CHAPTER ONE

1. INTRODUCTION TO MIS

1.1. Definition and Importance of MIS

Since it emerged as a field of study in 1970s, MIS has been defined by different authors in different ways. Some of the most popular definitions are given here below:

- ✓ 'A computer system or related group of systems which collects and presents management information to a business in order to facilitate its control.' (CIMA: Computing Terminology)
- ✓ 'A system to convert data from internal and external sources into information and to communicate that information, in an appropriate form, to managers at all levels in all functions to enable them to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible (Lucey: Management Information systems).
- ✓ Management information system (MIS) is an integrated, user-machine system for providing information to support operations, management, and decision-making functions in an organization. The system utilizes computer hardware and software; manual procedures; models for analysis, planning, control and decision-making; and a database (Davis and Olson: 1985). The fact that it is an integrated system does not mean that is a single, monolithic structure; rather, it means that the fact parts fit into an overall design. The elements of the definition are highlighted below

Management information system is

- An integrated user-machine system (Some can be performed using machine, other without machines).
- For providing information;
- To support the operations, management, analysis, and decision-making functions of an organization.
- In an organization (an organization is a stable, formal social structure that takes resources from the environment and processes them to produce outputs).

The system utilizes:

- Computer hardware and software,
- Manual procedures,
- Models for analysis, planning, control, and decision making and,
- A database.

Importance of MIS in Business: Overall cost of information systems is growing overtime and should be spent wisely. Well managed IS can bring about

- Improves process;
- Improves products and services;
- Improves quality;

- Cuts costs;
- Improves management, problem solving and decision making.

At strategic level, MIS can support organization in supporting their strategic goals such as cost leadership, product differentiation, market niche, etc..,

Scope of MIS: What is common to these definitions is that information is presented to management. However, this is not the only function of an organization's information systems. A number of tasks might be performed simultaneously:

- ✓ initiating transactions (e.g. automatically making a purchase order if stock levels are below a specified amount);
- ✓ recording transactions as they occur (e.g., a sale is input to the sales ledger system);
- ✓ processing data (as described in earlier chapters);
- ✓ producing reports (e.g., summaries);
- ✓ Responding to enquiries.

Objectives of MIS: The objective of an MIS is to provide information for decision making on planning, initiating, organizing, and controlling the operations of the subsystems of the firm and to provide a synergistic organization in the process.

1.2. Subsystems of MIS

MIS has been introduced as a broad concept referring to a federation of subsystems. Two approaches to defining the subsystems of an MIS are according to the **organizational functions** which they support and according to **managerial activities** for which they are used.

1.2.1. Organizational Function Subsystems

Because organizational functions are somewhat separable in terms of activities and are defined managerially as separate responsibilities, MIS may be viewed as a federation of information system-- one for each major organizational function such as production, marketing, finance, etc... There may be common support systems used by more than one subsystem, but each functional system is unique in its procedures, programs, models, etc. Typical subsystems for a business organization engaged in manufacturing are marketing, manufacturing, logistics and personnel:

Table 1.1 Functional subsystems

Major functional subsystem	Some typical uses
Marketing	Sales forecasting, sales planning, customer and sales analysis

Manufacturing	Production planning and scheduling, cost control analysis
Logistics	Planning and control of purchasing, inventories, distribution
Personnel	Planning personnel requirements, analyzing performance, salary administration
Finance and accounting	Financial analysis, cost analysis, capital requirements planning, income measurement
Information processing	Information system planning, cost-effectiveness analysis
Top management	Strategic planning, resource allocation

The **database** is the primary means of integration of the various subsystems. A data item that is stored or updated by one subsystem is then available to the other subsystems. For instance, the sales and inventory information used by the marketing subsystem is supplied through the logistical subsystem; the same data is used by the manufacturing subsystem for production planning and scheduling.

1.2.2. Activities Subsystems

Another approach to understanding the structure of an information system is in terms of the subsystems which perform various activities. Some of the activities subsystems will be useful for more than one organizational function subsystem; others will be useful for only one function.

Table 1.2: Organizational activities

Activity subsystem	Some typical uses
Transaction processing	Processing of orders, shipments, and receipts.
Operational control	Scheduling of activities and performance reports.
Management control	Formulation of budgets and resource allocation.
Strategic planning	Formulation of objectives and strategic plans.

Note that these activities subsystems correspond to the levels of the pyramid structure that defines MIS (some at strategic, others at tactical and still others in the operational levels).

Another way of considering MIS in an organization is in terms of inputs, processes and outputs as shown in the following table.

Table 1.3: Inputs, processes and output of MIS at all levels of management

	INPUTS	PROCESS	OUTPUTS
Strategic	Plans, competitor Information, overall market information	Summarize, Investigate, Compare, Forecast	Key ratios, ad hoc market analysis, strategic plans
Management/ Tactical	Historical, and budget data	Compare, Classify, Summarize.	Variance analysis Exception report

Operational	Customer orders, programmed stock control levels, cash Receipts/payments	Update files, Output reports.	Updated files listings, invoices

1.3. Contemporary Approaches To MIS

Multiple perspectives on management information systems show that the study of MIS is a multidisciplinary field. No singe theory or perspective dominates.

Figure 1.1 Contemporary approaches to MIS

Figure 1.1 illustrates the major disciplines that contribute problems, issues, and solutions to the study of management information systems. In general, the field can be divided into technical and behavioral approaches. Information systems are socio-technical systems. Though they comprise machines, devices and "hard" physical technology, they still require substantial social, organizational, and intellectual investments to make them work properly.

Technical Approach: The technical approach to MIS emphasizes mathematically based models to study information systems as well as the physical technology and formal capabilities of these systems. The disciplines that contribute to the technical approach are computer science, management science, and operations research. Computer science is concerned with establishing theories of computability, and methods of efficient data storage and access. Management science emphasizes the development of models for decision

making and management practice. Operations research focuses on mathematical techniques for optimizing selected parameters of organization, inventory control and transaction costs.

Behavioral Approach: An important part of the information systems field is concerned with behavioral issues that arise in the development and long-term maintenance of information systems. Issues such as strategic business integration, design, implementation, utilization, and management cannot be explored usefully with the models used in the technical approach. Other behavioral disciplines contribute important concepts and methods. For instance, sociologists study information systems with an eye toward how groups and organizations shape the development of systems and also how systems affect individuals, groups, and organizations. Psychologists study information systems with an interest in how human decision makers perceive and use formal information; they also study how people deal with the changes brought about by new technology. Economists study information systems with an interest in the impact systems have on control and cost structures within the firm and within the markets.

The behavioral approach does not ignore technology. Indeed, information systems technology is often stimulated for a behavioral problem or issue. But, the focus of this approach is generally not on technical solutions. Instead, it concentrates on changes in attitudes, management and organizational policy and behaviors.

Sociotechnical Systems: Adopting a sociotechnical systems perspective helps to avoid a purely technological approach to information systems. For instance, the fact that information technology is rapidly declining in cost and growing in power does not necessarily or easily translate into productivity enhancement or bottom-line profits.

In this approach, there is the need to optimize systems performance as a whole. Both technical and behavioral components need attention. This means that technology must be changed and designed in such a way as to fit organizational and individual needs. At times, the technology may have to be "de-optimized" to accomplish fit. Organizations and individuals must also be changed through training, learning, and planned organizational change to allow the technology to operate and prosper. People and organizations change to take advantage of new information technology change.

1.4 The Evolution and Characteristics of the Information Age

1.4.1 The Evolution of The Information Age

Before 1800s, long before the day of the Lexus, people lived in partnership with the land. In most parts of the world, the majority of people were farmers whose lives revolved around agriculture. During the **Agriculture Age,** entire families worked hand to provide enough food for themselves (table 1.1). This is still the case in many of the world's developing countries.

Gradually, new tools and techniques improved and extended the land that farmers could use for growing crops or grazing their lands. With these new technologies, more food could be produced; for the first time, more food was produced than was needed to feed the family. People began to have surplus food; for the first time, more food was produced than was needed to feed the family. These surpluses led to the barter and sale of food in return for other goods, food, and services.

	Agriculture Age	**Industrial Age**	**Information Age**
Time period:	Pre-1800s	1800s to 1957	1957 to present
Majority of workers:	Farmers	Factory workers	Knowledge workers
Partnership:	People and land	People and machines	People and people
Principal tool:	Hand tools	Machines	Information Technology

Table 1.4 the Evolution of the Information Age

With the coming of the Industrial Age**,** first to England in the 1800s (and strictly later to other countries), machines began assisting people with their work. These machines extended workers' capabilities, and the partnership became one between people and machines. As the 1800s progressed, machines became the primary tools for the majority of the workers. More and more processes were simplified through mechanization and automation, and the number of people working in manufacturing and industry increased.

Of course, both agriculture and manufacturing are still important today, in the Information Age. But the majority of today's workers are involved in the creation, distribution, and application of information. These knowledge workers now outnumber those employed in agriculture or manufacturing in the developed world. (In the United States, white-collar workers outnumbered blue-collar workers for the first time in 1957; the date often used to mark the beginning of the Information Age). In the Information Age, the partnership is one of people with other people, and the principal tool is information technology.

Some knowledge workers are very visible, because they use concrete information daily. Stockbrokers, bankers, accountants, financial planners, and risk managers come to mind immediately. Other types of knowledge workers include telephone communication specialists, physicians, attorneys, systems analysts, computer programmers, journalists, and medical researchers.

Knowledge workers often depend on front-line workers for important data. The counter attendants at Hotels are not knowledge workers, but they do capture data when entering details of your order into a cash register-like computer terminal. Those data are in turn used by a knowledge worker to manage inventory, other supplies, and schedule workers. Knowledge workers use information generation throughout the organization: on the front line, in back office, and in the executive suite.

1.4.2 The Characteristics of the Information Age

The information age is distinguished from previous ages on the basis of five characteristics.

- The Information Age came about with the rise of an information based society.
- Businesses in the Information Age depend on information technology to get their work done.
- In the Information Age, work processes are transformed to increase productivity.
- Success in the Information Age is largely determined by the effectiveness with which information technology is used.
- In the Information Age, information technology is embedded in many products and services.

Underlying all of these characteristics is the central importance of data and information processing in the day-to-day activities of most people in the industrialized world.

An Information Society: The Information Age came about with the rise of an information society. In an information society, more people work at handling information than at agriculture and manufacturing combined. This is true in most advanced western countries.

The Information Age is all about working with information technology and allowing people easy access to IT. Person-to-person communications and the links between individuals and businesses are important features of the information age.

Dependence on Information Technology: In the information age, businesses depend on information technology. Furthermore, an information society depends on much more than computers alone. Knowing when to use computers is as important as knowing how to use them. Equally important are the abilities to communicate information using computers and to interconnect people through information technology.

Transformation of Work: In addition to providing new tools, the Information Age transforms earlier tools and work processes by increasing their productivity and effectiveness. Work processes are the activities that workers perform, the way they perform these activities, and the tools they use. Productivity is a measure of the amount of work that can be accomplished with a given level of effort. Effectiveness is the extent to which desirable results are achieved.

Information Technology Influences Successes: In the Information Age**,** the most successful are those who know how to make the most of information technology. Using information technology means much more than just knowing how to key data into a computer or how to print reports. It also means knowing what IT can improve your personal performance and how it can exchange a business's products and services in a way that increases their value to the firm's customers.

Embedded Information Technology: In the Information Age, information technology is embedded in many products and services. Keep in mind, however, that knowledge-based products are desirable only if the

knowledge adds extra value to the product. Value may be convenience, quality, reliability, or novelty--- any characteristic the consumer feels is useful. Currently, many products are affected by the information technology such as travel, automobile, television, aircraft, etc.,

1.5 What is Information Technology?

The term Information Technology (IT) refers to whole variety of items and abilities used in the creation, storage, and dispersal of information. It is important to distinguish between data, information, and knowledge (these concepts will be discussed in detail in chapter two). **Data** are simply raw facts, figures, and details. **Information** is an organized, meaningful, and useful interpretation of data. **Knowledge** is an awareness and understanding of a set of information and how that information can be put to the best use.

Simple examples will clarity these differences. At a retail store, a specific customer's order contains raw data identifying the customer, the item(s) and quantity purchased, and the price. At the end of the business period, the details of all orders are assembled, summarized, and compared with expectations. The resulting information tells the store's managers that performance is better or worse than expected. This information may be combined with another set of information to create the knowledge that some customers are going elsewhere because of a competitor's new low price program. This knowledge may cause the store's managers to the role of good information in improving performance.

Information technology is divided into three primary components: computers, communications networks and know-how (the issue of information technology will be treated in detain in chapter three). The ways in which these elements are combined create opportunities for people and organizations to be productive, effective, and generally successful.

Computers: In simplest terms, a computer is any electronic system that can be instructed to accept, process, store and present data and information. The computer includes hardware, software and information. The computer has become a part of the day-to-day existence of people around the globe. It is difficult to think of any field that does not involve or is not affected by computers. Computers come in four different sizes: microcomputers, midrange/minicomputers, mainframes, and supercomputers.

Communication Networks: The invention of the telephone by Alexander Graham Bell in 1876 did a great deal to foster communication between people. Today, you can call someone virtually anywhere in the world. As you speak into the telephone, your voice reaches its destination in less than one second. When the person on the other end of the line talks, you also hear his or her words in a fraction of a second, whether the voice is coming from Britain, USA, Russia, Japan, etc., virtually any of the 200 countries in the world.

The reason we purchase telephones, and telephone services, is to communicate. A telephone not connected to the public telephone network is not useful at all. (And, increasingly, a computer not connected to a

communications network or to other computers will also have limited usefulness.) An integral part of information technology is the ability to communicate: to send and receive data and information over a communications network.

A communication network is the interconnection of stations at different locations through a medium that enables people to send and receive data and information. Telephone wires and cables are common communications media. Data communication is the transmission of data and information over a communication medium.

Communications networks are revolutionizing both personal life and products and services of business. For instance, airlines use communications network to connect with each other, sharing information on passenger reservations, meal requirements, and baggage handling.

Know How: Although computers and the data communications are very important parts of information technology, an equally critical par of IT is the ability to draw on the power of IT to solve problems and to take advantage of the opportunities it creates. Information technology, therefore, implies a need for know-how, know how to do something well.

Know how includes:

- Familiarity with the tools of IT;
- The skills needed to use these tools;
- Understanding when to use IT to solve a problem or capitalize on an opportunity.

1.6 The Principles of Information Technology

A principle is a fundamental rule, guideline, or motivating idea that, when applied, produces a desirable result rather than focusing on a particular situation or set of facts, principles prepare you to deal with the wide variety of situations (problems and opportunities) that you will encounter everyday. The most important principle of information technology describes the purpose of IT: The purpose of information technology is to solve problems, to unlock creativity and to make people more effective than they would be if they did not involve IT in their activities.

An equally important principle of information technology, the more important it is to consider the "high – touch. It says: **the more you rely on advanced technology, like information technology, the more important it is to consider the "high-touch" aspects of the matter --- that is, "the people side."** A related principle stresses that: we should always fit information technology to people, rather than ask people to adjust to information technology.

These principles suggest that the more we rely on IT, whether in personal activities or in business, the more important it is to be sure that the personal element is not forgotten.

1.6.1 The Functions of Information Technology

What exactly can IT do? IT performs six information handling functions: capture, processing, generation, storage, and retrieval, and transmission. The way a person or organization applies these functions determines the impact and results of using IT.

1. **Capture:** It is often useful to compile detailed records of activities. This process, data capture, is performed when IT users expect the data to be useful later.

2. **Processing:** The activity most often associated with computers, processing, is usually the reason that people and organizations purchase computers. The processing function entails converting, analyzing, computing, and synthesizing all forms of data or information. One of the first business applications of computers, data processing, focuses on handling data (raw numbers, symbols, and letters) and transforming them into information. **Information Processing** is a general term for the computer activity that entails processing any type of information and transforming it into a different type of information. Text (reports, correspondence), sound (voice, music, tones) and images (visual information such as charts, graphs, drawings, and animated drawings) can all be processed.

3. Advances in computer technology have led today to a growing interest in **multimedia systems.** These systems process multiple types of information simultaneously – for example, an animated presentation displayed on a computer screen using information retrieved from within the computer, perhaps accompanied by music, voice, or other types of sound. Other types of processing may have encountered include the followings:

    - **Word processing** --- The creation of text-based documents, including reports, newsletters, and correspondence. Word processing systems assist people in entering data, text, and images and presenting them in an attractive format.

    - **Image Processing** – Converting visual information (graphics, photos, and so forth) into a format that can be managed within a computer system or transmitted between people and locations. A process called scanning converts a print or film image into a form that a computer can use.

    - **Voice processing ---** The processing of spoken information. Currently, voice information is most frequently entered through telephone. Other systems that enable people to "speak" information directly into a computer system are also emerging.

4. **Generation:** Information technology is frequently used to generate information through processing. Generating information means organizing data and information into a useful form, whether as numbers, text, sound, or visual image. Sometimes the information is generated in its original form. Other times, a new form may be generated, as when recorded musical notes are "played" as sound with rhythm and pauses --- that is, as music.

5. **Storage and Retrieval:** Through information storage, computers keep data and information for later use. Stored data and information are placed on a storage medium (for example, a magnetic disk, or CD-ROM optical disk) that the computer can read. The computer converts the data or information into a form that takes less space than the original source. For example, voice information is not stored as a voice we know, but rather as specialty coded form that the computers can manage.

   Retrieval entails locating and copying stored data or information for further processing or for transmission to another user. The person using the computer must keep track of the medium on which he or she has stored that data or information and make it available to the computer for processing.

6. **Transmission:** The sending of data and information from one location to another is called transmission. As noted earlier, telephone systems transmit our conversations from a point of origin to a destination. Computer systems do precisely the same thing, often using telephone lines. Computer networks can also send data and information through other media, including satellites and light beams transmitted along plastic or glass optical fibers. People can send data and information to and from one another, using the networks to overcome distance barriers.

   Two of the most common forms of information transmission are:

   - **Electronic mail (e-mail) ---** The acceptance, storage and transmission of text and image messages between users of a computer system. Messages can be sent between individuals or broadcast to a large number of people simultaneously. Typically, these messages are entered through a computer keyboard and are viewed on the receiving parties' computer monitor (thus eliminating the need for sending paper messages).

   - **Voice messaging (voice mail) –** A form of voice processing in which callers leave spoken messages entered through their telephone receiver. The voice information is transmitted, stored, and retrieved ("played") by the recipients.

1.6.2 The Benefits of Information Technology

Information technology is used because of the benefits it provides to the people who use it in their personal and business activities. Computers and communication systems collectively offer four benefits to users: speed, consistency, precision, and reliability.

Speed: Unlike people, computers do everything in fraction of seconds. They are very fast--- much faster than people could ever be. They can perform complex calculations, recall stored information, transmit information from one location to another, and move objects around a computer screen in a matter of seconds.

Consistency: People often have difficulty repeating their actions exactly. Indeed, doing something once is not nearly as difficult as doing it the same way, and with the same result, repeatedly.

Computers excel at repeating actions consistently whether running a spell-checker built into a word processor or playing multimedia animation for training purposes, a computer will carry out the activity the same way every time.

Precision: In addition to being fast and accurate, computers are extremely precise. They can detect small, even minute, differences the people may not be able to see. In manufacturing an automobile, for example, the precise placement of a part into position may take the difference between long use and early wear. Computers excel in managing the smaller differences --- in being precise.

