

2. Information Systems Concepts

2.1 Information

- Technically, Information means processed Data. Data is facts or values of results, and information is the relations between data and other relations.
- Information may be represented in the form of text, graph, pictures, voice, videos etc.
- Example – “85”, “Ira”, “scored”, “Maths”, “in”, “marks” itself represents data but it conveys information when we write sentence “Ira scored marks in Maths = 85” which is obtained after manipulating the data.
- Information relate to description, definition or perspective (what, who, when, where). It is essential because it adds knowledge, helps in decision making, analyzing the future and taking action in time.

- **Attributes of Information:**

Some of the important attributes of useful and effective information are given as follows:

- ✦ **Availability –**

- Information is useless if it is not available at the time of need.

- ✦ **Purpose/Objective –**

- Information must have purposes at the time it is transmitted to a person or machine, otherwise it is simple data. The basic objective of information is to inform, evaluate, persuade, and organize.

- ✦ **Mode and format –**

- The mode of communicating information should be in such a way that it can be easily understand by the people. The mode may be in the form of voice, text and combination of these two.
- Format of information should be simple, relevant and should highlight important points but should not be too cluttered up.

- ✦ **Current/Updated –**

- The information should be refreshed from time to time as it usually rots with time and usage.

- ✦ **Rate –**

- Useful information is the one which is transmitted at a rate which matches with the rate at which the recipient wants to receive.

- ✦ **Frequency –**

- The frequency with which information is transmitted or received affects its value.

- ✦ **Completeness and Adequacy –**

- The information provided should be complete and adequate in itself because only complete information can be used in policy making.

- ✦ **Reliability –**

- It is a measure of failure or success of using information for decision making.

✦ **Validity –**

- It measures how close the information is to the purpose for which it asserts to serve.

✦ **Quality –**

- It means the correctness of information.

✦ **Transparency –**

- It is essential in decision and policy making.

✦ **Value of Information –**

- It is defined as difference between the value of the change in decision behavior caused by the information and the cost of the information.

2.2 System

- A system is a group of inter connected components working towards the accomplishment of a common goal by accepting inputs and producing outputs in an ordered transformation process.
- A system generally consists of input, processing, storage and output.
 - Input is the data entering the system.
 - Processing is the manipulation of the input data.
 - Output is the data/instruction given by the system after processing and
 - Storage refers to the storage of data for current or future use.
- For example – a business is said to be system because it contains input e.g. people, machine, money, materials etc., which are processed by means of different processes such as production, marketing, finance etc. and produces output i.e. services and goods.

2.2.1 Classification of System

1. **On the basis of Elements:**

System may be categorized as Abstract or Physical System on the basis of the element in the system.

✦ **Abstract System (or Conceptual System) –**

- Abstract System is defined as an orderly arrangement of interdependent ideas or constructs.
- For example – a system of theology is an orderly arrangement of ideas about God and the relationship of humans to God.

✦ **Physical System –**

- Physical System is a set of tangible elements, which operated together to accomplish an objective. Example – Computer system, University system etc.

2. **On the basis of Interactive behavior:**

System may classified as Open or Closed System based on 'how system interact with environment'.

✦ **Open System –**

- An Open System interacts with other systems in its environment.
- For example – Information system is an open system because it takes input from the environment and produces output to the environment.

✦ **Closed System –**

- Closed System does not interact with the environment and does not change with the changes in environment.
- Example – A ‘throw-away’ type sealed digital watch is a closed system as it is completely isolated from its environment for its operation.

3. **On the basis of Degree of Human intervention:**

According to degree of human intervention, system may be classified as Manual or Automated System.

✦ **Manual System –**

- In a Manual System, the activities like data collection, maintenance and final reporting are done by human.

✦ **Automated System –**

- In an Automated System, the activities like data collection, maintenance and final reporting are carried out by computer system or say machine itself.

4. **On the basis of Working/Output:**

On the basis of working style/output, system can be classified as Deterministic and Probabilistic System

✦ **Deterministic System –**

- A Deterministic System operates in a predictable manner.
- For example – software that performs on a set of instructions is a deterministic system.

✦ **Probabilistic System –**

- A Probabilistic System can be defined in terms of probable behavior.
- Example - inventory system is a probabilistic system where the average demand, average time for replenishment, etc. may be defined, but the exact value at any given time is not known.

2.3 Information Systems and its Components

- Information systems are of various type i.e. Manual information system, Informal information system, Formal information system and Computer based information system.
- Information Systems play a vital role in the enterprise collaboration and management and strategic success of business that must operate in an inter-networked global environment.
- An Information System comprise of People, Hardware, Software, Data and Network for communication support.
 - People mean the IT professionals i.e. system administrator, programmers and end users;
 - Hardware means the physical components of the computers;
 - Software means the system software (e.g. LINUX, WINDOW), application & utility softwares;
 - The data is the raw fact, which may be in the form of database; and
 - The network means communication media (Internet, Intranet, Extranet etc.).

- An Information System model comprises of following steps:
 - (i) Data is collected from an organization or from external environments and converted into suitable format required for processing (**Input**);
 - (ii) This is converted into information (more meaningful form) obtained after manipulation of these collected data (**Processing**); and
 - (iii) Then information is stored for future use or communicated to user after application of respective procedure on it (**Output**).
- **Computer Based Information Systems –**
 - ✦ A Computer Based Information system is a combination of people, IT and business processes that helps management in taking important decisions to carry out the business successfully.
 - ✦ Some of the important characteristics of Computer Based Information Systems are given as follows:
 - All systems work for predetermined objectives and are designed and developed accordingly.
 - In general, a system has a number of interrelated and interdependent subsystems. No subsystem can function in isolation; it depends on other subsystems for its inputs.
 - If one subsystem or component of a system fails; in most of the cases, the whole system does not work. However, it depends on 'how the subsystems are interrelated'.
 - The way a subsystem works with another subsystem is called interaction. The different subsystems interact with each other to achieve the goal of the system.
 - The work done by individual subsystems is integrated to achieve the central goal of the system.
- **Major areas of computer based applications are finance and accounting, marketing and sales, manufacturing, inventory and human resource management etc., which are given as follows:**
 - ✦ **Finance and Accounting –**
 - The main goal of this subsystem is to ensure the financial viability of the organization. It helps in forecasting revenues, determining best resources and uses of funds.
 - Typical sub-application areas are - Financial accounting; General ledger; Accounts receivable/ payable; Investment management; Cash management; Treasury management and Balance sheet.
 - ✦ **Marketing and Sales –**
 - The objective of this subsystem is to maximize the sales and ensure customer satisfaction.
 - The marketing system facilitates the chances of order procurement by marketing the products of the company, creating new customers and advertising the products.
 - ✦ **Production or Manufacturing –**
 - The objective of this subsystem is to optimally deploy man, machine and material to maximize production or service.

