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# system

1. A set of detailed methods, procedures and routines created to carry out a specific activity, perform a duty, or solve a problem.

2. An organized, purposeful structure that consists of interrelated and interdependent elements (components, entities, factors, members, parts etc.). These elements continually influence one another (directly or indirectly) to maintain their activity and the existence of the system, in order to achieve the goal of the system. All systems have

- (a) **inputs, outputs and feedback mechanisms,**
- (b) **maintain an internal steady-state (called homeostasis) despite a changing external environment,**
- (c) **display properties that are different than the whole (called emergent properties) but are not possessed by any of the individual elements, and**
- (d) **have boundaries that are usually defined by the system observer.** Systems underlie every phenomenon and all are part of a larger system. Systems stop functioning when an element is removed or changed significantly. Together, they allow understanding and interpretation of the universe as a meta-system of interlinked wholes, and organize our thoughts about the world.

Although different types of systems (from a cell to the human body, soap bubbles to galaxies, ant colonies to nations) look very different on the surface, they have remarkable similarities. At the most basic level, systems are divided into two categories:

**A system is a set of interacting or interdependent components forming an integrated whole.**

Every system is delineated by its spatial and temporal boundaries, surrounded and influenced by its environment, described by its structure and purpose and expressed in its functioning.

Fields that study the general properties of systems include systems science, systems theory, systems modeling, systems engineering, cybernetics, dynamical systems, thermodynamics, complex systems, system analysis and design and systems architecture. They investigate the abstract properties of systems' matter and organization, looking for concepts and principles that are independent of domain, substance, type, or temporal scale. Some systems share common characteristics, including :

- A system has structure, it contains parts (or components) that are directly or indirectly related to each other;
- A system has behavior, it exhibits processes that fulfill its function or purpose;
- A system has interconnectivity: the parts and processes are connected by structural and/or behavioral relationships;
- A system's structure and behavior may be decomposed via subsystems and sub-processes to elementary parts and process steps;

- A system has behavior that, in relativity to its surroundings, may be categorized as both fast and strong.

The term system may also refer to a set of rules that governs structure and/or behavior.

Alternatively, and usually in the context of complex social systems, the term institution is used to describe the set of rules that govern structure and/or behavior.

## **System concepts**

### **Environment and boundaries**

Systems theory views the world as a complex system of interconnected parts. We scope a system by defining its boundary; this means choosing which entities are inside the system and which are outside – part of the environment. We then make simplified representations (models) of the system in order to understand it and to predict or impact its future behavior. These models may define the structure and/or the behavior of the system.

### **Natural and human-made systems**

There are natural and human-made (designed) systems. Natural systems may not have an apparent objective but their outputs can be interpreted as purposes. Human-made systems are made with purposes that are achieved by the delivery of outputs. Their parts must be related; they must be “designed to work as a coherent entity” – else they would be two or more distinct systems.

Open system have input and output flows, representing exchanges of matter, energy or information with its surroundings.

### **Theoretical framework**

An open system exchanges matter and energy with its surroundings. Most systems are open systems; like a car, coffeemaker, or computer. A closed system exchanges energy, but not matter, with its environment; like Earth or the project Biosphere2 or 3. An isolated system exchanges neither matter nor energy with its environment. A theoretical example of such system is the Universe.

### **Process and transformation process**

An open system can also be viewed as a bounded transformation process, that is, a black box that is a process or collection of processes that transforms inputs into outputs. Inputs are consumed; outputs are produced. The concept of input and output here is very broad. E.g., an output of a passenger ship is the movement of people from departure to destination.

### **Subsystem**

A subsystem is a set of elements, which is a system itself, and a component of a larger system.

### **System model**

A system comprises multiple views. For the man-made systems it may be such views as concept, analysis, design, implementation, deployment, structure, behavior, input data,

and output data views. A system model is required to describe and represent all these multiple views.

### **Systems architecture**

A systems architecture, using one single integrated model for the description of multiple views such as concept, analysis, design, implementation, deployment, structure, behavior, input data, and output data views, is a kind of system model.

### **Elements of a system:** an example

Following are considered as the elements of a system in terms of Information systems: –

1. **Input**
2. **Output**
3. **Processor**
4. **Control**
5. **Feedback**
6. **Boundary and interface**
7. **Environment**

**1. INPUT:** Input involves capturing and assembling elements that enter the system to be processed. The inputs are said to be fed to the systems in order to get the output. For example, input of a 'computer system' is an input unit consisting of various input devices like a keyboard, mouse, joystick etc.

**2. OUTPUT:** Those elements that exist in the system due to the processing of the inputs is known as output. A major objective of a system is to produce output that has value to its user. The output of the system may be in the form of cash, information, knowledge, reports, documents etc. the system is defined as output is required from it. It is the anticipatory recognition of output that helps in defining the input of the system. For example, output of a 'computer system' is an output unit consisting of various output devices like the screen and the printer etc.

**3. PROCESSOR(S):** The processor is the element of a system that involves the actual transformation of input into output. It is the operational component of a system. For example, processor of a 'computer system' is central processing unit that further consists of arithmetic and logic unit (ALU), control unit and memory unit etc.

**4. CONTROL:** The control element guides the system. It is the decision-making sub-system that controls the pattern of activities governing input, processing and output. It also keeps the system within the boundary set. For example, control in a 'computer system' is maintained by the control unit that controls and coordinates various units by means of passing different signals through wires.

**5. FEEDBACK:** Control in a dynamic system is achieved by feedback. Feedback measures output against a standard input in some form of cybernetic procedure that includes communication and control. The feedback may generally be of three types viz., positive,

negative and informational. The positive feedback motivates the system. The negative indicates need of an action. The feedback is a reactive form of control. Outputs from the process of the system are fed back to the control mechanism. The control mechanism then adjusts the control signals to the process on the basis of the data it receives. Feed forward is a protective form of control. For example, in a 'computer system' when logical decisions are taken, the logic unit concludes by comparing the calculated results and the required results.

**6. BOUNDARY AND INTERFACE:** A system should be defined by its boundaries - the limits that identify its components, processes and interrelationships when it interfaces with another system. For example, in a 'computer system' there is a boundary for the number of bits, the memory size etc. that is responsible for different levels of accuracy on different machines (like 16-bit, 32-bit etc.). The interface in a 'computer system' may be a CUI (Character User Interface) or a GUI (Graphical User Interface).

**7. ENVIRONMENT:** The environment is the 'supersystem' within which an organisation operates. It excludes input, processes and outputs. It is the source of external elements that impinge on the system. For example, if the results calculated/the output generated by the 'computer system' are to be used for decision-making purposes in the factory, in a business concern, in an organisation, in a school, in a college or in a government office then the system is same but its environment is different.

