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BACHELOR OF BUSINESS ADMINISTRATION (B.B.A.)

THIRD YEAR

PAPER – X : MANAGEMENT INFORMATION SYSTEM

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BLOCK 1

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TEXT BOOK

C.S.V. MURTHY, Management Information System, HPH.

REFFERENCE BOOKS

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2. Lucas, The analysis, design and implementation of information system, MGH.
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UNIT – I

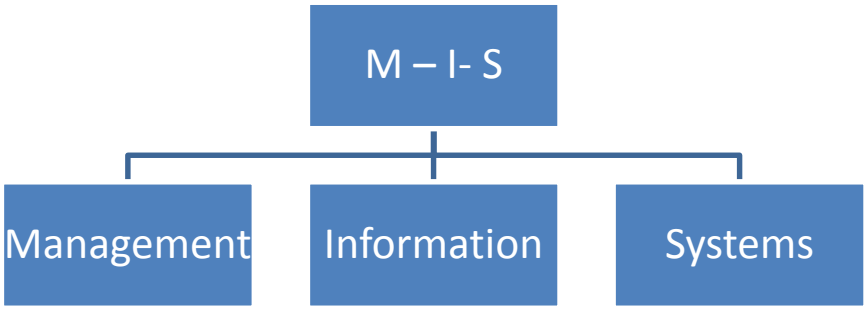
1.1 AN INTRODUCTION TO MANAGEMENT INFORMATION SYSTEM

The accelerating complexities of modern organization demands new dimensions in modern management. Perhaps the most profound and promising of these dimensions is the utilization of more advanced systems. These systems are changing the process of management in several ways.

MIS may be defined as the combination of men; machine and procedures for collecting pertinent information form the internal and external source of a firm, and processing this information for the purpose of facilitating the process of decision making.

MIS is not new; only its computerization is new. Before computers, MIS techniques exited to supply mangers with the information that would permit them to plan and control operations. The computer has added one or more dimensions such as speed, accuracy and increased volumes of data that permit the consideration of more alternatives in a decision.

The scope and purpose of MIS is better understood if each part of them is defined. Thus,



1.1.1 MANAGEMENT

Management has been defined in a variety of ways, but for our purpose 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 sitting 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. They control the performance of the work by sitting performance standards and avoiding deviations form standard.

Because decision making is such a fundamental prerequisite to each of the foregoing processes, the job of an MIS becomes that of facilitating decisions necessary for planning, organizing, and controlling the work and functions of the business.

1.1.2 INFORMATION

Data must be distinguished from information, and the 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 form the historical records that are recorded and filed without immediate intent to retrieve for decision making. An example would be any one of the supporting documents, ledgers, and so on that comprises the source material for profit and loss statements. Such material would only be of historical interest to an external auditor.

Information consists of data that have been retrieved, processed, or otherwise used for informative or inference purposes, argument, or as a basis forecasting or decision making.

1.1.3 SYSTEMS

A system can be described simply as a set of elements joined together for a common objective. A subsystem is part of larger systems with which we are concerned. All systems are parts of larger systems. For our purpose the organization is the system and the parts (divisions, departments. Functions, units etc) are the subsystems.

The system concept of MIS is therefore one of optimizing the output of the organization by connecting the operating subsystems through the medium of information exchange.

1.1.4. MEANING OF MANAGEMENT INFORMATION SYSTEM

Information is the lifeblood of an organization, particularly in the case of system approach management. The information can be defined as the knowledge communicated by others or obtained from investigation or study. It is a system of providing needed information to each manger at the right time, in right form and relevant one which aids his understanding and stimulates his. MIS and organized method of providing past present and projection information relating to internal operations and external intelligence. It supports the planning, control and operational functions of an organization by furnishing uniform information in proper time frame to assist the decision making process.

1.1.5. DEFINITION OF MIS

Management information system is generally defined as an integrated user machine system for providing information to support operations management and decision making function in an organization. The system utilizes computer hardware and software, manual procedure, models for analysis. Information is viewed as a resource much like land, labor and capital. It is not a free good. It must be obtained; processed, stored, received,

manipulated and analyzed, distributed etc. an organization with a well – defined information system will generally have a competitive advantage over organization with poor systems.

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

For an effective MIS design a proper framework is desired. A proper frame work would take into account the following key questions

1. What are the essential economic and technical characteristics of the industry in which the company participates?
2. What trends suggesting future changes in the economic and technical characteristics are apparent?
3. What is the nature of competition both within the industry and across the industry?
4. Given the technical, economic, social and political developments. What is the range of the strategies available to any company in the industry?