✦ **Inventory /Stores Management-**

- The system is used
 - to regulate the maximum and minimum level of stocks,
 - raise alarm at danger level stock of any material,
 - give timely alert for re-ordering of materials with optimal re-order quantity and facilitate various queries about inventory like total inventory value at any time,
 - identification of important items in terms stock value etc.

✦ **Human Resource Management-**

- Human resource is the most valuable asset for an organization. Utilization of this resource in the most effective and efficient way is an important function for any enterprise.
- An HRM system have following modules – Personnel administration; Recruitment management; Travel management; Benefit administration; Salary administration; Promotion management etc.

2.4 Types of Information Systems

- Information system performs important operational and managerial support roles in businesses and other enterprises.
- Conceptually, information systems are categorized as follows:

2.4.1 Operational Level Systems –

- Operational-Level Systems support operational managers in tracking elementary activities and include tracking customer orders, invoice tracking, etc.
- Operational-level system/Operational Support System main objective is to improve the operational efficiency of the enterprise. It produces a variety of information for internal and external use.
- Its role is to effectively process business transactions, control industrial processes, support enterprise communications and collaborations and update corporate database.
- These are further categorized as follows:

2.4.1.1 Transaction Processing System (TPS) –

- TPS is an information system that manipulates data from business transactions at the lowest level of management. TPS will record and manipulate transaction data into usable information.
- A TPS may follow the periodic data preparation and batch processing or online processing. However, the people involved in TPS are not in a position to take any management decision.
- Major activities involved in a TPS are given as follows:
 - Capturing data and organizing in files or databases;
 - Processing files/databases using application software;
 - Generating information in the form of reports; and
 - Processing queries from various quarters of the organization.
- **TPS Components:**

The principal components of a TPS include inputs, processing, storage and outputs. The components or elements are part of both manual and computerized systems.

✦ **Inputs –**

- Source documents, such as customer orders, sales, invoices, purchase orders, and employee time cards, are the physical evidence of inputs in to the Transaction Processing System.

✦ **Processing –**

- This involves the use of journals and registers to provide a permanent and chronological record of inputs.
- Journals are used to record financial accounting transactions, and registers are used to record other types of data not directly related to accounting.

✦ **Storage –**

- Ledgers and files provide storage of data on both manual and computerized systems.

✦ **Outputs –**

- Any document generated in the system is output. Some documents are both output and input.
- For example; a customer invoice is an output from the order-entry application system and also an input document to the customer.

- **Features of TPS**

- ✦ **Large volume of data –**

- As TPS is transaction oriented and generally consists of large volumes of data.

- ✦ **Automation of basic operations –**

- Any TPS aims at automating the basic operations of a business enterprise and plays a critical role in the day-to-day functioning of the enterprise.

- ✦ **Benefits are easily measurable –**

- Most of benefits of the TPS are tangible and easily measurable. Therefore, cost benefit analysis regarding the desirability of TPS is easy to conduct.

- ✦ **Source of input for other systems –**

- TPS is the basic source of internal information for other information systems.

2.4.2 Knowledge-Level Systems –

- These systems support discovery, processing and storage of knowledge and data workers.
- These support the business to integrate new knowledge into the business and control the flow of paperwork and enable group working. It is the fastest growing application in business today.
- It helps the organization's knowledge and data workers.

2.4.2.1 Office Automation Systems (OAS) –

- The application of computers to handle the office activities is also termed as office automation. Different office activities can be broadly grouped into the following types of operations:

- ✦ **Document Capture –**

- Documents originating from outside sources like incoming mails, notes, handouts, charts, graphs etc. need to be preserved.

- ✦ **Document Creation –**

- This consists of preparation of documents, dictation, editing of texts etc. and takes up major part of the secretary's time.

- ✦ **Receipts and Distribution –**

- This basically includes distribution of correspondence to designated recipients.

- ✦ **Filing, Search, Retrieval and Follow up –**

- This is related to filing, indexing, searching of documents, which takes up significant time.

- ✦ **Calculations –**

- These include the usual calculator functions like routine arithmetic, operations for bill passing, interest calculations, working out the percentages and the like.

- ✦ **Recording Utilization of Resources –**

- This includes record keeping in respect to specific resources utilized by office personnel.

- **Benefits of Office Automation Systems –**

- ✦ Office Automation System improve communication within an organization & between enterprise
- ✦ They reduce the cycle time between preparation and receipt of messages at the recipients' end.
- ✦ They also reduce the costs of office communication both in terms of time spent by executives and cost of communication links.
- ✦ Office Automation Systems ensure accuracy of information and smooth flow of communication.

- **Computer Based Office Automation Systems –**

Major computer based OAS are given as follows:

1. **Text Processing Systems –**

- ✦ Text processing systems are the most commonly used components of the OAS. As, a large proportion of the office communication takes place in writing using words of natural language.
- ✦ Text processing systems automate the process of development of documents such as letters, memos etc. Further, reduces keying effort and minimizes the chances of errors in document.
- ✦ The text processor may be simple word processing systems or desktop publishing systems. The desktop publishing systems help in quick production of multiple copies of the document.
- ✦ The desktop publishing systems are often supported with laser printers, inkjet printers, scanners and other such devices for producing good quality documents.

