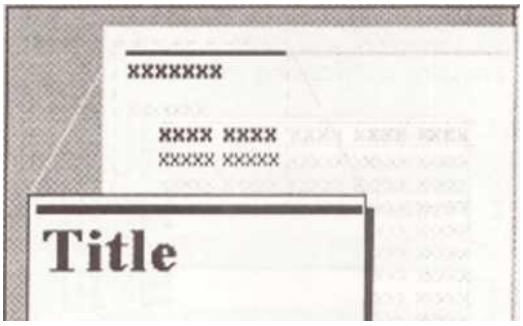
- Select a layout and page orientation for the report and click Next >.



- Select a color and graphics style for the report and click Next >.

Report Wizard

What style would you like?



Casual
Compact
Corporate
Formal Soft
Gray

Label above Detail

Control from Detail

Cancel < Back Next > Finish

On the final screen, name the report and select to open it in either Print Preview or Design View mode. Click the Finish button to create the report.

Report Wizard

What title do you want for your report?

{Mailing List Repor t|

That's all the information the wizard needs to create your report.

Do you want to preview the report or modify the reports design?

Preview the report.

Modify the report's design.

r Display Help on working with the report?

Cancel <£ack t&?7 finish

To insert a picture in a report

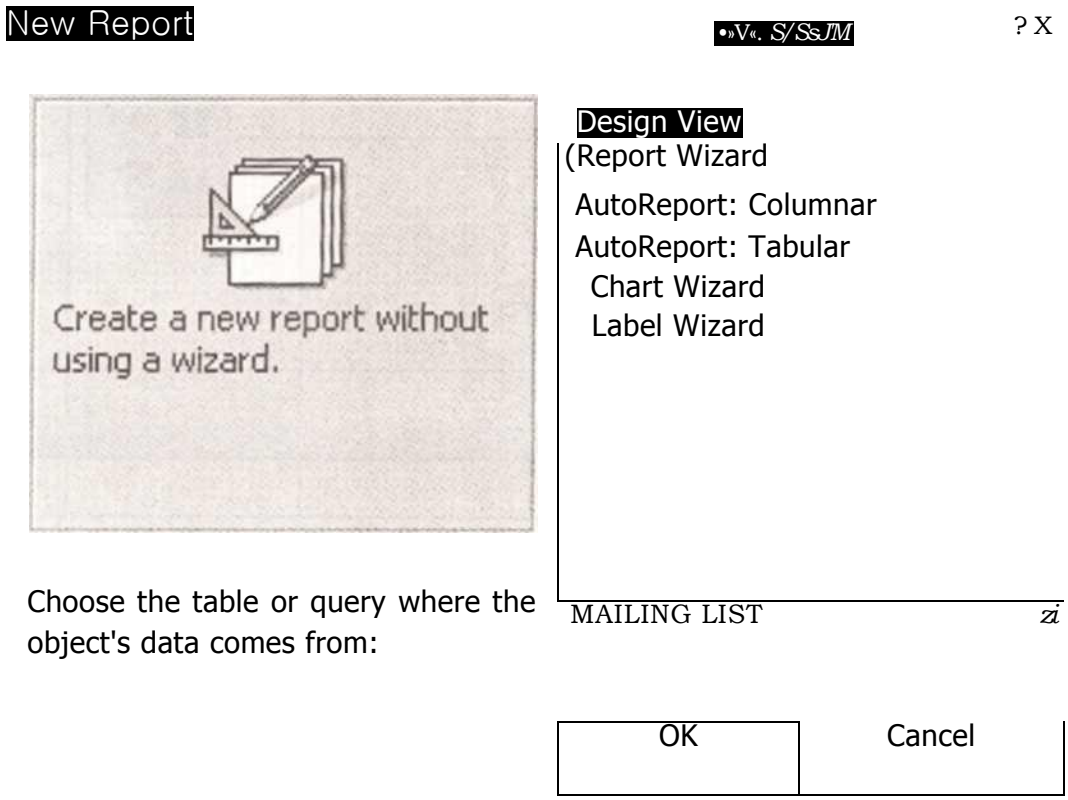
1. In Design view,'.click the section of the report where you want to insert a picture.
2. On the Insert menu click Picture.
3. From the drop-down list in the Insert Picture dialog box, select the folder containing the picture. Then double-click the file you want to insert.
4. Click OK. The picture is inserted into the selected area of the report.

Follow this same process for inserting hyperlinks, except click Hyperlink instead of Picture on the Insert menu.

