

## Information Systems Concepts

### Learning Objectives

- To explain the basic concepts of Systems and their types;
- To understand the concepts of Information Systems;
- To explain various types of Information systems and their applications;
- To understand Information and its applications in businesses and organizations; and
- To explain the role of Information Technology (IT) in organizations and businesses.

### Task Statements

- To distinguish among different types of systems e.g. open, closed, probabilistic, deterministic, manual, physical etc.;
- To differentiate between data and information;
- To distinguish among different information systems e.g. TPS, MIS, DSS, EIS and office automation systems etc;
- To select the appropriate information system for a given problem; and
- To understand various terms e.g. database, data mining, data warehouse, ERP and business intelligence.

### Knowledge Statements

- To know the concepts of computer based information systems;
- To know the features, components and applications of different types of information systems e.g. TPS, MIS, DSS, OAS etc.;
- To know the types of information needed in top, middle and lower management levels of an organization;
- To know the role of information in different management levels of an organization;
- To know the attributes of information;
- To know the role of IT in various types of business applications e.g. E-business, wholesale marketing, retailing, public sectors etc.; and
- To know the underlying technologies for a computer based information system.

## 2.1 Introduction

An understanding of the effectual and accountable use as well as management of information systems/technologies is important for managers, business professionals, and other knowledge workers in today's inter-networked enterprises. Auditors in their role as reviewers of controls have to understand the key concepts and practice of information systems. Information system supports an organization's business processes and operations, business decision-making and strategic competitive advantage. There are various types of information systems available for use by an organization/business to achieve operational excellence, develop new products and services, and promote competitive advantages. Examples of information systems are: Management Information System, Decision Support System, Knowledge Management System etc.

An **Information System** is termed as a system that comprises of people, computer systems, data and network that helps to collect, store and analyze data to produce the desired information for the functioning, betterment and expansion of business. Information systems play a vital role in the enterprise collaboration and management and strategic success of businesses that must operate in an inter-networked global environment and also facilitate E-business and E-commerce operations. The field of information systems has become a major functional area of business administration and management.

The easy availability of internet enables even smaller enterprises the opportunity to compete against large companies. E-commerce enables buying, selling and exchanging of products, services and information between Business to Business, Business to Customer, Customer to Business and Customer to Customer via computer networks. By having online advertising, even smaller enterprises can reach to broad number of customers to increase the ability to find and sell to customers.

Senior management requires information to aid in planning and decision making whereas middle level management requires information that can help them in monitoring and controlling the business activities. Employees at operational level need information that can enable them to perform their day-to-day activities easily and speedily. This makes it clear that different types of information systems are required at different levels of management within the same enterprise.

Ensuring successful implementation of effective information system so as to obtain strategic and competitive advantage requires long term investment in an IT strategy as per the strategic needs of the management. This cannot be achieved by simply making one time heavy investment in one or more business applications but requires continuous and regular investment and monitoring effective implementation in the required areas so as to ensure that information system acts as the foundation to sustain and maintain growth.

In this chapter, the prime focus is on the systems, types of systems, general concept of information systems and its role in business. The chapter provides detailed description of classification of the information systems, its components, their use in various business applications and the role of IT in businesses and organizations.

### 2.2 Overview of Information Systems and Practical Aspects of their Applications in Enterprise Processes

In the present era of rapid growth in the technology, IT is a key enabler in all walks of life for all types of enterprises whether commercial or non-commercial. IT helps the storage, processing, transmission and exploitation of information so as to meet the needs of individuals, enterprises or government. IT has ushered in rapid and dynamic changes in business environment and the way enterprises operate and provide products or services. Because of the global competition, enterprises are in greater need of efficient and timely provision of information to enhance the ability to make decisions based on relevant information.

With the advent of new tools for information and knowledge gathering in IT, we can expect continued refinement in the traditional skills of management i.e. planning, organizing, decision making and controlling processes and operations.

#### 2.2.1 Information

Technically, Information means processed Data. Data is facts or values of results, and information is the relations between data and other relations. e.g. in spread sheet student name, roll number and marks obtained in science and arts subjects represents data whereas the graph that shows the percentage of students acquire more than 80% in science subjects and 65% in arts subjects represents information. Information may be represented in the form of text, graph, pictures, voice, videos etc. Let us take another 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.

The collection of data is not information and collection of information is not knowledge. Information relates to description, definition, or perspective (what, who, when, where). Information is essential because it adds knowledge, helps in decision making, analyzing the future and taking action in time. Information products produced by an information system can be represented by number of ways e.g. paper reports, visual displays, multimedia documents, electronic messages, graphics images, and audio responses.

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

- **Availability** - It is a very important aspect of information. Information is useless if it is not available at the time of need. Database is a collection of files which is collection of records and data from where the required information is derived for useful purpose.
- **Purpose/Objective** - Information must have purposes/objective at the time it is transmitted to a person or machine, otherwise it is simple data. Depending upon the activities in an organization the Information communicated to people has a purpose. The basic objective of information is to inform, evaluate, persuade, and organize. This indeed helps in decision making, generating new concepts and ideas, identify and solve problems, planning, and controlling which are needed to direct human activity in business enterprises.

- **Mode and format** - The modes of communicating information to humans should be in such a way that it can be easily understandable by the people. The mode may be in the form of voice, text and combination of these two. Format also plays an important role in communicating the idea. It should be designed in such a way that it assists in decision making, solving problems, initiating planning, controlling and searching. According to the type of information the different formats can be used e.g. diagrams, graphs, curves are best suited for representing the statistical data. 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. For example, the running score sheet of a cricket match available in Internet sites should be refreshed at fixed interval of time so that the current score will be available. Similar is the case with broker who wants the latest information about the stock market.
- **Rate** - The rate of transmission/reception of information may be represented by the time required to understand a particular situation. Useful information is the one which is transmitted at a rate which matches with the rate at which the recipient wants to receive. For example- the information available from internet site should be available at a click of mouse.
- **Frequency** - The frequency with which information is transmitted or received affects its value. For example- the weekly reports of sales shows little change as compared to the quarterly and contribute less for accessing salesman capability.
- **Completeness and Adequacy** - The information provided should be complete and adequate in itself because only complete information can be used in policy making. For example-the position of student in a class can be find out only after having the information of the marks of all students and the total number of students in a class.
- **Reliability** - It is a measure of failure or success of using information for decision-making. If information leads to correct decision on many occasions, we say the information is reliable.
- **Validity** - It measures how close the information is to the purpose for which it asserts to serve. For example, the experience of employee supports in evaluating his performance.
- **Quality** - It means the correctness of information. For example, an over-optimistic manager may give too high estimates of the profit of product which may create problem in inventory and marketing.
- **Transparency** - It is essential in decision and policy making. For example, total amount of advance does not give true picture of utilization of fund for decision about future course of action; rather deposit-advance ratio is perhaps more transparent information in this matter.
- **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. In other words, given a set of possible decisions, a decision-maker may select one on basis of the

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information at hand. If new information causes a different decision to be made, the value of the new information is the difference in value between the outcome of the old decision and that of the new decision, less the cost of obtaining the information.

### 2.2.2 System

To understand the concepts of Information system, one should begin with the understanding of basic concepts of system. Let us first understand, what is a 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.

### 2.2.3 Classification of System

System can be classified on the basis of various parameters like elements, interactive behavior, degree of human intervention and working output as shown in Fig. 2.2.1.

