

1.1 System : Definition

A set of inter-related, inter-connected or inter-dependent elements that operates collectively to accomplish some common purpose or goal, is called SYSTEM."

For example :

Human Body

Elements : Head, Hand, Legs, Heart, Eyes, etc.
Objective : To make human life comfortable, tolerable and possible.

Computer

Elements : Monitor, CPU, Keyboard, Printer, Disks, Software etc.
Objective : Data Processing.

Business Organization

Elements : Men, Machine, Material, Method Money etc.
Objective : Maximization of Profit

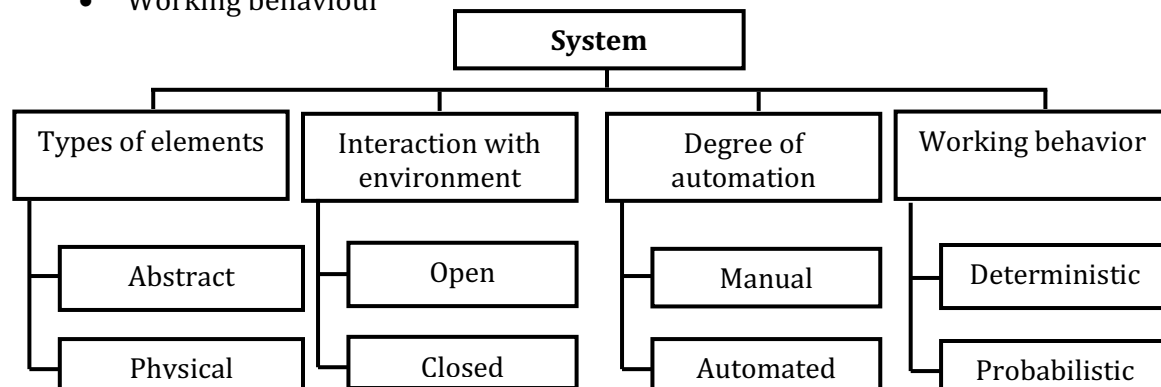
All the elements of a system can be classified into two main categories : **Abstract elements** and **Physical elements**. The elements which can't be seen and touched but their presence can only be felt are called Abstract and the elements which can be seen and touched are called Physical. E.g. –

- In a human body heart is a physical element and heart beats are abstract.
- In computer system CPU, VDU, keyboard are all physical element an the data, software are all abstract.
- In Business organization money, material machine are all physical elements and the business processes like marketing, forecasting, planning are abstract.

1.2 Types of System

We can distinguish systems on the following basis –

- Types of element
- Interaction with environment
- Degree of automation
- Working behaviour



1.2.1 Types of elements -

Depending upon the majority of elements we also classify system into two categories : **Abstract System** and **Physical system**.

1.2.1.1.1 Abstract System

Also known as Conceptual system, Abstract system is an orderly arrangement of concepts, ideas, of theories. For example – **Theology**, is a system of orderly arrangement of ideas about God and its relationship with Human.

1.2.1.2 Physical System

A physical system is a set of tangible elements operates together to accomplish objectives. For example – Computer system, Circulatory system, Transportation system etc.

1.2.2 Interaction with Environment -

	Open	Closed
1.	The system which interacts with its environment.	The system which does not interacts with its environment.
2.	It takes input from environment and gives output back to environment.	It neither take input nor provides output to environment Self contained, self sufficient systems.
3.	It gets influenced by the changes taking place in the environment.	It remains uninfluenced by the environmental changes.
4.	The life time OS such system is relatively longer.	It's life time is much shorter compared to open system.
5.	E.g. Business organization.	E.g. Use and throw digital watch.

1.2.3 Degree of Automation

	Manual	Automated
1.	Here data collection, manipulation and final reporting is done absolutely by human efforts.	Here computer or microprocessor perform all the tasks.
2.	It can handle less volume of data.	It can handle relatively huge volume of data which is not possible by human efforts.
3.	Their processing speed is relatively slow and change of human error is always there.	It offers quick and accurate processing of data.
4.	Data are difficult to transmit from one place to another.	Data can be transported easily through computer network.
5.	Data analysis can be done only on sample and conclusion is drawn about population.	Full population can be analysed.

1.2.4 Working behaviour

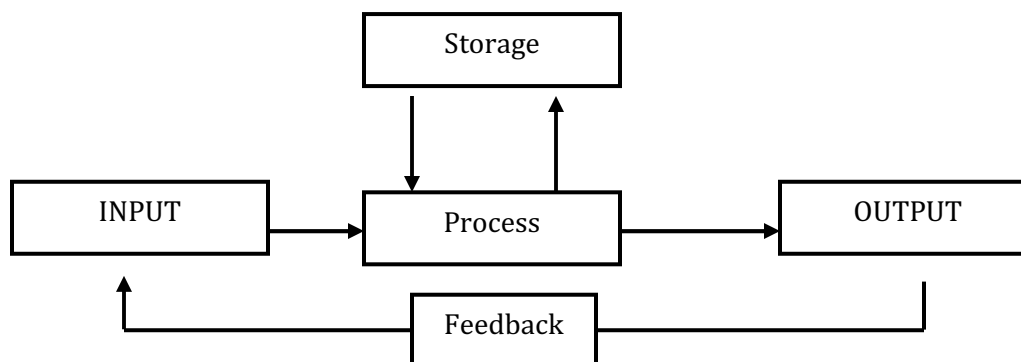
	Deterministic	Probabilistic
1.	It behave in a predictable manner.	It behaves in a unpredictable manner.
2.	If the current state of the system is known to us then its future state can be determined.	The future state can't be determined even if the current state is known for sure.
3.	It has strong relationship among elements.	It has weak relationship among the elements.
4.	An error free computer program is an example of such type of system.	Business organization is an example of such type of system.

1.3 System Entropy

- When system is put in use it depreciates. The quantitative measure of depreciation is called **Entropy**. If it is continue to exist in the system the system terminates soon in future.
- To offset the increase in entropy requires inputs of matter and energy to repair the system and extend it's termination. This maintenance input is called as **Negative Entropy**.
- Open system require more negative entropy than relatively closed system.

1.4 General Model of a system

A system, no matter in what way it defined, always takes some input, perform some value addition in the input and gives some output. Thus, A general model of a system can be drawn as –



A system may have many inputs and outputs.

Input is the data flowing into the system from outside. For example: A newspaper takes a news feed from a news wire service such as Reuters.

Processing is the action of manipulating the input into a more useful form. For example: The newspaper takes the pure text obtained from the news wire service and creates front page layout using pictures and formatted text.

Output is the information flowing out of a system. For example: The raw news wire information is viewed on your website as a story, all nicely formatted in the company style.

Storage is the means of holding information for use at a later date.

Feedback occurs when the outcome has an influence on the input.

1.5 System Environment

Like system, environment is also a set of elements operating together to achieve common goal. These elements surround the system and often interact with it. All systems function within some sort of environment.

The entity which separates system from environment is called **Boundary**. The system is inside the boundary and environment is outside of boundary.

System	Boundary	Environment
Human body	Skin, hair, nail, skull etc.	All things outside body
Computer	CPU, cabinet, wires, etc.	All things outside cabinets
Production	Machines, WIP inventory etc.	Rest of the company

An entity that can behave as both system as well as environment is called “**Supra system**”. In other words Supra system is a system consisting of other systems with which it interacts. For e.g. If we view business organization as environment then Marketing is system on the other hand is Market research, Sales, Advertising are systems then Marketing is environment, so ideally Marketing is a supra system.