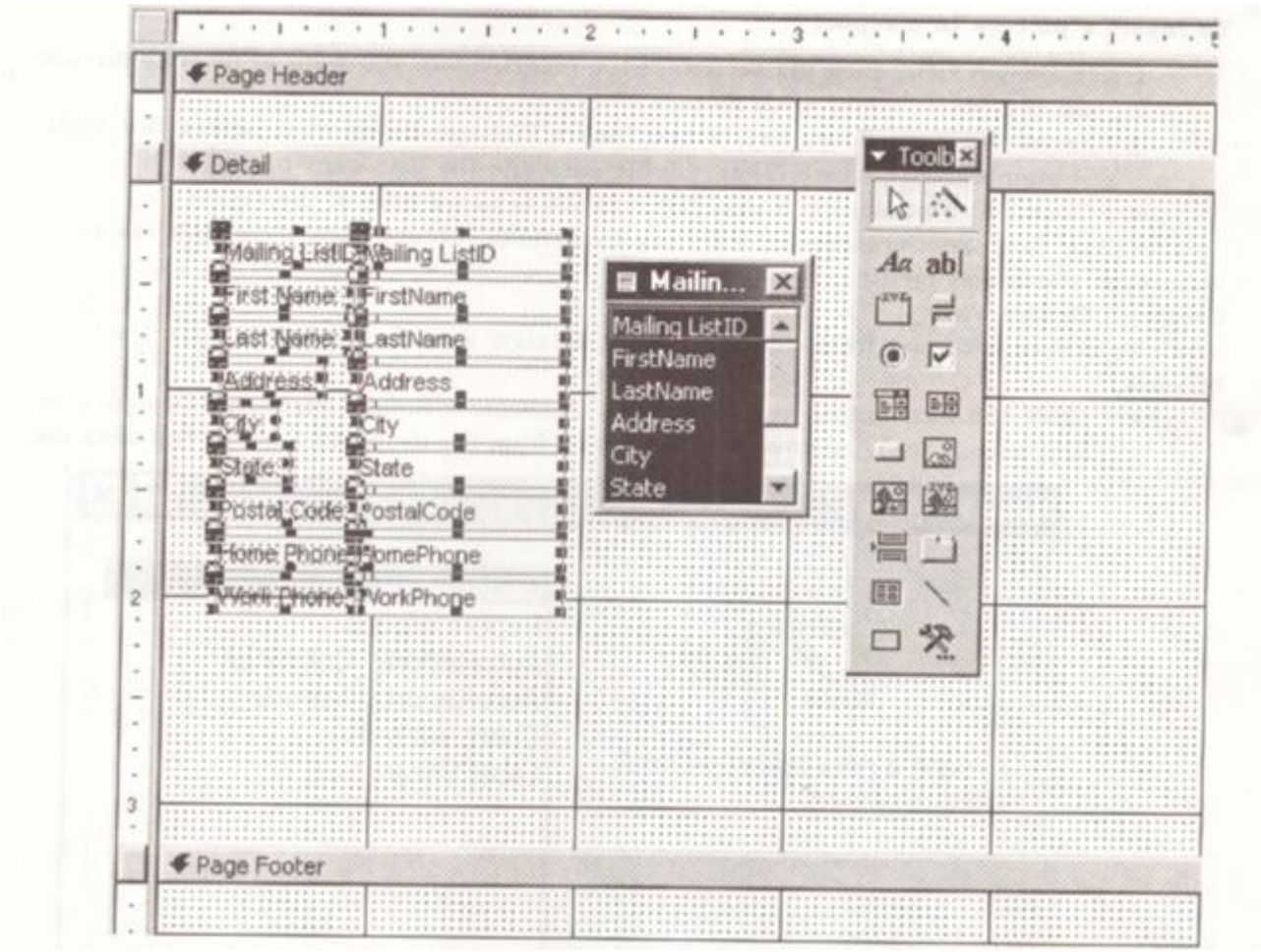
Create in Design View

To create a report from scratch, select Design View from the Reports Database Window.

- Click the New button on the Reports Database Window. Highlight "Design View" and choose the data source of the report from the drop-down menu and click OK.



- You will be presented with a blank grid with a Field Box and form element toolbar that looks similar to the Design View for forms. Design the report in much the same way you would create a form. For example, double-click the title bar of the Field Box to add all of the fields to the report at once. Then, use the handles on the elements to resize them, move them to different locations, and modify the look of the report by using options on the formatting toolbar. Click the Prir.t View button at the top, left corner of the screen to preview the report.



Printing Reports

Select File Page Setup to modify the page margins, size, orientation, and column setup. After all changes have been made, print the report by selecting File Print from the menu bar or click the Print button on the toolbar.

SELF CHECK EXERCISE 1

1. List the application areas of database
2. What is microsoft access?
3. Explain the term forms

Keywords: Database, keys, reports, Microsoft Access

REVIEW QUESTIONS

SHORT QUESTIONS

1. What is database
2. Explain briefly primary key and foreign key
3. How are forms created?

Long questions

1. Explain in detail what is microsoft access and how to create a database?
2. What are forms and how are they created?
3. What is a report and how are pictures inserted in a report?

SOLUTIONS TO SELF CHECK EXERCISE 13

1. Some of the applications are :
    a. Banking
    b. Airlines
    c. Educational Institutions
    d. Finance
    e. Sales
    f. Telecommunications
    g. Human Resources

2. Microsoft Access is a powerful program to create and manage databases. It has many built in features to assist users in constructing and viewing their information. Access is much more involved and is a more genuine database application as compared to others.