DEFINITIONS

The definition of the term 'Management Information System' varied from person to person. However, a few definitions are given here to make the concepts of MIS clear.

1. According to Schwartz, ' MIS is system of people, equipment, procedures, documents and communication that collects, validates, operates on transformers, stores, retrieves, and present data for use in planning, budgeting, accounting, controlling and other management process'.
2. Coleman and Riley state that 'an MIS (a) applies to all management levels; (b) is linked to an organizational sub system; (c) functions to measure performance, monitor progress, evaluate alternatives or provide knowledge for change or collective action, and (d) is flexible both internally and externally'.
3. Davis and Olson defined MIS as 'an integrated user – machine system designed for providing information to support operational control, management control and decision making functions in an organization. The information systems make use of resources such as hardware, software, men, procedures as well as supplies'.
4. Canith defined MIS as 'an approach that visualizes the business organization a single entity composed of various inter related and

inter dependent sub systems looking together to provide timely and accurate information for management decision making, which leads to the optimization of overall enterprise goals'.

1.2. ENVIRONMENT OF ORGANIZATION

1.2.1. ELEMENTS (OR COMPONENTS) OF A SYSTEM

Systems analysts generally operate in a dynamic environment where change is a way of life. The environment may be a business firm, a business application, or a computer system. To reconstruct a system, the following key elements must be considered:

1. Inputs 2. Processor(s) 3. Outputs

4. Control 5. Feedback 6. Environment

7. Boundaries and Interface.

1. Input. Input involves capturing and assembling elements that enter the system to be processed. A system feeds on input to produce output in much the same way that a business brings in human, financial, and material resources to produce goods and services.

2. Processor(s). The processor is the element of a system that involves the actual transformation of input into output. It is the operational component of a system Processors may modify the input partially or totally, depending on the specifications of the output. This means that as the output specifications change, so does the processing.

3. Output. A major objective of a system is to produce an output that has value to its user. Whatever the nature of the output (goods, services, or information), it must be in line with the expectations of the intended user. Determining the output is a first step in specifying the nature, amount, and regularity of the input needed to operate a system.

4. Control. The control element guides the system. It is the decision-making sub-system that controls the pattern of activities governing input, processing and output. In an organizational context, management as a decision-making body controls the inflow, handling, and outflow of activities that affect the welfare of the business.

5. Feedback. Control in a dynamic system is achieved by feedback. Feedback measures output against a standard in some form of cybernetic procedure that includes communication and control. In figure 1.1, output information is fed back to the input and/or to management for deliberation. After the output is compared against performance standards, changes can result in the input or processing and, consequently, the output.

Feedback may be positive or negative, routine or informational. Positive feedback reinforces the performance of the system. It is routine in nature. Negative feedback generally provides the controller with information for action.

5. **Environment.** The environment is the "super system" within which an organization operates. It is the source of external elements that impinge on the system. It is the environment that determines how a system must function. As shown in figure 1.1, the organization's environment, consisting of competitors, customers, the community and others, may provide constraints and, consequently, influence the actual performance of the business.