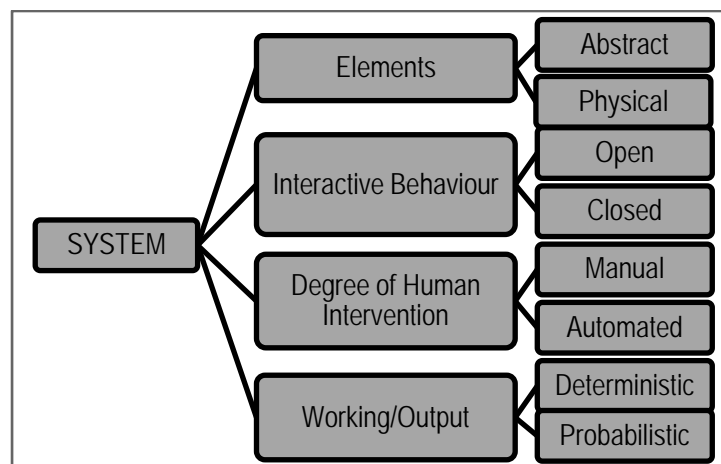


Fig. 2.2.1: Classification of System

- (i) **On the basis of Elements:** System may be categorized as **Abstract** or **Physical System** on the basis of the elements used in the system.
- **Abstract System** also known as **Conceptual System or Model** can be 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**, on the other hand, is a set of tangible elements, which operated together to accomplish an objective e.g. Computer system, University system etc.

- (ii) **On the basis of Interactive behavior:** Systems may be classified as **Open Systems** or **Closed System** based on 'how the system interacts with environment'.
- 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, which changes as per the changes in the environment.
  - **Closed System** does not interact with the environment and does not change with the changes in environment. Consider a 'throw-away' type sealed digital watch, which is a system, composed of a number of components that work in a cooperative fashion designed to perform some specific task. This watch is a closed system as it is completely isolated from its environment for its operation.
- (iii) **On the basis of Degree of Human intervention:** According to the degree of human intervention, the system may be classified as **Manual** or **Automated System**.
- In a **Manual System**, the activities like data collection, maintenance and final reporting are done by human.
  - In an **Automated System**, the activities like data collection, maintenance and final reporting are carried out by computer system or say machine itself.
- (iv) **On the basis of Working/Output:** On the basis of working style and the output, the systems can be classified as **Deterministic** and **Probabilistic System**.
- A **Deterministic System** operates in a predictable manner. For example - software that performs on a set of instructions is a deterministic system.
  - A **Probabilistic System** can be defined in terms of probable behavior. For 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.

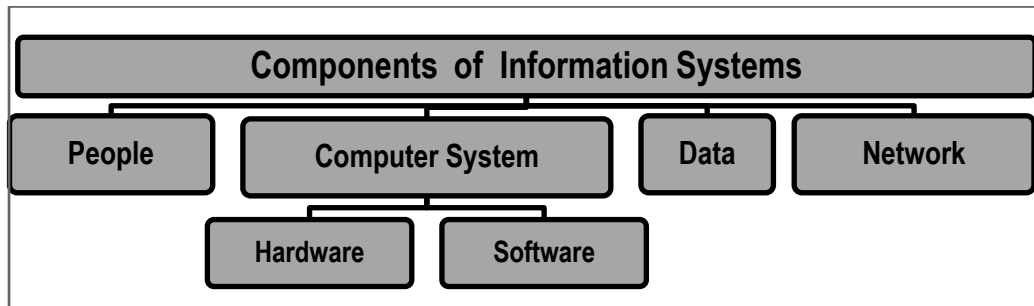
#### 2.2.4 Information Systems and its Components

With the help of information systems, enterprises and individuals are able to use computers to collect, store, process, analyze, and distribute information. There are different types of information systems, i.e. Manual (paper and pencil) information system, Informal (word to mouth) information system, Formal (written procedures) information system and Computer based information system. This chapter mainly focuses on computer based information system. 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.

An Information System comprise of **People, Hardware, Software, Data** and **Network** for communication support shown in Fig. 2.2.2. Here, people mean the IT professionals i.e. system administrator, programmers and end users i.e. the persons, who can use hardware and software for retrieving the desired information. The hardware means the physical components of the computers i.e. server or smart terminals with different configurations like

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corei3/corei5/corei7 processors etc. and software means the system software (different types of operating systems e.g. UNIX, LINUX, WINDOWS etc.), application software (different type of computer programs designed to perform specific task) and utility software (e.g. tools). The data is the raw fact, which may be in the form of database. The data may be alphanumeric, text, image, video, audio, and other forms. The network means communication media (Internet, Intranet, Extranet etc.).



**Fig. 2.2.2: Components of Information Systems**

An Information System model comprises of following steps:

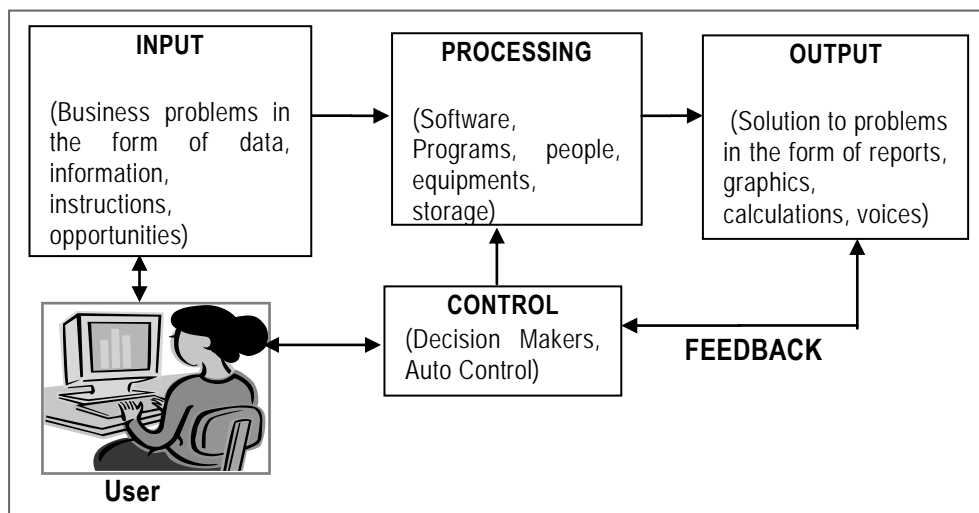
- Data is collected from an organization or from external environments and converted into suitable format required for processing (**Input**);
- This is converted into information (more meaningful form) obtained after manipulation of these collected data (**Processing**); and
- Then information is stored for future use or communicated to user after application of respective procedure on it (**Output**).

Three basics activities of an information system that are defined above, helps enterprise in making decisions, control operations, analyze problems and create new products or services as an output, as shown in Fig. 2.2.3. Apart from these activities, information systems also need feedback that is returned to appropriate members of the enterprises to help them to evaluate at the input stage.

Some of the important characteristics of Computer Based Information Systems are given as follows:

- All systems work for predetermined objectives and the system is designed and developed accordingly.
- In general, a system has a number of interrelated and interdependent subsystems or components. 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. The goal of individual subsystem is of lower priority than the goal of the entire system.



**Fig. 2.2.3: Functions of Information Systems**

Major areas of computer based applications are finance and accounting, marketing and sales, manufacturing, inventory/stock management, human resource management etc., which are given as follows:

- Finance and Accounting** – The main goal of this subsystem (considering Business functions as whole system) is to ensure the financial viability of the organization, enforce financial discipline and plan and monitor the financial budget. It also helps in forecasting revenues, determining the best resources and uses of funds and managing other financial resources. Typical sub-application areas in finance and accounting are - Financial accounting; General ledger; Accounts receivable/payable; Asset accounting; Investment management; Cash management; Treasury management; Fund management and Balance sheet.
- Marketing and Sales** – Marketing and sales activities have a key role for running a business successfully in a competitive environment. 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.

The sales department may use an order processing system to keep the status and track of orders, generate bills for the orders executed and delivered to the customer, strategies for rendering services during warranty period and beyond, analyzing the sales data by category such as by region, product, sales man or sales value. The system may also be used to compute commissions for dealers or salesmen and thus helps the corporate managers to take decisions in many crucial areas.