2. **Electronic Document Management System –**

- ✦ The computer based document management systems capture the information contained in document, stored for future reference and make them available to user as and when required.
- ✦ These systems are linked to the office automation systems such as text processors, electronic message communication systems etc.
- ✦ These systems are very useful in remote access of documents that is almost impossible with manual document management systems.
- ✦ In the case of internal communication, document management systems can prove to be very useful. For example, the loan application form filed in a branch of a bank can be accessed by the sanctioning officer for scrutiny at the head office or any office for scrutiny of loan proposal.
- ✦ With computer based document management systems, location of the executive becomes irrelevant for access to documents.

3. **Teleconferencing and Video-conferencing Systems –**

- ✦ Teleconferencing is conducted in a business meeting involving more than two persons located at two or more different places.
- ✦ The teleconferencing helps in reducing the time and cost of meeting as the participants do not have to travel to attend the meeting.
- ✦ The computer based teleconferencing has the advantage of flexibility in terms of pre-recorded presentations and integration with other information systems.
- ✦ Teleconferencing may be audio or video conferencing with or without use of computers.

- ✦ The communication links are still quite expensive.

4. **Electronic Message Communication Systems –**

- ✦ The computer based message communication systems offer a lot of economy not only in terms of reduced time in sending or receiving the message but also in terms of reliability of the message and cost of communication.

✦ **Components of Message Communication Systems –**

Three basic components based message communication systems are given as follows:

a) Electronic Mail-

Various features of electronic mail are stated below:

- **Electronic Transmission-**

- The transmission of messages with email is electronic and message delivery is very quick, almost instant. The confirmation of transmission is quick and the reliability is very high.

- **Online Development and Editing –**

- The email message can be developed and edited online before transmission. It eliminates the need for use of paper.

- **Broadcasting and Rerouting –**

- Email permits sending a message to a large number of target recipients. The email could be rerouted to people having direct interest in the message with or without changing.

- **Integration with other Information Systems –**

- The E-mail has the advantage of being integrated with the other information systems.

- **Portability –**

- Email renders the physical location of the recipient and sender irrelevant.

- **Economical –**

- The advancement in communication technologies have made Email the most economical mode for sending and receiving messages.

b) Facsimile (Fax) –

- It is electronic communication of images of documents over telephone lines. The computer based fax technology automates fax communication and permits sharing of fax facilities.
- It uses special software and fax servers to send and receive fax messages using common communication resources.
- These servers have the ability to receive fax messages and automatically reroute them to the intended recipient after viewing it at the central computer.
- The use of fax is gradually fading away with more and more use of electronic communication through emails.

c) Voice Mail –

- Voice mail is a variation of the email in which messages are transmitted as digitized voice
- The recipient of the voice mail has to dial a voice mail service or access the e-mail box using specified equipment and he can hear the spoken message in the voice of sender .
- The secured type of voice mail service may require the recipient to enter identification code before the access is granted to the stored information.

2.4.2.2 Knowledge Management System (KMS) –

- Knowledge Management (KM) is the process of capturing, developing, sharing, and effectively using organizational knowledge. It refers to a multi-disciplined approach to achieving organizational objectives by making the best use of knowledge.
- Knowledge Management Systems (KMS) refers to any kind of IT system that stores and retrieves knowledge, improves collaboration, locates knowledge sources, mines repositories for hidden knowledge, captures and uses knowledge, or in some other way enhances the KM process.
- KMS treats the knowledge component of any organization's activities as an explicit concern reflected in strategy, policy, and practice at all levels of the organization.
- KMS makes a direct connection between an organization's intellectual assets — both Explicit [recorded] and Tacit [personal know-how] — and positive results.
- There are two broad types of knowledge - Explicit and Tacit.

✦ Explicit knowledge:

- Explicit knowledge is that which can be formalized easily and as a consequence is easily available across the organization.
- Explicit knowledge is articulated, and represented as spoken words, written material and compiled data.
- This type of knowledge is codified, easy to document, transfer and reproduce.
- For example – Online tutorials, Policy and procedural manuals.

✦ Tacit knowledge:

- Tacit knowledge resides in a few often-in just one person and hasn't been captured by the organization or made available to others.
- Tacit knowledge is unarticulated and represented as intuition, perspective, beliefs, and values that individuals form based on their experiences.
- It is personal, experimental and context-specific.
- It is difficult to document and communicate the tacit knowledge.
- For example – hand-on skills, special know-how, employee experiences.

2.4.3 Management-Level Systems:

- It supports the middle managers in monitoring, decision making and administrative activities. It provides periodic reports rather than instant information on operations.
- This type of systems mainly answer “what if” questions.

- MSS supports managers in effective decision making by providing relevant and required information at the right time to the right people.
- Management Information System & Decision Support System are type of Management Level system.

2.4.3.1 Management Information Systems (MIS) –

- MIS supports the managers at different levels to take strategic (at top level) or tactical (at middle level) management decisions to fulfill the organizational goals.
- MIS is defined as “An integrated user-machine system designed for providing information to support operational control, management control and decision making function in an organization”.
- “MIS is a computer based system that provides flexible and speedy access to accurate data”.
- Nature of MIS at different levels has different flavors. MIS at the top level is much more comprehensive but is condensed compared to the information provided to those at middle level management.
- MIS provide reports to management that can help in making effective, structured types as applicable to decisions of day-to-day operations.
- **Characteristics of an effective MIS:**
 - ✦ **Management Oriented –**
 - It means that efforts for the development of the information system should start from an appraisal of management needs and overall business objectives.
 - ✦ **Management Directed –**
 - Because of management orientation of MIS, it is necessary that management should actively direct the system’s development efforts.
 - ✦ **Integrated –**
 - The best approach for developing information systems is the integrated approach as all the functional and operational information subsystems are tied together into one entity.
 - ✦ **Common Data Flows –**
 - It means the use of common input, processing and output procedures and media whenever required. This eliminates duplication in data collections.
 - ✦ **Heavy Planning Element –**
 - An MIS usually takes one to three years and sometimes even longer period to get established firmly within a company. Therefore, a MIS designer must be present in MIS development.
 - ✦ **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 phased plan.
 - ✦ **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 stored in many separate data files.