1.6 Sub-system

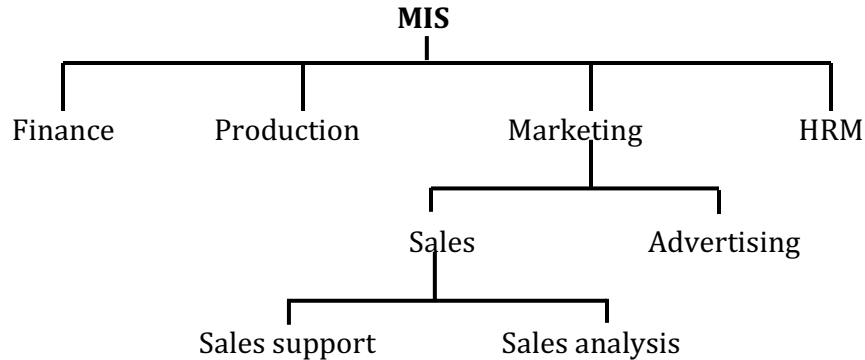
One of the main property of a system is that it should be divisible into sub-systems. For two main reasons this sub-division of the system is required : **Development** and **Analysis**. A new system can't be developed if it is not considered as set of sub-systems and an existing systems can't be analysed as a single entity.

1.6.1 Characteristics

With respect to sub-system every system has the following characteristics:

1.6.1.1 Decomposition

The process of dividing a system into sub-systems is called **Decomposing**. Since a large complex systems is difficult to understand when considered as a whole, therefore it is decomposed into sub-systems. The process of decomposition is continued with sub-systems further divided into smaller sub-system until a sub-system of manageable size is obtained.



Decomposition into sub-system is used to analyse an existing systems and to design and implement a new system. The designer decided how to factor i.e. where to draw boundary. The decision will depend on the objective of the decomposition and also on individual designer.

1.6.1.2 Simplification

No sub system can work in isolation to each other in order to achieve objective of the system, therefore we need to establish interconnection between them. As such the no. of interfaces between subsystems of a system can be calculated by the formula – “ $n(n - 1) / 2$ ”, where n is the number of subsystems.

More the number of subsystem, more will be the interfaces. It will make the system a complex entity. Simplification can be defined as the process of reducing the number of interfaces between the subsystems without reducing number of sub systems.

1.6.1.3 Decoupling

It is the strength with which subsystems are connected with each other. If two different subsystems are connected very tightly, very close coordination between them is required. For e.g. – If the raw material is put directly into production the moment it arrives then raw material and production systems can be said to tightly coupled. Raw materials inventory allows material subsystem and production system to work somewhat independently.

The standard decoupling allow a subsystem to plan and organize its operations with reduced need to communicate with other subsystems i.e. two subsystems can run independently.

1.7 System Stress and Change

Every system operates within some sort of environment which is also called its Supra system. System Stress is a force transmitted by a system's supra system that causes a system to change, so that the supra system can better achieve its goals. In trying to accommodate this stress system may impose stress on its subsystems and so on.

- System Stress can be classified into two categories
 - i. Stress to change the entire goal set and
 - ii. Stress to change the level of achievement of goals.
- System accommodate stress through making some relevant changes in the form as –
 - i. Structural change
 - ii. Procedural change

1.8 Information

According to Davis and Olson –

“Information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current and progressive decision.”

The term data and information are often used interchangeably. However the relation of data to information is that of raw material and finished goods. Information is a basic resource in the modern society. It is a substance on which business decisions are based. Therefore the quality of decision depends upon the quality of information. This phenomenon is also called GIGO (Garbage In Garbage Out).

Some of the attributes of information are –

- a. **Availability** – available on time
- b. **Purpose** – recipient must have some purpose
- c. **Mode and Format** – audio, video, printed; paragraphical, tabular, graphical
- d. **Decay** – refreshed time to time
- e. **Rate** – speed of transmission
- f. **Frequency** – repetition
- g. **Completeness** – relevancy
- h. **Reliability** – degree of significance must be marked
- i. **Cost Benefit analysis** – must be cost effective
- j. **Validity** – period of use
- k. **Quality** – unbiased
- l. **Transparency** – must reveal the facts to take the decision
- m. **Value** – value must be positive

1.8.1 Type of Information

In the context of business organization, information can be divided into two categories : **Internal** and **External**.

1.8.1.1 Internal Information

- The information which is collected from the sources, internal to the organization are called Internal Information.
- These information are generated from the operations of the organization at various functional level.
- These information always pertains to the various operational units of the organization.
- These information are generally required by middle or supervisory level of management.
- Production figures, sales forecast, budgets, stock level, employee's data, accounting reports are the examples of internal information.

1.8.1.2 External Information

- The information which is collected from the sources external to the organization are called External Information.
- These informations are generated in the external environment of the organization.
- These information are considered to affect the organizational performance in the external environment.
- These informations are generally required by top level management.
- These information are used in the planning process of management to give shape to its future.
- Govt. policies, Economic trends, Market information, Competitive information etc. are the examples of external information.

1.9 Information system and its role in management

- IS will help managers in effective decision-making.
- Based on IS, organization will gain edge in the competitive environment.
- IS helps taking right decision at the right time.
- Knowledge gathered through IS is useful in unusual situation.
- IS can be integrated to formulate a strategy of action.
- IS ensures pervasiveness of decision making.
- IS makes the organization transparent.
- IS helps managerial learning about organization.

1.10 Factors on which information requirement depend

Information requirement of managers depends upon their **functional area**, **type of decisions** they are taking and the **level of management** they are in.

1.10.1 Operational Function

- Organization sub-systems are called operational function. Such as Marketing, Finance, Production etc.
- Information requirement depends heavily upon operational function in a sense that marketing managers need information relating to marketing activities, production managers need production related information and similarly other department heads needs information related to their functional area.
- The information requirements here, differs not only in respect of contents but also in characteristics from one operational function to other.

1.10.2 Type of Decisions

	Programmed	Non-Programmed
1.	Routine.	Non-Routine.
2.	Repetitive.	Non-Repetitive.
3.	Time-tested.	Unique.
4.	Set procedure to take such decisions.	Not set procedure.
5.	Taken for familiar problems.	Taken in unfamiliar problems.
6.	There is single best way to solve.	No single best way.
7.	Taken by middle or supervisor level.	Taken by top level of management.
Information requirement difference		
1.	Information need is known in advance.	Not known in advance.
2.	Information required is available with MIS.	Generally not be available.
3.	Structured information is required.	Semi-or un-structured information.
4.	Managers rarely need information in these decision making problem.	Information is required in such problems.
5.	Information is sufficient to solve such type of problems.	Information forms only a part to of knowledge needed to solve problems.
6.	Mostly internal information needed.	Mostly external information is needed.

1.10.3 Level of Management

Different levels of managements are Top, Middle and Bottom and their information requirement differs as follows –

a. Top or Strategic level –

Positions : Chairman, Management Director, CEO or other positions directly responsible to the whole organization.

Functions : Setting corporate goals and objectives
Developing long range plan
Developing business policy
Taking strategic decisions

Information requirement :

- Mostly futuristic information is required which are of external in nature.
- Information is not fully accurate.
- Information may not be available on time.
- Information is not enough to take decision.
- Summary level information is required.
- They need more external information then internal.

b. Middle or Tectical Level

Positions : Head of the functional department such as Managers Sales, Manager Production, Manager Finance etc.

Functions : Elaborate & classify corporate goals to create department goals.

Formulation of plans and strategies to achieve them.

They set the operating policy and procedures

Identification and acquisition of resources

Short range decision.

Information requirement :

- They get information from both top and supervisory level management.
- Does not require futuristic information.
- They are interest in data of present performance of company.
- Information is needed equally from both the internal and external sources.

c. Bottom or Supervisory Level –

Positions : Section officer, Superintendent, Foreman, Supervisor, Officer-in-Charge.

Functions : Operationalise the plans developed by higher level of management.

Instruct and supervise the efforts of blue coller employee.

Implementation of corporate policy.

Taking routine and daily decisions that do not require much judgement.