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- **Production or Manufacturing** – The objective of this subsystem is to optimally deploy man, machine and material to maximize production or service. The system generates production schedules and schedules of material requirements, monitors the product quality, plans for replacement or overhauling the machinery and also helps in overhead cost control and waste control.
- **Inventory /Stores Management**- The inventory management system is designed with a view to keeping the track of materials in the stores. 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 (ABC analysis), identification most frequently moving items (XYZ analysis) etc. Similarly well-designed inventory management system for finished goods and semi-finished goods provides important information for production schedule and marketing/sales strategy.
- **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. Effective and efficient utilization of manpower in a dispute-free environment in this key functional area ensures to facilitate disruption free and timely services in business. Human Resource Management System (HRMS) aims to achieve this goal. Skill database maintained in HRM system, with details of qualifications, training, experience, interests etc. helps management for allocating manpower to right activity at the time of need or starting a new project. This system also keeps track of employees' output or efficiency. Administrative functions like keeping track of leave records or handling other related functions are also included HRM system. An HRM system may have the following modules – Personnel administration; Recruitment management; Travel management; Benefit administration; Salary administration; Promotion management etc.

### 2.2.5 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:

These aforementioned systems are described as follows:

**I. Operational-Level Systems:** These support operational managers in tracking elementary activities. These can include tracking customer orders, invoice tracking, etc. Operational-level systems or Operational Support Systems (OSS) ensure that business procedures are followed. Information systems are required to process the data generated and used in business operations. OSS 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. The main objective of OSS is to improve the operational efficiency of the enterprise. These are further categorized as follows:

TYPES OF SYSTEMS		GROUPS SERVED
ESS	<p><u>Strategic Level Systems</u></p> <p>5-year operating plan    5-year budget forecasting    5-year sales trend forecasting    Profit planning    Manpower planning</p>	Senior Managers
MIS DSS	<p><u>Management Level Systems</u></p> <p>Sales management    Inventory Control    Annual budgeting    Capital Investment analysis    Relocation analysis</p> <p>Sales region analysis    Production Scheduling    Cost analysis    Pricing/profitability analysis    Contract cost analysis</p>	Middle Managers
KMS OAS	<p><u>Knowledge Level Systems</u></p> <p>Engineering workstations    Graphics workstations    Managerial workstations</p> <p>Word processing    Document Imaging    Electronic Calendars</p>	Knowledge and Data Workers
TPS	<p><u>Operational Level Systems</u></p> <p>Machine control    Securities trading    Payroll    Compensation</p> <p>Order Tracking    Plant scheduling    Accounts payable    Training &amp; development</p> <p>Order processing    Material movement control    Cash management    Accounts receivable    Employee record keeping</p> <p>Sales and marketing    Manufacturing    Finance    Accounting    Human Resources</p>	Operational Managers

Fig. 2.2.4: Types of Information Systems and the Groups Served

(A) **Transaction Processing Systems (TPS)** - At the lowest level of management, TPS is an information system that manipulates data from business transactions. Any business activity such as sales, purchase, production, delivery, payments or receipts involves transaction and these transactions are to be organized and manipulated to generate various information products for external use. For example, selling of a product to a customer will give rise to the need of further information like customer billing, inventory status and increase in account receivable balance. TPS will thus record and manipulate transaction data into usable information. Typically, a TPS involves the following activities:

- Capturing data to organize in files or databases;
- Processing of files/databases using application software;
- Generating information in the form of reports; and
- Processing of queries from various quarters of the organization.

A TPS may follow the periodic data preparation and batch processing (as in payroll application) or on-line processing (as in inventory control application). However, in industries and business houses, now-a-days on-line approach is preferred in many applications as it provides information with up-to-date status. However, the people involved in TPS usually are not in a position to take any management decision.

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- (a) **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, slips, invoices, purchase orders, and employee time cards, are the physical evidence of inputs in to the Transaction Processing System. They serve several purposes like capturing data, facilitating operations by communicating data and authorizing another operation in the process, standardizing operations by indicating, which data require recording and what actions need to be taken and providing a permanent file for future analysis, if the documents are retained etc.
  - **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. Some of the common journals are sales journal, purchase journal, cash receipts journal etc.
  - **Storage** – Ledgers and files provide storage of data on both manual and computerized systems. The general ledger, the accounts/vouchers payable ledgers, and the accounts receivable ledger are the records of final account that provide summaries of a firm's financial accounting transactions.
  - **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. The trial balance lists the balances of all the accounts on the general ledger and tests the accuracy of the record keeping. Financial reports summarize the results of transaction processing and express these results in accordance with the principles of financial reporting.

(b) **Features of TPS**

Basic features of TPS are given as follows:

- **Large volume of data** - As TPS is transaction oriented and generally consists of large volumes of data, it requires greater storage capacity. Their primary objective is to ensure that the data regarding the economic events in the enterprises are captured quickly and correctly.
- **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. Any failure in the TPS for a short period of time can play havoc with the functioning of the enterprise. Thus, TPS is an important source of up-to-date information regarding the operations in the enterprise.
- **Benefits are easily measurable** - TPS reduces the workload of the people associated with the operations and improves their efficiency by automating some of the operations. Most of these benefits of the TPS are tangible and

easily measurable. Therefore, cost benefit analysis regarding the desirability of TPS is easy to conduct. As the benefits from TPS are mainly tangible, the user acceptance is easy to obtain.

- **Source of input for other systems** - TPS is the basic source of internal information for other information systems. Heavy reliance by other information systems on TPS for this purpose makes TPS important for tactical and strategic decisions as well.

**II. 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 helps the organization's knowledge and data workers and is especially in the form of workstations. It is the fastest growing application in business today.

**(A) Office Automation Systems (OAS)** – It is most rapidly expanding computer based information systems. 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.
- **Filling, Search, Retrieval and Follow up** – This is related to filling, 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, where necessary, record keeping in respect to specific resources utilized by office personnel.

All the activities mentioned have been made very simple, efficient and effective by the use of computers. The application of computers to handle the office activities is also termed as office automation.

**(a) Benefits of Office Automation Systems** – Major benefits of OAS are given as follows:

- Office Automation Systems improve communication within an organization and between enterprises.
- They reduce the cycle time between preparation of messages 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.

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- Office Automation Systems ensure accuracy of information and smooth flow of communication.
- (b) **Computer Based Office Automation Systems** – Major computer based OAS are given as follows:
  - **Text Processing Systems** – The key points relating to Text Processing systems are given as follows:
    - Text processing systems are the most commonly used components of the OAS. This is so because a large proportion of the office communication takes place in writing using words of a natural language.
    - Text processing systems automate the process of development of documents such as letters, reports, memos etc. They permit use of standard stored information to produce personalized documents. Such automation reduces keying effort and minimizes the chances of errors in the 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 with quality printing.
    - The desktop publishing systems are often supported with laser printers, inkjet printers, scanners and other such devices for producing good quality documents.
  - **Electronic Document Management System** – The key points relating to these systems are given as follows:
    - The computer based document management systems capture the information contained in documents, stored for future reference and make them available to the users 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, For example, a customer may have a complaint concerning delivery of goods not being in accordance with the delivery instructions in the order. The computer based document management system would enable the executive to access the document through his notebook computer connected to any telephone line and show it to the customer, his order document in the office.
    - 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 proposals.

- With computer based document management systems, location of the executive becomes irrelevant for access to documents. Thus, these systems can be very useful in an office environment where traveling executives share work space in the office.
- **Electronic Message Communication Systems** – Business enterprises have been using a variety of communication systems for finding and receiving messages. These include telephone, mail and facsimile (Fax), etc. 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 instantaneous. The confirmation of transmission is also quick and the reliability is very high.
- ✓ **Online Development and Editing** - The email message can be developed and edited online before transmission. The online development and editing eliminates the need for use of paper in communication. It also facilitates the storage of messages on magnetic media, thereby reducing the space required to store the messages.
- ✓ **Broadcasting and Rerouting** - Email permits sending a message to a large number of target recipients. Thus, it is easy to send a circular to all branches of a bank using Email resulting in a lot of saving of paper. The email could be rerouted to people having direct interest in the message with or without changing or and appending related information to the message.
- ✓ **Integration with other Information Systems** - The E-mail has the advantage of being integrated with the other information systems. Such integration helps in ensuring that the message if accurate and the information required for the message is accesses quickly.
- ✓ **Portability** - Email renders the physical location of the recipient and sender irrelevant. The email can be accessed from any Personal computer/tablet/smart phones equipped with the relevant communication hardware, software and link facilities.
- ✓ **Economical** - The advancements in communication technologies and competition among the communication service providers have made Email the most economical mode for sending and receiving messages. Since the speed of transmission is increasing, the time cost on communication media per page is falling further, adding to

the popularity of email. The email is proving to be very helpful not only for formal communication but also for informal communication within the enterprise.