### **Types of systems**

Systems are classified in different ways:

1. **Physical or abstract systems.**
2. **Open or closed systems.**
3. **'Man-made' information systems.**
4. **Formal information systems.**
5. **Informal information systems.**
6. **Computer-based information systems.**
7. **Real-time system.**

**Physical systems** are tangible entities that may be static or dynamic in operation.

An open system has many interfaces with its environment. i.e. system that interacts freely with its environment, taking input and returning output. It permits interaction across its boundary; it receives inputs from and delivers outputs to the outside. A closed system does not interact with the environment; changes in the environment and adaptability are not issues for closed system.

#### **1. Abstract and physical systems**

An abstract or conceptual system is an orderly arrangement of interdependent ideas or constructs, which may or may not have any counterpart in the real world.

On the other hand, physical systems are generally concrete operational systems made up of people, materials, machines, energy and other physical things; Physical systems are more than conceptual constructs.

## 2. Deterministic and Probabilistic Systems

A deterministic system is one in which the occurrence of all events is known with certainty. A probabilistic system is one in which the occurrence of events cannot be perfectly predicted. Though the behavior of such a system can be described in terms of probability, a certain degree of error is always attached to the prediction of the behavior of the system.

## 3. Open and Closed Systems

An open system is one that interacts with its environment and thus exchanges information, material, or energy with the environment, including random and undefined inputs. Open systems are adaptive in nature, as they tend to react with the environment in such a way, so as to favor their continued existence. Such systems are 'self organizing', in the sense that they change their organisation in response to changing conditions.

A closed system is one, which does not interact with its environment. Such systems in business world, are rare, but relatively closed systems are common. Thus, the systems that are relatively isolated from the environment but not completely closed, are termed closed system.

(1) **Closed systems:** theoretical systems that do not interact with the environment and are not influenced by its surroundings. Only the components within the system are significant. Example: a sealed jar--nothing enters or exits the jar, but whatever is inside can interact.

### Closed Systems

- a. Shuns any kind of the exchange with the environment.
- b. Is rigid in nature.
- c. Is not at all amenable to the change.
- d. Is also self contained.
- e. Is somewhat isolated in the nature.
- f. Is having a well defined boundary.
- g. Is not at all adaptive in the nature.

(2) **Open systems:** real-world systems whose boundaries allow exchanges of energy, material and information with the larger external environment or system in which they exist. Example: a company--even if there are separate departments in one organization, the workers share data and interact with each other on a daily basis. Different systems methodologies (such as systems dynamics and systems thinking) classify systems differently.

### Open Systems

- a. Involve continuous interaction with the environment.
- b. So exchanges the information, material, energy with the environment.
- c. Is open and also self organizing in the nature.
- d. Is also adoptive or adaptive to the changing environment as it is flexible.

#### 4. User Machine Systems

Most of the physical systems are user-machine (or human-machine) systems. It is difficult to think of a system composed only of people who do not utilize equipment of some kind to achieve their goals. In user-machine systems, both, i.e. human as well as machine perform some activities in the accomplishment of a goal (e.g. decision-making). The machine elements (may be computer hardware and software) are relatively closed and deterministic, whereas the human elements of the system are open and probabilistic.

#### 5. Conceptual Systems

- a. Are theoretical and explanatory in the nature.
- b. Provide the much needed clarification.
- c. Provide theoretical framework for which there may or may not be any real life counterpart.
- d. E.g. of such systems can be philosophy, theology etc.

#### 6. Empirical Systems

- a. Are very practical, specific and also very operational in the nature.
- b. Can be based on the conceptual system.
- c. Examination system, surgery act as very good examples of the empirical systems.

#### 9. Natural Systems

- a. Such Systems exist and also abound in the nature.
- b. Are also not at all the results of the human endeavors.
- c. Rivers, mountains, minerals etc. are the major examples of the natural Systems.

#### 10. Artificial Systems

- a. Are manufactured (man made).
- b. Examples of such Systems are dams, canals, roads, machines, factories etc.

#### 11. Probabilistic Systems

- a. Based on the predictability of the behavior or the outcome.

#### 12. Deterministic Systems

- a. In such Systems, the interaction of the elements is known.
- b. As the behavior of the elements is pre determined, it becomes possible to work upon the reaction well in the advance.

# System Approach Theory of Management: Features and Evaluation

Systems Approach identifies the inter-dependencies and inter-relations between the various parts of the organisation and helps to get a holistic view while dealing with business issues.

**Following are the important features of systems approach to management thought:**

1. System approach considers the organisation as a dynamic and inter-related set of parts. Each part represents a department or a sub-system. Each department has its sub-system. Continuous and effective interaction of sub-systems helps to attain goals of the larger system. Thus, every sub-system is a system and has sub-systems which together make an organisation a set of mutually dependent parts and their sub-parts.
2. It considers the impact of both near and distant future on organisational activities. Organisations constantly respond to changes in the internal and external environmental conditions. They also act as market leaders in the dynamic, competitive environment.
3. System approach integrates goals of different parts of the organisation (sub-systems or departments) with the organisation as a whole. It also integrates goals of the organisation with goals of the environment or society in which it operates. Integration of goals maintains equilibrium or balance and enables organisations to grow in the dynamic environment.
4. It synthesizes knowledge of different fields of study such as biology, sociology, psychology, information systems, economics etc. As business organisation deals with different components of society, it makes best use of different fields of study to improve interaction with its counterparts.
5. System approach enables organisations to frame policies that promote business objectives and social objectives. Business operates in the social system and social values, culture, beliefs and ethics are important constituents of business operations.

**The system approach has the following merits:**

1. System approach provides a holistic view of the organisations and emphasises on their adaptive nature. It increases organisation's adaptability to environmental changes. The organisation is studied as a whole and not through its parts. This enables it to adapt to the needs of the environment. Decisions are made keeping in mind organisation-environment interface.
2. It analyses the system at different levels and inter-relates and integrates it into a unified set of direction. Starting from individual goals, it focuses on overall organisational goals, synthesizes the two and converges them into global economy.
3. System approach provides a framework for effective interaction of parts of the organisation in a specific arrangement for attainment of its goals. It does not focus on one part of the organisation.
4. It considers the impact of environment on the organisation and vice versa. Interaction of external environment with the internal environment is the most significant contribution of systems theory. System approach, thus, analyses the organisation as an adaptive and dynamic entity.
5. System approach synthesizes the classical and behavioural theories into a broader framework to solve managerial problems. It, thus, focuses on organisations as multi-dimensional in nature.
6. It increases organisation's adaptability to environmental changes. The organisation is studied as a whole and not through its parts. This enables it to adapt to the needs of the environment. Decisions are made keeping in mind the macro as well as micro environment.