✦ **Computerized –**

- Though MIS can be implemented without using a computer; the use of computers increases the effectiveness of the system.

• **Misconceptions about MIS –**

- ✦ Any computer based information system is a MIS.
- ✦ Any reporting system is MIS.
- ✦ MIS is a management technique.
- ✦ MIS is a bunch of technologies.
- ✦ MIS is an implementation of organizational systems and procedures. It is a file structure.
- ✦ The study of MIS is about use of computers.
- ✦ More data in generated reports refers more information to managers.
- ✦ Accuracy plays vital role in reporting.

• **Pre-requisites of an Effective MIS –**

✦ **Database –**

- It is collection of files, which is collection of records and records are nothing but collection of data. The main characteristics of database are given as follows:
 - It is user-oriented.
 - It is capable of being used as a common data source to various users, helps in avoiding duplication of efforts in storage and retrieval of data and information.
 - It is available to authorized persons only.
 - It is controlled by a separate authority, known as Database Management System (DBMS).

✦ **Qualified System and Management Staff –**

- The second pre-requisite of effective MIS is that it should be manned by qualified officers.
- For this, the organizational management base should comprise of two categories of officers; Systems and Computer experts and Management experts.
 - Systems and Computer experts in addition to their expertise should also understand the management concepts to facilitate the understanding of problems faced by the concern.
 - Management experts should also understand the concepts and operations of a computer.

✦ **Support of Top Management –**

- The support from top management is required for the effectiveness of MIS because :
 - Any implementation, which does not receive the support of top management will not be effectively controlled and tend to be get lesser priority and may be delayed or abandoned.
 - The resources involved in computer-based information systems are large and are growing larger in view of importance gained by management information system.
 - To gain the support of top management, the officers should place before top management all the supporting facts and state clearly the benefits, which will accrue from it to concern.

✦ **Control and maintenance of MIS –**

- Control of the MIS means the operation of the system as it was designed to operate. Sometime, users develop shortcut methods to use the system, which reduce its effectiveness.
- Maintenance is closely related to control.

● **Evaluation of MIS –**

- ✦ An effective MIS should be capable of meeting the information requirements in future as well. This capability can be maintained by evaluating the MIS and taking appropriate timely action.
- ✦ The evaluation of MIS should take into account the following major points:
 - Examining whether enough flexibility exists in the system to cope with any expected or unexpected information requirement in future.
 - Ascertaining the views of users and the designer about the capabilities and deficiencies of system.
 - Guiding the appropriate authority about the steps to be taken to maintain effectiveness of MIS.

● **Constraints in operating a MIS –**

- ✦ Non-availability of experts, who can diagnose the objectives of the organization and provide a desired direction for installing operating system.
- ✦ Experts usually face the problem of selecting sub-system of MIS to be installed & operated upon.
- ✦ Due to varied objectives of business concerns, the approach adopted by experts for designing and implementing MIS is a non-standardized one.
- ✦ Non-availability of cooperation from staff is a crucial problem, which should be handled tactfully.

● **Limitations of MIS –**

- ✦ The quality of the outputs of MIS is basically governed by the quantity of input and processes.
- ✦ MIS is not a substitute for effective management.
- ✦ It is merely an important tool in the hands of executives for decision making and problem solving.
- ✦ MIS may not have requisite flexibility to quickly update itself with the changing needs of time, especially in fast changing and complex environment.
- ✦ MIS cannot provide tailor-made information packages suitable for the purpose of every type of decision made by executives.
- ✦ MIS is less useful for making non-programmed decisions. Such types of decisions are not of the routine type and require information, which may not be available from existing MIS to executive.
- ✦ The effectiveness of MIS is reduced in enterprises, where the culture of hoarding information and not sharing with other holds.
- ✦ MIS takes into account mainly quantitative factors, thus it ignores the non-quantitative factors like morale and attitude of members of organization.
- ✦ MIS effectiveness decreases due to frequent changes in top management, organizational structure and operational team.

2.4.3.2 Decision Support Systems (DSS) –

- Decision Support System is a type of computerized information system that supports business and organizational decision-making activities.
- A properly-designed DSS is an interactive software-based system intended to help decision makers to compile useful information from raw data, documents, personal knowledge, and business models to identify and solve problems and make decisions.
- Decision Support System can be defined as a system that provides tools to managers to assist them in solving semi-structured and unstructured problems in their own way, somewhat personalized.
- A DSS supports the human decision-making process, rather than a means to replace it.
- Two types of planning languages that are commonly used in DSS are:

✦ **General Purpose Planning Languages –**

- General-purpose planning languages that allow users to perform many routine tasks. The languages in most spreadsheets are good examples of general-purpose planning languages.
- These languages enable user to tackle a broad range of budgeting, forecasting, and other worksheet-oriented problems.

✦ **Special Purpose Planning Language –**

- Special-purpose planning languages are more limited in what they can do, but they usually do certain jobs better than the general-purpose planning languages.
- Some statistical language, like SAS & SPSS, are examples of special purpose planning language.

• **Characteristics of DSS –**

- ✦ DSS supports decision making and occurs at all levels of management.
- ✦ Instead of helping individuals working on independent task, it should help in group making decision.
- ✦ It should be flexible and adaptable.
- ✦ DSS focuses on decision rather than data and information.
- ✦ It should be easy to use.
- ✦ DSS can be used for structured problems.
- ✦ DSS should be user-friendly.
- ✦ DSS should be extensible and evolve overtime.
- ✦ DSSs are used for decision making rather than communicating decisions and training purposes.
- ✦ The impact of DSS should be on decision where the manager's judgment is essential and there is sufficient structure for computers.

• **Components of DSS –**

✦ **The user –**

- The user of a DSS is usually a manager with an unstructured or semi-structured problem to solve. Manager and staff specialist (analyst) are the two broad classes of users.

- The key points relating to these users are given as follows:

- i). **Manager –**

- These are the users, who have basic computer knowledge and want the DSS to be very user friendly. The manager may be at any level of authority in the organization.

- ii). **Staff Specialist (Analysts) –**

- These are the people, who are more details oriented and willing to use complex system in their day-to-day work.