Information requirement :

- They get information from routine business activities
- Mostly they need informations from internal sources.
- Their decision are totally based on information provided.

1.11 CBIS

CBIS is kind of information system where computer does most of the operations.

1.11.1 Components

A CBIS consists of following components -

1.11.1.1 Hardware

The term hardware refers to the machinery including input devices, output devices, CPU, storage devices / media and communication devices.

1.11.1.2 Software

The term software refers to the computer programs and manual procedures that convert data into information.

1.11.1.3 Data

Data are facts that are used by programs to produce useful information. They are generally stored in machine-readable form.

1.11.1.4 Procedure

Procedures are the policies that govern the operations of computer system. For e.g. – Login procedure, Backup and Recovery procedure etc.

1.11.1.5 People

User, programmer, system analyst and DBA are some of the people associated with CBIS. People influence the success or failure of the system.

All system are designed and work for pre-determined objectives.

1.11.2 Characteristics

- All system are designed and work for pre-determined objectives.
- A system has a number of inter-related and inter-dependent subsystems. No subsystem can function in isolation.
- If one subsystem of a system fail, generally, the whole system does not work. However it depends on decoupling of subsystems.
- Subsystem interact with reach other to achieve goal of the system.
- The work done by individual subsystem is integrated to achieve the central goal of the system.

1.11.3 Types of CBIS

1.11.3.1 Finance and Accounting system

The objectives of this system is to improve the quality of the operations such as – Budgeting, Forecasting, Financial accounting, General ledger, Accounts Receivable / Payable, Investment management, Cash / Debt management etc.

1.11.3.2 Marketing and Sales system

The objectives of this system are maximize sales, ensure customer satisfaction, advertising for products and services, order processing, generating bills and customer services.

1.11.3.3 Production or Manufacturing system

The objectives of this system are: Optimally deploy man, machine and material to maximize production or service, production scheduling, Quality control and plant maintenance.

1.11.3.4 Inventory Management system

The objectives of this system are: keeping track of material, regulate the maximum and minimum level of stock, performing ABC analysis, XYZ analysis etc.

1.11.3.5 HRM system

The objectives of this system are: Recruitment, Selection, Training, Compensation, Transfer and promotion, Keep track of leave record etc.

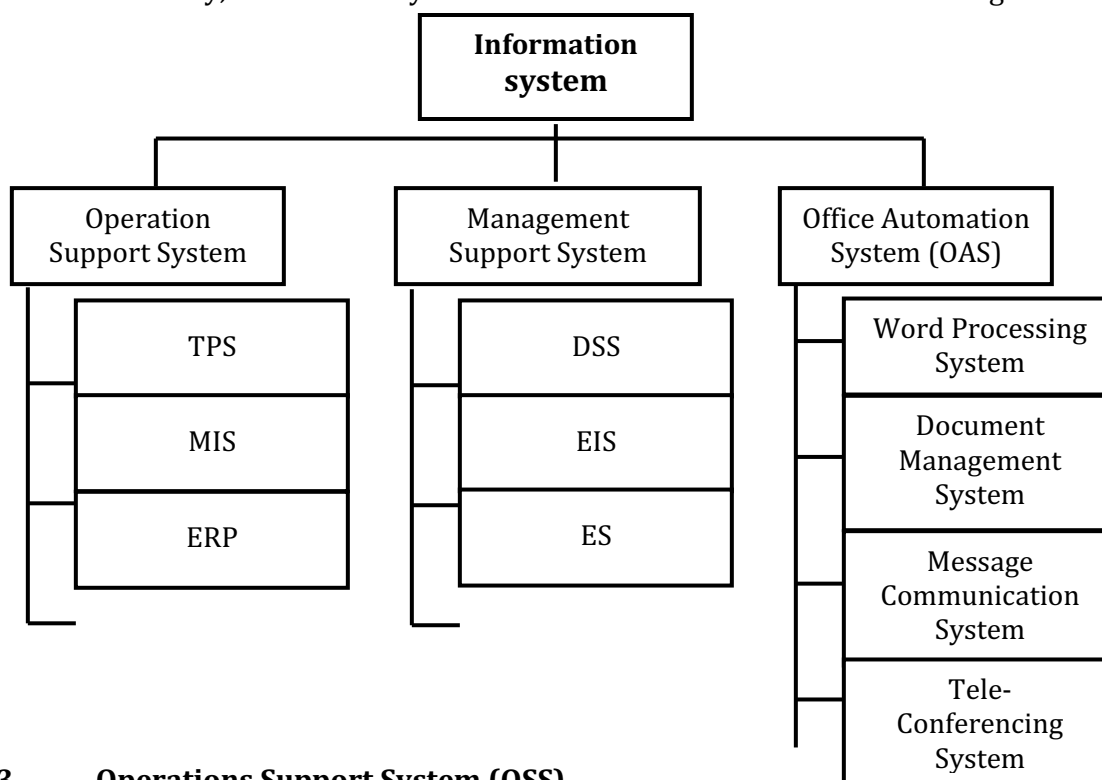
1.12 Type of Information Systems

Management at different level take decisions matching to their hierarchy position in the organization and different types of information system are designed and developed for them.

The lowest level is managed by operational level managers. The routine office work are mostly done at this level. No decision making process is carried out here but proper organization and processing of data is important task. So, data processing systems like **TPS** are developed for them.

The middle levels management is responsible for routine decision making. In order to help them information system like MIS is designed for them. It collects data from internal and external sources and provides information to management. The top level management is responsible for non-routine, strategic decision making. In order to help them information system like DSS is designed for them. It helps them by providing information and decision model.

Primarily, information system can be classified into three broad categories –



1.13 Operations Support System (OSS)

OSS is aimed to improve operational efficiency of the enterprise. It is further classified into three categories : TPS, MIS and ERP.

1.13.1 Transaction Processing System

- All business activity such as Sales, Purchase, Production, Transportation, Payment, Receipt etc. involves transaction and these transactions are to be organized and manipulated to generate information.
- TPS is fully automated system which is aimed at improving routine transaction processing activities. Reports generated by TPS are used by bottom level of management.
- Typically, TPS involves the following activities –
 1. Capturing data to organize in files or databases.
 2. Processing of files / database using application software.
 3. Generating information in the form of reports.
 4. Processing of queries from various functional areas of organization.
- **TPS Components –**

INPUT: Source document such as customer order, sales slips, invoices, purchase orders employee time cards etc are inputs to TPS. They serve several purposes -

 - ◆ Capturing data
 - ◆ Communicating facts
 - ◆ Standardization of data recording
 - ◆ Permanent record, if retained

PROCESSING : TPS employee two mode of data processing : Batch and On-line processing.

STORAGE: Ledger and files provides storage of data in TPS.

OUTPUT : Any document generated in the system is output. Some output of TPS sever the purpose of input to other system
- **Features of TPS –**
 - ◆ *Large volume of data:* TPS is transaction-oriented hence it generally handles large volume of data.
 - ◆ *Automation of basic operations :* TPS aims to automate the day-to-day functioning of the enterprise.
 - ◆ *Benefits are easily measurable "*.Most of the benefits of TPS are tangible and easily measurable.
 - ◆ *Source of input for other systems:* Output of TPS is used as input to other systems.

1.13.2 Management Information System(MIS)

Traditionally Only 5 resources were needed by managers to run a business organization and they are **5M's** : Men, Money, Machine, Material, Method. But today due to volatile and complex business environment and intense competition, **Information** is regarded as an important resource by managers to manage business.

MIS is an organization's functional area that provides this information to managers. It is obligatory for any organization to provide right information, in right quantity, to right person, at right time. MIS deals with the critical information that effects the success of any business organization. MIS is a tool for better management and scientific decision making.

1.13.2.1 Definition :-

According to G.B. Davis -

MIS is an : Integrated man- machine system,
for providing timely information to managers,
to support managerial function and decision making.