Reliability: With speed, consistency and precision comes reliability. When you know that the same procedure will be followed consistently, you can expect reliability of results. In other words, you can expect the same result to be achieved again and again. Another kind of reliability, reliability of use, means that you can count on computers and communications networks to be available and properly functioning when you need them.

Computers in general are very reliable. Many people have personal computers that have never needed a service call. Communications networks are also very reliable, and are generally available for use whenever needed.

1.6.3 The Opportunities for Information Technology

IT provides many opportunities to benefit people in general. These opportunities fall into two general categories: opportunities to help people and opportunities to solve problems.

Helping People: Can I be better than I am now? Can I be more effective, more productive, and more creative? These questions you should ask yourself regularly, for they challenge you to perform at your best and to reach your potential.

Another question focuses your attention outward. How I can help other people? How can I work towards providing affordable health care to all, and jobs to those who want them? How can I help to safeguard the environment, protecting the air, water, and land from pollution and saving endangered species from extinction? How can my business improve the society in which I live? IT can play significant role in improving society. It also describes many opportunities for IT to assist people in their personal lives and in their career.

Solving Problems: A problem is the perceived difference between a particular condition and a desired condition. For example, the study time you need to prepare for an exam and the time you actually have. Problems occur every day. Some are dramatic as accidents that cause serious harm. Others cause more hassles than they do harm, but all problems can be challenging.

Problem solving is the process of recognizing a problem, identifying alternatives for solving the problems, and successfully implementing a solution. Information technology presents many opportunities for helping people to identify and solve problems. Using a word processing program to prepare term papers and a spreadsheet program to analyze financial cases may help you solve a study time problem, because these programs can enable you to accomplish more in a given amount of time.

1.6.4 Role of Information Technology In Our Lives

Information technology is everywhere. Most people are aware of the many uses of computers where they work, study, and play. But, the ways that IT touches on and improves our lives every day go well beyond what we see on a day-to-day basis. Here are a few of the diverse uses of information technology in different industries.

Television: The television networks of the world, including the BBC in England, TF in France, ABC, CBS, and NBC in the United States; and CNN around the World, rely heavily on graphics and animation to illustrate weather patterns, present sports results, and (of course) reports of News. Virtually all of these graphics are produced on powerful microcomputers. Whether they are showing the movement of storm clouds across a region or the results of a public opinion poll, the graphics grab our attention in a way the words might not.

Shipping: Couriers and package carriers around the world rely on information technology. DHL, Federal Express, and United Parcel Service (USA), and EMS (Ethiopia) use computer systems to keep track of every package they pick up and deliver. Their worldwide communications networks make it possible to determine instantly the origin, location, and destination of the package.

Paperwork: Despite early predictions, we have not yet entered the age of paperless office. Businesses still send, receive, and store large quantities of paper. However, some companies are taking steps to lighten the paper load. For instance, in some companies such as insurance, papers, policies, claims etc. can be scanned into the computer for processing. This means quicker services for the customer and less paper for the company.

Money and Investments: Stock markets around the world are in transition. On some trading floors, paper is disappearing. In fact, the trading floor itself is disappearing. The London Stock Market launched a system known as “Big Bang” that makes it possible for stockholders through a data communication network, brokers

submit and receive bids using their PCs and computer workstations. Electronic trading is the wave of the future for investment markets around the world.

Agriculture: Several chemical and fertilizer companies now offer a planning service that combines their expertise in agriculture with effective use of information technology. Working with company advisors and sophisticated computer programs, farmers can analyze alternative uses for their land. These programs evaluate different planting and fertilizing strategies while estimating crop sensitivity to rain and other environmental conditions. Each strategy can be analyzed to determine the course of action that will bring about the most desirable results in terms of productivity and profits.

Taxation and Accounting: People don not like to pay taxes, and they do not like filling out forms. In the United States, the Internal Revenue Services (IRS) has installed a system that allows people to file their tax returns electronically using the PC in their home or office. Use of the service has grown substantially every year since its inception in 1989. However, the manual system of Ethiopian Inland Revenue for VAT reporting, every company is expected to report every month or face a penalty of Birr10, 000 per month for delay of reporting.

Some pioneering public accounting firms have developed the capability to file returns for their customers electronically.

Education: The ability to read and to do mathematics are prerequisites for success in the modern world. IBM Corporation distributes multilingual computer packages for use in the countries in which it does business. These packages, called “Write to Read” and “Exploring Measurement, Time, and Money,” help young and old people to acquire these basic skills. Microcomputers present information in a variety of forms tailored to the user’s needs and keeps track of his or her progress. The plasma system in Ethiopian high schools is also delivery of education using information technology.

Training: Some companies are using information technology in employee training programs. For example, insurance adjusters in training at Sate Farm Insurance (USA) can view damage scenes (from automobile accidents or natural disasters) on a computer display screen. Photographs and images of the damage can be “turned” electronically so that all views can be examined for damage and for information about the extent of the repairs needed. Interacting with the computer, the trainees ask questions and retrieve information about the damage. They receive answers only to the questions they ask. At the end of the session, the trainee receives suggestions about other questions to raise and the different views of the damage to check for amore complete analysts.

Airlines around the world, conduct pilot training in special flight simulations. The computer controlled systems duplicate the interior of the cockpit and simulate conditions identical to those that occur during real flights. They also allow pilots to practice corrective actions under simulated emergency conditions that they hope they will never have to face in the air.

The Home: France Telecom, the French telephone Company, stopped giving its customers telephone directories several years ago. Instead, it gave them computer terminals connected to a communication network. Today Minitel, as the network service is called, has become a major vehicle for obtaining a wide variety of goods and services: airline reservations, theater tickets, and of course telephone numbers. Minitel is available to every home in France and is included free with telephone installation. The service is so successful that France Telecom now exports a version of Minitel to Europe and North America and even in Ethiopia.

Health and Medicine: It will come as no surprise that hospitals and clinics use computers to keep records and generate invoices. But, computers also play an important role in medical diagnosis and treatment. For example, the CAT scanner is an imaging device that enables physicians to look beneath the patient's skin. As the scanner passes over the patient, it displays an image of bone and tissue structures on a computer screen. The CAT's scanner has become invaluable in identifying cancer and other dangerous conditions that require early treatment.

Manufacturing: Robots have moved from the real of science fiction to the manufacturing floors of factories over the last few decades. Virtually all automobiles manufactured around the world are touched by robots at some point in the manufacturing process. Often they perform the monotonous jobs that people do not want to perform, such as spraying paint or welding seams.

Journalism: Reporters and journalists rely heavily on word processors to prepare news articles and write their columns. Few writers use typewriters any more. The same goes for the graphics people who design the illustrations (Illustration software is used by artists or designers) that accompany the text.

Energy: In many countries, a gas pump that accepts credit cards is the wave of the present situation. Place your credit card in the reader and begin fueling your vehicle. When you are through, the pump's built-in computer notes the cost of the fuel pumped, transmits the details of the transaction over communications lines to your bank or credit card agency, and prints a receipt for you. You never have to go into the station, or move away from your car, or wait for an attendant. Automated gas pumps do not reduce the amount of fuel consumption, but they do reduce the time and energy you burn in fueling up.

Large office buildings consume huge quantities of energy in both summer and winter. Thanks to information technology, this energy usage is better managed than ever before. Using a system of thermostats and sensors

interconnected through a communications network, a computer monitors temperatures around the clock, controlling heating and cooling devices to maintain the right, prespecified comfort level. At the end of the workday and on weekends, the system automatically adjusts the temperature, thus conserving additional energy. Some systems can also determine whether a room is occupied, shutting off lights when it is empty.

Sports: Auto racing draws enthusiasts around the world. In all the auto circuits, such as Formula 1, computers are an integral part of race cars and a central element in racing strategy. Today's race cars are fitted with onboard computers and communications capabilities. Data regarding fuel use, engine functions, braking patterns, and speed are monitored, displayed in the driver cockpit, and transmitted from the race car to the pits. These data provide information that can influence racing strategy and determine whether a team wins or loses.

1.6.5 The Responsibilities in Practice

We use computers and networks almost every day without thinking about them. Those who use information technology (in other words, all of us) have three fundamental responsibilities:

- **To be informed**: To know the capabilities and limitations of IT and how computers and networks can be applied in different situations.
- **To make proper use**: To utilize the inherent capabilities of IT in a desirable and ethical manner that helps people and does not infringe on their privacy, rights, or well-being.
- **To safeguard:** To protect data and information against international or accidental damage or loss, and to protect the failure of a process that relies on information technology.

An important principle follows from these responsibilities: people who use information technology have the obligation to consider both the benefits and drawbacks of any use.

1.7 The Career Side of Information Technology

Some careers require detailed knowledge of the intricacies of computers and communication systems. Most business careers, however, require only a good understanding of what you can and should do with IT and what you cannot and should not do with IT.

1.7.1 Information Technology as a Career

Careers in the "technical" side of information technology can emphasize many different aspects of the field, from the writing of computer programs to the installation of hardware to the determination of users' needs. This will be examined in detail in chapter three. For now, though, it is enough to be aware the substantial and growing demand for career specialists in information technology throughout the world. In many areas, there

is a shortage of IT professionals. Businesses in some countries are concerned that a continuing shortage of people with IT skills will force companies to relocate outside their countries.

As in all other careers, good "people skills" and the ability to communicate ideas effectively are critical ingredients for success in the field of information technology.

1.7.2 Information Technology as an Aid to Your Career

Even if you do not plan a career in information technology, IT can help you in the career you decide to pursue. Knowing how IT is used in organizations, acquiring demonstrable skills in IT, and being able to list your IT accomplishments on your resume can give you an advantage over those with whom you will be competing for a job. Especially important are the abilities to use a PC, to do word processing, to perform problem solving activities, and to communicate electronically. In business as well as in the arts, in science, education, medicine, law, and government, information technology ---- computers, communication networks, and know how --- is an essential tool. Best of all, you don't have to wait until you start your career to begin using information technology.

CHAPTER TWO

2. FOUNDATIONAL CONCEPTS IN MIS

2.1 Introduction

In this chapter, the basic concepts such as management, information, systems and information systems will be discussed so that subsequent discussions can be easy.

2.2 Business and Management Functions

MIS is a concept that combines management, information and system.

2.2.1 Management

Management has been defined in a variety of ways, but for our purposes it comprises the processes or activities that describe what managers do in the operation of their organization: plan, organize, initiate, and control operations. They plan by setting strategies and goals, and selecting the best course of action to achieve the plan. They organize the tasks necessary for the operational plan, set these tasks up into homogeneous groups, and assign authority delegation. Because decision making is such a fundamental prerequisite to each of the foregoing management processes, the job of an MIS becomes that of facilitating decisions necessary for planning, organizing, and controlling the work and functions of the business.

2.2.2 Managers and Decision Making

Decision making is often a manager's most challenging role. Information systems have long helped managers communicate and distribute information; however, they have provided only limited assistance for management decision making. Because decision making is an area that system designers have sought most of all to affect (with mixed success), we now turn our attention to this issue.

2.2.2.1 The Process of Decision Making

Decision making can be classified by organizational level, corresponding to the strategic, management, knowledge and operational levels of the organization.

- ***Strategic decision making:*** determines the objectives, resources, and policies of the organization.

- ***Management control decision making:*** (also known as middle or tactical level management) is primarily concerned with how efficiently and effectively resources are used and how well operational units are performing.
- ***Operational control decision making:*** determines how to carry out the specific tasks set forth by strategic and middle management decision makers.
- ***Knowledge-level decision making:*** deals with new ideas for products and services, ways to communicate new knowledge, and ways to distribute information through out the organization.

Within each of these levels of decision making, researchers classify decisions as structured, semi-structured and unstructured.

- ***Unstructured decisions*** are those in which the decision maker must provide judgment, evaluation, and insights into the problem definition. All of these decisions are novel, important, and non-routine, and there is no well-understood or agreed upon procedure for making them.
- ***Structured decisions***, by contrast, are repetitive and routine and involve a definite procedure for handling them so that they do not have to be treated each time as if they were new.
- Some decisions are ***semi-structured***, in such cases, only part of the problem has a clear-cut answer provided by an accepted procedure.

Operational control personnel face fairly-well structured problems while strategic planners tackle highly unstructured problems. Many of the problems knowledge workers encounter are fairly unstructured as well. Nevertheless, each level of the organization contains both structured and unstructured problems. Note that there are information systems to support or execute each of these types of decisions.

2.2.2.2 Stages in Decision Making

Making decision consists of several different activities. Simon (1960) described four different stages in decision making: intelligence, design, choice, and implementation.

1. **Intelligence: -** consists of identifying and understanding the problems occurring in the organization--- whether there is a problem, what is the real problem (not just its symptoms), why there is a problem, where the problem is, and what the effects of the problem are. Traditional MIS systems that deliver a wide variety of detailed information can help identify problems, especially if the systems report exceptions.
2. **Design: -** here the decision maker designs possible solutions to the problems. Smaller DSS systems are ideal in this stage of decision making because they operate on simple models, can be developed quickly, and can be operated with limited data.
3. **Choice: -** this stage consists of choosing among solution alternatives. Here the decision maker might need a larger DSS or a GDSS to develop more extensive data on a variety of alternatives and complex models or data analysis tools to account for all of the choice's costs, consequences, and opportunities.
4. **Implementation: -** is a stage where the decision is put into effect. Managers can use a reporting system that delivers routine reports on the progress of a specific solution. Support systems can range from full-blown MIS systems to much smaller systems as well as project-planning software operating on personal computers.

2.2.2.3 Individual Models for Decision Making

A number of models attempt to describe how people make decisions. Some of these models focus on individual decision making while others focus on decision making in groups.

A. Individual models of decision making

The basic assumption behind individual models of decision making is that human beings are in some sense rational. The **rational model of human behavior** is built on the idea that people engage in basically consistent, rational, value-maximizing calculations. Under this model, an individual identifies goals, ranks all possible alternative actions by their contributions to those goals, and chooses the alternative that contributes most to those goals.

B. Organizational Models for Decision Making

Decision making often is not performed by a single individual but by entire groups of organizations. Organizational models of decision making take into account the structural and political

characteristics of an organization. Bureaucratic, political, and even "garbage can" models have been proposed to describe how decision making takes place in organizations. We shall consider each of these models.

i. **Bureaucratic models: -** According to bureaucratic models of decision making**,** an organization's most important goal is the preservation of the organization itself. The reduction of uncertainty is another major goal. Policy tends to be incremental, only marginally different from the past, because radical policy departures involve too much uncertainty. These models depict organizations generally as not "choosing" or "deciding" in a rational sense. Rather, according to bureaucratic models, whatever organizations do is the result of standard operating procedures (SOPs) honed over years of active use.

   Some organizations do, of course, change; they learn new ways of behaving; and they can be led. But all of these changes usually require a long time.

ii. **Political Models of Organizational Choice: -** Power in organizations is shared; even the lowest-level workers have some power. In political models of decision making, what an organization does is a result of political bargain struck among key leaders and interest groups. Organizations do not come up with "solutions" that are "chosen" to solve some "problem." They come up with compromises that reflect the conflicts, the major stakeholders, the diverse interests, the unequal power, and the confusion that constitute politics.

iii. **"Garbage Can" Model: -** A more recent theory of decision making, called the "garbage can" model of decision making, states that organizations are not rational. Decision making is largely accidental and is the product of a stream of solutions, problems, and situations that are randomly associated. If this model is correct, it should not be surprising that the wrong solutions are applied to the wrong problems in an organization or that, over time, a large numbers of organizations make critical mistakes that lead to their demise.

2.2.2.1 Implications for Information Systems

Research on organizational decision making should alter students of information systems to the fact that decision making in a business is a group and organizational process. Systems must be built to support group and organizational decision making. As a general rule, information systems designers should design systems that have the following characteristics.

- They are flexible and provide many options for handling data and evaluating information.
- They are capable of supporting a variety of styles, skills and knowledge.
- They are powerful in the sense of having multiple analytical and intuitive models for the evaluation of data and the ability to keep track of many alternatives and consequences.
- They reflect understanding of group and organizational processes of decision making.
- They are sensitive to the bureaucratic and political requirements of systems.

2.3 Data, Information, Knowledge and Wisdom

2.3.1 General Overview

Data must be distinguished from information, and this distinction is clear and important for our purposes. *Data* are facts and figures that are not currently being used in a decision process and usually take the form of historical records that are recorded and filed without immediate intent to retrieve for decision making.

(I) Data: - are collections of facts or events represented in the form of symbols, such as digits, alphabets, pictures, graphs, etc. Capturing, processing and storage of data are the essential functions of any IT infrastructure. Data are the basic raw materials in the process of generation of information. Data may be collected from internal as well as external sources.

Based on their properties, mainly in computing, data types can be categorized as:

- *Text (Non-Graphic):* is often represented as strings of alphabetic and numeric characters. Tools are available can be text processing programs like MS word, etc.

- *Graphic*: represents the concepts in pictures, diagrams, charts, tables, etc. Graphic software and hardware are available.

- *Image:* represents the reproduction of a real object. Different standard formats are available for image representation such as Joint Photographers Encoding Group (JPEG), Graphic Interchange Format (GIF) and Tag Image Format (TIF).

- *Animation*: represents simple sequences of pictures with animated effect created by flipping through them such as animated face in visual speech.

- *Audio*: represents sounds and their sequences. The three types of audio data are: speech, music, and sound effects.

- *Video*: represents successive capture and storage of image as they change with time, i.e., motion images.

One should note that a given data/information can be represented in one or more of the above forms. That is, for instance, a data on the population size of Addis Ababa can be represented as about 3 million in text, as a Bar chart in Graphic, and as speech given by the CSA population expert in audio. The question is which mode(s) is (are) most appropriate. This depends on the nature of the data/information, the user, and the media available for recording the data/information, etc. These different types of data have led to the notion of multimedia, multimedia database, and multimedia information system.

(II) <u>Information</u> consists of data that have been retrieved, processed, or otherwise used for informative or inference purposes, argument, or as a basis for forecasting or decision making.

Information is knowledge that one derives from facts placed in the right context with the purpose of reducing uncertainty. From the manager's point of view, information serves the purpose of reducing uncertainty regarding the alternative course of action, in the process of decision making. Availability of information regarding the alternatives improves the odds in favor of making a correct decision. Information is recognized as one of the most important corporate resources.

The late scholar Fritz Machlup (1983) carefully assessed the different meanings associated with information. Some interpretations that have been made from these sources are as follows:

The nature of information is;

- *Something one did not know before.*
- *Something that affects what one already knows.*
- *Something useful in some way to the person receiving it.*
- *The meaning of words in sentences.*
- *Something that provides more than what is stated.*

Our understanding of the basic nature of information is clouded by the fact that the word information is used in a variety of different contexts in our daily speech. The most prevalent of these everyday uses are discussed below.

- Information as a Commodity
- Information as Energy
- Information as Communication
- Information as Facts
- Information as Data and
- Information as Knowledge

(III) <u>Knowledge:</u> includes the capability of evaluating information in some meaningful or purposeful way. Having the knowledge or ability to perform some complex task involves more than just having a list of instructions or the information needed; that is, the ability to manipulate the information or perform the sub-tasks is required. Knowledge, thus, is a cognitive state beyond awareness. It can also refer to the organized record of human experience such as books, reports etc.