- ✦ **Databases –**

- A DSS includes one or more databases that contain both routine and non-routine data from both internal and external sources.
- DSS users may construct additional databases themselves. The database may also capture data from other subsystems such as marketing, production, and personnel.

- **Implementation of Database –**

Database is implemented at three levels as listed below:

- i). **Physical level –**

- It involves the implementation of the database on the hard disk i.e. storage of data in the hard disk. The management of storage and access is controlled by operating system.

- ii). **Logical Level –**

- It is designed by professional programs, which have complete knowledge of DBMS. It deals with the nature of data stored, the scheme of the data.

- iii). **External level –**

- The logical level defines schema, which is divided into smaller units known as sub-schemas and given to the managers, each sub-schema containing all relevant data needed.

- ✦ **Model base –**

- The planning language in a DSS allows the user to maintain a dialogue with the model base.
- The Model base is the “brain” of DSS because it performs data manipulations and computations with the data provided to it by the user and the database.
- There are many types of model bases, but most of them are custom-developed models that do some types of mathematical functions like cross tabulation, regression analysis, time series analysis, linear programming and financial computations.
- The analysis provided by the routines in the model base is the key to supporting the user decision.

- **Examples of Decision Support Systems in Accounting –**

Many DSS are developed in-house using either a general type of decision support program or a spreadsheet program to solve specific problems. Below are several illustrations of these systems:

✦ **Cost Accounting System –**

- The health care industry is well known for its cost complexity. Cost accounting applications help health care enterprises calculate product costs for individual procedures or services.
- Example – A healthcare organization combines a variety of DSS applications in productivity, cost accounting, case mix & staff scheduling to improve its management decision making.

✦ **Capital Budgeting System –**

- Decision makers need to supplement analytical techniques, such as net present value and internal rate of return, with decision support tools that consider some benefits of new technology not captured in strict financial analysis.
- One DSS designed to support decisions about investments is Auto Man, which allows decision makers to consider financial, non-financial, quantitative, and qualitative factors in their decision-making processes. They can evaluate up to seven investment alternatives at once.

✦ **Budget Variance Analysis System –**

- Computerized DSS is used to generate monthly variance reports for division comptrollers.
- The system allows these comptrollers to graph, view, analyze, and annotate budget variances, as well as create additional one or five year budget projections using the forecasting tools.
- The DSS helps the comptroller to create and control budgets for the cost-center managers.

✦ **General Decision Support System –**

- Some planning languages used in Decision Support Systems are general purpose and therefore have the ability to analyze many different types of problems.
- These types of decision support systems are a decision-maker's tools. The user needs to input data and answer questions about a specific problem domain to make use of this type of DSS.
- Example – A program called Expert Choice which supports a variety of problems needing decision.

• **Difference between DSS and traditional MIS –**

Dimension	Decision Support Systems	Traditional MIS
Philosophy	Providing integrated tools, data, models and languages to end users.	Providing structured information to end users.
Orientation	External orientation	Internal orientation
Flexibility	Highly flexible	Relatively inflexible
Analytical Capability	More analytical capability	Little analytical capability
System Analysis	Emphasis on tools to be used in decision process	Emphasis on information requirement analysis
System Design	Interactive process	System development based on static information requirements

2.4.4 Strategic Level Systems:

- It supports the senior level management to tackle and address strategic issues and long term trends, both inside organization and the outside world.
- It answers questions like what products should be launched to increase the profit and capture the market. It helps in long term planning.

2.4.4.1 Executive Information Systems (EIS) –

- Executive Information System (EIS) also referred to as an Executive Support System (ESS). ESS serves the strategic level i.e. top level managers of the organization.
- ESS creates a generalized computing and communications environment rather than providing any preset applications or specific competence.
- **Characteristics of EIS –**
 - ✦ EIS is a Computer-based-information system that serves the information need of top executives.
 - ✦ EIS enables users to extract summary data and model complex, problems without the need to learn query languages statistical formulas or high computing skills.
 - ✦ EIS provides rapid access to timely information and direct access to management reports.
 - ✦ EIS is capable of accessing both internal and external data.
 - ✦ EIS provides extensive online analysis tool like trend analysis, market conditions etc.
 - ✦ EIS can easily be given as a DSS support for decision making.
- **The Executive Decision-Making Environment –**
 - ✦ The type of decisions that executives must make are very broad.
 - ✦ Often, executives make these decisions based on a vision they have regarding ‘what it will take to make their enterprise successful.’ To a large extent, executives rely much more on their own intuition than on the sophisticated analytical skills.
 - ✦ Five characteristics of the types of information used in executive decision-making are as follows:
 - i). **Lack of structure –**
 - Many of the decisions made by executives are relatively unstructured. These types of decisions are not as clear-cut as deciding how to debug a computer program etc.
 - ii). **High degree of uncertainty –**
 - Executives work in a decision space that is often characterized by a lack of precedent.
 - Executives also work in a decision space where results are not scientifically predictable from actions. As, if prices are lowered, product demand will not automatically increase.
 - iii). **Future orientation –**
 - Strategic-planning decisions are made in order to shape future events. It is the executive’s responsibility to make sure that the organization keeps pointed toward the future.
 - Some key questions about future include: “How will future technologies affect what the company is currently doing? What products will consumers demand five year from now?”

iv). Informal Source –

- Executives rely heavily on informal source for key information. For example, lunch with a colleague in another firm might reveal some important competitor strategies.

v). Low level of detail –

- Most important executive decisions are made by observing broad trends. This requires the executive to be more aware of the large overview than the tiny items.
- This focus is very valuable to an organization if the information reported is actually important and represents a balanced view of the organization's objectives.