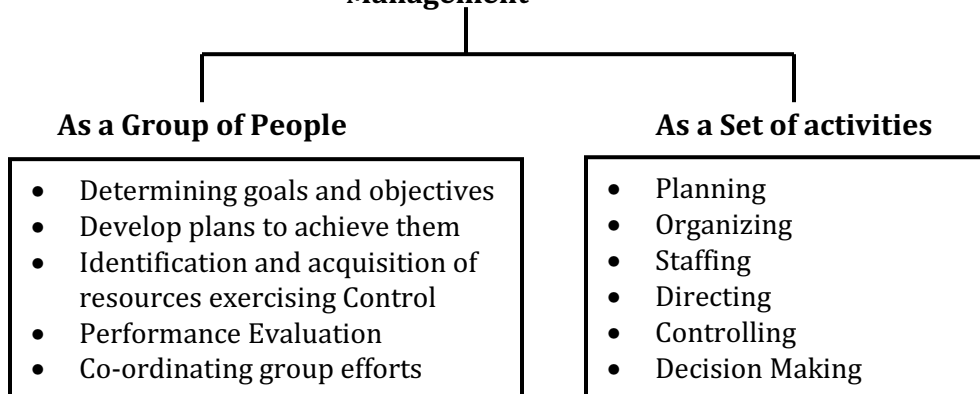
It utilizes : Computer Hardware and Software,
Manual procedures,
Decision Models and
Data Bases

1.13.2.2 Elements of MIS:-

MIS consists of 3 elements : **Management, Information** and **System**.

i.

Management



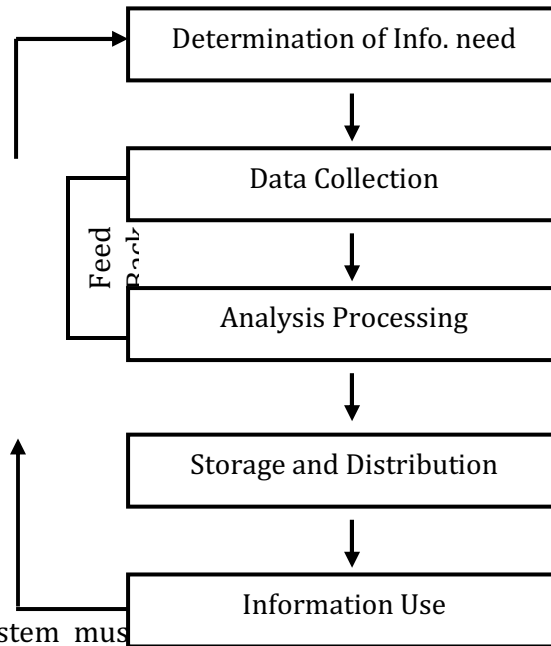
ii. **Information**

According to Davis and Olsan -

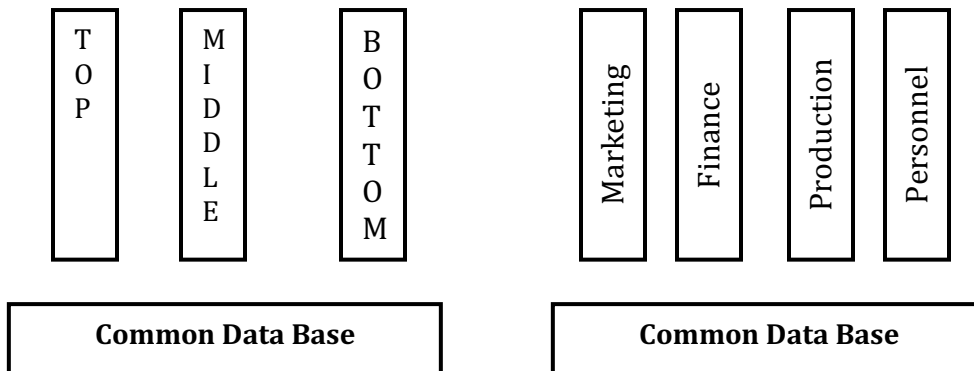
“Information is data that has been processed into a form that is meaningful to the recipient and is of some value in current or progressive decision”.

iii. **Systems**

A set of elements which are interdependent, interacting and operating together to achieve a common goal. Example – Business organization, Computer, MIS etc. since MIS can be defined as system following is the diagram showing functions of MIS as system –



As every system must have feedback, MIS is also divided into sub-systems as follows –



1.13.2.3 **Characteristics of an effective MIS :-**

- [1] **Management Oriented:** It means that effort for the development of the information system should start from an appraisal of management needs and overall business objectives.
- [2] **Management Directed:** Because of management orientation of MIS, it is necessary that management should actively direct the system's development efforts.

- [3] **Integrated:** Development of information should be an integrated one which means that all the functional and operational information sub-system should be tied together into one entity.
- [4] **Common Data Flows:** It means the use of common input, processing and output procedures and media whenever required.
- [5] **Heavy Planning Element:** An MIS usually takes 3 to 5 years and sometimes even longer period to get established firmly within a company.
- [6] **Sub System Concept:** Even though the information system is viewed as a single entity, it must be broken down into digestible sub-systems which can be implemented one at a time by developing a phasing plan.
- [7] **Common Database:** Database is the mortar that holds the functional systems together. It is defined as a “super-file” which consolidates and integrates data records formerly stored in many separate data files.
- [8] **Computerized:** Though MIS can be implemented without using a computer, the use of computers increases the effectiveness of the system.

1.13.2.4 Misconception about MIS :-

- ❑ The use of MIS is about the use of computer.
- ❑ More data in reports means more information for managers.
- ❑ Accuracy in reporting is important.

1.13.2.5 Pre-requisites of MIS :-

An effective MIS should have the following ingredient ready before it is operationalised -

a. Data Base -

A rich data base is required for an effective MIS. This database should be -

- ❑ User oriented
- ❑ Common to all Sub-system
- ❑ Accessable to authorised person only
- ❑ Controlled by separate authority

b. Qualified system and Management Staff -

- ❑ Success of any system depends upon the people who operate it, their knowledge and experience.
- ❑ MIS need 2 type of experts:
 - (i) System expert
 - (ii) Management expert
- ❑ System expert in addition to their expertise should also understand management concepts and processes of decision making.
- ❑ Management expert should understand the concept and operations of computer.
- ❑ This pre-requisite is confronted with many problems such as non-availability of experts, their high turnover, high mobility. These can be offset by recruiting fresh candidate and developing them accordingly.

c. Support of Top Management -

For the 2 main reasons support of top management is required -

- (i) To obtain data from sources
- (ii) To get funds in order to acquire the resource involved in computer based system.

To gain support of top management MIS should place, before top management all the facts and the benefits to the organization from MIS.

d. Control & Maintenance of MIS -

- ☐ Users sometimes creates shortcut to use the system, which reduce effectiveness of MIS. A control plan should be developed to check such practices.
- ☐ Similarly there are times when improvements in the system is required. Formal plan & methods should be devised to provide periodic maintenance to the system.

e. Evaluation of MIS -

Evaluation of MIS means testing -

- ☐ Whether it is capable of meeting current and future information requirement of managers or not.
- ☐ Whether it is enough flexible to meet changing information requirement in future or not.

Following factors must be considered in evaluation -

- (1) Examining the existence of flexibility in the system
- (2) Ascertaining the views of user & developers
- (3) Guide the steps to be taken to improve the effectiveness of MIS.

1.13.2.6 Constraints in operating MIS :-

S.No	Constraints	Remedy
(1)	Non - availability of experts	
(2)	High turnover of experts	Grooming internal staff
(3)	Mobility of experts	
(4)	Problem in selecting the sub-system	Considering need and importance of the function
(5)	Non-standardize approaches of Development and implementation	Adopt the industry specific approach(trend)
(6)	Non-availability of co-operation from staff.	Strong management control.
(7)	Difficulty in measuring benefits of MIS	Consider how many times managers asks for information.