(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, similarly, the managers in an enterprise can leave the fax messages to the server which will send it to the intended recipient automatically. 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 the specified equipment and he can hear the spoken message in the voice of the 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.

- **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. Teleconferencing may be audio or video conferencing with or without use of computer systems.

The computer based teleconferencing has the advantage of flexibility in terms of pre-recorded presentations and integration with other information systems. These systems are based on Personal computers featuring a digital camera and run on visual communication software. The communication links are still quite expensive making the desktop video conferencing useful only for selected applications.

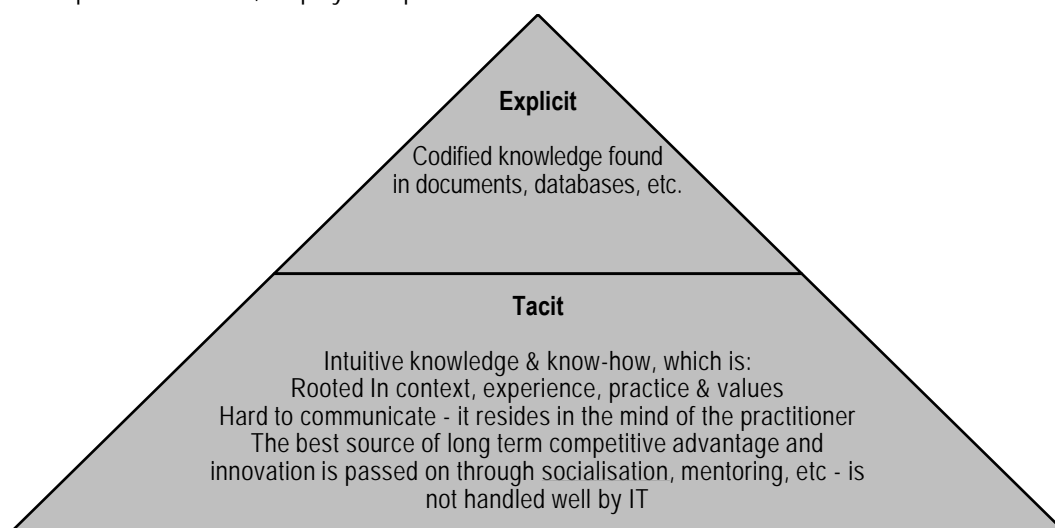
(B) **Knowledge Management System (KMS)** - The world is moving swiftly in the direction of a knowledge-based system as enterprises adapt more and more cost-cutting measure. There is a paradigm shift from an economy principally concerned by the management of tangible resources (equipment, machinery, buildings, ....) to an economy in which renovation and growth are determined by intangible resources and investments (knowledge, technology, competencies, abilities to innovate....). Information and Knowledge are the key elements of this economy. A firm's competitive gain depends on its knowledge processing i.e. what it knows; how it uses & how fast it can know something new. It's much more influential than the harmony of land, labour & capital (i.e. three most important production factors). Even though there is not a lucid and exclusive

definition of the so-called knowledge-based or knowledge-driven economy, it seems to be unstated as the 'upshot of a set of structural changes'.

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.

There are two broad types of knowledge - Explicit and Tacit as shown in the Fig. 2.2.5. KMS makes a direct connection between an organization's intellectual assets — both Explicit [recorded] and Tacit [personal know-how] — and positive results.

- ◆ **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, on the other hand, 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.



**Fig. 2.2.5: Types of Knowledge**

It is this tacit knowledge that differentiates between organizations when push comes to shove, and hence provides the strategic edge to any organization. A regular example in the software



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industry is how to write code to get around a particular limitation, or to include a particularly tricky condition.

**III. Management-Level Systems:** These support the middle managers in monitoring, decision-making and administrative activities and are helpful in answering questions like - Are things working well and in order? These provide periodic reports rather than instant information on operations. For example - a college control system gives report on the number of leaves availed by the staff, salary paid to the staff, funds generated by the fees, finance planning etc. These type of systems mainly answer "what if" questions. For example - What would be quality of teaching if college has to achieve top ranking in academics? These types of questions can be answered only after getting new data from outside the organization, as well as data from inside which cannot be easily obtained from existing operational level systems.

MSS supports managers in effective decision making by providing relevant and required information at the right time to the right people. Management Information System and Decision Support Systems are types of Management Level systems. Each of them is briefly discussed below:

**(A) Management Information Systems (MIS)** – Management Information System enables management at different levels in decision making and problem solving in contrast to TPS, which is operations oriented. They use results produced by the TPS, but they may also use other information. In any organization, decisions must be made on many issues that recur regularly and require a certain amount of information. Since the decision making process is well understood, the manager can identify the information that will be needed for the purpose. In turn, the information systems can be developed so that reports are prepared regularly to support these recurring decisions.

Many experts have defined MIS in different ways. MIS has been defined by Davis and Olson as "An integrated user-machine system designed for providing information to support operational control, management control and decision making functions in an organization". Other notable definition of MIS is "**MIS is a computer based system that provides flexible and speedy access to accurate data**". 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. Nature of MIS at different levels has different flavors and they are available in the form of reports, tables, graphs and charts or in presentation format using some tools. MIS at the top level is much more comprehensive but is condensed or summarized 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. These reports and displays can be made available on demand, periodically or whenever exceptional conditions occurred.

**(a) Characteristics of an effective MIS:** Major characteristic of an effective MIS are given as follows:

- **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. Such a system is not necessarily for top

management only but may also meet the information requirements of middle level or operating levels of management as well.

- **Management Directed** – Because of management orientation of MIS, it is necessary that management should actively direct the system's development efforts. For system's effectiveness, it is necessary for management to devote their sufficient time not only at the stage of designing the system but for its review as well to ensure that the implemented system meets the specifications of the designed system.
- **Integrated** – The best approach for developing information systems is the integrated approach as all the functional and operational information sub-systems are tied together into one entity. An integrated Information system has the capability of generating more meaningful information to management as it takes a comprehensive view or a complete look at the interlocking sub-systems that operate within a company.
- **Common Data Flows** – It means the use of common input, processing and output procedures and media whenever required. Data is captured by the system analysts only once and as close to its original source as possible. Afterwards, they try to utilize a minimum of data processing procedures and sub-systems to process the data and strive to minimize the number of output documents and reports produced by the system. This eliminates duplication in data collections, simplifies operations and produces an efficient information system.
- **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 and should consider future enterprise objectives and requirements of information as per the organization structure of the enterprise as per requirements.
- **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. The breaking down of MIS into meaningful sub-systems sets the stage for this phasing 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 formerly stored in many separate data files. The organization of a database allows it to be accessed by several information sub-systems and thus, eliminates the necessity of duplication in data storage, updating, deletion and protection.
- **Computerized** - Though MIS can be implemented without using a computer; the use of computers increases the effectiveness of the system. In fact, its use equips the system to handle a wide variety of applications by providing their information requirements quickly. Other necessary attributes of the computer to MIS are accuracy and consistency in processing data and reduction in

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clerical staff. These attributes make computer a prime requirement in management information system.

**(b) Misconceptions about MIS** – Following are the major 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.

**(c) Pre-requisites of an Effective MIS** – The pre-requisites of an effective MIS are given as follows:

- **Database** - It is collection of files, which is collection of records and records are nothing but collection of data. The data in database is organized in such a way that accessing to the data is improved and redundancy is reduced. 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 established for the purpose, 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. These officers, who are experts in the field, should understand clearly the views of their fellow 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 in their subject area/s should also be capable of understanding management concepts to facilitate the understanding of problems faced by the concern. They should also be clear about the process of decision making and information requirements for planning and control functions.
  - Management experts should also understand quite clearly the concepts and operations of a computer. This basic knowledge of computers will be

useful to place them in a comfortable position, while working with systems technicians in designing or otherwise of the information system.