(IV) <u>Wisdom:</u> Implies the application of knowledge as contained in human judgment centered on certain criteria or values that are generally accepted by the culture or society.

Data …...……> Database system

Information ….> Information system/Information base = the description of all the information which is stored by the information system.

Knowledge …> Knowledge base system

Information has been used in its broad context to represent all accumulated knowledge and facts. However, it is good to differentiate the hierarchies as indicated. Data and facts make up the lower forms of information. They are collected, observed, or generated by human and computer endeavors. Accumulated data, the organization of facts to form the basis of what we know, is the next level called information.

The two higher levels, knowledge and wisdom, are individual and personal in nature. Wisdom is the further integration of information and knowledge into theory which has been both societal and personal meaning. It is the highest level of the information use continuum.

Information is different from knowledge in several ways;

(1) Information is piecemeal, fragmented, particular, where as knowledge is structured, coherent, and often universal; (2) information is timely, transitory where as knowledge is of enduring

significance; (3) information is a flow of messages, where as knowledge is a stock; (4) information is acquired by being informed, where as knowledge can be acquired by thinking (Machlup, 1983 in Tague-Sutcliffe, 1995).

Some Examples

Data: population size, average family income, family size, sex, age, educational level, etc., of family members, available services and resources such as schools, hospitals, and health centers, languages spoken and ethnic compositions of the area, etc. In a business environment, we may have roughly the following categories of data: product data, customer/supplier data, financial data, personnel / personal data, and strategic and tactical data. A governmental unit may have data categories such as Military/ defense data, Personal data, Survey/statistical data, criminal/judiciary data, and financial/budget data.

The data with which a business is concerned may also be categorized as:

- External environment data which includes matters relating to social, political and economic factors;
- Competitive data which embraces details with regard to the past performance of main competitors, their present activities and future plans;
- Qualitative and quantitative data relating to quality control, levels of performance, costs, overheads, profits and losses, financial strengths and weaknesses relating to cash flows and lines of credit; and
- Organizational data relating to manpower levels, the structure of departments

including the span of control and other similar details.

Information: Indicators for poverty level of the area, dominant language(s) in the area, literacy rate and health services coverage rate, etc.

Knowledge: Interpretation of the indicator indexes and rates such as to know how about the degree of poverty prevailing in the area, what type of intervention is necessary to minimize the problems of the area, etc.

Wisdom: If one comes up with a theory or a generalized statement, say on the relationship between literacy level and family size, family income, age, etc., based on the data available on this specific case.

2.4 The Information Needs and Sources of Managers

2.4.1 Information Need

It refers to the information required by the users to accomplish their tasks. How is it possible to determine the information needs of users? Information needs may be learnt by engaging in variety of information gathering activities including:

- User analysis: Personal interviews, observations, survey, etc. ; and
- Through activity/task analysis, and record searches.

The nature of the information systems required by an organization depends primarily on the kinds of activities performed and the type of the decisions made by the information users. The information needs of managers tend to vary with the level of organization because the nature of managerial activities tends to differ at different levels. The information required at each level also tends to come from different sources. Top management, for instance, need segregated or summarized reports and mostly depends on external sources. Lower-level management, on the other hand, depend on internal sources such as on the organization's information system and mostly use factual and detailed information.

2.4.2 Sources of Data/Information

- Formal Sources
  - Primary sources via different data collection methods.
  - Secondary sources such as Statistical sources and Databases in different media, other documentary sources, Web pages (on the Internet), discussion groups, online bulletin boards, etc.
- Informal Sources such as business contacts, invisible colleges, etc.

2.4.3 Data processing, Information processing, and Knowledge processing

(I) Data Processing

The whole objective of data processing is "getting the right information to the right person at the right time". This processing involves the selection and combination of facts from the store of data in order to convey a meaningful message to someone.

If the information is to be valuable in the operation and control of a business, it must meet three criteria of data processing: accuracy, timeliness and meaningfulness.

Accuracy: - The input data to the processing system must be accurate. The individual steps in the processing of data must also be accurate.

Timeliness: - The right information delivered too late can be as useless as no information at all. (i.e. a need for fast data processing system).

Meaningful: - The information produced by the data processing must be meaningful to the people using the information. i. e.

- The information must be appropriate and relevant to the user's needs.
- The report presented must be comprehensible. Both the format and the content of the reports must be easy to read and understand.

(II) Information processing

Information processing includes all those activities which turn a set of uncorrelated facts into a meaningful correlated whole for use in the management processes of planning, decision-making and control. The preparation of reports containing information involves subjecting the basic facts, i.e. the data, to a number of processing operations which typically include: verification (when data has been subjected to data conversion into a 'machine - sensible' form), validation, sorting, merging, computing, comparing, updating, printing, etc.

Information Processing involves information acquisition, organization, integration, utilization, and evaluation from the different sources for gaining and using information.

The process of generation of information involves a series of activities. Broadly speaking, there are three basic activities:

a. **Data acquisition**
b. **Data transformation**

c. Management of information

a. <u>Data Acquisition:</u> As stated earlier, data are facts expressed with the help of symbols such as alphabets, digits, graphs, diagrams, pictures, etc., or in any other form. Data may describe an event or it may represent status of an element of the environment. Whatever may be the source of data; it may be initially recorded and later verified for accuracy and authenticity. This activity is called data capture.

Data may be captured by punching with keyboard or scanning with scanning devices, facts from documents on which they were recorded.

b. <u>Data Transformation:</u> Data transformation may be done by performing any of the following operations on data:

i. <u>Rearranging</u>**:** Rearranging data in some specified order is a very common data processing activity. For example, data regarding stores may be rearranged in order of date of purchase or in order of value of each unit or in the alphabetic order of names if these are items. **Such a rearrangement is also known as sorting of data**. Sorting may add to the usefulness of data.

ii. <u>Classifying:</u> Data may be classified on the basis of the selected variables/factors. For example, sales data may be classified on the variables like customer's code, city, and product or sales person involved in obtaining order.

iii. <u>Calculating:</u> For a layman, data is processed only by calculating. A series of calculations performed on numeric values is called computation. This is the logic behind for the computer to be called computing machine. Calculating involves performing arithmetic operations (like addition, subtraction, multiplication, division and logic operations).

iv. <u>Summarizing:</u> is a process of aggregating various data elements, reducing the bulk of data to a more meaningful form. For example, a finance manager may be interested in knowing the total number of shares applied for in a public issue. The data in this regard may be summarized and such summary report may be more useful to him than the entire statement giving details of each share application received.

c. <u>Management of information</u>

After the acquisition and/or transformation, the processed data may be either communicated to end user or may be stored for future reference. If the information is to be communicated to the user, the

format for the reporting must be selected. The format for reporting may include simple columnar/tabular format or visual formats such as charts, diagrams, graphs, etc.. Once the report format is decided, appropriate channels of communication need to be selected and used. In case the information generated is to be used in future, it may be stored on some mass storage medium. Such activities of communicating and/or storing information may be termed as managing information.

(III) Knowledge Processing

It includes knowledge creation, knowledge sharing and knowledge application. This includes databases, documents, expertise and experience of employees.

Create	Capture/organize	Access use
Knowledge use	Knowledge sharing	Knowledge application.

Knowledge management aimed at improving process and productivity towards building competitive advantage.

2.4.4 Users of information

In any organization, information users could be managers, technical and professional specialists, or clerical or operations personnel. External users could be clients/customers, donors, governmental and international agencies and the public at large.

What are some of the characteristics of information users?

- Information users have different wants, needs and cognitive styles;
- Information users have different information sources or types that best satisfy their preferences; and
- They have dynamic needs depending on the task they are performing at present, which is changing through time.

Who are Information Users? Information as we have seen is sent to users. The information generated by an organization can be valuable to many different people. Users of an organization's information can be external or internal.

Bear in mind that information may be relevant to people outside the organization as well as its internal management and employees. In fact, decisions relating to an organization can be taken by outsiders. Some of the external users may be;

- *The government* (e.g. Department of Trade and Industry
- *The Inland Revenue Authorities* require information for taxation.
- *An organization's suppliers* take decisions to trade with the organization.

Internal users of information by status include the following:

- The board of the company; or public sector equivalent.
- Divisional general managers, reporting to these directors.
- Department heads.

Internal users of information by function are:

- Marketing, finance, administration, production, technical, personnel, research, etc.

2.4.5 Types of Information in terms of management hierarchy

A more functional classification of information is based on the basis of types of decisions. Information, as required at different levels of management can be classified as operational, tactical and strategic.

1. Operational Information: Operational information relates to the day-to-day operations of the organization and thus, is useful in exercising control over the operations that are repetitive in nature. Since such activities are controlled at lower levels of management, operational information is needed by the lower level management. Examples are such as cash positions and daily sales.

Operational information:

- Is derived almost entirely from internal sources;
- Is highly detailed, being the processing of raw data;
- Relates to the immediate term and task specific;
- Is prepared constantly, or very frequently;
- Is largely quantitative.

2. Tactical information: Tactical information helps middle level managers allocating resources and establishing control to implement the top-level plans of the organization. For example, information regarding the alternative sources of funds and their uses in the short run, opportunities for deployment of surplus funds in short term securities, etc., may be required at the middle levels of management.

Tactical information is;

- Is derived from a more restricted range of external sources, so is thus primarily generated internally;
- Summarized at a lower level - a report might be included with summaries and raw data as backup;
- Describes or analyses activities or departments and it is relevant to the short and medium terms;
- Is prepared routinely and regularly based on quantitative measures.

3. Strategic information: While the operational information is needed to find out how the given activity can be performed better, strategic information is needed for making choices among the business options. The strategic information helps in identifying and evaluating these options so that a manager makes informed choices which are different from the competitors and the limitations of what the rivals are doing or planning to do. Such choices are made by leaders only. Strategic information is used by managers to define goals and priorities, initiate new programs and develop policies for acquisition and use of corporate resources.

Strategic information is therefore;

- Derived from both internal and external sources;
- Summarized at a high level and relevant to the long term;
- Deals with the whole organization (although it might go in some detail);
- Often prepared on an 'ad hoc' basis in both quantitative and qualitative;
- Incapable of providing complete certainty, given that the future cannot be predicted.

2.4.6 The Attributes of Information

The attributes of information are the characteristics that are meaningful to the user of each individual item of information. That is, each ***individual item of information*** can be described with respect to accuracy, form, frequency, breadth, origin, and time horizon.

Accuracy: Information is true or false, accurate or inaccurate. Accurate and true information describes whether information represents a situation, level, or state of an event as it really is. Inaccurate information is the result of errors, which could have occurred during collection, processing, or report preparation.

Form: Form is the actual structure of information. It includes the dimensions of quantifiability (qualitative or quantitative), level of aggregation (summary form or detailed form), and medium of presentation (printed or displayed on screen, television).

Frequency: The frequency of information is a measure of how often it is needed, collected, pr produced. It may be produced very frequently or very seldom, depending on the users' need. Information for preparation of federal income tax returns, for example, may be collected only once in a year.

Breadth: Breadth is the scope of events, places, people, and things that are represented by information. A broad scope of sales information, for example, may include all the sales territories of a company doing business in the country. A narrow scope may include just one territory for the company or part of one territory.

Origin: The origin of information is the source from which it is received, gathered, or produced. Internal information originates from within an organization, and external information originates outside it -- from the government, for example, or from trade associations.

Time horizon: Information is oriented toward the past (historical information), toward present situations, or toward future activities and events. Historical information provides as perspective on what happened at an earlier time

The attributes of information that we have just discussed pertain to individual pieces of information. However, it is common to use several pieces of information together, that is, a set of information. Certain attributes are associated with ***sets of information***; these characterize the set for the situation in which it will be used. They are relevance, completeness, and timeliness.

Relevance: Information is relevant if an individual needs it in a particular decision-making or problem-solving situation. It is necessary part of the resources used to select a course of action. The important point is its application to the current situation. A set of information that was relevant at one time may not be relevant now if it is not actually needed and will not be used by the recipient.

Completeness: If a given set of information tells the user everything that needs to be known about a particular situation, we say that it is complete. If a report, on the other hand, leaves an individual with a number of unanswered questions, it is an incomplete set of information.

Timelines: Any manager has two important concerns: (1) is the information available when I need it? And (2) is it outdated when I receive it or when I want to use it? Substantial delays in the processing of information may significantly reduce its usefulness to a manager.

The attributes of information deal with the quality of information that will be used by managers. If any of them are substandard, the user is ill advised to rely on them to guide any actions or activities.

2.5 A Framework for Information Systems

Each of the management levels-- operational, tactical and strategic planning requires different information systems with the characteristics discussed here below:

2.5.1 Operational Systems

At the operational level the primary concern is to collect, validate, and record transactional data describing the acquisition or disbursement of corporate resources. When a sale is transacted, data on the items ordered are recorded, the inventory level for these items is adjusted, a shipping label and packing slip are prepared and an invoice is generated. Operational-level information systems often have the following characteristics:

Repetitiveness: The information they produce is usually generated repetitively at periodic intervals, such as daily, weekly, or monthly.

Predictability: The information they produce usually does not contain any surprises or unexpected results for the manager or other users of the system. That is, people are paid what they were expected to be paid and customers are billed for what they purchased during the month.

Emphasis on the past: The information produced usually describes past activities of the organization.

Detailed Nature: The information produced is very detailed. Customer invoices specify details regarding purchases made during the period, the terms under which the purchases must be paid, and the total amount, taxes, and other charges due.

Internal Origin: the data for operational systems usually spring entirely from internal sources.

Structured Form: The form of the data used as input and the form of the information produced by operational-level systems usually very structured.

Great Accuracy: the accuracy of the data used as input to such systems is usually very high. The data input and information output are carefully checked in a variety of ways.

2.5.2 Tactical Systems

The second level in the framework consists of tactical systems. Tactical systems provide middle-level managers with the information they need to monitor and control operations and to allocate their resources more effectively. In tactical systems, transaction data are summarized, aggregated, or analyzed. Tactical systems are designed to generate a variety of reports, including summary reports, exception reports, and ad hoc reports.

Summary reports: provide management with important totals, averages, key data, and abstracts on the activities of the organization (E.g. List Total regular and overtime hours earned at each plant, Total weekly sales, by salesperson, by product, and sales region).

Exception reports: warn managers when results from a particular operation have exceeded or not met the expected standard for the organization (sales fall by 10% for some employees, more over time in certain plants).

Ad hoc reports: are reports that managers need, usually quickly, that may never be needed again. Ad hoc reports present information that the manager needs to solve a unique problem.

Tactical information systems differ from operational information systems in their basic purpose. Their purpose is not to support the execution of operational tasks but to help the managers control these operations. Tactical information systems often have the following features:

Periodic Nature: the information from a tactical system is sometimes produced periodically (E.g. accounts receivable report).

Unexpected Findings: the information produced by a tactical information system may not be the information that was expected to be produced.

Comparative Nature: the information produced is usually comparative in nature rather than merely descriptive. Tactical information systems should provide managers with information that alerts them to variances from accepted standards or results that are not within the normal range, so that remedial actions can be taken swiftly.

Summary Form: the information produced is usually not detailed but in summary form. The credit manager is not interested in a detailed listing of each customer account and its balance

Both Internal and External Sources: The data used for input to the system may not be confined to sources internal to the organization.

2.5.3 Strategic Information Systems

Strategic planning-level information systems are designed to provide top management with information that assists them in making long-range planning decisions for the organization.

Strategic planning information systems often have these characteristics:

Ad Hoc Basis: The information may be produced either regularly or periodically. For example, periodic accounting system reports are used by top management in its planning function. However, strategic planning information is more often produced when it is needed, on an ad hoc basis.

Unexpected Information: The information produced by the system may not be the information that was anticipated.

Predictive Nature: The Information produced is usually predictive of future events rather than descriptive of past events. Long-range planners try to set a course for an organization through an uncharted future. The information that the strategic planning system provides should help these planners the risks involved in their choice of routes.

Summary Form: The information produced is usually not detailed but in summary form. Long-range planners are not usually interested in detailed information. They are usually concerned with more global data.(Example, buying trends, overall demographic characteristics of groups of customers).

External Data: A large part of the data used for input to the system may be acquired form sources external to the organization. (Investment opportunities, rates of borrowed capital, demographic characteristics of a market make group and economic conditions must be obtained from data maintained outside the organization).

Unstructured Format: The data used for input to the system may contain data that are unstructured in format. For instance, forecasts of future market trends may use the opinions of store buyers, salespeople, or market analysts obtained in casual conversations.

Subjectivity: The data used for input the system may be highly subjective and their accuracy may be suspect. For instance, forecasts of future stock market trends may be based partly on rumors

reported by brokers. Forecasts of the expected market share of your organization within the industry observers who are basing their opinion on rumors and on conversations held with a variety of industry personnel are examples of subjective information.

2.6 Business Systems

2.6.1 System Concepts

A system can be described simply as a set of elements joined together for a common objective. A system is a collection of people, machines, and methods organized to accomplish a set of specific tasks. A system is defined as a number of components, entities that form a whole. These entities interact in such a way as to achieve a goal. It is a set of objects that are relevant and may not be described in terms of their attributes or component parts.

Systems boundary: All systems have a boundary that separates them from their environment. The activities in a class include lectures, discussion, testing, grading, and preparation of assigned course work. When defining a system, you need to establish a boundary.

Systems and subsystems: Systems may consist of numerous subsystems, each of which has elements, interactions, and objectives. Subsystems perform specialized tasks related to the overall objectives of the total system.

Outputs and Inputs: The inner workings of a system or subsystem are organized to produce outputs from inputs. In this conversion process, some value, or utility, should be added to the inputs. For example, a training program should produce trained employees with certain skills, knowledge, or behavior from its inputs--- untrained employees. The outputs of one subsystem usually become inputs into the next.

An *interface* is a connection at system or subsystems boundaries. Two typical business systems that interface with each other are inventory control and purchasing.

Open and closed Systems: Open systems operate in an external environment and exchange information and material with that environment. The external environment consists of the activities external to the system boundary with which the system can interact. In contrast, a *closed system* is relatively self-contained; exchange with its environment does not occur. Closed systems do not get the feedback they need from the external environment and tend to deteriorate.

Systems Feedback: A system needs feedback to do its job. Feedback is form of control, because it requires continuing adjustments in the activities of the system. Employees need feedback to learn how they are doing job goals. Students receive grades or other kinds of evaluations from instructors to see whether they are meeting course objectives.

Abstract and Physical Systems: An *abstract system* is conceptual, a product of the human mind. That is, it cannot be seen or pointed to as an existing entity. Social, theological, cultural systems are abstract systems. None of these entities can be photographed, drawn, or otherwise physically pictured. However, they do exist and can be discussed, studied and analyzed. A *physical system*, in contrast, is a set of elements-- rather than ideas or constructs-- that operate in relation to one another to accomplish a common goal or purpose. Examples of physical systems include:

- *Computer systems*: collection of hard wares to process and produce output.
- *Communication system*: components that can transmit information.
- *Marketing systems*: collection of people, equipment, and procedures that develop, produce, and distribute commodities, ideas and other entities to consumers or users.

A system must have an objective or goal. It is probably true to say that all systems have more than one objective.