1.13.2.7 Effect of using Computer for MIS :-

- (1) Speed of processing & accessing of data increases -timeliness of information can be met
- (2) Scope of use of MIS has expanded -due to the use of network & communication system
- (3) Scope of analysis widened -more data can be considered in analysis
- (4) Complexity of system design and operation increased - because technicality in its use and operations is increased.
- (5) Integration of Sub-system is possible - common database is possible even in high volume due to computer disks.
- (6) Effectiveness of information system increases - because timeliness and accuracy of information is increased.
- (7) More comprehensive information is made available to executives - covering all aspect of the problem.

1.13.2.8 Limitations of MIS :-

- (1) Quality of output depends upon quality of input - i.e. GIGO
- (2) MIS is just a tool in hands of management & does not replace managerial judgement,
- (3) MIS is not very flexible to update itself quickly with the changing need.
- (4) MIS cannot provide tailor-made information.
- (5) MIS takes into account only quantitative factors and not qualitative factors.
- (6) MIS is less useful in non programmed decisions.
- (7) MIS is less effective in the organization where culture of not sharing information with other holds.
- (8) Effectiveness of MIS decreases due to frequent changes in top mgmt.

1.13.3 ERP : Enterprise Resource Planning

"An ERP is a fully integrated business management system that integrates the core business and management processes to provide an organization a structured environment in which decisions are supported by accurate and reliable real-time information."

1.13.3.1 Objectives

- ☐ Provide support for adopting best business practices
- ☐ Implement these practices with the view towards enhancing productivity and
- ☐ Empower the customers and suppliers to modify the implemented business processes to suit their need.

1.13.3.2 ERP supported business processes

1. **Business system:** Business planning and forecasting, Strategy formulation, Resources allocation, Monitoring & controlling company performance, **BIS** etc. are some of the activities of this process which are supported by ERP.

2. **Production:** Production planning and control, Production scheduling, Inventory management, and **PIS** are some of the activities of this process which are supported by ERP.
3. **Maintenance:** Plant maintenance-Breakdown & Preventive; Maintenance management-initiation, execution, control, and costing; Monitoring performance of maintenance program and **MIS** are some of the activities of this process which are supported by ERP.
4. **Quality Control:** Setting quality standards, quality assessment, analysis of quality by reasons, building quality assurance and **QCIS** are some of the activities which are supported by ERP.
5. **Marketing:** Marketing analysis by customer and product; Sales forecasting; Sales budgeting; SCM; Order processing and analysis and **MIS** are some of the other activities of this process which are supported by ERP.
6. **Finance:** Financial Accounting; Asset management; Cash/Debt management; Accounts payable and receivable; Tax management; Cost/Profit center accounting etc are some of the activities of this process which are supported by ERP.
7. **Personnel:** HR planning, Recruitment and Selection; Training; Performance appraisal; Compensation; Employee welfare and **PIS** are some of the activities of this process which are supported by ERP.
8. **Consolidation of business operations:** Consolidation of accounts maintained by units and divisions; Comprehensive reporting are some of the activities supported by ERP.

1.13.3.3 Characteristics/Features of ERP :

A system has to possess few key characteristics to qualify for a true ERP system. These features are –

a. Flexibility

ERP should be flexible to respond to the changing needs of enterprise. C/S technology (to run ERP) and backend with ODBC can provide flexibility. Every user, operating client computer, can obtain any information according to their individual requirement.

b. Modular & Open

ERP must be based on Open System Architecture that allow any module to attach and detach whenever required without affecting other module. ERP must support multiple hardware platforms and third party add-Ins.

c. Comprehensive

ERP should support variety of organizational functions and wide variety of organizations.

d. Beyond the company

ERP should not be confined to the organizational boundaries rather support inter - organizational activities also.

e. Best business proactive

ERP must have a collection of best business processes applicable worldwide, combined with company's policy, strategy and culture.

f. Multiple

Being international package an ERP system must provide multi-platform, multi-facility, multi-mode of manufacturing, multi-currency, multi-lingual.

g. Support for planning

Being a planning package an ERP system should supports all the planning elements of an enterprises including strategic and business planning activities, operational planning and execution activities, creation of material & resource planning.

h. Supply chain Management

ERP must have supply chain management to optimize the overall demand and supply data from supplier to business and from business to their supplier.

i. Integration

ERP has company-wide integrated information system covering all functional areas and further across companies under same management.

j. Building corporate image

ERP system automate all core activities of the enterprises and increase customer service, thereby augmenting the corporate image.

k. Bridge information gap

ERP bridges the information gap across organizations by providing smooth communication medium between organizational functional areas.

l. Project Management

ERP offers better project management techniques for better time and cost estimation,

m. Technology involved

ERP includes latest technologies like, EFT, EDI, INTERNET, INTERANET, Video Conferencing E-Commerce etc.

n. Solution to the business problem

ERP eliminates most business problem like Material shortages, Inventory problems, Quality problems, Delivery problems, Cash & Debt management etc.

o. Integration of Intelligent business tools

ERP provides intelligent business tools like MIS, DSS, EIS, ES, Modeling etc. for support to managerial decision making.

1.13.3.4 Benefits of ERP

- i. Better utilization of organizational resources
- ii. Lowering operating cost
- iii. Proactive Decision Making
- iv. Decentralized decision making
- v. Enhanced customer satisfaction
- vi. Flexibility in business operations

1.13.3.5 Limitation of ERP

- 1. An ERP system provides current status only.
- 2. The methods used in ERP are not integrated with other organizational or divisional systems.
- 3. They do not use external intelligence.

1.14 Management Support Systems (MSS)

MSS focus on the managerial uses of information resources and provide information to managers for planning and decision making. It is further classified into three categories: **DSS**, **EIS** and **ES**.

1.14.1 Decision Support System (DSS)

- ☐ DSS is a system that provides tools to managers to assist them in solving semi-structured and unstructured problem in their own way.
- ☐ DSS is not intended to make decisions for managers, but rather to provide managers with a set of capabilities that enable them to generate the informations required by them.
- ☐ Such systems are particularly useful to higher level managers whose requirement for information are some what unpredictable.
- ☐ Unlike MIS, which provide fixed, pre-formatted information in a standardized way, DSS is more flexible and adaptable to changing decision making requirement.
- ☐ In other words - A DSS supports the human decision making process, rather than providing a means to replace it.

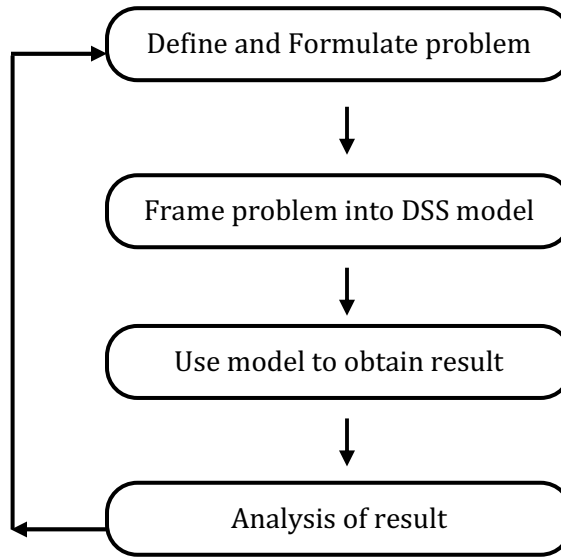
1.14.1.1 Characteristics of DSS :-

DSS are characterised by at least three properties -

i. DSS must be able to support Semi-structured or Unstructured decisions

- ☐ Un-structured or semi-structured decisions are those for which information obtained is only a portion of the total knowledge needed to make the decision.
- ☐ In a well designed DSS, the depth to which the available data can be tapped to obtain useful information depends upon time availability and patience of managers.