- **Support of Top Management** – The support from top management is required for the effectiveness of MIS in an organization. The reasons for the same are as follows:
  - Any implementation, which does not receive the support of top management will not be effectively controlled and tends 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 the concern. This step will certainly enlighten management, and will change their attitude towards MIS. Their wholehearted support and cooperation will help in making MIS an effective one.
- **Control and maintenance of MIS** - Control of the MIS means the operation of the system as it was designed to operate. Some time, users develop their own procedures or short cut methods to use the system, which reduce its effectiveness. To check such habits of users, the management at each level in the organization should devise checks for the information system control.

Maintenance is closely related to control. Formal methods for changing and documenting changes must be provided.

- (d) **Evaluation of MIS** – An effective MIS should be capable of meeting the information requirements of its executives 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 designers about the capabilities and deficiencies of the system.
  - Guiding the appropriate authority about the steps to be taken to maintain effectiveness of MIS.
- (e) **Constraints in operating a MIS** – Major constraints, which come in the way of operating an information system, are given as follows:
  - Non-availability of experts, who can diagnose the objectives of the organization and provide a desired direction for installing operating system. This problem may be overcome by grooming internal staff, which should be preceded by proper selection and training.

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- Experts usually face the problem of selecting the sub-system of MIS to be installed and operated upon. The criteria, which should guide the experts, depend upon the need and importance of a function for which MIS can be installed first.
- 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. This task should be carried out by organizing lectures, showing films and also explaining to them the utility of the system. Besides this, some persons should also be involved in the development and implementation of the system.

**(f) Limitations of MIS – Major Limitations of MIS are given as follows:**

- The quality of the outputs of MIS is basically governed by the quality of input and processes.
- MIS is not a substitute for effective management, which means that it cannot replace managerial judgment in making decisions in different functional areas. 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 takes into account mainly quantitative factors, thus it ignores the non-quantitative factors like morale and attitude of members of organization, which have an important bearing on the decision making process of executives or senior management.
- MIS is less useful for making non-programmed decisions. Such types of decisions are not of the routine type and thus require information, which may not be available from existing MIS to executives.
- The effectiveness of MIS is reduced in enterprises, where the culture of hoarding information and not sharing with other holds.
- MIS effectiveness decreases due to frequent changes in top management, organizational structure and operational team.

**(B) Decision Support System (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/or business models to identify and solve problems and make decisions. In other words, a Decision Support System (DSS) can be defined as a system that

provides tools to managers to assist them in solving semi-structured and unstructured problems in their own, somewhat personalized, way. A DSS is not intended to make decisions for managers, but rather to provide managers with a set of capabilities that enable them to generate the information required by them in making decisions. 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** and **Special-purpose planning languages**. These are discussed below:

- **General-purpose planning languages** that allow users to perform many routine tasks, for example; retrieving various data from a database or performing statistical analyses. The languages in most electronic 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 languages** are more limited in what they can do, but they usually do certain jobs better than the general-purpose planning languages. Some statistical languages, such as SAS and SPSS, are examples of special purpose planning languages.

(a) **Characteristics of DSS** – The key characteristics of DSS are given as follows:

- This supports decision making and occurs at all levels of management.
- Instead of helping individuals working on independent tasks, it should be able to help group making decisions.
- It should be flexible and adaptable, i.e. it should be able to fit itself in the style of a particular manager and ready to change according to changes in the environment.
- DSS focuses on decision rather than data and information.
- It should be easy to use. A user should not have knowledge of computer programming to generate reports that helps in decision making.
- DSS can be used for structured problems.
- DSS should be user-friendly.
- DSS should be extensible and evolve overtime.
- DSSs are used mainly 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.

(b) **Components of DSS** – A Decision Support System comprise of the following basic components, which are discussed below:

- **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

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the two broad classes of users. Typically, users do not need a computer background to use a decision support system for problem solving. The most important knowledge is a thorough understanding of the problem and the factors to be considered in finding a solution. The key points relating to these users are given as follows:

- **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 (e.g., either top management or operating management).
- **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. The data from external sources include data about the operating environment of an organization. For example; data about economic conditions, market demand for the organization's goods or services, and industry competition. DSS users may construct additional databases themselves. Some of the data may come from internal sources. An organization often generates this type of data in the normal course of operations. For example; data from the financial and managerial accounting systems such as account, transaction, and planning data. The database may also capture data from other subsystems such as marketing, production, and personnel. External data include assumptions about such variables as interest rates, vacancy rates, market prices, and levels of competition.

**Implementation of Database** - Database is implemented at three levels as listed below:

- **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.
- **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. Storage which is logically divided into various tables having rows and columns and the techniques for defining relationships with indexes.
- **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 by one manager.
- **Model base** – The planning language in a DSS allows the user to maintain a dialogue with the model base, which 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, for example; 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's decision.

- (c) **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. Managing costs in this industry require controlling costs of supplies, expensive machinery, technology, and a variety of personnel. Cost accounting applications help health care enterprises calculate product costs for individual procedures or services. One health care organization, for example, combines a variety of DSS applications in productivity, cost accounting, case mix, and nursing staff scheduling to improve its management decision making.
  - **Capital Budgeting System** - Companies require new tools to evaluate high-technology investment decisions. 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 in automated manufacturing technology is Auto Man, which allows decision makers to consider financial, non financial, quantitative, and qualitative factors in their decision-making processes. Using this decision support system, accountants, managers, and engineers identify and prioritize these factors. Then they can evaluate up to seven investment alternatives at once.
  - **Budget Variance Analysis System** - Financial institutions rely heavily on their budgeting systems for controlling costs and evaluating managerial performance. One institution uses a computerized DSS 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-and five-year budget projections using the forecasting tools provided in the system. The decision support system thus helps the comptrollers create and control budgets for the cost-center managers reporting to them.
  - **General Decision Support System** - As mentioned earlier, some planning languages used in Decision Support Systems are general purpose and therefore have the ability to analyze many different types of problems. In a sense, 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 decision support system. An example is a program called Expert Choice which supports a variety of problems requiring



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decisions. The user works interactively with the computer to develop a hierarchical model of the decision problem. The DSS then asks the user to compare decision variables with each other. For instance, the system might ask the user how important cash inflows are versus initial investment amount to a capital budgeting decision. The decision maker also makes judgments about which investment is best with respect to these cash flows and which requires the smallest initial investment. Expert choice analyzes these judgments and presents the decision maker with the best alternative.

- (d) **Difference between DSS and traditional MIS:** Major difference between the DSS and the traditional MIS are shown in following Table 2.2.1.

**Table 2.2.1: Difference between DSS and Traditional MIS**

Dimensions	Decision Support System	Traditional MIS
<b>Philosophy</b>	Providing integrated tools, data, models, and languages to end users	Providing structured information to end users
<b>Orientation</b>	External orientation	Internal orientation
<b>Flexibility</b>	Highly flexible	Relatively inflexible
<b>Analytical capability</b>	More analytical capability	Little analytical capability
<b>System analysis</b>	Emphasis on tools to be used in decision process	Emphasis on information requirement analysis
<b>System design</b>	Interactive process	System development based on static information requirements

**IV. Strategic Level Systems:** These systems are for strategic managers to track and deal with strategic issues, assisting long-range planning. These systems support the senior level management to tackle and address strategic issues and long term trends, both inside organization and the outside world. These answer questions like what products should be launched to increase the profit and capture the market. It helps in long term planning. A principle area is tracking changes in the external conditions (market sector, employment levels, share prices, etc.) and matching these with the internal conditions of the organization.

**(A) Executive Information Systems (EIS) –** It is sometimes referred to as an Executive Support System (ESS). It 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.