• Contents of EIS –

- ✦ EIS implementations begin with just a few measures that are of interest to senior management and then expand in response to questions asked by those manager as they use the system.
- ✦ A practical set of principles to guide the design of measures and indicators to be included in an EIS is presented below:
 - EIS measures must be easy to understand and collect. An EIS should not add substantially to the workload of managers or staff.
 - EIS measures must be based on a balanced view of the organization's objective.
 - Performance indicators in an EIS must reflect everyone's contribution in a fair and consistent manner. Indicators should be as independent from variables outside the control of manager.
 - EIS measures must encourage management and staff to share ownership of the organization's objectives. Performance indicators must promote both team-work and friendly competition.
 - EIS information must be available to everyone in the organization. The objective is to provide everyone with useful information about the organization's performance.
 - EIS measures must evolve to meet the changing needs of the organization.

• Difference between EIS and Traditional Information Systems –

Dimensions of Difference	Executive Information System	Traditional Information System
Level of Management	For top or near top executives	For lower staff
Nature of information Access	Specific issues/problems	Status reporting
Nature of information provided	Online tools and analysis	Offline status reporting
Information sources	More external and less internal	Internal
Drill down facility to go through details at successive levels	Available	Not Available
Information format	Text with graphics	Tabular
Nature of interface	User friendly	Computer operator generated

2.4.5 Specialized Systems

- There exists other categories of information systems also that provide comprehensive end to end IT solutions and services to various corporations globally.
- Some of them are Expert Systems, Cross Functional Information Systems and Core Banking System.

2.4.5.1 Expert System –

- An Expert System is highly developed DSS that utilizes knowledge generally possessed by an expert to share a problem.
- 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.
- For instance, an expert system in the area of investment portfolio management might ask its user a number of specific questions relating to investments for a particular client like – how much can be invested. Does the client have any preferences regarding specific types of securities? And so on.
- A characteristic of Expert Systems is the ability to declare or explain the reasoning process that was used to make decisions.
- **Some of the business applications of Expert Systems are as follows:**
 - ✦ **Accounting and Finance –**
 - It provides tax advice and assistance, helping with credit- authorization decisions, selecting forecasting models, providing investment advice.
 - ✦ **Marketing –**
 - It provides establishing sales quotas, responding to customer inquiries, referring problems to telemarketing center, assisting with marketing timing decision, determining discount policies.
 - ✦ **Manufacturing –**
 - It helps in determining whether a process is running correctly, analyzing quality, maintaining facilities, selecting transportation routes, assisting with product design and faculty layouts.
 - ✦ **Personnel –**
 - It is useful in assessing applicant qualifications, giving employees assisting at filling out forms.
 - ✦ **General Business –**
 - It helps in assisting with project proposals, recommending strategies, educating trainees, etc.
- **Need for Expert Systems –**

Major reasons for the need of expert systems is given as follows:

 - ✦ Expert labor is expensive and scarce. Knowledge workers employee, who routinely work with data and information to carry out their day-to-day duties are not easy to find and keep.
 - ✦ No matter how knowledgeable certain people are, they can handle only a few factor at a time.
 - ✦ Both these limitations imposed by human information processing capability, which is putting a need for expert systems.

- **Benefits of Expert Systems –**

- ✦ Expert Systems preserve knowledge that might be lost through retirement, resignation or death of an acknowledged company expert.
- ✦ Expert Systems put information into an active-form so it can be summoned almost as a real-life expert might be summoned.
- ✦ Expert Systems assist novices in thinking the way experienced professional do.
- ✦ Expert Systems are not subjected to human fallings such as fatigue or being emotional.
- ✦ Expert Systems can be effectively used as a strategic tool in the areas of marketing products, cutting costs and improving products.

- **Some of the properties that potential applications should possess to qualify for Expert System development are given as follows:**

- ✦ **Availability –**

- One or more experts are capable of communicating ‘how they go about solving the problems to which the Expert System will be applied.’

- ✦ **Complexity –**

- Solution of the problems for which the Expert Systems will be used is a complex task that requires logical inference processing.

- ✦ **Domain –**

- The domain of problem is relatively small and limited to a relatively well-defined problem area

- ✦ **Expertise –**

- Solutions to the problem require the efforts of experts.

- ✦ **Structure –**

- The solution process must be able to cope with ill-structured, uncertain, missing, and conflicting data, and a dynamic problem-solving situation.

2.4.5.2 Cross Functional Information Systems –

- Cross Functional Information System is also known as integrated information system that combines most of information systems and designed to produce information and support decision making for different levels of management and business functions. Ex. – Enterprise Resource Planning (ERP).

- **Enterprise Resource Planning (ERP) –**

- ✦ Enterprise resource planning (ERP) is process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.
- ✦ ERP software integrates all facets of an operation, including product planning, development, manufacturing, sales and marketing.
- ✦ ERP software is considered an enterprise application as it is designed to be used by larger businesses and often requires dedicated teams to customize and analyze the data and to handle upgrades and deployment.

- **Components of ERP –**

- ✦ ERP model is consists of four components which are implemented through a methodology. All four components are as follows:

- i). **Software Component:**

- The software component is the component that is most visible part and consists of several module like Finance, Human Resource, Inventory Management & Customer Relationship.

- ii). **Process Flow:**

- It is the model that illustrates the way how information flows among the different modules within an ERP system. By creating this model makes it easier to understand how ERP work.

- iii). **Customer mindset:**

- In order to lead ERP implementation to succeed, the company needs to eliminate negative value or belief that users may carry toward utilizing new system.

- iv). **Change Management:**

- In ERP implementation, change needs to be managed at several levels - User attitude; resistance to change; and Business process changes.

- **Benefits of ERP –**

- ✦ Streamlining processes and workflows with a single integrated system.
- ✦ Reduce redundant data entry and processes and shares information across the department.
- ✦ Establish uniform processes that are based on recognized best business practices.
- ✦ Improved workflow and efficiency.
- ✦ Improved customer satisfaction based on improved on-time delivery, increased quality, etc.
- ✦ Reduced inventory costs resulting from better planning, tracking and forecasting of requirement.
- ✦ Turn collections faster based on better visibility into accounts and fewer billing & delivery errors.
- ✦ Decrease in vendor pricing by taking advantage of quantity and tracking vendor performance.
- ✦ Track actual costs of activities and perform activity based costing.
- ✦ Provide a consolidated picture of sales, inventory and receivables.