- ☐ Following are the steps involved in solving a problem with DSS -



ii. Ability to adapt to changing needs

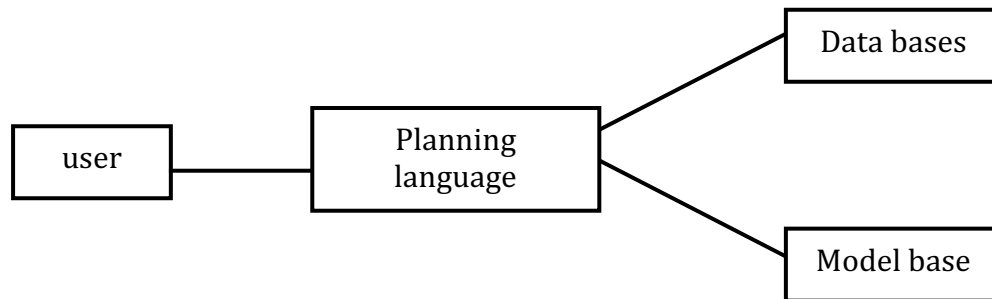
- ☐ Semi-structured and Un-structured decisions, often do not follow a predefined set of decision making rule, therefore DSS must provide for enough flexibility to enable user to model their own information need.
- ☐ In MIS specific outputs are established well ahead of the time they are used, the type of information supplied to the manager by that report are "*Frozen*". But the DSS designer know that managers usually don't know in advance what information they need, even if they do, those information needs keep changing constantly. Therefore tools and capabilities are provided by DSS to enable user to meet their own need.
- ☐ Since the demand made by user on the DSS are not fully predetermined, the user might request information in a variety of format.
- ☐ Flexibility in a DSS is of paramount importance because requests made to a DSS will often relatively un-systematic and distinctive.

iii. Ease of learning and use

- ☐ Since DSS are used by end user directly with the assistance of professionals the tools provided by DSS should be relatively easy to learn and use.
- ☐ These softwares must employ user - friendly interface, non-procedural 4 GLs, and easily read documentation.
- ☐ An interactive system enable the user to base each new request on the responses of the system supplied for earlier requests.
- ☐ Many DSS employ display devices (terminals) which provides user with relatively fast, often real-time, responses to help them in decision making process.

1.14.1.2 Components of A DSS

A DSS has 4 basic components : *User, Data bases, Planning language* and *Model Base*.

**i. The User**

- ❑ A manager with an unstructured or semi- structured problem at any level of authority is the user of DSS.
- ❑ User need not have computer background to use DSS, but thorough understanding of the problem and factors to be considered in finding the solution is important.
- ❑ A special planning language perform the communication between DSS and user, therefore user can concentrate on what should be accomplished rather than how to accomplish. (Programming knowledge not required)

ii. Data Base

- ◆ DSS includes multiple databases, containing both routine and non-routine data from both internal and external sources.
- ◆ Users may constructs additional database themselves in DS S.
- ◆ DSS databases can capture data from other information sub-systems viz. TPS, MIS etc.
- ◆ Database is implemented at three levels as
 - Physical level** : It involves implementation of database on the hard disk.
 - Logical level** : It involves logically dividing the physically implemented database into tables having rows and columns.
 - Extern al level** : It involves dividing tables into sub sets to fulfill individual users need.

iii. Model Base

- ❑ It is the "Brain" of the DSS and performs manipulation and computations on the data provided to it.
- ❑ They are mostly custom - developed i.e. designed according to the requirement of user.
- ❑ They take needed data from user or database and perform functions like-Cross tabulation, Regression analysis, LPP, OR modelling etc.

iv. Planning Language

- ☐ Two types of planning languages are generally used with DSS:
 1. General Purpose
 2. Special Purpose
- ☐ General purpose languages like spreadsheet software performs routine tasks, such as -
 1. Retrieving data from data base
 2. Statistical Analysis
 3. Forecasting
 4. Budgeting
- ☐ Special purpose languages performs limited jobs but specialize to perform them. SPSS, SAS are the most commonly used special purpose planning languages.

1.14.1.3 Example of DSS in A/C :-

i. Cost Accounting system

Health care company is using a DSS to calculate cost of an individual procedure for more effective operations. Industry require controlling cost of supplies, expensive technology, variety of personnel. DSS can accumulate these product costs to calculate total cost per patient.

ii. Capital Budgeting system

Companies use a DSS to evaluate investment decisions. This uses techniques such as - NPV, IRR to support investment decisions. E.g.-AUTOMAN is a DSS designed to support decisions about investments in automated manufacturing technology. It considers financial, non-financial, quantitative and qualitative factors in their decision making process.

iii. Budget Variance analysis

Financial institutions use a DSS to generate monthly variance reports which allows them to graph, view, analyse budget variances as well as create budget projection.

iv. General DSS

These are decision maker's tools and have the ability to analyze many different types of problems. E.g. "Expert Choice" is a computer based DSS that supports a variety of problems requiring decisions.

1.14.2 Executive Information System (EIS)

- ◆ EIS, sometimes referred to as an Executive support system (ESS) is designed to meet the special need of top-level executives.
- ◆ Executive is a manager at or near the top of the organization hierarchy who has a strong influence on the plans and operations taken by the organization. Executives are the good link between top and other levels of management.

1.14.2.1 Characteristics of EIS

"An EIS is a tool that provides direct on-line access to relevant information in a useful & navigable Format. It has the following characteristics -

- (a) Specifically designed to meet executive's information need.
- (b) Able to access data about specific issues and problems.
- (c) Provide on -line analysis tool
- (d) Can access both internal and external data
- (e) Easy to use i.e. GUI based software, user friendly hardware like mouse, touch screen etc.
- (f) Used directly by executive with out technical assistance
- (g) Present information by graphical means
- (h) Present summary information instead of details
- (i) Able to manipulate data to perform "what -if" analysis
- (j) Require large amount of storage & processing capacity in both terminal & server.

1.14.2.2 Executives Roles and Decision making :

Most executive decisions falls into 3 categories:

Strategic Planning : CEO's are involved in general, long range decisions in the organization.

Tactical Planning : Tactical planning refers to how, when, where and what issues involved with carrying out strategic plan. Although executives will not normally be concerned with tactical details, but they do need to know about general tactics.

Fire Fighting : It is a planning or decision making required to solve a major problem arises in environment. *Example:* The announcement of an important product by competitor, strike etc.

1.14.2.3 Executive Decision Making Environment :-

The 3 main Sources of Executive informations are: (a) Environmental (b) Competitive (c) Internal Characteristics of the type of information used in executive decision making are as follows -

a. Lack of structure -

Since ratively unstructured decisions are taken by them their information requirement is also lack structure, i.e. any information at any time in any format can be asked.

b. High degree of uncertainty-

Executives work is characterised as un-precedented. No previous example can be referenced for help, no information can be demanded repeatedly.

c. Future orientation -

Executives decisions are made to shape future of the company. They need futuristic information like- future technology, future competition, future products etc.

d. Informal Source -

Executives rely more on informal sources for key informations. Lunch meeting, TV shows, meetings, brain storming sessions, interviews, get-together etc. are the good sources of executive information.

e. Low-level details -

Executives need summerised information broad trends, pictorial presentation etc. so that the same can be analysed, review within the limited time.

1.14.2.4 Contents of EIS :-

- ☐ In the broadest sense the contents of EIS are "*whatever is interesting to executive*".
- ☐ EIS implementations begins with just a few contents that are of interest to executives and then expand in response to managers need as they use the system.
- ☐ Following is a set of principles to guide the design of contents to be included in EIS -
 - (a) EIS contents must be easy to understand and collect. It should not add to the work load of mgrs.
 - (b) EIS content should reflect the objectives of the organization in the area of productivity, resource management, quality, customer service.
 - (c) Performance indicator in EIS must reflect everyone's contribution.
 - (d) Performance indicator must promote both team-work and friendly competition.
 - (e) EIS content must be available to everyone in the organization
 - (f) EIS content must be open to meet the changing need of the organization

1.14.3 Expert System (ES)

Expert systems are the softwares that imitate the reasoning processes of human experts and provide decision makers with the type advice they would normally receive from such experts.