A business organization, for example, might list as its objectives**:**

- To generate a reasonable financial return for shareholders;
- To maintain a high market share;
- To increase productivity annually;
- To offer an up-to-date product range of high quality and proven reliability;
- To be known as responsible employers;
- To acknowledge social responsibilities;
- To grow and survive autonomously;

The system theorists argue that 2 + 2=5 or 2+2=3. Do you agree with their postulation?

2.6.2 Information Systems

In many ways, information systems have the same characteristics as systems in general. The major purpose an information system is to convert data into information --- information is data with meaning. In a business context, an information system is a subsystem of the business system of an organization. Each business system has goals, such as increasing profits, expanding market share, and providing service to customers. The information systems of an organization should provide

information on the day-to-day activities of a business, such as processing sales orders or checking credit. These systems are called **operational systems**. Information systems also must also be designed to provide information that lets management allocate resources effectively to achieve business objectives. These systems are known as **tactical systems**. Finally, information systems must support the strategic plans of the business, and these systems are known as strategic planning systems.

2.6.3 Classification of Information System

These days when we talk about MIS, we should note that it is more of a computer-based system. As it has been indicated earlier, the system in place is supposed to provide information that satisfies various needs. The same system is expected to provide information for planning, decision making, and for routine day to day operations. In view of satisfying these differing needs we have the following sub systems?

Transaction Processing Systems (TPS): Transaction processing systems' focus is data. These systems are designed to handle routine transactions and maintenance of database. Transaction processing systems (TPS) form the basis of many of the information processing applications in organizations of today. Transactions may be introduced into the system on-line in the form of time cards, inventory adjustments slips, insurance applications, and the like. The essential activity of transaction processing system includes data capture and validation, transaction-dependent processing steps, and database maintenance.

Knowledge Work Systems (KWS) and Office Automation Systems (OAS): serves information needs at the knowledge and other levels of the organization. Knowledge work systems aid knowledge workers, while office automation systems primarily aid data workers (although they are also used extensively by knowledge and other workers).

In general, knowledge is people who hold formal university degrees and who are often members of a recognized profession, like engineers, doctors, lawyers, and scientists. Their job consists primarily of creating new information and knowledge. Knowledge work systems, such as scientific or engineering design applications, promote the creation of new knowledge and ensure that new knowledge and technical expertise are properly integrated into the business. They are primarily secretaries, accountants, filling clerks, or managers whose jobs are principally to use, manipulate or disseminate information. Office automation systems are information technology applications

designed to increase data workers' productivity by supporting the coordinating and communicating activities of the typical office.

Management Reporting Systems: The focus of these systems is information. They are designed to supply information for routine responsibility reporting from databases. The principal identifying attribute of management reporting systems (MRS) are: they are built for situations where information requirements are reasonably well known, they are oriented toward reporting on the past and present, and, they generally report on internal operations. These characteristics clearly deal with operational and tactical types of activities.

Decision Support System (DSS): Decision support systems' focus is a decision; such systems are designed to accommodate individual and group decision- makers. Decision support systems provide managers with opportunities to evaluate alternatives related to a given problem or task. The principal identifying attributes of decision support systems (DSS) are: direct support the decision-making process and permitting projection. These characteristics clearly relate to managers, their information needs, and activities. **Group decision support systems (GDSS)** use computer mediated-communication tools, such as networks, anonymous input and voting, and whiteboards, to support groups as they make decisions.

Executive information systems (EIS): The focus of these systems is accessibility. That is, senior executives need access to internal and external information. Principal identifying attributes of executive information system (EIS) are: they provide immediate access to information reflecting.

Key success factors and access to internal and external information and they are easily tailored to user's preferences. These characteristics are critical for senior executive's types of activities and decisions.

Expert Systems: Expert systems are computer programs designed to operate within a narrow problem domain and to capture and present to the user expert knowledge. These systems can be developed to assist decision- makers in such diverse areas as classification, diagnosis, and monitoring, among others. Most importantly, the knowledge base of an expert system consists of human judgment and rules of thumb, as well as accepted facts and rules within its domain.

Expert systems consists of a knowledge base, a friendly user interface, an inference engine to control the system operation as well as the application of the system's knowledge, and an explanation subsystem to permit the system to explain to the user how it arrived at conclusions.

CHAPTER THREE

3. INFORMATION TECHNOLOGY

3.1 Introduction

What is information Technology? As stated earlier in chapter one, information technology refers to a wide variety of items and abilities used in the creation, storage, and dispersal if information. The elements of information technology include computer systems and telecommunication systems.

Computer systems are made up of five components: hardware, programs, information (database), people, and procedures. We will discuss each of these elements in this chapter.

3.2 Hardware: Computing, Storing and communicating

A computer system refers to the computer and all the hardware interconnected with it.

Hardware is the general term for the machines (sometimes called the devices) that carry out the activities of computing, storing, and communicating data. Generally, computer hardware falls into four categories:

- Input devices,
- Processors,
- Output devices,
- Secondary Storage devices.

3.2.1 Input Devices

Input has two meanings: (1) the data or information entered into a computer, or (2) the process of entering data or information into the computer. A *cursor*--- a blinking box or line on the computer screen --- usually indicates the point at which data or information will be input.

Seven devices are commonly used to input data or information into a computer. These are:

- **Keyboards:** Keyboards containing the letters of the alphabet, numbers, and frequently uses symbols (such as $, &, and #).
- **Mice:** this devices offer the advantage of allowing people to control the computer system by pointing to commands rather than entering them through the keyboard. The underside of the mouse is a ball that rotates, causing a corresponding movement of a pointer (an arrow) on the display screen. Two or three buttons (depending on the make) on the top side of the mouse let the user invoke a command or initiate an action.
- **Microphones:** Often used in multimedia system, microphones capture the voices or sounds around them for us in computer processing. The microphone is attached to a computer by a cable that transmits the sounds.
- **Image Scanners:** Image scanners can be used to input both words and images (including drawings, charts, and graphs) directly into the computer. Image scanners range in size from those that can fit into in the palm of your hand to others the size of a newspaper page. Once in memory the images can be modified or combined with other information.

- **Point-of-sale terminals:** A standard business cash register can be a good example here, these terminals typically does not contain alphabet letters. Rather, they consist of a number of data pad and special purpose function keys, such as for a sale, refund, or void. The number key board is used to enter details of the purchase, the cost of the product or the amount of money tendered for a cash purchase.
- **Bar code scanners and wands:** Many retail stores have found that the scanning of bard code information is faster and more accurate than entering the same information though a keyboard. A bard code is a computer-readable code consisting of bars or lines of varying widths or lengths. As the wand is waved across the bar on the package, it recognizes the special letters and symbols in the bar code and inputs this information directly into a PC, midrange computer, or point-of-sale terminal. There the code is translated into the product and price information
- **Prerecorded sources:** Tape recorders, cassette decks, record players, and stereo amplifiers can be connected to a computer that captures the sounds as they are played. This method of input allows high-quality music and voice reproductions to be merged with text and image information to produce multimedia presentation for education, training, marketing, and many other uses.

3.2.2 The processor

The center of action in a computer is the processor**,** also called the *central processing unit (CPU).*

A *chip* is a collection of electronic components in a very small, self-contained package. Chips perform the computer's processing actions, including arithmetic calculations and the generation of lines, images, and sounds. Some chips are general purpose and perform all types of actions. Others have a special purpose. Sound chips, for example, do exactly what their name suggests: they generate signals to be outputs as tones.

Mother (System) Board: The processor/CPU can take several forms. Microcomputers contain a specific microprocessor chip as their CPU. This chip is put into a protective package, and then mounted onto a board contained within the computer. This board is called a system broad or mother board. The system board also contains chips and other circuitry that carry out processing activities.

The two parts of the processor are the control unit and the arithmetic/logic unit.

(a) Control Unit

Computers "think" by using the on/off pulses of electronic current. You might liken the *control unit* to the human brain, which oversees and controls all of our activities, whether we are working, playing, or screening.

All computer activities occur according to instructions the control unit receives. Instructions are the detailed descriptions of the actions to be carried out during input, processing, output, storage, and transmission. Typical instructions may be to add two numbers together, to retrieve information for processing, or to print the results of processing.

(b) Arithmetic/Logic Unit (ALU)

The other component of the central processor is the *arithmetic/logic unit (ALU).* The ALU contains the electronic circuitry that performs the two activities that underlie all computing capabilities, arithmetic and logical operations. *Arithmetic operations* include addition, subtraction, multiplication, and division.

Logical operations compare one element of information to another. The comparison determines whether one item is greater than, less than, or equal to the other. The outcome of a logical comparison usually determines what type of processing occurs.

Arithmetic and logical comparisons are possible because computers' memory capability. But what exactly is memory.

Memory: Peoples refer to computer memory by different names, including *primary storage, main memory,* and *internal memory*. Memory space is used in different ways:

- To hold the computer's operating systems program --- the software that oversees processing and acts as an interface between the hardware and the applications programs.
- To hold application programs – word processing, inventory control programs, games.
- To hold data and information temporarily, receiving data or information from input devices and sending them to output devices during processing.
- To store other data or information needed in processing in the *working storage* area.

Two types of main memory are random access memory (RAM) and read only memory (ROM).

a) RAM: The largest area of memory within the computer is composed of random access memory or RAM chips. "Random access" means that data or information can be written into or recalled (read) from any memory address any time**.** With RAM, information can be written to or read from RAM in less than 100 billionths of a second. However, RAM stores data and information only as long as the computer is turned on. The electronic currents that comprise the data and information stop when the power is turned off.

b) ROM: Like RAM, read only memory (ROM) offers random access to a memory location. However, ROM chips are able to hold data and information even after the electronic current to the computer is turned off. The contents of a ROM chip cannot be changed. Whatever, is inserted into a location during manufacturing of the ROM chip cannot be altered.

3.2.3 Output Devices

People use computers for the outputs they generate ---- that is, the results of inputting and processing data and information. Output falls into two categories: (1) information that is presented to the user of the computer, and (2) information in the form of computer commands that are input to another device.

The most common forms of output geared to the user are reports, schedules, budgets, newsletters, and correspondence. These results can be printed out, displayed on a computer screen, and sometimes played through the speaker built in or attached to a computer.

3.2.3.1 Types of Output Devices

Four types of devices are used to display and distribute computer output: monitors, printers, plotters, and film recorders.

Visual Displays (Monitors): A computer's visual display is probably its most visible component. These visual displays, usually called video display terminals (VDTs) or monitors, differ in size, color, resolution, bit mapping, and graphic standard.

Monitors come in many different sizes, from the small screen built into palmtops and laptops to extra-large monitors used for special purposes

Printers: Generally speaking, a printer is an output device that produces hard copy --- that is, paper output. There are two general categories of printers: impact printers and nonimpact printers.

In *impact printing*, the paper and the character being printed come in contact with one another.

In *nonimpact printing*, there is no physical contact between the paper and the print device. The characters are produced on the paper through a heat, chemical, or spraying process.

Impact printers have existed for many years and have historically been very common in large and small computer configurations. Although they are being supplanted by nonimpact printers, they remain in widespread use. Three important types of impact printers are dot matrix, line, and character printers. In other hand Laser, ink jet, and thermal printing are the most frequently used kinds of nonimpact printers.

Plotters: literally draw image information, such as charts and graphs, line drawings, and blueprints of buildings. Just as if it were drawing them by hand, a plotter creates every line and character, including shadows and patterns, stroke by stroke.

Film Recorders: Slides, transparencies, and other types of film output are produced on film recorders. Virtually anything than can be shown on a computer screen can be copied to a film recorder. Under the control of a computer program, the film recorder transforms the electronic image on the screen into a film image. You might think of the film recorder as the equivalent of an electronic camera, with the film recorder setting the exposure and controlling the shutter to capture the electronic image on the computer screen on film.

3.2.4 Secondary Storage Devices

Computers that run multimedia and other complex programs require great quantities of storage capacity. For this reason, computer systems have several secondary storage options. Secondary storage provides the capability to storage outside of the central processor.

The difference between primary and secondary memory make secondary storage an integral and important part of information technology. This is true for several reasons:

- First, the contents of primary memory can reside there only temporarily. Main memory itself is used by many different applications, and between each application the memory is in effect cleared and reassigned to the next applications. Hence any information or results obtained from an application must be stored separately from primary storage in secondary storage.
- Second, primary memory holds data only while the computer is turned on. When the computer is turned off, the contents of primary memory are lost.
- Third, primary memory is rarely large enough to hold large volumes of data and information.

The most widely used types of secondary storage are briefly described here below:

– **Diskettes:** Flexible, flat, disks on which data and information are stored magnetically. For this reason, they are sometimes called magnetic disks.

– **Hard disks:** Magnetic disks those are not flexible. Hard disks can store data and provide for more rapid storage and retrieval of data and information than diskettes can. Hard disks are usually mounted inside the computer and, unlike diskettes, are not easily removed.

- **Optical disks:** A storage medium similar in design to the compact discs (CDs) played on stereo systems. Many optical disks are read only, which means that they can only be played. Because of this characteristic, optical disks are sometimes known as CD-ROM (compact disk-read only memory). The following forms are currently in common use:
    - CD, CD-ROM, DVD Read only storage, used for mass distribution of digital information (music, video, computer programs)
    - CD-R, DVD-R, DVD+R: Write once storage, used for tertiary and off-line storage
    - CD-RW, DVD-RW, DVD+RW, DVD-RAM: Slow write, fast read storage, used for tertiary and off-line storage.

Information is written to or read from each type of secondary storage medium by a read/write unit contained in a drive. The drive rotates the medium during the read/write process. Disk and tape drives read information magnetically, in much the same way that stereo systems read information from cassette tapes. Optical drives use a laser beam to read information.

3.3 Programs: In Charge of the Hardware

3.3.1 Systems Software

To manage a computer system's hardware components, to coordinate them so that they work together efficiently, and to schedule to make the best use of the computer's time, it is necessary to add a set of instructions that monitors and manages the system. This set of instruction is commonly referred to as *systems software*. By managing a computer system's hardware and available time, systems software acts as the linkage, or *interface*, between the computer system and the application programs the use want to run.

People who write or maintain systems software are called *systems programmers*. Organizations with large computer systems usually include systems programmers on their staffs to modify the systems software they use to the special needs of their organization. Systems programmers are also responsible for optimizing the performance of the organization's computer systems.

Systems software includes many different types of programs, such as operating system software, communications software, database management software, systems utility software, and language translators.

Operating Systems (OS): An operating system is a set of programs that manages and controls computer resources, including the CPU, peripherals, main memory, and secondary storage. An operating system must be loaded into main memory for the computer system to function completely.

Operating systems programs coordinate hardware through such activities as scheduling jobs to be run, queuing jobs, allocating memory to various job tasks, and communicating to the computer operator the status of the jobs and the computer system.

Communications Software: is really an extension to the operating system of a computer. It provides the additional logic for the computer system to control a variety of communications equipment so that it can communicate with peripherals, such as display terminals located far from the CPU. Communications software supervises such functions as communicating with remote terminals, monitoring communications equipment and lines, and managing traffic on communications lines, logging and analyzing communications traffic, and diagnosing communications problems.

Database Management Systems Software: Many people regard database management systems software as another extension of the operating systems. Database management systems handles records and files so that many users are able to access data quickly and easily. Database management systems software will be presented later on in this chapter.

Other Systems Software: There are many other types of systems software, only one of which will be mentioned here: *systems utility programs* are just that --- programs that operating systems users find useful. Often, system utility programs are designed to handle repetitive functions.

3.3.2 Application Software

Application programs are programs that perform specific data or text processing functions. For example, word processing and payroll programs are application programs. Programmers who develop application programs are called *application programmers*. To develop programs, application programmers use a programming language to create instructions in source. The common application packages are listed below:

1. **Word Processing Software**: Word processing software is a collection of application programs that permit the user to enter, edit and print text material.
2. **Project Management Software**: while managing projects, you will use one or more project management tools, such as for constructing Gantt chart and PERT charts. These tools help you to sequence project events and identify events that are critical to successful project completion.

3.3.3 Programming Languages

Any type of programmer may use programming languages to create and maintain their programs. These languages consist of programming commands and other words that are put together into programming statements that tell computer systems what to do and when to do it. Programming statements are often called *program code*, and the process of writing programming statements is referred to as *coding*.

There are many programming languages. These programming languages are sorted into levels that indicate the degree to which they are easily understood by a human and are therefore user friendly.

3.4People: The Most Important Element

People are the most important element in any computer system. Without them, there would be no need for computers. The people associated with information technology are either users or information technology professionals.

3.5.1 Users

Users are the people who use information technology in their jobs or personal lives. Because they are the final users of a computer system, they are sometimes called end-users. There are four types of users.

- **Hands-on users** use computers or communications systems directly, interacting with them to enter data, do processing, store and retrieve information, transmit details, or produce output.
- **Indirect end users** do not directly operate a computer but benefit from IT as the recipients of reports, electronic messages, communications, or multimedia presentations.
- **User managers** these users may not use IT themselves, but they do ensure that their staff members have reliable computer and communication capabilities. Manufacturing managers, editors, and hospital administrators, for instance, may be in charge of departments or work groups that use IT every day. It is increasingly rare, however, to find user managers who are not themselves hands-on users.

- **Senior managers** evaluate the organization's dependence on IT and identify the problems that could arise if the appropriate operating procedures are established or followed.

3.5.2 Information Technology Professionals

Information technology professionals are responsible for acquiring, developing, maintaining, or operating the hardware and software associated with computers and communication networks. The following IT professionals have the highest profile:

- **Programmers** use programming languages to create computer or network software.
- **Systems Analysts** work with users to determine the requirements an application must meet.
- **Systems designers** formulate application specifications and design the features of custom software.
- **Project managers** coordinate the development of a system development project
- **Network specialists** design, operate, and manage computer communications networks.
- **Trainers** work with end-users, helping them to become comfortable in using IT.

All of the above IT professionals usually work businesses that use computers or communication technology but that do not design and manufacture the hardware they use. IT professionals in the business of manufacturing computers or computer-related components (such as communication cables and electrical power supplies) generally fall into two categories: **computer engineers**, who design, develop, and oversee the manufacturing of computer equipment, and **systems engineers,** who install and maintain hardware.

3.5 Procedures: The Way It Goes

A procedure is a step-by-step process or a set of instructions for accomplishing specific results. Procedures, combined with people and applications, make up the know-how that is an integral component of IT.

There are four primary categories of procedures: operations, backup and recovery, security, and development. All of these procedures are for people. They help to avoid problems and provide guidance in dealing with them if they arise.

3.5.1 Operating Procedures

Operating procedures pertain to the execution of an application. Typically, operating procedures include:

- How a system or application is used.
- Who is authorized to use the system and what each individual is authorized to do.
- How often certain applications are to be used.
- Where results of processing (the output) should go.

Depending on the application, operations procedures can be very simple or quite involved (for example, "At the end of every month, make a backup copy of all database, a copy of all transactions, and reset all account totals to begin the next month").

3.5.2 Backup and Recovery Procedures

Nobody wants to spend several days creating a high-impact graphic only to lose it because a power line goes down or because a diskette gets misplaced.

Backup procedures describe when and how to make extra copies (called *backup copies*) of data, information, or software to protect yourself against losses. Should any of these be lost or accidentally changed, the backup

copy can be used to restore the original version so that a minimum of work is lost. *Recovery procedures* describe the actions to be taken when data and information or software must be recovered.