7. The focus is on achieving the individual as well as overall goals of the organisation.
8. Uniformity in decision making such that no specific domain gets preferential treatment.
9. Adaptive and Dynamic.
10. Focuses on multiple dimensions of management.

#### Limitations of System Approach:

1. Critics of this theory claim this as a theoretical approach to management. The way an organisation actually works and solves problems (by applying different techniques and methods) has no appeal in the theory.
2. Relationship amongst parts of the organisation is emphasised upon but the exact nature of inter-dependence is not defined.
3. Exact relationship between internal and external environment of the organisation is also not defined. For example, it specifies that change in economic policies necessitates change in internal policies of the organisation but what changes are required to match the changes in economic environment is not talked about.
4. System approach fails to provide uniform approach to management. Management practices change with changes in environmental variables. No standard set of principles apply to all types of organisations. It has added nothing new to the study of management. Even before this approach was introduced, managerial decisions were taken keeping in mind the environmental variables. No specific decision-making techniques are offered to deal with specific problems.
5. It fails to provide concepts that apply to all types of organisations. The small organisations are less adaptive to environmental variables than large organisations. The theory assumes that most of the organisations are big, complex and open systems. It, thus, fails to provide a unified theory.
6. May not be always practical and lead to delays in decision making.
7. Nature of inter-dependence is not defined.3. Classification of the inter relationships has to be done properly otherwise



## Management Information System

Management Information System (MIS) is a planned system of collecting, storing, and distributing data in the form of information needed to carry out the functions of management.

### Information System

"Information systems (IS) is the study of complementary networks of hardware and software that people and organizations use to collect, filter, process, create, and distribute data."

"Information systems are combinations of hardware, software, and telecommunications networks that people build and use to collect, create, and distribute useful data, typically in organizational settings."

"Information systems are interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and visualization in an organization."

Information can be defined as meaningfully interpreted data. If we give you a number 1-212-290-4700, it does not make any sense on its own. It is just a raw data. However if we say Tel: +1-212-290-4700, it starts making sense. It becomes a telephone number. If I gather some more data and record it meaningfully like:

Address: 350 Fifth Avenue, 34th floor  
New York, NY 10118-3299 USA  
Tel: +1-212-290-4700  
Fax: +1-212-736-1300

It becomes a very useful information - the address of New York office of Human Rights Watch, a non-profit, non-governmental human rights organization.

So, from a system analyst's point of view, information is a sequence of symbols that can be construed to a useful message.

An **Information System** is a system that gathers data and disseminates information with the sole purpose of providing information to its users.

The main object of an information system is to provide information to its users. Information systems vary according to the type of users who use the system.

A **Management Information System** is an information system that evaluates, analyzes, and processes an organization's data to produce meaningful and useful information based on which the management can take right decisions to ensure future growth of the organization.

### Information Definition

"Information can be recorded as signs, or transmitted as signals. Information is any kind of event that affects the state of a dynamic system that can interpret the information."

Conceptually, information is the message (utterance or expression) being conveyed. Therefore, in a general sense, information is "Knowledge communicated or received, concerning a particular fact or circumstance". Information cannot be predicted and resolves uncertainty."

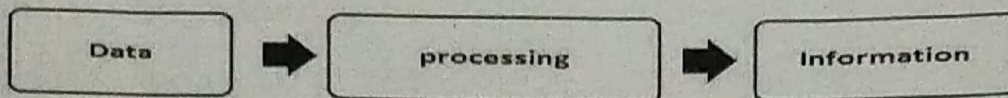
## Information v/s Data

Data can be described as unprocessed facts and figures. Plain collected data as raw facts cannot help in decision-making. However, data is the raw material that is organized, structured, and interpreted to create useful information systems.

Data is defined as 'groups of non-random symbols in the form of text, images, voice representing quantities, action and objects'.

Information is interpreted data; created from organized, structured, and processed data in a particular context.

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



## Information, Knowledge and Business Intelligence

Professor Ray R. Larson of the School of Information at the University of California, Berkeley, provides an *Information Hierarchy*, which is:

- Data - The raw material of information.
- Information - Data organized and presented by someone.
- Knowledge - Information read, heard, or seen, and understood.
- Wisdom - Distilled and integrated knowledge and understanding.

Scott Andrews' explains *Information Continuum* as follows:

- Data - A Fact or a piece of information, or a series thereof.
- Information - Knowledge discerned from data.
- Business Intelligence - Information Management pertaining to an organization's policy or decision-making, particularly when tied to strategic or operational objectives.

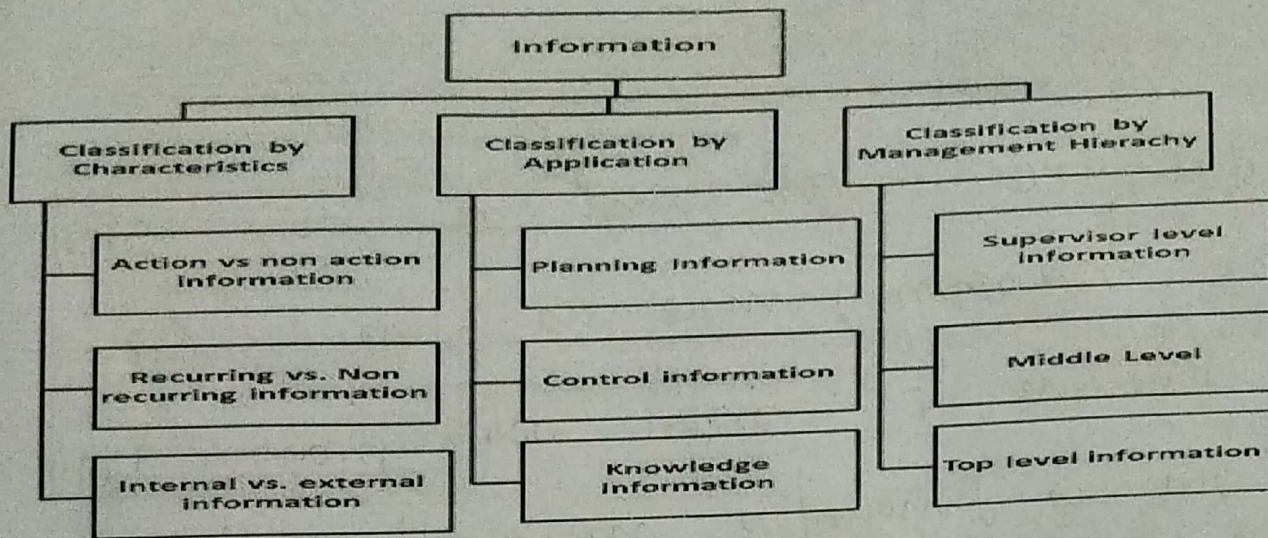
## Information/Data Collection Techniques

The most popular data collection techniques include:

- Surveys: A questionnaire is prepared to collect the data from the field.
- Secondary data sources or archival data: Data is collected through old records, magazines, company website etc.
- Objective measures or tests: An experimental test is conducted on the subject and the data is collected.
- Interviews: Data is collected by the system analyst by following a rigid procedure and collecting the answers to a set of pre-conceived questions through personal interviews.