2.4.5.3 Core Banking System (CBS) –

- Core Banking is a banking services provided by a group of networked bank branches where customers may access their bank account and perform basic transactions from any of the member branch offices.
- Normal core banking functions will include transaction accounts, loans and payments. Banks make these services available across multiple channels like ATMs, Internet banking, and branch.
- Core banking functions differ depending on the specific type of bank.
- Core Banking System (CBS) is defined as a back-end system that processes daily banking transactions, and posts updates to accounts and other financial records.
- **Examples –** Infosys' Finacle, Nucleus FinnOne and Oracle's Flexcube application.

- **Elements of core banking include:**
 - ✦ Making and servicing loans.
 - ✦ Opening new accounts.
 - ✦ Processing cash deposits and withdrawals.
 - ✦ Processing payments and cheques.
 - ✦ Calculating interest.
 - ✦ Customer Relationship Management (CRM) activities.
 - ✦ Managing customer accounts.
 - ✦ Establishing criteria for minimum balance, interest rates, number of withdrawals allowed and so on.
 - ✦ Establishing interest rates.
 - ✦ Maintaining records for all the bank's transactions.

2.5 Application of Information Systems in Enterprise Processes

- **Information Systems perform following three vital roles in business firms:**
 - i). **“Support an organization's business processes and operations”:**
 - This includes operations support systems such as Transaction Processing Systems, Process Control Systems.
 - ii). **“Support business decision-making”:**
 - This includes Management Information Systems, Decision Support Systems, and Executive Information Systems.
 - iii). **“Support strategic competitive advantage”:**
 - This includes Expert Systems, Knowledge Management Systems, Strategic Information Systems, and Functional Business Systems.
- **To operate Information Systems (IS) effectively and efficiently a business manager should have following knowledge about it:**
 - ✦ **Foundation Concepts –**
 - It includes fundamental business, and managerial concepts e.g. ‘what are components of a system and their functions’, or ‘what competitive strategies are required’.
 - ✦ **Information Technologies (IT) –**
 - It include operation, development and management of hardware, software, data management, networks and other technologies.
 - ✦ **Business Applications –**
 - It includes major uses of IT in business steps i.e, processes, operations, decision-making etc.
 - ✦ **Development Processes –**
 - It comprise how end users and IS specialists develop and execute business solution to problems.

✦ **Management Challenges –**

- It includes 'how the function and IT resources are maintained and utilized to attain top performance and build the business strategies.

• **Following are some of the important implications of information systems in business:**

- ✦ Information system help manager in efficient decision-making to achieve the organizational goal.
- ✦ An organization will be able to survive and thrive in a highly competitive environment on the strength of a well-designed Information system.
- ✦ Information systems helps in making right decision at the right time i.e. just on time.
- ✦ A good information system may help in generating innovative ideas for solving critical problems.
- ✦ Knowledge gathered through Information system may be utilized by managers in unusual situations.
- ✦ Information system is viewed as a process; it can be integrated to formulate a strategy of action or operation.

2.6 Relative Importance of Information Systems from Strategic and Operational Perspectives

- A **Business Model** can be defined as an outline of 'how business is to be done by a company to generate maximum revenue'.
- A Business Strategy is defined as a long term planning for success. A good business strategy is one that enables company to satisfy customers, uses resources efficiently and explore business opportunities outside of the standard business practice to help inspire company expansion.
- **Importance of Information System are as follows –**
 - ✦ An Information System can be large or small depending upon the size of the company and can help in decision making, produce high quality of products and perform logistical functions.
 - ✦ In operations management, information systems design can apply to production control, research, development, and manufacturing to produce desired results of products in terms of quality and cost.
 - ✦ Information systems applications in the area of human resources management can help in retaining highly qualified employees.
 - ✦ Information systems support logistical processes in various ways, such as real time inquiries to track an item from the point of shipment, receiving & storage and inventory status of the item.
 - ✦ Information systems can also provide the structure for programmers, database managers and data administrators to collaborate on new and existing projects.
 - ✦ Information system is used in every aspects of business right from customer relationship management, marketing strategies, retailing, communication, product promotion, product development, forecast future sales to supply chain management etc.
 - ✦ ERP, Data Mining tools, Data warehouse, Business intelligence, MIS, internet, intranet, extranet etc. are the information systems.

- ✦ Information System also provides new platform to business world where space and time is no more obstacle. Example, selling and purchasing of the products can be done on web anytime and anywhere.

2.7 Role of Information in Business –

- The information can be categorized on the basis of its requirement by the top, middle and lower level management.
- **The Top Management –**
 - ✦ The top management generally comprise of owners/shareholders, board of directors, its chairman, managing director, or chief executive, or managers committee having key officers.
 - ✦ Top level management strives for the information that can help them in major policy decisions.
 - ✦ Such information can help top management of company to decide to work on new products as well as the location where it has to be launched for maximum profit and sale which is one of the objectives and goals of the top management.
 - ✦ The top management requires strategic information that helps them in making strategy of an enterprise in terms of scope of products, targets of products i.e. customers, competition with market i.e. price, quality, long term planning etc.
- **The Middle Management –**
 - ✦ The middle management comprises of heads of functions departments e.g. purchase manager, production manager, marketing managers, financial controller and divisional sectional officers working under these functional heads.
 - ✦ Middle managements require tactical information that helps in implementing decisions taken by the top management.
 - ✦ For example - information of customers likely to purchase certain product in a particular location can help sales managers to fulfill their sales target efficiently.
 - ✦ Tactical information is used for short term planning whereas strategy information is used for long term planning. Example, the offers of companies during festive season are a short term planning, which is done by having information about the customers buying capacity in that location.
- ✦ **The Lower Management –**
 - ✦ The lower level managers are superintendents, supervisor, etc.
 - ✦ The lower management requires operational information, which is required in day-to-day activities.
 - ✦ The operational information mainly comprises of information about stock on hand, information about customer order pending, information about bill payable by customer etc.
 - ✦ These are essential for smooth running of the daily activities of a business at primary level.
 - ✦ For example, if a regular customer demands for a product other than the daily purchase then this information is important for salesman because it will help him in providing better service.