3.5.3 Security Procedures

Security procedures are designed to safeguard data centers, communications networks, computers, and other IT components from accidental intrusion or intentional damage. Backup copies protect against loss; security procedures prevent actions that could lead to that loss.

Security software can play an integral role in protecting systems and data. Such programs allow IT managers to restrict access to files and databases, to disk drives, and even to input/output devices. Of particular importance is protection against *viruses*—hidden programs that can alter the way a computer operates or modify the data and programs, thereby spreading itself from one computer to another. If undetected for long periods of time, a virus can do a great deal of damage to stored information.

3.6 Information: The Reasons for Using Information Technology

The desire to apply information effectively is one of the primary reasons that people use information technology. Computer hardware and software have been developed primarily to process data and generate information.

As stated earlier, information is an organized, meaningful, and useful interpretation. Using information, you determine conditions, assess whether a problem has occurred, evaluate alternative solutions, and select actions. But, information is not composed of data only. Information may also include text, sound, and images.

3.7 Communication Technologies

3.7.1 Telecommunication Systems

Telecommunication be defined as; Electronic transmission of data (text, graphics, sound, video) over one or more of a variety of communications channels.

Basic building blocks of a telecommunications network are: -

A. Computers; Computers originate and receive the data involved.
B. Communications channel (link or line)**;** forms the path over which data travel as they pass from a sending device to a receiving device in a telecommunications system.
C. Communications Equipment; assists in sending and receiving data.
D. Communications Software; helps to control the functions of the telecommunications system. These functions include:
- Establishing the available paths between sender and receiver;
- Directing the data along the most efficient path;
- Making sure the data reach the right place;
- In general, controlling the overall flow of communication.

3.7.2 Communications Channels

1. Electromagnetic Radiation

- Usage: All transmission media make use some form of electromagnetic radiation to communicate information.

- Invisible: Generally invisible to the human eye.
- Source: Generated both by nature (the sun is a major source) and by electronic devices.
- Form: Radiation is emitted in the form of waves or stream of particles that can be transmitted through space or a physical medium like a wire.

2. Types of Transmission Media

a. Twisted-Pair wire

- Is the oldest and most common form of transmission media
- It consists of strands of insulated copper wire twisted together in pairs.
- Already-installed telephone lines can be used to transmit data.
- Low installation and maintenance cost.
- Relatively slow compared to other transmission media.
- Susceptible to electrical interference that can distort data.
- Example; Telephone wire

b. Coaxial Cable

- It is often the transmission medium of choice.
- It consists of copper wire surrounded by several layers of insulation.
- Can transmit a larger amount of data at faster speeds than twisted-pair wire (up to 200 megabits per second compared to about 10 megabits per second for twisted-pair wire)
- Does not suffer from electrical interference.
- The layers of insulation made the cable thick and harder to install
- Example; Cable television.

c. Fiber Optic Cable

- Is suitable for the transmission of the large amount of data needed to create complicated graphics and images such as photographs and moving videos. Many organizations are choosing fiber optic cable for their communications system's backbone (a communications channel that connects various smaller networks together).
- Consists of hundreds of strands of smooth, clear glass fiber that are as thin as a human hair and bound together. Data are transformed into pulses of light emitted by a laser device and can be transmitted at very fast rates of speed (nearly 1 billion bits per second).
- Is smaller, lighter, and more durable than wire-based media.
- Is Unaffected by magnetic or electrical fields, thus lower error rates.

d. Microwave transmission channels

For heavy users, microwave transmission channels provide large amount to bulk rate service. Long distance microwave transmission facilities can be leased from common carriers.

e. Radio Transmission channels

There is an increasing use of Radio channels for short-distance voice telephone service, and it is being used by employees who must spend a great deal of time away from their offices.

f. Satellite transmission channel

It is an object which has been placed into space orbit by human endeavor for the purpose of telecommunication and others. Communication satellites are cost effective for transmitting large quantities of data over long distances.

3. Types of signals
- **Analog:** Continuous wave of patterns that vary with regular twisted-pair wire telephone signal.
- **Digital:** Transmit either of two states or amplitude pulses, on or off, which correspond to 1s and 0s, respectively.

4. Data Transmission

a. Direction of Transmission
- **Simplex:** Data can travel in only one direction Example: data collection devices.
- **Half-Duplex:** Data can travel in both directions but only one direction at a time,
- **Full-Duplex:** Data can travel in both directions simultaneously.

3.7.3 Telecommunications Networks

Computers and other communications equipment connected by a communication channel in such a way that data, programs, and peripheral devices like printers can be shared or communicated.

Two primary types of networks;

a. Local networks: Used for communications over short distances (i.e., within several floors of a building).
b. Wide Area Networks (WANs): The transmission of data over long distance. It requires extensive communications hardware and software.

3.7.4 Local Area Network (LAN)

A LAN is combination of hardware, software, and communications channels that connect two or more computers within a limited area. In a LAN Expensive hardware devices such as laser or color printers or large hard drivers can be shared, lowering costs and enabling the resource to be used more efficiently. It also provides users with access to shared programs and data files, improving work flow, Productivity and communication within an organization.

Components of a Typical LAN can be;

i. Desktop microcomputers (two or more), each equipped with a network interface card that enables the microcomputers to send and receive messages through the LAN.
ii. Cabling system connecting the components
iii. File Server as a high-speed /high capacity microcomputer or workstation (help manage the network, processes communications, and allows users to share data, programs and peripheral devices).
iv. Network operating system software; manage all activity on the network.
v. Hub or repeater and Shared peripheral devices (such as printers).

3.7.5.1 Types of LAN networks

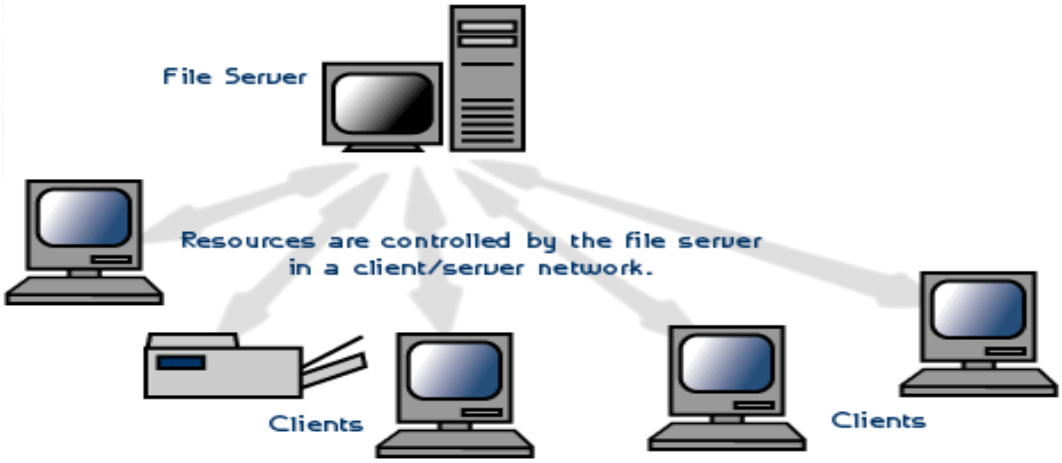
i. Peer-to-Peer

Peer-to-peer network allow users to share resources and files located on their computers and to access shared resources found on other computers. Small offices with 2-15 workstations can benefit from this type of network.

ii. Client/Server

Another method is client/server networking, this system employs dedicated PC's or file server's, which hold a companies information databases in one location. All users on the network can access files from the servers, and save files to the servers. This keeps all critical data in one place, and gives each user a dedicated link to that information.

3.7.5.2 LAN Topology



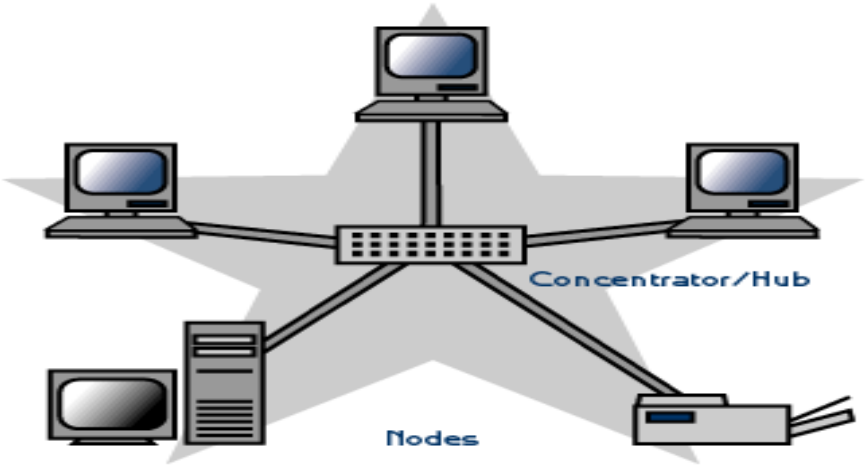
It is defined as the physical layout, or shape, of a network (formed when hardware devices are connected together.

Types of LAN topology;

a) Star Topology

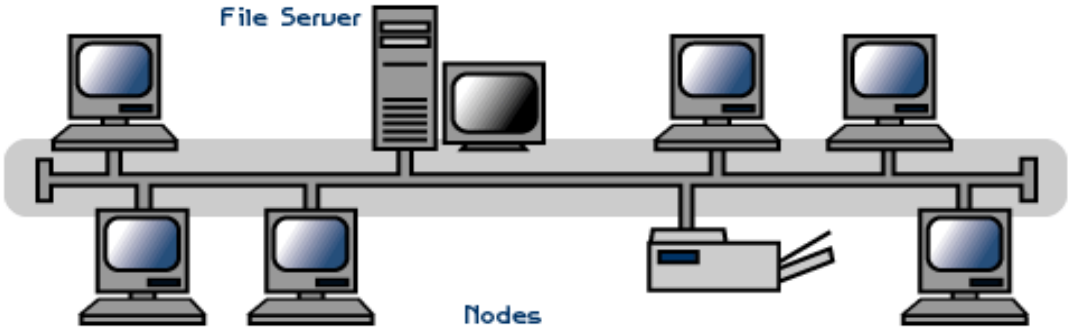
- Each device is connected to a central unit. Communication between on device and another must go through the central unit.

– It keeps close control over data being processed on the net work.
– If the host computer stops, the entire network will halt.



b) Bus Topology

– Each device is connected to a single, common communications channel.
– Bus networks may be organized along peer-to-peer lines or may use a client /server architecture.
– The computer "broadcast" through the communications channel in both directions to the entire network.
– The communications channel can handle only one message at a time.
– When two computers transit at the same time, a "collision" occurs and the messages must be present. Bus network slow down when this happens.

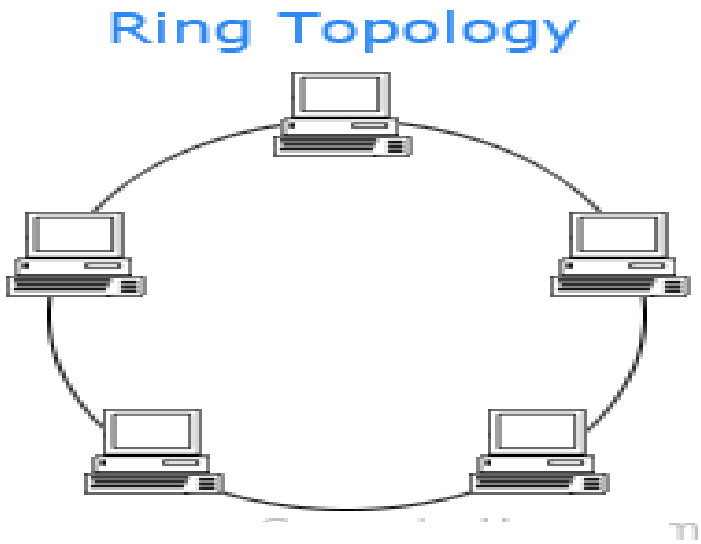


c) Ring Topology

i. Description

– Each terminal is connected to two others forming a closed loop (circle or ring).
– Ring networks avoid the data collisions that can slow bus networks by creating an electronic signal called a "token" that circulates around the network and must be attached to messages being sent to other devices.

- When a computer on the network is ready to send a message to another, it checks the token as it passes by to see if it is free. If it is, it captures it, attaches its message to the token, and then transmits the data.
- When the data are received, the receiving device releases the token back to the network.
- If a connection between any of the devices fails, the network shuts down.



3.8 Database Management Systems (DBMS)

3.8.1 File Management vs. Database Systems

Early business computer systems were used primarily for accounting functions. These functions had to be carried out for a business to operate. Because these systems performed normal record keeping functions, they were called **data processing system**s. Not surprisingly, the programmers and analysts who designed them followed their natural inclination to mimic the existing manual procedures in their programming. Thus, the computer files corresponded to paper files, and the records in the computer files contained information that an individual file folder in a manual system might contain.

A database is a collection of data and information describing items of interest. The components of the database have included text, numbers, image, graphic, and voice information. On the other hand, a database system is comprised of a database general purpose software called the database management systems (DBMS) that manipulates the database, and manipulates the database, and appropriate hardware and software and personnel.

3.8.2 Limitations of Traditional File Systems

A file system has a number of shortcomings;

Data Redundancy: A major difficulty was that many applications used their own special files of data. Thus, some data items were common to several applications.

Poor Data Control: In file systems, there was no centralized control at the data element level. It was very common for the same data element to have multiple names.

Inadequate data manipulation capabilities: if we want to get more information from different files, it would be difficult to obtain from a file system because file systems are unable to provide strong connections between data in different files.

3.8.3 Database systems

Database concepts: Whereas a file is a collection of related records, a database is a collection of related files.

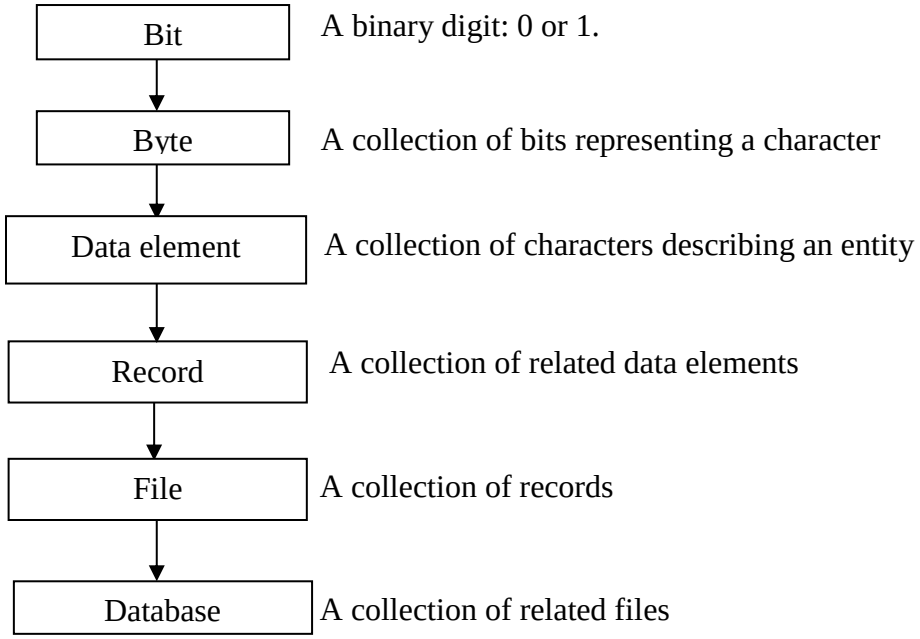


Fig. Building blocks of a computer based electronic database.

A database management system or DBMS is a collection of software programs that,

1. Stores data in a uniform way.
2. Organizes the data into records in a uniform way.
3. Allows access to the data in a uniform way.

In a database management system, application programs do not obtain the data they need directly from the storage media. They must first request the data from the DBMS. The DBMS then retrieves the data from the storage media and provides them to the application programs. Thus, a database system operates between application programs and the data.

3.8.4 Components of Database Management Systems

Database management system software is usually developed by commercial vendors and purchased by other organizations. The components of a particular DBMS will vary somewhat from one vendor to another. Some of the components are described below:

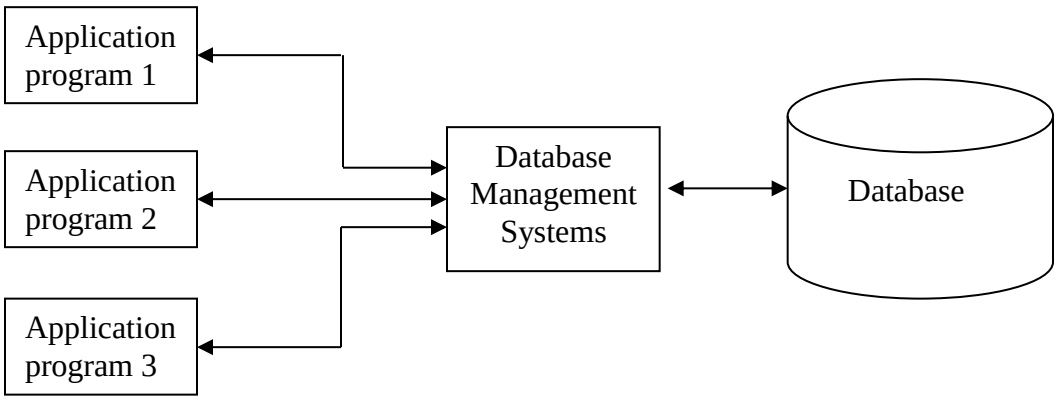


Figure: The relationship of applications, a database management system and database.

3.8.5 Advantages of Database Management Systems (DBMS)

Companies find a number of advantages in using a database management system instead of a series of separate files controlled by file management software.

Data Sharing: The data from the entire company are at the disposal of uses that need them.

Reduced Data Redundancy: A database minimizes duplication of data from file to file. Thus, a student's name and address might appear only one record in a university.

Improved Data Integrity: Because data redundancy is minimized, data inconsistency and the threat to data integrity are substantially reduced. Data inconsistency naturally leads to conflict reports.

Data Independence: A database system keeps descriptions of data separate from the applications that use the data. Thus, changes in the data definitions can occur without necessarily requiring changes in every application program that uses those data.

Increased Application Programmer and User Productivity: Most database management systems offer application program development tools that help application programmer write program code. These tools can be very powerful and they usually improve an application programmer's productivity substantially.

Improved Data Administration and Control: Placing responsibility for the database in the hands of one person or department provides a number of advantages. It permits better enforcement of standards for defining data elements and data relationships. In this way, the discipline of the data dictionary becomes easier to enforce and control.

Increased Emphasis on Data as a Resource: Establishing database administration and deploying a database management system emphasize throughout an organization the importance of information to the management function. The DBA acts as an advocate for the concept of information as a corporate resource. The result is likely to be greater corporate attention to information systems as an aid to managerial decision making and long-range planning suing the database as the basic information resource.

3.8.6 Features of DBMS

Backup and Replication: Copies of attributes need to be made regularly in case primary disks or other equipment fails. A periodic copy of attributes may also be created for a distant organization that cannot readily access the original. DBMS usually provide utilities to facilitate the process of extracting and disseminating attribute sets.