## Types of Information

Information can be classified in the following ways:



### Classification by Characteristic

Based on Anthony's classification of Management, information used in business for decision-making is generally categorized into three types:

- **Strategic Information:** Strategic information is concerned with long term policy decisions that defines the objectives of a business and checks how well these objectives are met. For example, acquiring a new plant, a new product, diversification of business etc, comes under strategic information.
- **Tactical Information:** Tactical information is concerned with the information needed for exercising control over business resources, like budgeting, quality control, service level, inventory level, productivity level etc.
- **Operational Information:** Operational information is concerned with plant/business level information and is used to ensure proper conduction of specific operational tasks as planned/intended. Various operator specific, machine specific and shift specific jobs for quality control checks comes under this category.

### Classification by Application

In terms of applications, information can be categorized as:

- **Planning Information:** These are the information needed for establishing standard norms and specifications in an organization. This information is used in strategic, tactical, and operation planning of any activity. Examples of such information are time standards, design standards.
- **Control Information:** This information is needed for establishing control over all business activities through feedback mechanism. This information is used for controlling attainment, nature and utilization of important processes in a system. When such information reflects a deviation from the established standards, the system should induce a decision or an action leading to control.

- **Knowledge Information:** Knowledge is defined as "information about information". Knowledge information is acquired through experience and learning, and collected from archival data and research studies.
- **Organizational Information:** Organizational information deals with an organization's environment, culture in the light of its objectives. Karl Weick's Organizational Information Theory emphasizes that an organization reduces its equivocality or uncertainty by collecting, managing and using these information prudently. This information is used by everybody in the organization; examples of such information are employee and payroll information.
- **Functional/Operational Information:** This is operation specific information. For example, daily schedules in a manufacturing plant that refers to the detailed assignment of jobs to machines or machines to operators. In a service oriented business, it would be the duty roster of various personnel. This information is mostly internal to the organization.
- **Database Information:** Database information construes large quantities of information that has multiple usage and application. Such information is stored, retrieved and managed to create databases. For example, material specification or supplier information is stored for multiple users.

Information is a vital resource for the success of any organization. Future of an organization lies in using and disseminating information wisely. Good quality information placed in right context in right time tells us about opportunities and problems well in advance.

Good quality information: Quality is a value that would vary according to the users and uses of the information.

Following are the dimensions or elements of Information Quality:

- **Intrinsic:** Accuracy, Objectivity, Believability, Reputation
- **Contextual:** Relevancy, Value-Added, Timeliness, Completeness, Amount of information
- **Representational:** Interpretability, Format, Coherence, Compatibility
- **Accessibility:** Accessibility, Access security
- **Reliability** - It should be verifiable and dependable.
- **Timely** - It must be current and it must reach the users well in time, so that important decisions can be made in time.
- **Relevant** - It should be current and valid information and it should reduce uncertainties.
- **Accurate** - It should be free of errors and mistakes, true, and not deceptive.
- **Sufficient** - It should be adequate in quantity, so that decisions can be made on its basis.
- **Unambiguous** - It should be expressed in clear terms. In other words, it should be comprehensive.
- **Complete** - It should meet all the needs in the current context.

- **Unbiased** - It should be impartial, free from any bias. In other words, it should have integrity.
- **Explicit** - It should not need any further explanation.
- **Comparable** - It should be of uniform collection, analysis, content, and format.
- **Reproducible** - It could be used by documented methods on the same data set to achieve a consistent result.

Information processing beyond doubt is the dominant industry of the present century. Following factors states few common factors that reflect on the needs and objectives of the information processing:

- Increasing impact of information processing for organizational decision making.
- Dependency of services sector including banking, financial organization, health care, entertainment, tourism and travel, education and numerous others on information.
- Changing employment scene world over, shifting base from manual agricultural to machine-based manufacturing and other industry related jobs.
- Information revolution and the overall development scenario.
- Growth of IT industry and its strategic importance.
- Strong growth of information services fuelled by increasing competition and reduced product life cycle.
- Need for sustainable development and quality life.
- Improvement in communication and transportation brought in by use of information processing.
- Use of information processing in reduction of energy consumption, reduction in pollution and a better ecological balance in future.
- Use of information processing in land record managements, legal delivery system, educational institutions, natural resource planning, customer relation management and so on.

**In a nutshell:**

- Information is needed to survive in the modern competitive world.
- Information is needed to create strong information systems and keep these systems up to date.

**Implications of Information in Business**

Information processing has transformed our society in numerous ways. From a business perspective, there has been a huge shift towards increasingly automated business processes and communication. Access to information and capability of information processing has helped in achieving greater efficiency in accounting and other business processes.

A complete business information system, accomplishes the following functionalities:

- Collection and storage of data.

- Transform these data into business information useful for decision making.
- Provide controls to safeguard data.
- Automate and streamline reporting.

The following list summarizes the five main uses of information by businesses and other organizations:

- **Planning** - At the planning stage, information is the most important ingredient in decision making. Information at planning stage includes that of business resources, assets, liabilities, plants and machineries, properties, suppliers, customers, competitors, market and market dynamics, fiscal policy changes of the Government, emerging technologies, etc.
- **Recording** - Business processing these days involves recording information about each transaction or event. This information collected, stored and updated regularly at the operational level.
- **Controlling** - A business need to set up an information filter, so that only filtered data is presented to the middle and top management. This ensures efficiency at the operational level and effectiveness at the tactical and strategic level.
- **Measuring** - A business measures its performance metrics by collecting and analyzing sales data, cost of manufacturing, and profit earned.
- **Decision-making** - MIS is primarily concerned with managerial decision-making, theory of organizational behavior, and underlying human behavior in organizational context. Decision-making information includes the socio-economic impact of competition, globalization, democratization, and the effects of all these factors on an organizational structure.