**(a) Characteristics of EIS –** Major Characteristics of an EIS are given as follows:

- 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.
- (b) **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. The intuitive character of executive decision-making is reflected strongly in the types of information found most useful to executives. Five characteristics of the types of information used in executive decision making are given as follows:
- **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 or how to deal with an overdue account balance. Also, it is not always obvious, ‘which data are required’ or ‘how to weigh available data when reaching a decision.’
  - **High degree of uncertainty** – Executives work in a decision space that is often characterized by a lack of precedent. For example, when the Arab oil embargo hit in mid 1970s, no such previous event could be referenced for advice. Executives also work in a decision space where results are not scientifically predictable from actions. If prices are lowered, for instance, product demand will not automatically increase.
  - **Future orientation** – Strategic-planning decisions are made in order to shape future events. As conditions change, enterprises must change also. It is the executive’s responsibility to make sure that the organization keeps pointed toward the future. Some key questions about the future include: “How will future technologies affect what the company is currently doing? What will the competition (or the government) do next? What products will consumers demand five years from now?” As one can see, the answers to all of these questions about the future external environment are vital.
  - **Informal Source** – Executives, more than other types of managers, rely heavily on informal source for key information. For example, lunch with a colleague in another firm might reveal some important competitor strategies. Informal sources such as television might also feature news of momentous concern to the executive – news that he or she would probably never encounter in the company’s database or in scheduled computer reports.

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- **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. Even so, many executives insist that the answers to some questions can only be found by mucking through details.

The powerful focus of an EIS is due to the saying “what gets measured gets done.” Managers are particularly attentive to concrete information about their performance when it is available to their superiors. 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.

- (c) **Contents of EIS** – A general answer to the question of ‘what data is appropriate for inclusion in an Executive Information System’ is “whatever is interesting to executives”. EIS implementations begin with just a few measures that are clearly of interest to senior management and then expand in response to questions asked by those managers as they use the system. Over the time, the presentation of this information becomes stale, and the information diverges from what is strategically important for the organization.

While the above indicates that selection of data for inclusion in an EIS is difficult, there are several guidelines that help to make that assessment. 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. Wherever possible, data should be collected naturally as part of the process of work. 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. Data in the system should reflect the objectives of the organization in the areas of productivity, resource management, quality and customer service.
- Performance indicators in an EIS must reflect everyone's contribution in a fair and consistent manner. Indicators should be as independent as possible from variables outside the control of managers.
- 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. Measures will be meaningful for all staff; people must feel that they, as individuals, can contribute to improving the performance of the organization.
- EIS information must be available to everyone in the organization. The objective is to provide everyone with useful information about the organization's performance. Information that must remain confidential should not be part of the EIS or the management system of the organization.
- EIS measures must evolve to meet the changing needs of the organization.

- (d) **Difference between EIS and Traditional Information Systems** - The main difference between EIS and Traditional Information Systems are shown in the following Table 2.2.2:

Table 2.2.2: 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 and	Status reporting
Nature of information provided	Online tools and analysis	Offline status reporting
Information Sources	More external, 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

### 2.2.6 Specialized Systems

Apart from the information systems discussed above, there exists other categories of information systems also that provide comprehensive end to end IT solutions and services (including systems integration, implementation, engineering services, software application customization and maintenance) to various corporations globally. Some of them are Expert Systems, Cross Functional Information Systems, and Core Banking System (CBS) etc.

**(A) 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.

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- **Marketing** - It provides establishing sales quotas, responding to customer inquiries, referring problems to telemarketing centers, assisting with marketing timing decisions, determining discount policies.
- **Manufacturing** - It helps in determining whether a process is running correctly, analyzing quality and providing corrective measures, maintaining facilities, scheduling job-shop tasks, selecting transportation routes, assisting with product design and faculty layouts.
- **Personnel** - It is useful in assessing applicant qualifications and assisting employees in filling out forms.
- **General Business** - It helps in assisting with project proposals, recommending acquisition strategies, educating trainees, and evaluating performance.

**(a) 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 and companies are often faced with a shortage of talent in key positions.
- Moreover, no matter how bright or knowledgeable certain people are, they often can handle only a few factors at a time.
- Both these limitations imposed by human information processing capability and the rushed pace at which business is conducted today put a practical limit on the quality of human decision making; thus putting a need for expert systems.

**(b) Benefits of Expert Systems** – The key benefit of expert systems are given as follows:

- 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 such human fallings as fatigue, being too busy, or being emotional.
- Expert Systems can be effectively used as a strategic tool in the areas of marketing products, cutting costs and improving products.

Still, Expert Systems are not always the answer to managerial or organizational problems. 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, which would not be easily handled by conventional information processing.
  - **Domain** – The domain, or subject area, of the problem is relatively small and limited to a relatively well-defined problem area.
  - **Expertise** – Solutions to the problem require the efforts of experts. That is, only a few possess the knowledge, techniques, and intuition needed.
  - **Structure** – The solution process must be able to cope with ill-structured, uncertain, missing, and conflicting data, and a dynamic problem-solving situation.
- (B) **Cross Functional Information Systems** – It 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. Example – 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. In contrast, Small business ERP applications are lightweight business management software solutions, customized for the business industry we work in.

**(a) 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 modules such as Finance, Human Resource, Supply Chain Management, Supplier Relationship Management, Customer Relationship, and Business Intelligent.

**(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:** By implementing ERP system, the old ways for working which user understand and comfortable with have to be changed and may lead to users' resistance. For example, some users may say that they have spent many years doing an excellence job without help from ERP

system. 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.

**(b) Benefits of ERP**

- Streamlining processes and workflows with a single integrated system.
- Reduce redundant data entry and processes and in other hand it 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, shortened delivery times.
- Reduced inventory costs resulting from better planning, tracking and forecasting of requirements.
- Turn collections faster based on better visibility into accounts and fewer billing and/or delivery errors.
- Decrease in vendor pricing by taking better advantage of quantity breaks and tracking vendor performance.
- Track actual costs of activities and perform activity based costing.
- Provide a consolidated picture of sales, inventory and receivables.

**(C) 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, mortgages and payments. Banks make these services available across multiple channels like ATMs, Internet banking, and branches.

Most commonly, Core Banking System (CBS) may be defined as a back-end system that processes daily banking transactions, and posts updates to accounts and other financial records. These systems typically include deposit, loan and credit-processing capabilities, with interfaces to general ledger systems and reporting tools. Core banking functions differ depending on the specific type of bank. Examples of core banking products include Infosys' Finacle, Nucleus FinOne and Oracle's Flexcube application (from their acquisition of Indian IT vendor i-flex). 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 balances, interest rates, number of withdrawals allowed and so on.
- Establishing interest rates.
- Maintaining records for all the bank's transactions.

### 2.2.7 Application of Information Systems in Enterprise Processes

Information Systems perform following three vital roles in business firms:

- “Support an organization's business processes and operations”:** This includes operations support systems such as Transaction Processing Systems, Process Control Systems.
- “Support business decision-making”:** This includes Management Information Systems, Decision Support Systems, and Executive Information Systems.
- “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:

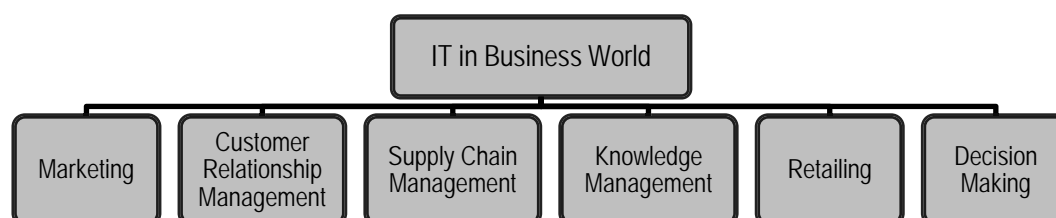
- **Foundation Concepts** – It includes fundamental business, and managerial concepts e.g. ‘what are components of a system and their functions’, or ‘what competitive strategies are required’.
- **Information Technologies (IT)** – It includes operation, development and management of hardware, software, data management, networks, and other technologies.
- **Business Applications** – It includes major uses of IT in business steps i.e. processes, operations, decision making, and strategic/competitive advantage.
- **Development Processes** – It comprise how end users and IS specialists develop and execute business/IT solutions 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.