Rule enforcement: Often one wants to apply rules to attributes so that the attributes are clean and reliable. For example, we may have a rule that says each car can have only one engine associated with it (identified by Engine Number). If somebody tries to associate a second engine with a given car, we want the DBMS to deny such a request and display an error message. However, with changes in the model specification such as, in this example, hybrid gas-electric cars, rules may need to change. Ideally such rules should be able to be added and removed as needed without significant data layout redesign.

Security: Often it is desirable to limit who can see or change which attributes or groups of attributes. This may be managed directly by individual, or by the assignment of individuals and privileges to groups, or (in the most elaborate models) through the assignment of individuals and groups to roles which are then granted entitlements.

Computation: There are common computations requested on attributes such as counting, summing, averaging, sorting, grouping, cross-referencing, etc. Rather than have each computer application implement these from scratch, they can rely on the DBMS to supply such calculations.

Change and access logging: Often one wants to know who accessed what attributes, what was changed, and when it was changed. Logging services allow this by keeping a record of access occurrences and changes.

CHAPTER FOUR

4. COMMON BUSINESS APPLICATIONS OF INFORMATION

So far, you have learned about computer information systems, the decision making process, and the basic computer resources available to the manager. What you learned generally emphasized the organizations as a whole, rather than the major areas of decision making commonly found in organizations. You will apply what you have learned about information systems, decision making, and computer system resources to problems in finance, marketing, manufacturing and production and human resources.

4.1 FINANCIAL INFORMATION SYSTEMS

Whether you are the chief operating officer of a large international organization or merely the supervisor of a small department at one location in that organization, you will find it necessary to make financial decisions. The financial decisions you may encounter as a manger are diverse and could include decisions similar to these:

Should you purchase a large new piece of equipment or lease it for a three-year period?

How much of your department's funds should you allocate to telephone usage rather than travel?

Should you invest money in new computer equipment or additional merchandise for resale?

Should you allow a particular customer to make a large purchase on credit?

Should your organization decide to offer a new product or service, or should it provide the same products and services in additional markets?

To make these and similar decisions, you need to understand the basic financial accounting systems found in most organizations. You must also understand how financial information systems can help you make improved decisions about the financial problems within your purview.

4.2.1 Operational Financial Information Systems

Typically, the applications first computerized by many organizations are accounting systems designed to produce operational-level output. The development of computerized financial information systems for use in tactical decision making and strategic planning is usually deferred until the basic operational-level information systems are in place and working.

Operational financial information systems produce the routine, repetitive information products that every organization finds necessary. These products, or output, include paychecks, checks to vendors, customer invoices, purchase orders, stocks reports, and other regular forms and reports. Financial operating information systems are typically task oriented. They focus on processing financial transactions to produce the financial products just described.

- ***Accounting Systems***

The heart of an organization's financial operating information system is the accounting system. A computerized accounting system is composed of a series of software modules or subsystems that may be used separately or in an integrated fashion. The subsystem modules include;

1. **General ledger**: The general ledger subsystem ties to other financial accounting systems subsystems together, provides managers with periodic account reports and statements, such as an income statement and a balance sheet, and provides support for budgeting.
2. **Fixed assets**: The fixed assets subsystem maintains records of equipment, property, and other long term assets an organization owns. The records include the original cost of the assets, the depreciation rate on each asset or groups of assets. the accumulated depreciation to date, and look value of the asset, which is the original cost less accumulated depreciation to date. The general ledger subsystem uses this

information to maintain up-to-date balances in the various long-term asset accounts of the organization. The subsystem also may maintain and process data on the gain or loss on the sale of fixed assets and prepare special income tax forms for fixed assets required by the federal government.

3. **The Sales Order Processing Subsystem**: The sale order process subsystem, or order entry subsystem, routinely records sales orders and provides the documents that other subsystems use to fill those orders that maintain inventory levels and that bill the customers (sales invoices). The subsystem provides sales tax data to the general ledger subsystem for updating inventory balances, and sales invoice data to the accounts receivable subsystem for posting to customer accounts.

   A computerized sales order subsystem usually tracks the sales made by each sales person and provides input to the payroll subsystem so that salesperson's commissions can be accumulated. The subsystem should also provide information to the shipping department to ensure that the correct stock is sent to the customer; provide for backorders when there is not enough stock on the shelves; accurately figure prices, totals, discounts, and taxes on the order; and allow a quick and accurate response to customer inquiries about the status of the order.

4. **Accounts receivable Subsystem**: The accounts receivable subsystem allows you to enter, update, and delete customer information, such as charge sales, credit terms, cash payments received, credit for returned or damaged merchandise, and accounts balances.

   Inputs to the accounts receivable subsystem include sales invoices, credit memoranda, and cash received from customers. Typical outputs are monthly customer statements of account and a schedule of accounts receivable listing each account and its balance.

   Many accounts receivable subsystems produce aged accounts receivable reports. These reports classify accounts balances into several categories (30, 60 or 90 days over due). An aging report identifies customers with overdue balances to managers, allowing them to use the computer system to prepare collection letters, start collection procedures, and disallow additional credit to poor credit risks. Without aging data, an organization may continue to grant credit to customers already long overdue on their payments.

5. **The Accounts Payable Subsystem**: The accounts payable subsystem processes much of the same routine, repetitive information as the accounts receivable subsystem, except that the information is about organization's creditors rather than customers. For example, the subsystem maintains creditor account information, prepares checks to creditors, and produces the accounts payable schedule. The accounts payable subsystem provides data directly to the general ledger subsystem and receives data from the purchase order subsystem.

   The accounts payable subsystem may also find the due dates for purchases on account and the last date on which cash discounts may be taken on those purchases. This subsystem provides important operational level information that can be used to schedule cash payments to creditors. The effect of such a subsystem is to allow the organization to keep its money working for it as long as possible and yet ensure that all cash discounts are taken.

6. **The Inventory Control Subsystem**: The inventory control subsystem provides input to the general ledger subsystem and receives input from the purchase order and the sales order subsystems. The basic purpose of the subsystem is to keep track of inventory levels and inventory costs fro the organization. The subsystem maintains information about each stock item, such as stock numbers and stock descriptions, receipts and issues of stock, and stock balances. The inventory subsystem may also trigger the purchase of stock when stock levels reach certain points, maintain information about stock item costs, and maintain selling price data on each stock item.

   The inventory subsystem maintains stock balance data by obtaining stock receipts from the purchase order system and stock issues from the order entry system. Updates for other stock changes, such as

damaged goods, lost stock, shrinkage, or spoilage are usually entered directly into the subsystem by inventory clerks after a physical inventory has been completed.

7. **The Purchase order Processing Subsystem**: The purchase order processing subsystem processes purchase orders and tracks which purchase orders have been filled, which stock items ordered are on backorder, which stock items have been damaged or do not meet the specifications of the original order, and when orders are expected to be received.

   The purchase order subsystem provides information to the accounts payable and inventory subsystems. The subsystem produces a variety of reports, including a backorder report listing all stock items on backorder and an open order report listing all purchase orders not yet received and their expected arrival dates.

8. **The Payroll Subsystem**: The payroll subsystem processes wage and salary information, such as payment to employees; deductions from employee checks; and payments to government taxing agencies for taxes owed. The payroll subsystem produces weekly payroll summary reports, overtime reports; forms for taxing agencies, such as wage and tax statements; payroll checks for payroll taxes owed to taxing agencies.

   When these computerized accounting subsystems are integrated, each subsystem receives data as input from other subsystems and provides information as output to other subsystems. The accounting subsystems might be integrated.

4.2.2 Tactical Financial Information Systems

The computerization of accounting systems usually changes the way managers view accounting information. Because a large database of information becomes available in computerized form and can easily be extracted or manipulated, this information begins to be viewed as a resource for tactical planning. Suddenly, it becomes possible for managers to get important summaries and comparisons of accounting data easily and swiftly. In the past this information would have taken a great deal of time to extract from a manual accounting system. The result is that managers view the accounting system as more than merely a producer of checks, invoices, and statements. It becomes repository of important data that can assist management in decision making. The computerization of accounting system has helped to spawn the use by managers of corporate databases to support tactical decisions and strategic planning. This has led to the development of computer-supported financial information systems for tactical decision-making and strategic planning information systems.

Tactical financial information systems support management decision making by providing managers with regular summary reports, regular exception reports, ad hoc reports, and other information that will help them

(1) Control their areas of responsibility and

(2) Deploy their resources to pursue organization goals. Whereas operational control systems are focused on tasks, tactical information systems are focused on resource allocation.

It is possible to design many computer-supported tactical-level information systems for the financial decisions that managers must make. Common systems include budgeting systems, cash management systems, capital budgeting systems, investment management systems. Each of these systems will be briefly described.

- Budgeting Systems

The general ledger subsystem of many computerized accounting systems permits the user to enter budget amounts by account number. Periodically (weekly, monthly, quarterly, or annually), the budgeted amounts (allocations) and the actual amounts spent or received (actual) for each account are compared and various reports are prepared. For example, the general ledger subsystem of a mainframe accounting system may provide the reports listed below.

1. Current budget allocations by line item,

2. Budget variances by line item type, or the differences between allocations and actual amounts,
3. Current budget allocations compared to the previous year's allocations,
4. Current revenues and expenditures compared to the previous year's revenues and expenditures,

Reports such as these may be prepared for a department, a division, a subsidiary, or the entire organization. The budgeting system permits managers to compare revenue and expense data against the standard of the budget allocations. It also allows prior fiscal period, other division or department, industry-wide data to be used as standards against which current budget amounts may be compared.

- Cash Management Systems

Important functions of financial management include ensuring that the organization has sufficient cash to meet its needs, putting excess funds from any period to use through investments, and providing borrowing power to meet the organization's cash needs in those periods when there is an insufficient cash flow.

There are two major reasons why an organization needs cash: for working capital (cash needed for day-to-day operations) and for the acquisition of long-term assets. To determine if adequate cash is available for its working capital needs and its long term asset acquisition plans, the organization must prepare a report of its expected cash flow for the time periods being considered. Typically, this report shows the cash flow for each month of the coming year.

A cash flow report shows the estimated amount of cash that will be received and spent each month. The report shows in which months there will be cash received and spent. The report shows in which months there will be excess funds that might be put to use, and in which months there will be insufficient funds, requiring the organization to borrow cash to meet its working capital or fixed asset acquisition needs.

The information provided by a cash flow helps the manager make decisions about investing, purchasing, and borrowing money. If this information is placed on an electronic spreadsheet, the manager may stimulate a number of possible business conditions, such as (1) increasing or decreasing revenue, (2) increasing or decreasing customer credit problems, (3) deferring the acquisition of an asset, or (4) repairing existing fixed assets instead of replacing them.

- Capital Budgeting Systems

A capital budget contains information about the planned acquisition or disposal of major plant assets during the current year. The manager may wish to compare the various capital spending plans in terms of three commonly used *evaluation tools: net present value, internal rate of return, and payback period.* These tools can easily be calculated using computer systems. "What if?" games are performed using software packages.

- Investment Management Systems

Investment management -- overseeing the organization's investments in stocks, bonds, and other securities -- - is an important part of cash management. Managing investment is also an important part of an organization's pension plan management. Whatever the source of the funds for investments, most organizations invest money in securities of one kind or another. Careful management of these investments is necessary to ensure the achievements of organization goals.

Current information systems provide unique ways to manage stock and bond portfolios. These ways typically involve the use of external databases that furnish immediate updating of stock and bond prices, information about the history of each investment, and various portfolio investment analysis tools to help the manager stay on top of the organization' s investments. The system may be a simple one in which the manager's microcomputer is equipped with a modem and he or she is provided with a subscription to an investment service. Possible information that can be generated are current dividend, price history, price stability index, projected changes earnings, current earnings per share, debt as a percent of capital, dividends history, industry ranking, low price per year and the like. Tactical financial information systems give the manager increased

control over the financial resources of a department or an entire organization, and provide considerable support when he or she is deciding the allocation of financial resources to meet organizational goals.

4.2.3 Strategic Financial Information Systems

You have learned that operational control-level information systems are task oriented and that tactical-level information systems are resource allocation oriented. In contrast, strategic information systems are goal oriented. That is, these systems are concerned about goal and direction setting for organizations.

Strategic information systems typically include several types of information flows:

1. Financial condition analysis data or an analysis of internally generated information describing the status of the organization,
2. Economic, demographic, and social data or an analysis of externally generated data describing the present and future environment for the organization,
3. Forecasts of the future of that organization in those environments.

Two major outcomes of financial strategic planning are the setting of financial goals and directions for the organization. The former may include setting investment goals and return on investment goals. The latter may involve deciding on new investment opportunities or on the mix of capital sources used to fund the organization.

A major source of computerized information about the current and future status of the organization is the organization's own financial accounting database. A promising source of computerized information pertaining to the present and future environment in which the organization must operate are on-line databases for economic, social, demographic, technological, and political information. Projecting likely scenarios (minimum, base case and maximum) for the organization using these two categories of data is the art of forecasting. A major purpose of strategic decision making is to use long-range forecasts to reduce the risk involved in major organization decisions.

- Financial Conditions Analysis Systems

Computerized accounting systems provide the user with a variety of reports on which many ratios and analysis tools may be applied. Example, working capital = current assets - current liabilities, return on assets = Profits after tax/Average assets.

- Long-Range Forecasting Systems

Strategic planners demand forecasts on a variety of factors that will affect organization performance in the future.

Forecasting the sales revenue of a potential new product makes important information available to planners considering the development and marketing of the new product.

The types of information used in forecasting the future environment of the organization are many and diverse. They include descriptions of the present economy and forecasts of the future economy, information on the present demographic structure of the region or country and forecasts of the demographic structure of the region or country, and descriptions of the current social structure and social mores and predictions on the future structure of society and societal mores.

4.2 MARKETING INFORMATION SYSTEMS

The basic goal of the marketing function in any organization is to satisfy the needs and wants of existing and potential customers. The marketing functions includes planning, buying, merchandising (standardization and grading and pricing), selling (advertising, sales promotion, packaging, publicity and personal selling),

physical distribution (transporting and storing) and facilitating (financing, risk bearing and obtaining information). The strategic decisions include new product design and development, target selection and old product management. On other hand, tactical planning (marketing mix decisions) includes product decisions, physical distribution decisions, adverting and promotion decisions and pricing decisions.

Marketing information systems support the major activities of a marketing organization. The information systems collect data that describe marketing operations, process those data, and make marketing information available to marketing managers to help them make effective decisions.

4.2.1 Operational Marketing Information Systems

Operational marketing information systems primarily produced routine, repetitive, expected, and regular data that describe past marketing activities. The information they produce is usually detailed, highly structured, and accurate, and is derived from internal sources.

- Sales Information Systems

Salespeople are responsible for many-sales activities. They must identify potential customers, make the customer contact, call on the customer, make the sales, close the sale, and follow up on the sale. These are the bread-and-butter sales activities of the salesperson. There are many information systems that support the salesperson in these activities. Among these information systems are the following:

1. *PROSPECT INFORMATION SYSTEMS*

Locating potential customers is often a time-consuming and frustrating part of the salesperson's work. The sources of information used to obtain leads about prospective customers are frequently diverse and may include other customers, other vendors who sell supporting or ancillary products, newspapers notices, telephone directories, and direct customer inquiries. The search of directories and other lists of customers may be very time consuming and yield few customers.

Files of sales leads are often called prospect files. When these files are stored on magnetic media, they are easier for the salesperson to search or summarize. Outputs of prospect information systems may include lists of prospects by location, by product category, by gross revenue, or by other classifications important to the sales force.

2. *CONTACT INFORMATION SYSTEMS*

Customer contact information systems provide information to the sales force pertaining to customers, their product or service preferences, sales history data, and a historical record of sales calls and/or visits. One output of these systems may be a call report showing the number of sales calls made by a salesperson categorized by size of organization, previous sales, or some other characteristic, and the number of sales made per customer, per visit, and or per category.

3. *INQUIRY INFORMATION SYSTMES*

When customers make inquiries about the products and services the organization offers, the inquiries need to be processed, recorded, and stored for analysis or for sales contact. It is important that inquiries be associated with the actual or potential customer who made the inquiry, what products or services the query pertained to, when the inquiry was made, and where the potential customer was located. It is also very important to record these data on a medium that will allow analysis easily at some future time.

4. *DOCUMENT INFORMATION SYSTEMS*

- Sales form letters for salespeople are used so that they can mail well-written, clear and effective letters,
- Quotation documents are frequently produced. A document information system provides marketing personnel with *ready-to-adapt documents* for their operations. The system also improves the quality of the documents developed by marketing personnel, and is likely to increase sales revenue.

5. ORDER ENTRY SYSTEMS

A great deal of marketing data is created through the financial accounting system of the organization. For example, the order entry system provides the marketing manager with the raw data from which to obtain gross sales by time period, salesperson, product, and territory. This information may be used for a variety of marketing decisions at several marketing decision levels. Analysis of product sales through analysis of the sales orders provides the marketing managers with some of the information on which sales forecasts can be based, for instance.

6. TELEMARKETING SYSTEMS

Using the telephone for selling is referred to as telemarketing. Using telemarketing has become a very important means by which companies have improved the productivity of their sales force. Using the telephone to initiate contacts, offer products and services, follow up on sales eliminates travel costs and travel time and lets salespeople reach many more customers in a given time period than they could have through conventional means.

Some telemarketing systems include computer support for the automatic calling of parties and/or the automatic delivering of a voice message to the answering party under the control of computer system.

MDSS is A system used to manipulate a collection of data to interpret and explore potential business scenarios in order to make management decisions. Marketing decision support systems (MDSS) are considered by some businesses a key tool in gaining the edge over competitors. MDSS can be used to assist, rather than supersede, employee decision makers in the complicated scenarios which are common in marketing.

4.2.2 Tactical Marketing Information Systems

Tactical information systems differ from operational marketing information systems in that they may provide information not only on a regular basis but also generate ad hoc reports, create unexpected as well as expected output, produce comparative as well as descriptive information, provide summary information as opposed to detailed data, include both internal and external data sources, and processes subjective as well as objective data.

Examples of tactical marketing information systems that will be discussed in this part of the paper include those that support the deployment and management of the sales force, the management of advertising and promotion campaigns, the distribution and delivery of products sold, and product pricing.

- Sales Management Information Systems

A major objective of sales managers is to reach the sales goals set by top management. To accomplish this objective, sales managers must make many tactical decisions, such as how sales territories should be shaped, how the sales force should be allocated within those territories, and what emphasis should be placed on each type of product offered and customers served.

To make these decisions effectively, sales managers should have at their disposal a great deal of data about the sales histories of each salesperson, territory, product and market segment. These data -- *provided by sales management information systems* -- can be used to develop reports analyzing sales activities in ways that help managers make decisions about the salespeople, territories, products and customers. Analysis of past sales effort might reveal, for instance, that the greatest volume of sales is obtained with certain market segments. This information may be obtained from a report that correlates product or service categories with customer categories.

- Advertising And Promotion Information Systems

Advertising and promotional tactics also need to be developed by marketing managers to implement strategic sales goals set by top management. Decisions have to be made pertaining to which advertising media to use

to reach the selected market segments, which promotional devices to use, when these media and devices should be used, and what overall mix of promotional activities should be deployed to achieve sales goals. *Advertising and promotion information systems* assist managers in these tasks.

To make decisions regarding the advertising and promotional tactics to use, marketing managers will need such information as market segment history, the effectiveness of previous advertising and promotional efforts on each market segment, and the sales history of product by market segment.