In short, this multi-dimensional information evolves from the following logical foundations:

- Operations research and management science
- Theory of organizational behavior
- Computer science:
  - Data and file structure
  - Data theory design and implementation
  - Computer networking
  - Expert systems and artificial intelligence
- Information theory

Following factors arising as an outcome of information processing help speed up of business events and achieves greater efficiency:

- Directly and immediate linkage to the system

- Faster communication of an order
- Electronic transfer of funds for faster payment
- Electronically solicited pricing (helps in determining the best price)

#### ❑ MIS Need for Information Systems

❑ Managers make decisions. Decision-making generally takes a four-fold path:

- ❑ • Understanding the need for decision or the opportunity,
- ❑ • Preparing alternative course of actions,
- ❑ • Evaluating all alternative course of actions,
- ❑ • Deciding the right path for implementation.

❑ MIS is an information system that provides information in the form of standardized reports and displays for the managers. MIS is a broad class of information systems designed to provide information needed for effective decision making.

❑ Data and information created from an accounting information system and the reports generated thereon are used to provide accurate, timely and relevant information needed for effective decision making by managers.

❑ **Management information systems provide information to support management decision making, with the following goals:**

- ❑ • Pre-specified and preplanned reporting to managers.
- ❑ • Interactive and ad-hoc support for decision making.
- ❑ • Critical information for top management.

❑ MIS is of vital importance to any organization, because:

- ❑ • It emphasizes on the management decision making, not only processing of data generated by business operations.
- ❑ • It emphasizes on the systems framework that should be used for organizing information systems applications.

❑ To the managers, Management Information System is an implementation of the organizational systems and procedures. To a programmer it is nothing but file structures and file processing. However, it involves much more complexity.

❑ The three components of MIS provide a more complete and focused definition, where **System** suggests integration and holistic view, **Information** stands for processed data, and **Management** is the ultimate user, the decision makers.

**Management information system can thus be analyzed as follows:**

### **Management**

Management covers the planning, control, and administration of the operations of a concern. The top management handles planning; the middle management concentrates on controlling; and the lower management is concerned with actual administration.

### **Information**

Information, in MIS, means the processed data that helps the management in planning, controlling and operations. Data means all the facts arising out of the operations of the concern. Data is processed i.e. recorded, summarized, compared and finally presented to the management in the form of MIS report.

### **System**

Data is processed into information with the help of a system. A system is made up of inputs, processing, output and feedback or control.

Thus MIS means a system for processing data in order to give proper information to the management for performing its functions.

### **Definition**

Management Information System or 'MIS' is a planned system of collecting, storing, and disseminating data in the form of information needed to carry out the functions of management.

### **Objectives of MIS**

The goals of an MIS are to implement the organizational structure and dynamics of the enterprise for the purpose of managing the organization in a better way and capturing the potential of the information system for competitive advantage.

Following are the basic objectives of an MIS:

- **Capturing Data:** Capturing contextual data, or operational information that will contribute in decision making from various internal and external sources of organization.
- **Processing Data:** The captured data is processed into information needed for planning, organizing, coordinating, directing and controlling functionalities at strategic, tactical and operational level. Processing data means:
  - making calculations with the data
  - sorting data
  - classifying data and
  - summarizing data
- **Information Storage:** Information or processed data need to be stored for future use.



- **Information Retrieval:** The system should be able to retrieve this information from the storage as and when required by various users.
- **Information Propagation:** Information or the finished product of the MIS should be circulated to its users periodically using the organizational network.

### Characteristics of MIS

#### Following are the characteristics of an MIS:

- It should be based on a long-term planning.
- It should provide a holistic view of the dynamics and the structure of the organization.
- It should work as a complete and comprehensive system covering all interconnecting sub-systems within the organization.
- It should be planned in a top-down way, as the decision makers or the management should actively take part and provide clear direction at the development stage of the MIS.
- It should be based on need of strategic, operational and tactical information of managers of an organization.
- It should also take care of exceptional situations by reporting such situations.
- It should be able to make forecasts and estimates, and generate advanced information, thus providing a competitive advantage. Decision makers can take actions on the basis of such predictions.
- It should create linkage between all sub-systems within the organization, so that the decision makers can take the right decision based on an integrated view.
- It should allow easy flow of information through various sub-systems, thus avoiding redundancy and duplicity of data. It should simplify the operations with as much practicability as possible.
- Although the MIS is an integrated, complete system, it should be made in such a flexible way that it could be easily split into smaller sub-systems as and when required.
- A central database is the backbone of a well-built MIS.

### Characteristics of Computerized MIS

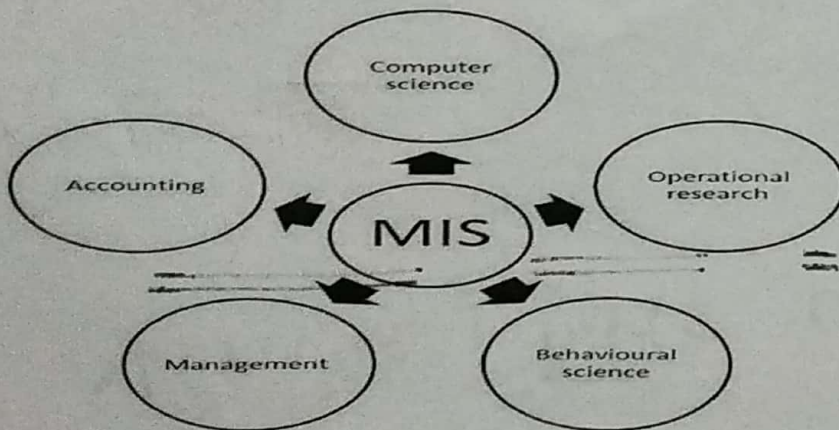
#### Following are the characteristics of a well-designed computerized MIS:

- It should be able to process data accurately and with high speed, using various techniques like operations research, simulation, heuristics, etc.
- It should be able to collect, organize, manipulate, and update large amount of raw data of both related and unrelated nature, coming from various internal and external sources at different periods of time.
- It should provide real time information on ongoing events without any delay.

- It should support various output formats and follow latest rules and regulations in practice.
- It should provide organized and relevant information for all levels of management: strategic, operational, and tactical.
- It should aim at extreme flexibility in data storage and retrieval.

#### Nature and Scope of MIS

The following diagram shows the nature and scope of MIS:



# **Role of Information in Decision Making Process**

## **Decision Making**

Decision making is a daily activity for any human being. There is no exception about that. When it comes to business organizations, decision making is a habit and a process as well.

Effective and successful decisions make profit to the company and unsuccessful ones make losses. Therefore, corporate decision making process is the most critical process in any organization.