IT can be viewed as a subsystem of information system that includes hardware, software, databases, networks and other electronic devices. Sometimes, the term Information Technology can be used interchangeably with information systems. Information Technology



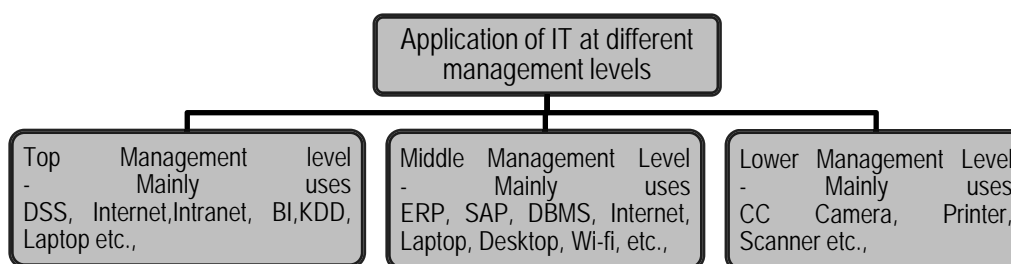
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refers to the technology of the production, storage and communication and management of information using computers and micro-electronics and is a crucial part of information systems. Most of the businesses use IT to create and process data.



**Fig. 2.2.6: IT in Prime Business Areas**

Small businesses generally need to purchase software packages, and may need to contract with IT businesses that provide services such as hosting, marketing web sites and maintaining networks. However, larger companies can consider having their own IT staffs to develop software, and otherwise handle IT needs in-house. IT has changed the working styles of staff at all levels of enterprises, from the executives to middle management and lower level staff e.g. Supervisors etc. The primary areas where IT enabled tools are used in any organization is shown in Fig. 2.2.6 whereas Fig. 2.2.7 showcases different IT enabled tools used at three layers i.e. top, middle and lower management of an organization.



**Fig. 2.2.7: Application of IT at Different Management Levels**

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

- Information system helps managers in efficient decision-making to achieve the organizational goals.
- 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.

In recent years, the advent of IT has transformed the way marketing is done and how companies manage information about their customers. The first step in marketing is the identification of patterns in a large data set of the customer and making critical marketing decisions. The technologies used to implement knowledge management are artificial intelligence, extranet, groupware, decision support system, document management system, data warehousing, data mining, intranet and internet.

By the use of IT tools, large volume of data related to customers can be stored and is available for use. This has created opportunities as well as challenges for businesses to gain competitive advantage.

### 2.3 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 i.e. tactics that are applied to manage business for increasing business revenue. It emphasizes on competition that business model does not. 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.

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. An information system can assist in determining scenarios such as unifications and achievements, and streamline the strategic planning process that can help top management to take corporate decision, easily. In operations management, information systems design can apply to production control, research, development, and manufacturing to produce desired results of the products in terms of quality and cost. Information systems applications in the area of human resources management can help in retaining highly qualified employees by having important data concerning employees obtained after several processes used by human resource managers or personnel. Information systems also support logistical processes in various ways, such as real time inquiries to track an item from the point of shipment, receiving and storage of the item and inventory status of the item. Not only this, information systems can also provide the structure for programmers, database managers and data administrators to collaborate on new and existing projects.

In this age of technology and competition, enterprises are looking for novel ideas and information that can enhance and expand their business. In order to achieve this, they are

## **2.35 Information Systems Control and Audit**

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becoming more and more dependent on information systems. 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 and information technologies that support managers in every step of business.

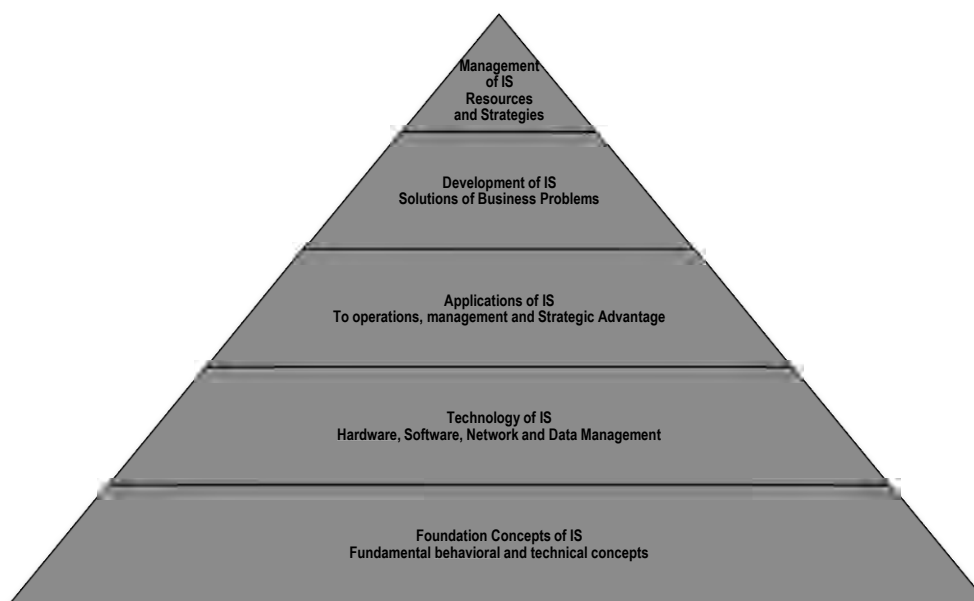
Information Systems have accelerated the pace of processing of enterprise information using IT and integrating all aspects of the operations of the business e.g. instead of gathering data manually and taking out hidden information from it by conducting meeting of executives, which is crucial in decision making for marketing strategies, customer relationship management etc., the same can be obtained by using the respective data mining tools and data warehouse. Not only this, Information System also provides new platform to business world where space and time is no more obstacle. For example, selling and purchasing of products can be done on web any time and from anywhere.

There are different kinds of systems depending upon the different interest, specialties and levels in an organization. The organization comprise of strategic, management, knowledge and operational levels, which is further divided into functional areas e.g. sales, marketing, manufacturing, finance, accounting and human resources.

For example - the sales area uses operational level system to keep track of daily sales figures, a knowledge level systems designs the promotional displays of the organization, a management level system generate report of the monthly sales by territory and a strategic level system predicts the sale of the product in coming five years.

Managers or business professionals are not required complete understanding of complex technologies, concepts and the specialized applications in the area of information systems but what they should know is illustrated in Fig. 2.3.1. This outlines five key areas of knowledge requirements, which are given below:

- Foundation concepts,
- Information technologies,
- Business applications,
- Development processes, and
- Management challenges.



**Fig. 2.3.1: Framework of Information Systems for Business Professionals**

## **2.4 Information as a Key Business Asset and its Relation to Business Objectives and Processes**

Information is a strategic resource that helps enterprises in achieving long term objectives and goals. In today's competitive and unpredictable business environment, only those enterprises survive, which have complete information and knowledge of customer buying habits and market strategy. Information management enhances an organization ability and capacity to deal with and achieve its mission by meeting challenges of competition, timely performance and change management. This is critical as the managed information and knowledge enables the enterprise to deal with dynamic challenges and effectively envision and create their future. This requires coordination between people, processes and technology.

### **2.4.1 Role of Information in Business**

In today's dynamic business environment, it becomes mandatory to have complete information and knowledge of customer buying habits and market strategy for any enterprise. Timeliness, accurate, meaningful and action oriented information enhances an organization ability and capacity to deal with and develop in mission, competition, performance and change.