4.2.3 Strategic Marketing Information Systems

To develop an overall marketing plan, an organization may engage in a variety of tactical and strategic planning activities. The strategic activities include segmenting the market into target groups of potential customers based on common characteristics or needs or wants, selecting those market segments the organization wishes to reach, planning products and services to meet those customers' needs, and forecasting sales for the market segments and products.

- Sales Forecasting Information Systems

Strategic sales forecasting usually includes several varieties of forecasts: forecasts of sales for the entire organization, forecasts of sales for each product or service, and forecasts of sales for a new product or service. The results of these sales forecasts will often be further categorized by sales territory and sales division. Regardless of the type of forecasts, sales forecasts are usually based on more than historical data; they are not merely projections of past trends. Sales forecasts are also based on assumptions about the activities of the competition, government action, shifting customer demand, demographic changes and movements, and a variety of other pertinent factors, including even the weather. Errors in sales forecasting will have many implications in the other aspects of the organization.

- Product Planning And Development Information Systems

The major objective of *product planning and development information systems* is to make information about consumer preferences obtained from the marketing research system available for the development of new products. The primary output of planning and development activities is a set of product specification. The specifications will serve as inputs for other decisions such as product design.

4.2.4 Tactical and Strategic Marketing Information Systems

Two important information-gathering systems provide support for both tactical and strategic marketing decisions. These two information systems are marketing research systems and information systems that collect data about the organization's competitors.

- Marketing Research Information Systems

In large organizations, research departments conduct and manage marketing research. In small companies, marketing research may be completed by outside consultants or by personnel who must wear several hats. Regardless of how the function is completed, the results of marketing research provide important inputs to tactical and strategic decision making.

Inputs to marketing research are heavily derived from sources external to the organization. These inputs include such widely diverse sources of customers as customers, potential customers, census and demographic data, industry or trade data, economic data, social trend data, environmental data, and scientific and technological data. These data may be obtained through such means as direct mail surveys of customers, personal and telephone interviews of consumers, library searches of governmental and industry reports, searches of the databases of information utilities, and reports filed by sales personnel.

Marketing research personnel make heavy use of statistical methodology in analyzing the data collected and in reporting the information to the organization. Obtaining totals, counts, and averages in terms of consumer responses to questions, correlating social and economic characteristics of customers with their buying

practices, completing times series analyses of past industry-wide sales to determine the projected sales of a product, and testing hypotheses about consumer response to differing product packaging represent only some of the statistical procedures that are used to analyze information for marketing managers.

Typical of the activities of a marketing research department are

1. Conducting trend analyses of the sales of products and services identical or similar to those offered by the organization to identify products or services that are on the ascent or descent,
2. Analyzing population and target group characteristics, especially for trends or changes in data that could affect the organization.
3. Analyzing and identifying consumer preferences, including the testing of products and services, ...

The results of marketing research are often presented graphically, in the form of tables, charts, and graphs.

- Competitive Tracking Information Systems

To ensure that the marketing mix offered by your organization will continue to be effective in satisfying customers, you must keep abreast of major competitors and their marketing activities. Market share is likely, in the end, to be the greatest for the organization that provides the marketing mix most closely matching a given market segment's needs and wants. Thus, knowledge of competitor prices, products, sales, advertising, and promotions must be gathered if the organization is to avoid falling behind the competition in the eyes of the customers. This task is carried out through *competitive tracking information systems*.

Information about competitor activities is also obtained from informal sources, through such activities as reading trade journals and newspapers, visiting competitor distribution outlets, and talking to competitor officers and employees at conventions. Salespeople in most organizations are encouraged to provide feedback about competitor activities by filing field reports. The information they obtain may be gathered through observation of competing salespeople or by seemingly casual questions that addressed to customers. Information about the competition may also be gathered more systematically by conducting keyword searches in external databases or information utilities.

4.3 MANUFACTURING AND PRODUCTION INFORMATION SYSTEMS

PURPOSE: Manufacturing systems encompasses all the activities necessary to ensure production. These activities may include the evaluation of sites for production; the planning, development, and maintenance of production facilities; and the setting of production goals to meet the requirements of the sales forecast generated by the marketing system. On the other hand, production systems typically focus on these aspects of the business:

1. Acquisition, storage, and availability of raw materials and production supplies.
2. Scheduling the necessary equipment, facilities and workforce to process these raw materials into finished goods ready fro the marketing system to sell.
3. Designing and testing the products and services.
4. Producing the correct quantity at the require level of quality within the projected cost parameters of the budget at the times required by the production goals.

Manufacturing and production information systems provide the data necessary to plan, organize, operate, monitor, control and otherwise manage production systems.

4.3.1 Operational Production Information Systems

There are numerous operational production information systems. Many are part of the financial accounting system of organization. For example, purchasing, accounts payable, inventory, order entry, accounts receivable, and payroll subsystems of the accounting system provide information to support manufacturing

and production activities. The next section briefly describes some major operational production information systems.

- Purchasing Information Systems

To produce goods and services, you must have the right quantity of raw materials and production supplies on hand. Furthermore, you will want to procure these materials and supplies at the lowest cost and have them delivered at the right time. To assist in this function, the purchasing information system has to maintain data on all phases of the acquisition of raw materials and purchased parts used in production.

- Quality Control Information Systems

Quality control information systems provide information about the status or production of goods as they move from the raw material state, through goods in process, to the finished goods inventory.

- Cost Accounting Information Systems

A variety of operational information subsystems of the financial accounting system collect and report information about the resources that are used in the production processes so that accurate costs of production can be obtained on products and services. Cost accounting systems monitor the three major resources used in production: *personnel, materials, and equipment and facilities*. Payroll information systems and materials information systems provide information about the cost s of these resources.

4.3.2 Tactical manufacturing and production information systems

Tactical information systems include inventory management and control systems, capacity planning, production scheduling, and product design and development.

- Inventory Management and Control Information Systems

The management and control of raw materials, goods-in-process, and finished goods inventories is an important part of production system. Careful management and control of these inventories will usually provide considerable savings to the organization. Inventory management and control systems use information from operational information systems, such as the shipping and receiving systems, purchasing systems, and order entry systems.

Maintaining inventories at their proper levels eliminates production shutdowns from lack of materials and lost sales from lack of finished goods. Ordering too much and ordering too little are costly in terms of inventory carrying costs and ordering costs respectively. Thus, the best or economical order quantity (EOQ) strikes a balance between carrying costs and procurement costs.

The computation of EOQ for each item in inventory would be a very large and tedious task if done manually. Also, for many inventory items, the manager may wish to play "What If?" games with the values in the EOQ formula. Without computers, these tasks would be laborious and may prove too time consuming to keep the order process fine-tuned to current data.

- Capacity Planning Information Systems

In addition to ensuring that there will be enough raw materials on hand for forecasted production, the production manager must also see to it that there will be enough production capacity available to meet production goals. The purpose of capacity planning is to make certain that there is sufficient personnel, space, machines, and other production facilities available at the right time to meet the organization's planned production. Managers also utilize capacity to minimize capacity in excess of planned production needs.

- Production Scheduling Information Systems

The purpose of the production schedule is to allocate the use of specific production facilities for the production of finished goods to meet current or forecasted orders. To manage the scheduling process, a number of

scheduling tools have been developed. Two of these are Gantt and PERT charts and there are project software packages at this time.

4.3.3 Strategic planning manufacturing information systems

As we just discussed, production information systems are primarily operational and tactical in nature. They are concerned with providing information to monitor and control the production of goods and services and to allocate resources to complete production processes. Manufacturing information systems are typically strategic in nature.

For example, the decision to construct a plant addition or a totally new plant, the selection of the plant site, and the creation of general plans for the design and layout of the facility are top-management decisions. Decisions of this magnitude will require the commitment of a large amount of capital and other resources over a long period of time and thus are strategic planning decisions. Such decisions are not made lightly.

The decision to locate a plant site requires a great deal of information that is external to the organization. Facilities planning information systems support top-management decisions in this area. Some of the information needed is relatively quantitative -- for example, the availability and cost of trained or experienced labor and the degree to which it is unionized, the availability and cost of transportation for raw materials and finished goods, the availability of suitable sites and the cost of land, the proximity of raw materials suppliers and/or finished goods customers, the availability and costs of power, and the rate of property and incoming taxation.

Other information used in locating a plant may be qualitative in nature -- for example, community attitudes toward an organization of the type of wishing to locate there and the quality of community services, such as education and training opportunities.

The final decision concerning plant location may be made using some form of weighted-average technique, in which factors such as those listed above are ranked and the total scored for several potential sites computed. It may also be made on largely emotional factors by top management.

4.4 HUMAN RESOURCE INFROAMTION SYSTEMS

The human resource management function is concerned with the individuals who constitute the organization. From the standpoint of the organization, the function is responsible for the acquisition and effective use of the individual, the function is concerned with the well-being, growth, and development of each worker. To achieve these ends, human resource management departments perform a variety of activities. The major activities of the personnel/human resources function in an organization include

1. Recruiting employees,
2. Evaluating applicants and employees,
3. Selecting, placing, promoting, terminating, and transferring employees,
4. Analyzing and designing jobs,
5. Training and development reports,
6. Producing required governmental reports,
7. Managing employee wage and benefit plans,
8. Planning short-and long-term staffing needs,

To perform these activities, managers rely on a number of operational, tactical, and strategic information systems

4.4.1 Operational Information Systems

Operational human resource information systems provide the manager with data to support the routine, repetitive personnel decisions that occur regularly. There are several operational-level information systems that collect and report personnel data. These include information systems pertaining to the organization's positions and employees, and about governmental regulations.

- Payroll Information Systems

The financial information system, through its payroll subsystems, collects and reports data pertaining to human resources that is largely operational in nature. Payroll files often contain a great deal of information about employees -- including information about employees' pay rates, wage classifications, and seniority -- that can be useful to managers making human resource decisions.

- Position Information Systems

A job is usually defined as a group of like or similar positions. A position, on the other hand, consists of tasks performed by one worker. The purpose of a position information system is to identify each position in the organization, the job category in which the position is classified, and the employee currently assigned to the position. Reference to the position information system allows a personnel manager to identify the details about unfilled positions. Position information systems also allow the personnel manager to identify human resource problems.

- Employee Information Systems

The personnel department must maintain information on each of the organization's employees for a variety of reporting purposes. One part of this information system is a personnel file, which usually contains personal and organization-related information such as name, address, sex, marital status, citizenship, years of service or seniority data, education and training, previous experience, employment history within the organization, salary rate, salary or wage grade, and retirement plans.

Another part of an *employee information system* is an employee skills inventory. The skills inventory contains information about every employee's work experience, work preferences, test scores, interests, and special skills or proficiencies. The skills inventory system provides information for many personnel decisions.

- Employee Evaluation Information Systems

Many organizations review the work of employees on a regular basis to make decisions regarding merit pay, pay increases, transfer, or promotion. Typically, a new employee is evaluated at the end of the first four months and other employees are evaluated semiannually. These reviews provided by the *employee evaluation information systems* are often called *performance appraisals.* The data for performance appraisals are frequently collected by administering employee appraisals forms to each employee's immediate superior. The forms may also be given to peers, the employees themselves, and even customers or clients.

4.4.2 Tactical human resource information systems

Tactical information systems provide managers with support for decisions that emphasize the allocation of resources. Within the human resource management area, these decisions include recruiting decisions, job analysis and design decisions, training and development decisions, employee compensation plan decision, and labor negotiation decisions.

- Job Analysis And Design Information Systems

The information inputs to the job analysis and design information system include data obtained from interviews of supervisors and workers and affirmative action guidelines. Inputs also include information from sources external to the firm, such as labor unions, competitors, and governmental agencies. The outputs of the job analysis information system are job descriptions and job specifications.

- Recruiting Information Systems

To develop recruitment plan and monitor its success, a *recruiting information system* is necessary to collect and process the many different types of information needed to construct the plan. These include a list of unfilled positions; the duties and requirements of these positions; lists of planned employee retirements, transfers or terminations; information about the skills and preferences of current employees; and summaries of employee appraisals. The sources of recruitment, affirmative action plans, information about the success of recent recruitment activities must also be included in the information systems.

- Compensation And Benefits Information Systems

Fringe benefit is anything in addition to the basic salary and over-time pay to an employee. Information on the benefits and compensation packages will help managers to make informed decisions.

4.4.3 Strategic Human Resource Information Systems

Human resource planning is conducted to ensure that the organization has the right kinds and the right numbers of people at the right places at the right time to achieve its objectives. There are two types of human resource planning that are strategic in nature. These are manpower planning, or staffing planning, and program planning.

- Manpower Planning

Organizations that are involved in long-term strategic planning, such as those planning to expand into new market areas, or to construct new factories or offices in new locations, or to add new products, will need information about the quantity and quality of the work force that is available to achieve their goal. Manpower planning serves this purpose. This type of planning involves identifying the human resources needed to meet the organizational objectives specified in the strategic plan. This means forecasting the supply and demand of the required work force. These forecasts are estimates of the characteristics, quantity, and pricing of the labor force needed to achieve the long-term plants of the organization.

Identifying the types and quantities of workers needed for the strategic plan is forecasting the demand for human resources. Identifying the human resources available internally and externally is forecasting the supply of those human resources. Forecasting demand and supply can be done on a macroeconomic level or a microeconomic (more specific to the organization) level.

- Program Planning

A second strategic planning function is to develop the policies, procedures, and activities that will achieve the human resource needs spelled out in the manpower plan. Two key activities in program planning are job analysis and design and recruiting. Job analysis and design is essential to describe the work force required by the organization. Recruiting plans must be developed to acquire the right kinds of workers in the right amounts to fill the jobs described. Where there are insufficient workers with the right skills, training programs may have to be developed, or the jobs may have to be redefined to fit the skills of the available work force.

4.5 MANAGERIAL DECISION SUPPORT SYSTEMS

There are three kinds of management support systems each distinguished by the type of decision and management level it supports.

(a) Executive Support Systems (ESS) support the senior management of a firm and the strategic planning function. Senior executives need information on changing government policies, demographics, the actions of competitors, and changing market conditions now and in the future. Executive information systems deliver news, reports prepared by external services, and broad overviews of the performance of the company, and in some cases permit senior executives to "drill down" into the company to discover how the numbers were produced, who was responsible for certain actions, and who might have an answer for a problem.

(b) Management Information systems (MIS) support middle managers whose job is to control the operations of the company on a daily, monthly, and quarterly basis. An MIS can produce scheduled summary reports, exception reports, and in some cases on-line ad hoc reports.

(c) Decision support systems (DSS) support middle management and information workers who need assistance with semi-structured problems. Decision support systems usually contain analytic models that permit the users to stimulate the business and to understand how to react to a change in business conditions. The focus of this part of the discussion is on the DSS.

4.5.1 Characteristics of the Decision Making Process

Before learning about the purpose and features of decision support systems, you should become acquainted with the decision making process, the types of problems addressed in decision making, the attributes of decision makers, and the strategies for decision making. All of these concepts have implications for the design of decision support systems.

4.5.2 Attributes of the Decision Maker

The attributes of decision makers also affect the types of decision strategies used. These attributes include perceptual ability, information capacity, risk-taking propensity, and aspiration level (MacGrimmon and Taylor, 1976).

Perceptual ability refers to the ways a decision maker perceives a decision problem. If a decision maker has experience dealing with a similar problem, the problem-solving situation will not seem as complex and as uncertain as in a case where his or her background with a similar situation is limited.

Information capacity is important, because all decision making requires an information base. In complex decision-making situations, decision makers who are receptive to new information are better prepared to handle the cognitive demands of information search when they are faced with difficult or uncertain tasks. In contrast, dogmatic decision makers tend to make rapid decisions based on little information. In either case, decision makers resist changing a decision once it has been made.

The other two attributes that account for differences in decision-making behavior are risk-taking propensity and aspiration level. In risky situations, decision makers are more uncertain about outcomes and possible loss of resources. The aspiration level of decision makers also influences their effectiveness in identifying problems, evaluating alternatives, and making choices. In general, decision makers attempt to achieve an optimal standard, and prior experiences of success or failure and knowledge of results both influence this standard.

4.5.3 Strategies for decision making

The types of decision problem and the attributes of the decision-maker influence whether the decision-maker will use a maximizing, "satisficing", or incrementalizing strategy (MacGrimmon and Taylor, 1976).

Maximizing when the outcome of a decision is clear, and the alternatives are well established, the decision maker will make the decision that maximizes the desired outcome. The maximizing approach assumes that the decision maker is rational and is aware of the probabilities of each alternative.

Satisficing Since many decisions are made in situations of uncertainty, decision makers are willing to settle for less than maximum utility. According to Simon (1960), decision makers display rationality only within limits imposed by their experience, background, and awareness of alternatives in a given decision situation. A decision maker will set up a reasonable aspiration level and will reach for possible alternatives until she or he finds one that achieves this level. Simon calls this satisficing because the decision maker will terminate his or her search as soon as a satisfactory alternative is found.

Incrementalizing In the third decision-making strategy, the decision maker attempts to take small steps away from the existing state toward a desired state. This approach may neglect important outcomes because the alternatives considered are generally familiar to the decision maker.

4.5.4 Implications of decision making for decision support systems

Decision support systems are designed to support semi-structured and unstructured decisions in situations in which information is incomplete and where "satisficing" is a goal. They are developed to support decisions that are so different each time that it would be hard to develop a standard set of procedures for programming them. Such decisions may be specific and may related to a one-time-only situation.

A decision support system should enable the decision maker to apply the right decision rules to a problem, rather than using standard rules that may not apply because of changing conditions. For example, it would be ineffective to apply an inventory reorder model assigned for slow-moving items to a problem situation involving fast-moving items. As you will see in the next section, a decision support system provides the decision maker with the flexibility to explore alternatives by using appropriate data and models.

4.5.5 Important Features of Decision Support Systems

Decision support systems are designed to support semi-structured and unstructured decisions in situations in which information is incomplete and where "satisficing" is a goal. They are developed to support decisions that are so different each time that it would be hard to develop a standard set of procedures for programming them. Such decisions may be specific and may relate to a one-to-only situation. An effective decision support system needs to incorporate the following features.

- **Support Of Unstructured Decisions**

To begin with, a decision support system must support semi structured and unstructured decisions. Semi structured and unstructured problems involve a decision-making process that can't be defined before actually going through the process of making the decision. For example, budget analysis is a structured problem but budget preparation is unstructured problem.

- **Support For All Phases Of The Decision-Support Process**

An effective decision support system should support the three phases of the decision making process: intelligence, design and choice. At each phase of the decision-making process, different operations occur. During the intelligence phase, data are collected as a basis for diagnosing a problem or a situation requiring a decision. When alternatives are weighted during the design phase, data may be manipulated or values may be assigned to each alternative. A simulation of the results of the alternatives or statistics describing them may be useful operations for choosing the best option.

- **Support For Communications Among Decision Makers**

Decision support systems must support decision making at all levels of the organization. Since some decisions require communications among decision makers at all levels, decision support systems need to support group decision making. In some cases, decisions are made sequentially, with each decision maker responsible for part of the decision before passing it to on to the next decision maker. Other decisions require a pooling of knowledge and result from negotiation and interaction among decision makers. A decision support system should support interaction among decision makers.