In the decision making process, we choose one course of action from a few possible alternatives. In the process of decision making, we may use many tools, techniques and perceptions. We may make our own private decisions or may prefer a collective decision. Usually, decision making is hard. Majority of corporate decisions involve some level of dissatisfaction or conflict with another party.

## **Role of Information in Decision Making Process**

Information plays a vital role in decision-making. Even to take very simple decisions, we need information. To understand the role played by information in decision-making, we have to understand how decisions are taken. Information is thus, very important to take decisions. At every stage of the decision-making he uses information that we captures visually. Information is thus, very important to take decisions. At every stage of the decision-making he uses information that we captures visually.

**Decision-making is basically a process that includes the following stages:**

### **Step 1: Identification of the purpose of the decision**

In this step, the problem is thoroughly analysed. There are a couple of questions one should ask when it comes to identifying the purpose of the decision.

- What exactly is the problem?
- Why the problem should be solved?
- Who are the affected parties of the problem?
- Does the problem have a deadline or a specific time-line?

### **Step 2: Information gathering**

A problem of an organization will have many stakeholders. In addition, there can be dozens of factors involved and affected by the problem. In the process of solving the problem, you will have to gather as much as information related to the factors and stakeholders involved in the problem. For the process of information gathering, tools such as 'Check Sheets' can be effectively used.

### **Step 3: Principles for judging the alternatives**

In this step, the baseline criteria for judging the alternatives should be set up. When it comes to defining the criteria, organizational goals as well as the corporate culture should be taken into consideration.

As an example, profit is one of the main concerns in every decision making process. Companies usually do not make decisions that reduce profits, unless it is an exceptional case. Likewise, baseline principles should be identified related to the problem in hand.

### **Step 4: Brainstorm and analyse the different choices**

For this step, brainstorming to list down all the ideas is the best option. Before the idea generation step, it is vital to understand the causes of the problem and prioritization of causes. For this, you can make use of Cause-and-Effect diagrams and Pareto Chart tool. Cause-and-Effect diagram helps you to identify all possible causes of the problem and Pareto chart helps you to prioritize and identify the causes with highest effect. Then, you can move on generating all possible solutions (alternatives) for the problem in hand.

### **Step 5: Evaluation of alternatives**

Use your judgement principles and decision-making criteria to evaluate each alternative. In this step, experience and effectiveness of the judgement principles come into play. You need to compare each alternative for their positives and negatives.

### **Step 6: Select the best alternative**

Once you go through from Step 1 to Step 5, this step is easy. In addition, the selection of the best alternative is an informed decision since you have already followed a methodology to derive and select the best alternative.

### **Step 7: Execute the decision**

Convert your decision into a plan or a sequence of activities. Execute your plan by yourself or with the help of subordinates.

### **Step 8: Evaluate the results**

Evaluate the outcome of your decision. See whether there is anything you should learn and then correct in future decision making. This is one of the best practices that will improve your decision-making skills.

First we get information about a problem, format it into a structure and then factor in the information about the context in which the problem has occurred. Therefore, we see that the context has a major role in the decision-making and information is required both about the problem and about the context in which the problem occurred. The next stage for the decision maker would be to generate alternatives.

Stages of Decision-making	Role of Information
Identification and structuring of problem/opportunity	One needs information to identify a problem and put it in a structured manner. Without information about a problem or opportunity, the decision-making process does not even start.
Putting the problem/opportunity in context	Without information about the context in which the problem has occurred, one cannot take any decision on it. In a way, the information about the context defines the problem.
Generation of alternatives	Information is a key ingredient in the generation of alternatives for decision-making. One has to have information about possible solutions to generate alternatives.
Choice of best alternative	Based on the information about the suitability of the alternatives, a choice is made to select the best alternative.

So the decision-maker generates these possible solutions to the problem at hand based on information about such possible solutions. Each of the alternatives represents a possible solution, which one can generate if one has information about them. In the case of the driver, obviously, he needs knowledge and information to generate these alternatives, i.e., to stop by breaking the driver would need to know that braking stops the vehicle. If he is unaware of this crucial information he would not have been able to generate this alternative. So information is vital for generation of alternatives. Now for the choice part also, the decision maker needs to have information about the suitability of each alternative to decide, which the 'best' is. In our example, the driver calculates the 'payoff' for each alternative based on his calculation of the outcome that again is based on information. He selects the 'best' option that solves the problem. Thus, we can see that information is the key to the decision making process, without information and the right kind of information decision-making is not possible. Information plays a crucial role in every stage of the decision-making process.

Decision-making is the most important task of managers in an organization. Therefore, to enable managers to take good quality decisions, it is very important to provide them with the right kind of information. Information management in organizations therefore assumes a special significance. In most

organizations, business or otherwise, a systematic systems based method is used for information management. Systems based information management works best under a computerized environment and such computer based information management system is normally called 'Management Information Systems (MIS)', which provides the service of information supply to the managers enabling them to take informed decisions. It may be worthwhile to mention here that MIS does not necessitates the use of computer based technology, but the use of computers and information technology makes MIS suitable for business organizations in a competitive environment as it helps to provide timely and accurate information. MIS done manually, without the help of computers is neither timely nor accurate.

Decision making is a very important and complex process. In order to aid decision makers make the right choice, quantitative techniques are used that improve the overall quality of decision making.

**Following are some of the commonly used techniques –**

### **Decision Trees**

Decision Trees are tools that help choose between several courses of action or alternatives. They are –

- Represented as tree-shaped diagram used to determine a course of action or show a statistical probability.
- Each branch of the decision tree represents a possible decision or occurrence.
- The tree structure shows how one choice leads to the next, and the use of branches indicates that each option is mutually exclusive.
- A decision tree can be used by a manager to graphically represent which actions could be taken and how these actions relate to future events.

### **Delphi Technique**

Delphi Technique is a method used to estimate the likelihood and outcome of future events. It is unique because –

- It is a group process using written responses to a series of questionnaires instead of physically bringing individuals together to make a decision.
- Individuals are required to respond to a set of multiple questionnaires, with each subsequent questionnaire built from the information gathered in the previous one.
- The process ends when the group reaches a consensus.
- The responses can be kept anonymous if required.

### **Payback Analysis**

Payback analysis is a technique generally used in financial management.

- It refers to the period of time required to recoup the funds expended in an investment, or to reach the break-even point.
- It is generally used to evaluate capital-purchasing alternatives.
- Alternatives are ranked according to the time each takes to pay back its initial cost.
- The strategy is to choose the alternative that has the quickest payback of the initial cost.

### **Simulations**

Simulation is a technique that attempts to replace and amplify real experiences with guided techniques.