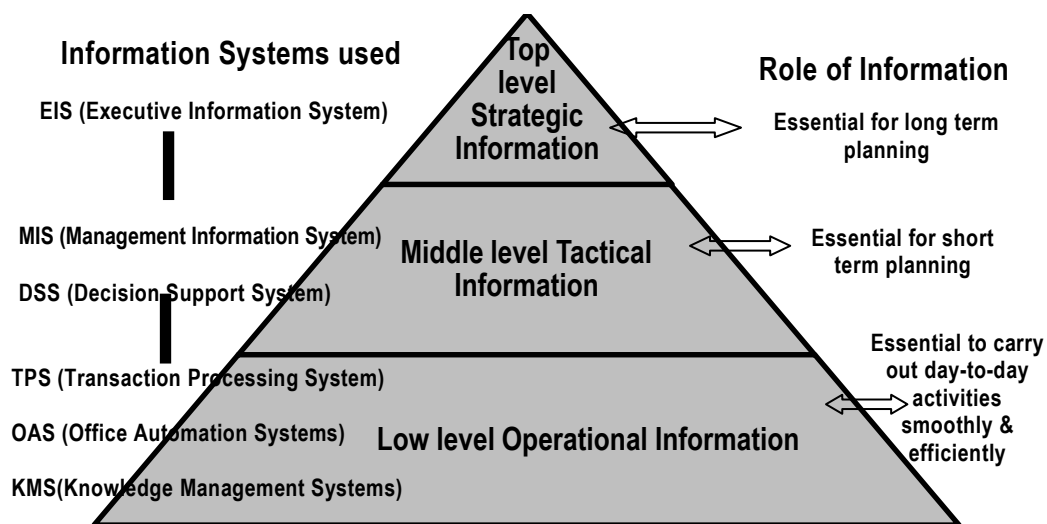
The information can be categorized on the basis of its requirement by the top, middle and lower level management as seen in Fig. 2.4.1.

The top management generally comprise of owners/shareholders, board of directors, its chairman, managing director, or the chief executive, or the managers committee having key officers, the middle management comprise of heads of functions departments e.g. purchase manager, production manager, marketing managers, financial controller, and divisional sectional officers working under these functional heads, whereas the lower level managers are superintendents, supervisor, etc.

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Top level management strives for the information that can help them in major policy decisions such as establishment of new plant, launching of new product etc. In other words, we can say that 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 information about the customers buying habits such as what combination of products and type of products they are likely to purchase together helps top managers to decide the launching of new products. e.g. if the information like a customer whose income is more than one lakh per month and working in IT sector and are in habit of buying latest model of laptops are more in a city where large number of IT companies are existing then it's better to launch notebook with latest operating system there. 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.

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. For example, the offers of companies during festive seasons are a short term planning, which is done by having information about the customers buying capacity in that location.



**Fig. 2.4.1: Types of Information Systems at Different Management Levels**

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.

## 2.5 Various types of Business Applications

Information system has changed traditional business system in their entirety. With the advent of IT, everything is just a mouse click away and is available anytime, anywhere. IT has increased the communication between executives by providing for online meeting and instant exchange of information, irrespective of their location. Information system also contributes to an organization's success by providing information that provides innovative ideas to managers and helps them in decision making which is very important to keep the organization ahead in this competitive era. Financial, trading, manufacturing, retail industries etc. are moving towards a real time business model where transaction and information sharing are near instantaneous. 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 the use of internet technologies. 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 hour 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. This is so because it does not require land for store or shops and anyone from anywhere can do business anytime as information regarding products etc. is available on the web. Only investment is needed in the purchase of space on internet, designing and maintenance of website. 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. Thus, we can say that IT has given new definition to business.
- (ii) **Financial Service Sector** – The financial services sector (banks, building societies, life insurance companies and short term insurers) 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. The associated substantial client databases are handled via large central mainframe systems that characterize the industry. IT has changed the working style of financial services and makes them easier and simpler for customers also. Now-a-days most of the services are offered by the financial services on internet, which can be accessed from anywhere and anytime that makes it more convenient to the customers. It also reduces their cost in terms of office staff and office building. It has been observed that automated and IT enabled service sectors reduces cost effectively. 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. For example, through emails or SMS

the customers can be made aware of launch of new policies; they can be informed on time the day of maturity of their policies etc.

In traditional banking system, the customer has to visit bank branch to deposit or withdraw money and get updated passbook from the respective counter. With the advancement of IT, the customer can do transactions by using internet banking, phone banking and the deposit or withdraw of money can also be done by using ATM (Automatic Teller Machine), internet or mobile banking. Banks also offers most of direct banking services free of charge to the customers. The customers can check the status of their accounts in different banks by using of direct banking. Retail banking in India has assured great importance recently with a number of retail banking products available to the consumer like real time account status, transfer of funds, bill payments and so on e.g. 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. The laser scanners used in most grocery supermarkets and superstores to read product bar codes are among the most distinctive examples of modern computer technology. By using internet or mobile phones retailers can collect and exchange data between stores, distribution centers, suppliers and head offices.

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 (suppliers, wholesalers, retailers, distributors) helps in carrying out transactions.

**Public sectors** – It includes services provided by the government mainly hospitals, police stations, universities etc. 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 actions. For example, IS like ERP can be implemented in a university to keep record of its employees in terms of their designation, leaves availed, department, achievements that can be used further in analyzing their performance. Owing to application of IT and IS, 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.

- (iv) **Others** – IT is efficiently used in entertainment industry (games, picture collection etc.), agriculture industry (information is just a mouse click away to the farmers), Tour industry (railway, hotel and airline reservations) and consultancy etc.

Thus, we can say that IT has changed the working style of business world drastically and make it simpler day-by-day with its advancement.

## 2.6 Overview of Underlying IT Technologies

Now day's business uses IT to carry out basic functions including systems for selling items, capturing the sales data by item, stock control, buying, management reports, customer information, decision making, accounting etc. Here, we discuss some of the IT tools crucial for business growth.

**(i) Business Website** – By having a website, enterprise/business becomes reachable to large amount of customers. In addition, it 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, 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. E-commerce 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. e.g. by having information of buying habits of customer, sales of product; marketing strategy can be built quickly and effectively with the use of data mining tools and Knowledge Discovery In Database (KDD). These can be used in Supply chain logistics, including planning, purchasing, replenishment, logistics, and space management.

### Enterprise Resource Planning (ERP) Packages

Now, progressively firms are replacing legacy systems with newer client/server based solutions. Data warehousing, data mining tools and knowledge discovery applications for analysis of market baskets, customer profiles and sales trends can be used in retailing. ERP is one of the latest high-end solutions that seek to streamline and integrate operation processes and information flows in the company to synergize the five major resources of an organization namely men, money, machine, materials and market. 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.



## 2.41 Information Systems Control and Audit

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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. For example, a module may be designed to process purchasing transactions and record all data about purchase orders. This module must integrate with accounts payable and inventory, since the vendor must be paid and inventory increased as the purchased goods arrive. Each of the software modules of an ERP system automates business activities of a functional area within an organization. Information is updated instantly using the same database and each functional area can easily share information with other areas of the organization as data is input once and processed as required and also linked to all related processes and made available for users as required. For example, when customer order is entered in an ERP system, a customer representative can have access to information such as the production schedules, and shipping schedules. Therefore, employee can answer any questions that the customer may ask, such as the following:

- Is the product in stock?
- If not, when will it be produced or restocked?
- How soon can it be shipped?
- When did we place the last order for this item?

To answer these questions, the customer service representative must have access to inventory information, production planning and scheduling information, shipping scheduling information, and customer history information. All of these functional areas have data stored in a single, shared database to enable the necessary integration.

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:

1. text mining,
2. web analysis,
3. customer profiling - it can list out what types of customers buy what products by using clustering or classification,
4. identifying customer requirements- it can identify the most demanding and appropriate products for different customers, and also can list the factors that will attract new customers by using prediction etc.,
5. provide summary information i.e. various multidimensional summary reports and statistical summary information,
6. finance planning and asset evaluation

7. cross-sectional and time series analysis, and
8. resource planning- it can summarize and compare the resources and spending.

**(iv) Business Intelligence** (BI) refers to applications and technologies that are used to collect and provide access and analyze data and information about companies operations. BI software consists of range of tools. 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.

## 2.7 Summary

Although information systems has set high hopes to companies for their growth as it reduces processing speed and helps in cutting cost, but in reality, most of the research studies show that there is a remarkable gap between its capabilities and the business-related demands that senior management is placing on it. Secondly, Information system is not simply one time investment but needs continuous updating.

This Chapter has provided an overview of different types of information system, the importance of information systems in an IT environment and how information is generated. Further, the information needs of different levels of managements differ and how these information systems have to be organized to process and present this, have been discussed. Use of technology impacts how enterprise can use information for not only data processing but for competitive and strategic advantage. Source of the enabling technologies with examples of business applications have also been briefly discussed.