- *Availability of Memory Aids*

In making decisions, managers constantly have to recall information or the results of operations conducted at previous times. Decision makers need memory aids, and so a decision support system should provide them.

Workspaces for displaying data representations or for preserving intermediate results from operations are useful.

4.5.6 Capabilities of DSS

Because there is no exact definition of DSS, there is obviously no agreement on the standard characteristics and capabilities of DSS. Turban, E.,Aronson, J.E., and Liang, T.P. constitute an ideal set of characteristics and capabilities of DSS. The key DSS characteristics and capabilities are as follows:

1. Support for decision makers in semi-structured and unstructured problems.
2. Support managers at all levels.
3. Support individuals and groups.
4. Support for interdependent or sequential decisions.
5. Support intelligence, design, choice, and implementation phases.
6. Support variety of decision processes and styles.
7. DSS should be adaptable and flexible.
8. DSS should be interactive and provide ease of use.
9. Effectiveness balanced with efficiency (benefit must exceed cost).
10. Complete control by decision-makers.
11. Ease of development by (modification to suit needs and changing environment) end users.
12. Support modeling and analysis.
13. Data access.
14. Standalone, integration and Web-based

Chapter 5

5. Knowledge Management

5.1 Introduction

In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge. When markets shift, technologies proliferate, competitors multiply, and products become obsolete almost overnight, successful companies are those that consistently create new knowledge, disseminate it widely throughout the organization, and quickly embody it in new technologies and products. These activities define the "knowledge-creating" company, whose sole business is continuous innovation.

The recent interest in organizational knowledge has prompted the issue of managing the knowledge to the organizations benefit. Knowledge management refers to identifying and leveraging the collective knowledge in an organization to help the organization compete. Knowledge management is purported to increase innovativeness and responsiveness. Such problem of maintaining, locating, and applying knowledge has led to systematic attempts to manage knowledge.

Knowledge Management

As the amount of data and information increases within an organization, there needs to be some formal policy to actively manage the resource so it can be accessed and used by managers. This process of managing and providing access to data is commonly called knowledge management. Effective knowledge management is a critical success factor in many organizations; it is something that must be done correctly in order for that organization to survive, perhaps by designing new products and providing good customer service.

Implementing and maintaining a knowledge management policy implies that the organization will be actively involved in the following.

- Providing an appropriate IT infrastructure to store and distribute knowledge around the organization.
- Employing staff to manage knowledge maintained in the organization's database, and
- Ensuring that knowledge workers are trained and have appropriate access to the organization's knowledge base.

Many organizations are now employing chief knowledge officer (CKO) to be responsible for the organization's knowledge management. The CKO will help design new systems, find new sources of knowledge and generally ensure that effective use is being made of the knowledge within an organization.

Most knowledge management projects have one of three aims:

- To make knowledge visible and show the role of knowledge in an organization, mainly through maps, yellow pages, and hypertext tools;
- To develop a knowledge-intensive culture by encouraging and aggregating behaviors such as knowledge sharing and proactively seeking and offering knowledge;
- To build a knowledge infrastructure-not only a technical system, but a web of connections among people given space, time, tools, and encouragement to interact and collaborate. Knowledge management is largely regarded as a process involving various activities. Like the creating of

knowledge storing and retrieving of knowledge, transforming of knowledge, and applying knowledge.

5.2 Type of knowledge

There are three types of knowledge that will be captured by knowledge management systems within an organization.

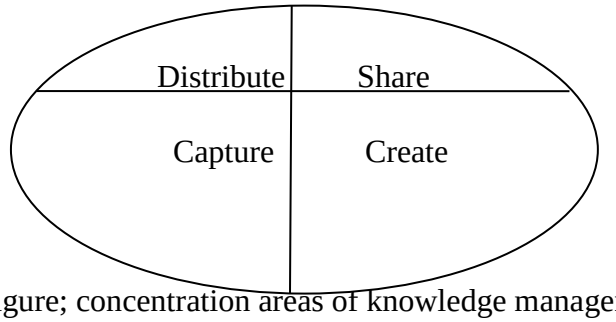
- Structured internal knowledge, relating to products being produced and manuals on how to use those products, as well as research and development reports on amendments to existing products or the design of completely new product.
- External knowledge relating to the products being providing by competitors and any intelligence or further information concerning research projects being undertaken.
- Informal internal knowledge (also called tact knowledge), which is located within the minds of the knowledge workers in the organization.

5.3 Knowledge management systems

Knowledge management systems (KMS) refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational process of knowledge creation, storage and retrieval, transfer, and application. While not all knowledge management (KM) initiatives involve an implementation of IT, many KM initiatives rely on IT as an important enabler. While IT does not apply to all of the issues of knowledge management, it can support KM in different ways. Examples include finding an expert or a recorded source of knowledge using online directories and searching database; sharing knowledge and working together in virtual team; access to information on past projects; and learning about customer needs and behavior by analyzing transaction data.

There are four different types of knowledge support systems that will be discussed in this section. these are related to:

- The distribution of knowledge
- The sharing of knowledge,
- The creation of knowledge, and
- The capture and codification of knowledge



Figure; concentration areas of knowledge management systems

One of the most common applications is internal benchmarking with the aim of transferring internal best practices. For example, an insurance company was faced with the commercialization of its market and declining profits. The company found that applying the best decision making expertise via a new underwriting process supported by a knowledge management system enabled it to move into profitable niche markets and hence, to increase income.

Another common application of knowledge management is the creation of corporate directories, also referred to as the mapping of internal expertise. Because much knowledge in an organization remains un-codified, mapping the internal expertise is a potentially useful application of knowledge management.

A third common application of knowledge management systems is the creation of knowledge networks. In such a case the key expertise (Knowledge) of an individual will not be locked in his mind for ever. Knowledge management systems can facilitate the sharing of knowledge by forming a network. Knowledge management has thus become one of the major strategic uses of IT. Many companies are building knowledge management systems (KMS) to manage organizational learning and discuss know-how. The goal of KMS is to help knowledge workers create, organize, and make available important business knowledge, wherever and whenever it is needed in an organization. This includes processes, procedures, patents, reference works, formulas, "best practices", forecasts, and fixes.

Internet and intranets web sites, groupware, data mining, knowledge bases, discussion forums, and video conferencing are some of the key IT infrastructures for gathering, storing, and distributing this knowledge.

Therefore, KMS are information systems that facilitate organizational learning and knowledge creation. They use a variety of ITs to collect and edit information, assess its value, disseminate it within the organization, and apply it as knowledge to the process of a business. KMS are sometimes called adaptive learning systems. That's because they create cycles of organizational learning called learning loops, where the creation, dissemination, and application of knowledge produces an adaptive learning process within a company.

Knowledge management systems can thus provide rapid feedback to knowledge workers, encourage behavior changes by employee, and significantly improve business performance. As the organizational learning process continues and their knowledge bases expand, the knowledge-creating company integrates its knowledge into its business process, products and services. This makes it a highly innovative and agile provider of high-quality products and customer services, and a formidable competitor in the marketplace. Knowledge management requires information technology infrastructures that facilitate knowledge creation, knowledge discovering and codifying, knowledge sharing, and knowledge distribution. See below the different systems we can use for the above organizational processes.

5.3.1 Distribution of knowledge

Within an organization, knowledge is distributed using some form of Office Automation System (OAS). The basis of these systems has been discussed in the past chapter. The main function of OAS is to distribute knowledge with in a specific organization. However, this distribution normally takes place on different levels:

- Firstly, co-coordinating work within one department or work group in the organization. Both data and knowledge workers will need to share information on a regular basis with their peers and the OAS will provide this basic communication medium.
- Secondly, distributing knowledge between the different departments of an organization. These departments may be located within different buildings, cities or even countries, but again the OAS provides the basic communication system to allow knowledge to be shared.

- Finally, providing connections to the external environment such as customers, suppliers, contract staff, bankers, etc. almost all external links from an organization are electronic or computerized in nature, meaning that the OAS is an ideal system to manage the sharing of knowledge with third parties, as a lot of the data to be shared is already captured in the OAS.

Office automation systems are generally established and maintained by data workers. However, one aim of the OAS is to increase the productivity of information workers.

The main activities carried out within the OAS will include:

- Documents management including creating appropriate documents, storing them within the OAS, retrieving the documents, when required and sending those documents to the appropriate workers.
- Scheduling the work of data and knowledge workers.
- Managing the different types of communication, such as digital, document and voice messages, between workers.
- Obtaining and managing data on the different groups such as employees, customers and suppliers.

5.3.2 Sharing of knowledge

Sharing knowledge within organization involves using the existing network systems to provide access to database and a communication system to send knowledge to other workers within the organization. Two specific software systems normally allow for the sharing of knowledge, namely groupware and intranets. These systems are explained in this section.

- ***Groupware fundamentals***

Groupware products allow for the sharing of information between different workers within an organization. Groupware systems will provide a variety of services to workers, as explained below.

Group writing and commenting

Individuals documents authored on a word-processor can be shared by placing the document on a central file server, so that more than one author can look at and amend a document. However, within this configuration, only one person is allowed access to that document at once, depending on the groupware products being used. Also, the document will be shareable across an entire WAN, rather than being limited to a LAN. These features enable more workers to access documents and make comments and amendments, by placing makers on each amendment showing who made that change. The author of an amendment can be easily identified, when required.

Electronic mail distribution

Part of groupware involves fast and efficient communication systems between workers in many diverse locations. Groupware provides an email system across the whole WAN in the organization. However, email is not simply sending message, the software will also maintain a track, or 'thread' of comments and responses to a message. Similarly, messages can be posted on to "bulletin boards" so all members on the board. Again, the thread principle means that all workers back to that message in the board. Again, the thread principle means that all workers can easily see who posted the initial message, and who has responded to that message.

Scheduling meetings

Many workers maintain electronic diaries. Within groupware, these diaries will still be available, but they will also be viewable via the network by all other workers, it dose enable group meetings to be booked without having to contact all members individually.

Meetings and conferences

Wide geographical distribution of workers has other problems such as actually attending meetings. Groupware will allow the use of video conferencing so that meetings can take place over the WAN. Each workstation is equipped with a small TV camera, and the software combines each image on the computer screen to provide the impression of a real-time meeting.

- ***Intranets*** - use by data and knowledge workers

An internet is essentially a private internet. The internet uses the same technology as the internet, including a web browsers and pages written in HTML (Hyper-text Markup language) but is kept secure by a firewall, which prevents members of the public viewing the intranet pages. The firewalls consist of hardware and software packages. It intercepts all managers between the intranet and the external internet and only allows authorized communication to pass between the two systems.

Intranets do not require any special hardware to run, and so can be established over an existing network relatively quick. The only software required is a web browser, such as Internet explorer or Netscape navigator, and a computer to act as a wave server. Where some form of group support is required in a hurry, an internet may provide a temporary, and in some cases a lasting, solution.

An extension of the intranet idea is an extranet. In this system, some third party access is allowed to the internal web sites. As mentioned above, intranets provide a relatively quick and easy method of providing an information sharing system within organization where a network has placing information that requires multiple accesses into some form of web-based documentation. However, when this has been done the documents can be accessed from any computer with browser software anywhere on the organization's network. Any information that needs to be shared can be placed onto the intranet-this information can range from basic reports through to technical documentation and procedures manuals. The intranet therefore supports the work of data and knowledge workers.

Some of the benefits of using an intranet include,

- Low start-up costs
- Reduced distribution costs for information
- Low training costs-most employees will have used a web browser
- Easily expandable, depending on the size of the organization
- Information provision can use all of the functionality available in HTML documents.

5.3.3 Creation of knowledge

Knowledge creation is one of the main activities of knowledge workers. The following are failities required to help knowledge workers actually create knowledge.

Helping knowledge workers create knowledge

To help knowledge workers create knowledge, the organization must provide the appropriate software as well as the correct working environment to support those workers.

Computer requirements include:

1. External knowledge base to provide appropriate input for the knowledge worker. Information concerning the activities of competitor, requirements of the market and deficiencies in existing products are all necessary items to help the worker improve existing products and create new knowledge.
2. A user-friendly interface allowing quick access to appropriate information as well as software applications such as MS projects and CAD tools to help design new products.
3. Appropriate computer hardware, with large memory and sufficient processing power to run the more advanced software applications.

Other requirements are:

Technical Support: Knowledge workers need to concentrate on the creation of knowledge, not on maintaining their computers. If the computer breaks down, then it needs to be fixed as quickly as possible. A broken computer means not only a frustrated worker but also lost income and missed deadlines.

Working environment: The environment may need to be quite with few interruptions-individual offices rather than shared 'open plan' desks may be appropriate. Alternatively, home working may be allowed, although this means ensuring that appropriate communication facilities are available at the home location.

Flexible working hours: Knowledge creation does not necessarily happen according to an office-based timetable. Workers may be allowed to work when they need, within reason: recognizing that working late one evening means no having to be in office at 9:00 am the next day.

5.3.4 Capture and codification of knowledge

Capturing knowledge involves entering knowledge into the computer systems. Codifying involves finding the rules that explain how that knowledge is used. Both data and knowledge workers can be involved in capturing and codifying knowledge, because either group of workers could start to provide the knowledge to be entered into the computer system. Similarly, both types of workers could use the output from a computer system that has specific knowledge entered into it. However, programming and establishing the computer system itself is likely to be a specialist task, and will therefore apply to knowledge workers only.

The idea of capturing and codifying knowledge in a computer system is to try and mimic human thought and decision-making processes. One of the objectives of computer research is to have a computer, or an artificial intelligence (AL), that can think like a human being. However, the range of possiblities shows that some form of computer system could replace both data and knowledge workers. See the following AI areas.

Expert systems

Knowledge to assist in these problems or other similar applications can be captured in an expert system. The expert system is a computer program that makes decisions based on the rules provided in the application itself. These rules are contained in a rule base, and are derived from human experts in a specific area of knowledge.

Rules take on the IF-THEN format found in many computer programs. So IF one condition is true, THEN a particular action takes place. However, if the condition is not true, a different action or no action at all may occur. For example, a human may look out of the widow before going a walk and

use the rule IF it is raining THEN takes an umbrella; however, if it is not raining, then no umbrella will be taken. This is called an inference engine.

Use of exert system

Expert systems are normally used in specific areas of knowledge. They are used by the human asking specific questions of the expert system, and the system using the rules determines the appropriate response to that question. The expert system may ask questions to clarify the situation before providing a response.

The system itself is built by a knowledge engineer who studies a human expert (or experts) at work, determines the rules in the area of knowledge and then programs this information into the expert system.

Expert systems tend to replace or supplement the work of experts or knowledge workers in a practical area of knowledge. For example, a medical expert system can help to provide a diagnosis of illness. By referring to its rule base, the expert system may be able to provide a diagnosis cannot be provided, or the diagnosis cannot be provided, or the diagnosis is uncertain, than a medical expert (a knowledge worker) can be called and a more detailed assessment made.

The expert system is effectively providing assistance to knowledge workers by eliminating routine tasks that knowledge worker has to undertake, allowing that worker to focus on the key uncertain areas where the worker's accumulated knowledge is actually required.

Many other expert systems are used to support the work of data workers, by providing checklists in areas such as banks, social services, selling of insurance, etc. it is relatively easy to determine the rules, for example, to decide whether or not to provide a bank loan to an individual. The expert system in effect assists the human operator talking to the loan applicant by providing the appropriate questions to ask and matching response against the rule base to see whether or not a loan should be given.

Intelligent agents

Intelligent agents are software programs that are given to undertake a specific task. The program is then left running while the human operator carries on with other tasks, the program reports back to the operator either when the task is complete or when future information is needed in order to complete the task. One of the main examples of intelligent agents currently in use is a search program for the internet. The agent is not necessarily a simple search carried out in a search engine such as Yahoo or Google, but a more detailed program that reviews web pages in detail and monitors new information being added to the Internet. When information is found matching the search criteria, than the agent then continues searching for more web pages that meet the search criteria.

Some web agents are available to help with task such as shopping. Some web sites such as Yahoo have agents to locate products you may be interested to purchase and provide comparative prices for those products. The internet bookstore, Amazon has a product called 'eyes' which monitors your book purchases and emails you with a review of similar new books in case you wish to purchase these as well.

From the point of view of business applications, intelligent agents will help to support the work of knowledge workers by performing searches for information that the worker requires. For example, a person researching car engines could program an agent to locate information on new types of

engine on the organization's own intranet or on the internet. The main benefit to the workers is saving time in carrying out the review themselves. Data workers may benefit from intelligent agents where basic accounting or other information is needed in response to a customer request. A search of the organization's databases may be possible using relatively limited intelligent agent.

5.4 Problems with knowledge management

Some of the problems with managing knowledge have been mentioned above. Now lets see a summary of those problems:

Inefficient process of capturing knowledge

Organizations tend to be quite good at capturing basic transaction data in the form of transaction processing systems, and summarizing this data for management use. However, data on knowledge can be more difficult to obtain and as data arises infrequently, there may be no formal system of capture. Knowledge data may therefore not be captured, or simply captured but adequately cross-referenced.

Failure to appreciate the knowledge that is already available

Some knowledge may available in organizations, but it can be hidden inside other systems such as EISs. If a knowledge worker is unaware of the existence of this data then it cannot be accessed or used! Some form of central knowledge registry may be required to keep track of all of the organization's knowledge.

Difficulty of measuring intangible benefits of information systems

Measuring the costs of implementing a new information system is relatively easy, as the cost tend to be tangible. However, many of the benefits especially in the area of increased product quality of better customer service tend to intangible. Attributing some values to those benefits may be guesswork and not show the true value of those benefits.

Information Overload

Information systems are generally very good at producing information. However, recipient of that information may be produced resulting in information overload for the recipient of that information. Care is needed in planning information systems to ensure that only the required quality output is produced, rather than producing reports simply because they are available.

Debre Markos University
College of Business and Economics
Department of Management

Management Information system assignment for management 2nd year students with a value of 20%

Instruction:-

Select one from those 6 given topics and prepare term paper

1. **Introduction to Information Systems Security**
   - History of computer security and Information Security
   - Definition of Information Systems Security
   - Critical concepts of Information Security
   - Security/Privacy Vulnerabilities
2. **Fundamentals of IS security**
   - ✓ IS Security Fundamentals
   - ✓ Components of Information Systems Security
   - ✓ Principles of Information Systems Security
   - ✓ Introduction to IS Security Policy
   - ✓ Plan, Design and Implement IS Security
3. **Attack types and protection schemes**
   - Categories of Attack Types and Security threats
   - Vulnerabilities of Information Systems
   - Malicious Security Threats
     - ✓ viruses,
     - ✓ worms,
     - ✓ Trojan horses
     - ✓ Spyware …etc.
   - Categories of Security controls
   - Social Engineering
4. **Security Techniques**
   - ✓ Cryptography
     - Introduction
     - Definitions and Terms
     - Private Key cryptosystems
     - Public key cryptosystems
     - Data Encryption Standards(DES) and Advanced Encryption Standards(AES)
     - Digital Signature
   - ✓ Access Control
   - ✓ Firewalls
   - ✓ Intrusion Detection Systems (IDS)
   - ✓ Authentication

5. Security at Different layers

- ✓ Physical Security
- ✓ Software Security
- ✓ Network Security
- ✓ Web security
- ✓ Advanced Security issues.

6. Ethical issues related to information security system

NB: -

- The term paper should be not more than 10 pages.