2.8 Various types of Business Applications

The impact of IT on Information Systems for different sectors is explained below:

i). **E-business –**

- ✦ This is also called electronic business and includes purchasing, selling, production management, logistics, communication, support services and inventory management through use of internet.
- ✦ The primary components of E-business are infrastructure (computers, routers, communication media e.g. wire, satellite etc., software and programmers), electronic commerce and electronically linked devices and computer aided networks.
- ✦ The advantage of E-business are 24 hrs sale, lower cost of doing business, more efficient business relationship, eliminate middlemen, unlimited market place and access with broaden customer base, secure payment systems, easier business administration and online fast updating.
- ✦ Different types of business can be done e.g. it may be B2B (Business to Business), B2C (Business to Customer), C2C (Customer to Customer) and C2B (Customer to Business).
- ✦ Because of no limitations of time and space, people prefer to involve in E-business. Only investment is needed in purchase of space on internet, designing and maintenance of website.

ii). **Financial Service Sector –**

- ✦ The financial services sector (banks, building societies, life insurance companies) manages large amounts of data and processes enormous numbers of transactions every day.
- ✦ Owing to application of IT, all the major financial institutions operate nationally and have wide networks of regional offices and associated electronic networks. It also reduces their cost in terms of office staff and office building.
- ✦ Through the use of internet and mobile phones financial service sectors are in direct touch with their customers and with adequate databases it will be easier for service sectors to manage customer relationships.
- ✦ With the advancement of IT, the customer can do transactions by using internet banking, and the deposit or withdraw of money can also be done by using ATM, internet or mobile banking.
- ✦ HDFC, SBI and ICICI are the banks in India that offer real time online transactions etc.

iii). **Wholesaling and Retailing –**

- ✦ A visit to any large store will show that IT has become a vital part of retailing. Retail business uses IT to carry out basic functions including till systems for selling items, capturing the sales data by item, stock control, buying, management reports, customer information and accounting.
- ✦ IT can be used in wholesale for supply chain logistics management, planning, space management, purchasing, re-ordering, and analysis of promotions.
- ✦ Data mining and data warehousing applications helps in the analysis of market baskets, customer profiles and sales trends. E-commerce among partners helps in carrying out transactions.

iv). **Public sectors –**

- ✦ IT/IS can be used here, to keep records of the cases, respective people involved it, other related documents and can consult the existing data warehouse or databases to take appropriate action.

- ✦ It includes services provided by the government mainly hospitals, police stations, universities etc.
- ✦ For example, it becomes easy to file FIR of a case without going to police station personally and also important documents like passports can be made easily by applying online.

v). **Others –**

- ✦ IT is efficiently used in entertainment industry (games, picture etc.), agriculture industry, Tour industry (railway, hotel and airline reservations) and consultancy etc.

2.9 Overview of Underlying IT Technologies

Some of the IT tools crucial for business growth are as follows –

i). **Business Website –**

- ✦ By having a website, business becomes reachable to large amount of customers and can also be used in an advertisement, which is cost effective and in customer relationship management.
- ✦ These websites can be designed by using HTML, XML, and ASP.NET etc.

ii). **Internet and Intranet –**

- ✦ It is the best source of communication. Time and space is no more obstacles for conducting meeting of people working in a team from multiple locations, or with different vendors and companies.
- ✦ Intranet is system that permits the electronic exchange of business data within an organization, mostly between managers and senior staff.
- ✦ E-commerce among partners (suppliers, wholesalers, retailers, distributors) using intranets, e-mail etc. provides new platform to the business world for conducting business in a faster and easier way.
- ✦ Ecommerce provides business to business, business to customer, customer to customer and customer to business communication with a click of mouse.

iii). **Software and Packages –**

- ✦ DBMS, data warehousing, data mining tools, knowledge discovery can be used for getting information that plays important role in decision making that can boost the business in the competitive world.
- ✦ **Enterprise Resource Planning (ERP) Packages**
 - ERP is one of the latest high-end solutions that seek to streamline and integrate operation processes.
 - ERP can be defined as a system, which 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 concerning demand, supply, operational, personnel, finance, logistics etc. are fully supported by accurate and reliable real-time information.
 - The objective of ERP is to provide support for adopting best business practices; to implement these practices with a view towards enhancing productivity and to empower the customers and suppliers to modify the implemented business processes to suit their needs.

- An ERP System is a multi-module software system that integrates all business process and functions of the entire Enterprise into a single software system, using a single integrated database. Each module is intended to collect, process, and store data of a functional area of the organization and to integrate with related processes.

✦ **Data Mining (DM) –**

- Data Mining (DM) can be applied in database analysis and decision support i.e. market analysis and management by finding patterns that are helpful in target marketing, customer relation management, market basket analysis, cross selling, market segmentation, risk analysis, customer retention, improved underwriting, quality control, competitive analysis and fraud detection.
- Other applications of DM are:
 - text mining,
 - web analysis,
 - customer profiling,
 - identifying customer requirements,
 - provide summary information,
 - finance planning and asset evaluation,
 - cross-sectional and time series analysis, and
 - resource planning.

iv). Business Intelligence (BI) –

- ✦ Business Intelligence (BI) refers to applications and technologies that are used to collect and provide access and analyze data and information about companies operations.
- ✦ Some BI applications are used to analyze performance or internal operations e.g. EIS (executive information system), business planning, finance and budgeting tools. While others are used to store and analyze data e.g. Data mining, data warehouses, Decision support system etc.
- ✦ Some BI applications are also used to analyze or manage the human resources e.g. customer relationship and marketing tools.
- ✦ A complete Business Intelligence provides consistent and standard information essential in enterprise operations.

v). Computer Systems, Scanners, Laptop, Printer, Webcam, Smart Phone etc. –

- ✦ Webcam, microphone etc. are used in conducting long distance meeting.
- ✦ Use of computer systems, printer; scanner increases accuracy; reduce processing times; enable decisions to be made more quickly and speed up customer service.
- ✦ For example, one can charge accurate prices and eliminates the need to apply price labels to individual items by the use of scanning system.