- It is a widely used technique in operations research.
- It models the behavior of individual elements within a given system.
- Methods generally used in simulation are random sampling to generate realistic variability.
- The overall behavior of the system emerges from the interactions between the elements.
- Widely used application areas of the simulation technique are - logistics and supply chain, service and operations management, business process improvement, health and social care information system, environment, etc.

Decision making style of managers depends greatly on their personality and approach towards problem solving. Every leader or manager has his own individualistic style augmented by his experience, background, and abilities.

### **Directive or Autocratic Decision Making**

Managers who follow this style assess few alternatives and consider limited information while taking any decision. They do not find it important to consult with others or seek information in any form and use their logic and idea while taking decisions.

### **Analytical Decision Making**

Managers using analytic decision making style would like to have more information and consider more alternatives before coming to a conclusion.

They seek relevant information from their sources and consider factual and detailed information before taking any decision. Such managers are careful decision makers as they have the ability to adapt or cope with unique situations.

### **Behavioral Decision Making**

Leaders who follow this model believe in participative management and consider the achievement of subordinates and always take suggestions from them.

They try to get inputs from subordinates through meetings and discussions. They try to avoid/resolve conflicts as acceptance by others is important to them.

### **Conceptual Decision Making**

Managers using conceptual decision making style are intuitive in their thinking and have high tolerance for ambiguity.

They look at many alternatives and focus on long run outcomes.

## Types of Information System

A typical organization is divided into operational, middle, and upper level. The information requirements for users at each level differ. Towards that end, there are number of information systems that support each level in an organization.

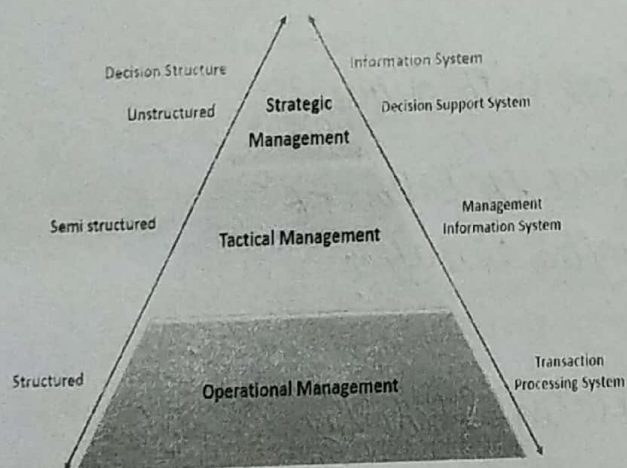
The different types of Information system are:

- Pyramid Diagram of Organizational levels and information requirements
- Transaction Processing System (TPS)
- Management Information System (MIS)
- Decision Support System (DSS)
- Artificial intelligence techniques in business
- Online Analytical Processing (OLAP)

### Pyramid Diagram of Organizational levels and information requirements

Understanding the various levels of an organization is essential to understand the information required by the users who operate at their respective levels.

The following diagram illustrates the various levels of a typical organization.



### Operational management level

The operational level is concerned with performing day to day business transactions of the organization.

Examples of users at this level of management include cashiers at a point of sale, bank tellers, nurses in a hospital, customer care staff, etc.

Users at this level use make structured decisions. This means that they have defined rules that guide them while making decisions.

For example, if a store sells items on credit and they have a credit policy that has some set limit on the borrowing. All the sales person needs to decide whether to give credit to a customer or not is based on the current credit information from the system.



### **Tactical Management Level**

This organization level is dominated by middle-level managers, heads of departments, supervisors, etc. The users at this level usually oversee the activities of the users at the operational management level.

Tactical users make semi-structured decisions. The decisions are partly based on set guidelines and judgmental calls. As an example, a tactical manager can check the credit limit and payments history of a customer and decide to make an exception to raise the credit limit for a particular customer. The decision is partly structured in the sense that the tactical manager has to use existing information to identify a payments history that benefits the organization and an allowed increase percentage.

### **Strategic Management Level**

This is the most senior level in an organization. The users at this level make unstructured decisions. Senior level managers are concerned with the long-term planning of the organization. They use information from tactical managers and external data to guide them when making unstructured decisions.

#### **1. Transaction Processing System (TPS)**

Transaction processing systems are used to record day to day business transactions of the organization. They are used by users at the operational management level. The main objective of a transaction processing system is to answer routine questions such as;

- How printers were sold today?
- How much inventory do we have at hand?
- What is the outstanding due for John Doe?

By recording the day to day business transactions, TPS system provides answers to the above questions in a timely manner.

- The decisions made by operational managers are routine and highly structured.
- The information produced from the transaction processing system is very detailed.

Examples of transaction processing systems include;

- **Point of Sale Systems** – records daily sales
- **Payroll systems** – processing employee salary, loans management, etc.
- **Stock Control systems** – keeping track of inventory levels
- **Airline booking systems** – flights booking management

#### **2. Management Information System (MIS)**

Management Information Systems (MIS) are used by tactical managers to monitor the organization's current performance status. The output from a transaction processing system is used as input to a management information system.

The MIS system analyzes the input with routine algorithms i.e. aggregate, compare and summarizes the results to produced reports that tactical managers use to monitor, control and predict future performance.

For example, input from a point of sale system can be used to analyze trends of products that are performing well and those that are not performing well. This information can be used to make future inventory orders i.e. increasing orders for well-performing products and reduce the orders of products that are not performing well.

Examples of management information systems include;

- **Sales management systems** – they get input from the point of sale system
- **Budgeting systems** – gives an overview of how much money is spent within the organization for the short and long terms.
- **Human resource management system** – overall welfare of the employees, staff turnover, etc.

Tactical managers are responsible for the semi-structured decision. MIS systems provide the information needed to make the structured decision and based on the experience of the tactical managers, they make judgement calls i.e. predict how much of goods or inventory should be ordered for the second quarter based on the sales of the first quarter.

Management information systems are especially developed to support planning, controlling, and decision-making functions of middle managers. A management information system (MIS) extracts transaction data from underlying TPSs, compiles them, and produces information products in the form of reports, displays or responses.

These information products provide information that conforms to decision-making needs of managers and supervisors. Management information systems use simple routines like summaries and comparisons which enable managers to take decisions for which the procedure of reaching at a solution has been specified in advance.

Generally, the format of reports produced by MIS is pre-specified. A typical MIS report is a summary report, such as a report on the quarterly sales made by each sales representative of the organization. Another type of management information system report is an; for example, exception report that specifies the exception conditions the sales made by some sales representative is far below than expected.

Usually, management information systems are used to produce reports on monthly, quarterly, or yearly basis. However, if managers want to view the daily or hourly data, MIS enables them to do so. In addition, they provide managers online access to the current performance as well as past records of the organization.