1.14.3.1 Application of ES

Some of the business applications of expert system are -

- ☐ **Accounting and Finance:** Tax advice and assistance, Forecasting, Providing investment advice etc.
- ☐ **Marketing:** Sales quotas, Handling customers inquiries, Discount policies, Telemarketing etc.
- ☐ **Manufacturing:** Process controlling, Quality controlling, Production scheduling, Selecting transporting route, Fault monitoring etc.
- ☐ **Personnel:** Recruitment, Training, Task assignment, Performance appraisal
- ☐ **General business:** Evaluating project proposal, Strategy selection, Reporting etc.

1.14.3.2 Need of ES

- ◆ Expert person is expensive and scarce.
- ◆ Expert people can handle only a few factor at a time.

1.14.3.3 Benefits of ES

- ◆ ES preserve the knowledge of an expert who is leaving the organization.
- ◆ ES put information into an active-form(readily accessible).
- ◆ ES assist novice in solving the problem they professionals do.
- ◆ ES does not get stressed out.
- ◆ ES can be effectively used as strategic tool.

1.14.3.4 Properties of ES

- ☐ **Availability:** ES is always available to solve a problem which experts need to discuss.
- ☐ **Complexity:** Problems for which ES will be used are complex task which would not be easily handled by conventional information processing.
- ☐ **Domain :** The subject area of the problem is relatively small in ES.
- ☐ **Expertise:** ES aim to solve the problem that require the efforts of experts.
- ☐ **Structure:** ES handle problems with un-structured, un-certain and conflicting data.

1.14.3.5 Components of ES

An expert system is typically composed of the Knowledge base, Inference engine, Knowledge acquisition facility and User interface.

(a) **Knowledge Base:**

The knowledge base stores the data of problem, their solutions and the relationship between them. It formally represents the knowledge acquired from the expert so that solution for the problem can be inferred easily. The power of a system tends to be related to the depth and breadth of the knowledge in the knowledge base.

(b) Inference Engine :

The inference engine is the main processing element consisting of system of programs that receives data from user, manipulate the knowledge base and provide a decision to the user. To identify solution of the problem, it employ different reasoning models such as –

Forward-Chaining mechanism : First examine the problem at hand and the KB; then it attempts to discover a solution.

Backward-Chaining mechanism : The IE starts a series of questions and tries to identify the user problem. Once the problem is diagnosed the solution is extracted from the KB and recommended to the user.

(c) Knowledge Acquisition Subsystem (KAS) :

The KAS is the software component of the ES that enables the knowledge engineer to build and refine and ES's Knowledge base. KB development and maintenance can be done using special, reasonable user-friendly software. This software provides a convenient and efficient means of capturing and storing the contents of the knowledge base.

(d) User Interface:

It is a program with which Expert system and User interacts with each other. The UI of ES prompts the user to supply information about the problem and the user types in the requested data. The system continue to prompt user for more information until the system has enough data about the current problem so that it can reach a conclusion. Thus the UI is a highly interactive component of ES.

1.15 Office Automation Systems (OAS)

OAS are among the newest and most rapidly expanding computer based information systems. Different office activities can be broadly grouped together into following categories -

- ❑ **Document capture:** This consists of capturing incoming documents such as mails, notes, handouts, graphs etc.
- ❑ **Document creation:** This consists of preparation of documents, tacking dictation, editing texts etc.
- ❑ **Receipts and Distribution :** This includes distribution of correspondence to designated recipients.
- ❑ **Filling, Search, Retrieval and Follow up:** This includes document filling, indexing and searching.
- ❑ **Calculation:** This includes routine arithmetic calculation for bill processing, interest calculation, commission calculation etc.
- ❑ **Recording usage of resources:** This includes Record keeping, Log book maintenance etc.

Benefits of OAS

- ☐ Improve communication within and between organization
- ☐ Reduce cycle time between preparation of messages and receipts of messages
- ☐ Reduce cost and time of office communication.
- ☐ Ensure accuracy of processing, calculation and communication.
- ☐ Improve documentation management.

1.15.1 Word processing System:

- ☐ May be simple word processor or Desktop publishing systems, supported by laser printer, Ink-jet printer and scanner these are the software used to produce good quality documents.
- ☐ Since large proportion of the office communication takes place in writing, this is the most' commonly used component of OAS.
- ☐ These systems automate the process of development of documents such as letters, memos, reports etc. They permits use of standard stored information to produce personalized documents thereby reducing keying efforts and minimizes the chances of errors.

1.15.2 Electronic Document Management Systems :

- ☐ The computer based document management system are used to capturing the information contained in document in electronic form, store for future reference and communicate the relevant parts to the users as and when required.
- ☐ These systems are very useful in remote access of document that is almost impossible with manual document management systems. For e.g. a customer may lodge a complaint about product or service to the company server, sales executive may submit customer order to the sales order processing system remotely, the loan application files in a branch office of a bank can be accessed by the sanctioning officer for scrutiny at the head office.
- ☐ With computer based document management system location of the user becomes irrelevant for access to document.

1.15.3 Electronic message communication systems

Business organizations have been using a verity of communication systems for sending and receiving messages. The computer based message communication systems offer a lot of economy not only in terms of reduced time but also in terms of reliability and cost of communication. Some of the EMCS are :

1.15.3.1 E-Mail

Transfer of message in electronic form is called e-mail, some of the best features are -

- ☐ Fast electronic transmission
- ☐ Online composing and editing
- ☐ Broadcasting and forwarding
- ☐ Integration with other information systems
- ☐ Portability
- ☐ Economical

1.15.3.2 Facsimile (Fax)

Fax is electronic communication of images of documents over telephone lines. The computer based fax technology permits sharing of fax facilities. It uses special software and fax server to send and receive fax messages using common communication resources.

1.15.3.3 Voice mail

Voice allows transfer of messages in the form digitized voice. The recipient of the voice mail can hear the spoken message in the voice of the sender.

1.15.3.4 Tele-conferencing or Video-conferencing systems

Conference is a business meeting involving two or more persons located at different places. Teleconferencing helps in reducing time and cost of meeting as the participants do not have to travel to attend the meeting. It may audio or video conferencing with or without computer systems. These systems are based on PCs with digital camera and multimedia softwares.

SYSTEM: A set of interrelated elements that operate collectively to accomplish some common purpose or goal.	TYPES OF SYSTEM 1. Elements: • Abstract system • Physical system 2. Interactive Behaviour: • Closed system • Open system • Entropy 3. Degree of Human Intervention: • Manual system • Automated system 4. Working/Output – • Deterministic system • Probabilistic system	GENERAL MODEL OF A SYSTEM: A general model of a physical system is input, process and output. This is, of course, very simplified because a system may have several inputs and outputs. • Input • Processing • Output • Storage • Feedback	SYSTEM ENVIRONMENT • Boundary: The features that define and delineate a system form its boundary. • Sybsystem: A subsystem is a part of a larger system. • Interfaces: The inter connections & interactions between the subsystem are termed interfaces.
CHARACTERISTICS OF SUBSYSTEMS: Decomposition Simplification Decoupling	INFORMATION: Information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or progressive decision.	CHARACTERISTICS OF INFORMATION: (CAR has MRF Tyres and Voice Recorder) • <u>C</u>ompleteness • <u>C</u>ost Benefit Analysis • <u>A</u>ccuracy and Quality • <u>R</u>elevance and Purpose • <u>M</u>ode and Format • <u>R</u>edundancy • <u>F</u>requency • <u>T</u>imeliness • <u>V</u>alidity • <u>R</u>eliability	TYPES OF INFORMATION: • Internal information • External information