### 3. Decision Support System (DSS)

Decision support systems are used by senior management to make non-routine decisions. Decision support systems use input from internal systems (transaction processing systems and management information systems) and external systems.

The main objective of decision support systems is to provide solutions to problems that are unique and change frequently. Decision support systems answer questions such as;

- What would be the impact of employees' performance if we double the production lot at the factory?
- What would happen to our sales if a new competitor entered in the market?

Decision support systems use sophisticated mathematical models and statistical techniques (probability, predictive modeling, etc.) to provide solutions, and they are very interactive.

Examples of decision support systems include;

- **Financial planning systems** – it enables managers to evaluate alternative ways of achieving goals. The objective is to find the optimal way of achieving the goal. For example, the net profit for a business is calculated using the formula Total Sales less (Cost of Goods + Expenses). A financial planning system will enable senior executives to ask what if questions and adjust the values for total sales, the cost of goods, etc. to see the effect of the decision and on the net profit and find the most optimal way.
- **Bank loan management systems** – it is used to verify the credit of the loan applicant and predict the likelihood of the loan being recovered.

A decision support system (DSS) is an interactive computer-based information system that, like MIS, also serves at the management level of an organization. However, in contrast to MIS, it processes information to support the decision making process of managers. It provides middle managers with the information that enables them to make intelligent decisions. A decision support system in a bank, for example, enable a manager to analyze the changing trends in deposits and loans in order to ascertain the yearly targets.

Decision support systems are designed for every manager to execute a specific managerial task or problem. Generally, they help managers to make semi-structured decisions, the solution to which can be arrived at logically. However, sometimes, they can also help in taking complex decisions. To support such decisions, they use information generated by OASs and TPSs.

Decision support systems have more analytical power as compared to other information systems. They employ a wide variety of decision models to analyze data or summarize vast amount of data into a form (usually form of tables or charts) that make the comparison and analysis of data easier for managers. They provide interactive environment so that the users could work with them directly, add or change data as per their requirements, and ask new questions.

#### 4. Artificial intelligence techniques in business

Artificial intelligence systems copy human expertise to identify patterns in large data sets. Companies such as Amazon, Facebook, and Google, etc. use artificial intelligence techniques to identify data that is most relevant to you.

Let's use Facebook as an example, Facebook usually makes very accurate predictions of people that you might know or went with to school. They use the data that you provide to them, the data that your friends provide and based on this information make predictions of people that you might know.

Amazon uses artificial intelligence techniques too to suggest products that you should buy also based on what you are currently getting.

Google also uses artificial intelligence to give you the most relevant search results based on your interactions with Google and your location.

These techniques have greatly contributed in making these companies very successful because they are able to provide value to their customers.

## 5. Online Analytical Processing (OLAP)

Online analytical processing (OLAP) is used to query and analyze multi-dimensional data and produce information that can be viewed in different ways using multiple dimensions.

Let's say a company sells laptops, desktops, and Mobile device. They have four (4) branches A, B, C and D. OLAP can be used to view the total sales of each product in all regions and compare the actual sales with the projected sales.

Each piece of information such as product, number of sales, sales value represents a different dimension. The main objective of OLAP systems is to provide answers to ad hoc queries within the shortest possible time regardless of the size of the datasets being used.

## 6. Office Automation Systems

An office automation system (OAS) is a collection of communication technology, computers and persons to perform official tasks. It executes office transactions and supports official activities at every organizational level. These activities can be divided into clerical and managerial activities.

Clerical activities performed with the help of office automation system include preparing written communication, typesetting, printing, mailing, scheduling meetings, calendar keeping, etc. Under managerial activities, office automation system helps in conferencing, creating reports and messages, and controlling performance of organization. Many applications like word processing, electronic filing and e-mail are integrated in office automation system.

**Word Processing:** Word processing is used for the preparation of documents like letters, reports, memos, or any type of printable material by electronic means. The text is entered by keyboard and displayed on the computer's display unit. This text can be edited, stored, and reproduced with the help of commands present in the word processor. Word processors have facilities for spell checking, grammar checking, counting (character, lines, pages, etc.), automatic page numbering, index creation, header and footer, etc.

**Email:** E-mail or electronic mail facilitates the transfer of messages or documents with the help of computer and communication lines. This helps in speedy delivery of mails and also reduces time and cost of sending a paper mail. E-mail supports not only the transfer of text messages but it also has options for sending images, audio, video, and many other types of data.

**Voice Mail:** Voice mail, an important call service, allows recording and storing of telephone messages into the computer's memory. The intended person can retrieve these messages any time.

**Knowledge Work Systems:** A knowledge work system (KWS) is a specialized system built to promote the creation of knowledge and to make sure that knowledge and technical skills are properly integrated into business. It helps the knowledge workers in creating and propagating new information and knowledge by providing them the graphics, analytical, communications, and document management tools.

The knowledge workers also need to search for knowledge outside the organization. Thus, knowledge work system must give easy access to external databases. In addition, knowledge work systems should have user-friendly interface to help users to get the required information quickly and easily.

Some examples of knowledge work systems are computer-aided design (CAD) systems, virtual reality systems, and financial workstations.

**Computer-aided design (CAD) systems:** These systems are used for automating the creation and revision of designs using computers and graphics software. The CAD software has the capability to provide design specifications for tooling and manufacturing process. This saves much time and money while making a manufacturing process.

**Virtual Reality System:** These systems have more capabilities than CAD systems for visualization, rendering and simulation. They make use of interactive graphics software to build computer-generated simulations which almost look like real. They can be used in educational, scientific and business work.

**Financial Workstations:** They are used to combine a wide range of data from internal as well as external sources. This data includes contact management data, market data and research reports. Financial workstations help in analyzing trading situations and large amount of financial data within no time. It is also used for portfolio management.

## 7. Executive Support Systems

An executive support system (ESS) – an extension of MIS – is a computer based information system that helps in decision making at the top-level of an organization. The decisions taken with the help of executive support system are non-routine decisions that affect the entire organization and, thus, require judgement and sight.

As compared to DSSs, ESSs offer more general computing capabilities, better telecommunications and efficient display options. They use the advanced graphics software to display the critical information in the form of charts or graphs that help senior executives to solve a wide range of problems. To make effective decisions, they use summarized internal data from MIS and DSS as well as data from external sources about events like new tax laws, new competitors, etc. They filter, compress, and track data of high importance and make it available to the strategic-level managers.

Executive support systems help to monitor performance, track activities of competitors, identify opportunities, and forecast trends. They also assist senior managers in answering the following question:

- What business should we do?
- How are our competitors doing the business?
- Which units can be sold and which new units are to be bought?