INFORMATION SYSTEM AND ITS ROLE IN MANAGEMENT: An information system can be considered as an arrangement of a number of elements that provides effective information for decision-making and/or control of some functionalities of an organisation: Implications: • Decision-making • Competitive edge • Innovative ideas • Knowledge • Formulate a strategy	FACTORS ON WHICH INFORMATION REQUIREMENTS DEPEND: Operational function Type of decision making: • Programmed decisions or structured decisions • Non-programmed or unstructured decisions Level of management activity: • Strategic Level or Top Level • Tactical Level or Middle Level • Supervisory or Operational Level	COMPONENTS OF COMPUTER BASED INFORMATION SYSTEM A Computer-based Information System (CBIS) is an information system in which the computer plays a major role. Such a system consists of the following elements: • Hardware • Software • Data • Procedures • People	OPERATIONS SUPPORT SYSTEMS (OSS) • Transaction Processing Systems – TPS • Management Information Systems – MIS • Enterprise Resource Planning Systems – ERP
TRANSACTION PROCESSING SYSTEM (TPS): It involves • Capturing data • Processing of files/databases • Generating information • Handling of queries	TPS COMPONENTS • Inputs • Processing • Storage • Outputs	FEATURES OF TPS • Large volume of data • Automation of basic operations • Benefits are easily measurable • Source of input for other systems	

MANAGEMENT INFORMATION SYSTEM (MIS): An integrated user-machine system designed for providing information to support operational control, management control and decision making functions in an organisation.	CHARACTERISTICS OF AN EFFECTIVE MIS: (MICS is a History) • <u>M</u>anagement Oriented • <u>M</u>anagement Directed • <u>I</u>ntegrated • <u>C</u>ommon Database • <u>C</u>omputerised • <u>S</u>ub system concept • <u>H</u>eavy Planning Element	MISCONCEPTIONS OR MYTHS ABOUT MIS: • The study of management information system is about the use of computers. • More data in reports means more information for managers. • Accuracy in reporting is of vital importance.	PRE-REQUISITES OF AN MIS: (D – CESS) • <u>D</u>atabase • <u>C</u>ontrol and Maintenance of MIS • <u>E</u>valuation of MIS • <u>S</u>ystem and Management Staff should be qualified • <u>S</u>upport of Top Management
CONSTRAINS IN OPERATING A MIS: (QUEST) • <u>Q</u>ualified staff not available • <u>Q</u>uantifying the benefits of MIS is difficult • <u>E</u>xpert's turnover is high • <u>S</u>election of sub system of MIS • <u>S</u>tandardised approach not possible • <u>S</u>taff's Cooperation not available	EFFECTS OF USING COMPUTER IN MIS: (ISCA) • <u>I</u>ncreases the effectiveness of Information Systems • <u>I</u>ntegrates the working of different information subsystem • <u>S</u>peed of processing and retrieval of data increases • <u>S</u>cope of use of information system has expanded • <u>C</u>omplexity of system design & operation increased • <u>C</u>omprehensive information • <u>A</u>nalysis widens	LIMITATIONS OF MIS: (LIMITATION) • <u>L</u>ess useful for unstructured data • <u>I</u>nternal information is taken into consideration • <u>M</u>anagement keeps changing so does their goals • <u>I</u>ntputs and processing quality determines the quality of outputs • <u>T</u>PS's limitations still exists in MIS • <u>A</u>d-hoc reporting is not possible • <u>T</u>he attitudes and moral are ignored in MIS • <u>I</u>ntegration is lacking • <u>H</u>oarding of information reduces the effectiveness • <u>N</u>ot a substitute for effective management	

ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS: • ERP system is a fully integrated business management system • It organizes and integrates – operation processes and information flows, to make optimum use of resources • ERP aims at one database, one application, and one user interface	OBJECTIVES: • Provide support for adopting best business practices • Implement these practices with a view towards enhancing productivity • Empower the customers and suppliers to modify the implemented business processes to suit their needs	AN ERP SYSTEM INTEGRATES VARIOUS BUSINESS PROCESSES: • Business System • Production • Maintenance • Quality Control • Marketing • Finance • Personnel • Consolidation of Business Operations	MYTHS OF ERP SYSTEM: • There is a misconception that ERP is a computer system. • There is a misconception that ERP is relevant for manufacturing organisations only.
BENEFITS OF ERP: • Better use of organisational resources • Lower operating costs • Proactive decision making • Enhanced customer satisfaction • Flexibility in business operations	LIMITATIONS OF ERP: • An ERP system provides current status only • The methods used in the ERP applications are not integrated with other organisational or divisional systems.	MANAGEMENT SUPPORT SYSTEMS (MSS): Focus on the managerial uses of information resources and provide information to managers for planning and decision making. There are three types of MSS, namely: • Decision Support Systems (DSS) • Executive Information (Support) System (EIS) • Expert Systems	

DECISION SUPPORT SYSTEMS (DSS): is a system that provides tools to managers to assist them in solving semi structured and unstructured problems in their own, somewhat personalized, way.	CHARACTERISTICS OF DSS: (SEA) • Support semi-structured/Unstructured decision making • Ease of learning and use • Ability to adapt to changing need	COMPONENTS OF A DSS: • The User: - Manager - Staff Specialist (Analysts) • Databases: - Physical Level - Logical Level - External Level • A planning language • Model Base
EXECUTIVE INFORMATION SYSTEMS (EIS): It is a tool that is designed to meet the special needs of top-level managers. It provides direct on-line access to relevant information in a useful and navigable format.	EXECUTIVE ROLES AND DECISION MAKING: • Strategic Planning • Tactical Planning • Fire Fighting • Control	PRINCIPLES TO BE FOLLOWED WHILE DESIGNING AN EIS: EIS must be: • Easy to understand and collect • Based on a balanced view of the organisation's objectives • Reflecting everyone's contribution in a fair and consistent way • Encouraging for the management and staff • Available to everyone in the organisation • Evolving to meet the changing needs of the organisation

EXPERT SYSTEMS Expert Systems are software systems that imitate the reasoning processes of human experts and provide decision makers with the type of advice they would normally receive from such expert systems.	NEED FOR EXPERT SYSTEMS • Expert labour is expensive and scarce. • No matter how bright or knowledgeable certain people are, they often can handle only a few factors at a time.	BENEFITS OF EXPERT SYSTEMS • preserve knowledge • put information into an active-form • assist novices in thinking the way experienced professional do. • not subject to such human fallings as fatigue, being too busy, or being emotional. • can be effectively used as a strategic tool is the areas of marketing products, cutting costs and improving products.	THE PROPERTIES THAT POTENTIAL APPLICATIONS SHOULD POSSESS TO QUALIFY FOR EXPERT SYSTEM DEVELOPMENT ARE: • Availability • Complexity • Domain • Expertise • Structure
COMPONENTS OF EXPERT SYSTEMS • Knowledge Base (KB) • Inference Engine - forward-chaining mechanism - backward chaining mechanism • Knowledge Acquisition Subsystem (KAS) • User Interface	OFFICE AUTOMATION SYSTEMS (OAS): is the application of computers to handle the office activities: • Document Capture • Document Creation • Receipts and Distribution • Filling, Search, Retrieval and Follow up • Calculations • Recording Utilisation of Resources	BENEFITS OF OFFICE AUTOMATION SYSTEMS • Improve communication • Reduce the cycle time between preparation and receipt of messages • Reduce the costs of office communication • Ensure accuracy of communication flows	CATEGORIES OF COMPUTER BASED OFFICE AUTOMATION SYSTEMS: • Text Processing Systems • Electronic Document Management Systems • Electronic Message Communication Systems • Teleconferencing and Video-conferencing Systems

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