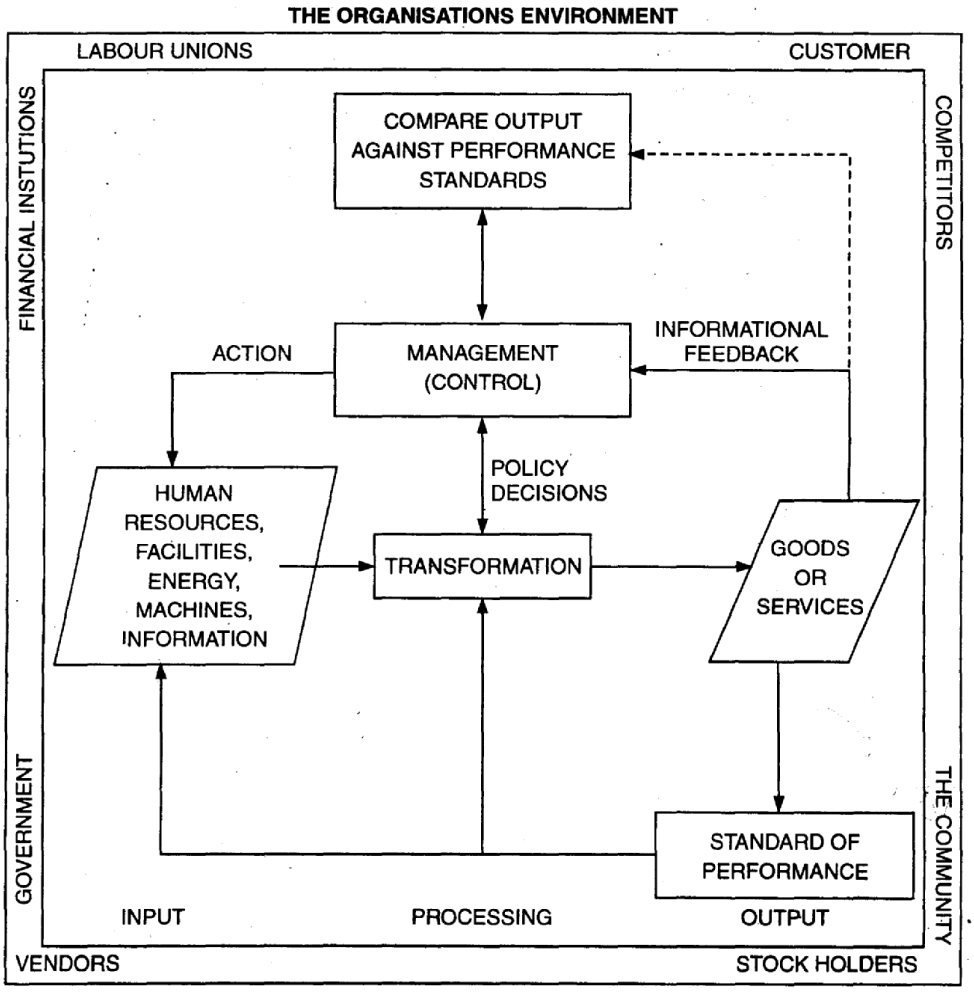


Fig. 1.1 Inputs and Output in business organization

7. Boundaries and Interface. A system should be defined by its boundaries - the limits that identify its components, processes, and interrelationships when it interfaces with another system.

1.3. ROLE OF THE MANAGEMENT INFORMATION SYSTEM

The role of the MIS in an organization can be compared to the role of heart in the body. The information is the blood and MIS is the heart. In the body the heart plays the role of supplying pure blood to all the elements of the body including the brain. The heart works faster and supplies more blood when needed. It regulates and controls the incoming impure blood, processes it and sends it to the destination in the quantity needed. It fulfills the needs of blood supply to human body in normal course and also in crisis.

The MIS plays exactly the same role in the organization. The system ensures that an appropriate data is collected from the various sources, processed, and sent further to all the needy destinations. The system is expected to fulfill the information needs of an individual, a group of individuals, the management functionaries: the managers and the top management.

The MIS satisfies the diverse needs through a variety of systems such as Query Systems, Analysis Systems, Modeling Systems and Decision Support Systems. The MIS helps in Strategic Planning, Management Control, Operational Control and Transaction Processing.

The MIS helps the clerical personnel in the transaction processing and answers their queries on the data pertaining to the transaction, the status of a particular record and references on a variety of documents. The MIS helps the junior management personnel by providing the operational data for planning, scheduling and control, and helps them further in decision making at the operations level to correct an out of control situation. The MIS helps the middle management in short term planning, target setting and controlling the business functions. It is supported by the use of the management tools of planning and control. The MIS helps the top management in goal setting, strategic planning and evolving the business plans and their implementation.

The MIS plays the role of information generation, communication, problem identification and helps in the process of decision making. The MIS, therefore, plays a vital role in the management, administration and operations of an organization.

1.4. INFORMATION FLOW

1.4.1. CLASSIFICATION OF THE INFORMATION

The information can be classified in a number of ways to provide a better understanding. John Dearden of Harvard University classifies information in the following manner:

Action versus no – action information

The information which induces action is called action information. The

information which communicates only the status of a situation is a no - action information. 'No stock' report calling a purchase action is action information but the stock ledger showing the store transactions and the stock balances is No action information.

Recurring versus non recurring information

The information generated at regular intervals is a recurring information. The monthly sales reports, the stock statements, the trial balance, etc. are recurring information. The financial analysis or the report on the market research study is non recurring information.

Internal versus external information

The information generated through the internal sources of the organization is termed as an internal information, while the information generated through the Government reports, the industry surveys, etc. is termed as an external information, as the sources of the data are outside the organization

The action information, the recurring information and the internal information are the prime areas for computerization and they contribute qualitatively to the MIS.

The timing an accuracy of the action information is usually important. The mix of the internal and the external information changes, depending on the level of the management decision. At the top management level, the stress is more on the operational and the middle management level, the stress is more on the internal information. Fig. 1.1 shows the source and kind of information required Vis –a- Vis levels of management in the organization.

The information can also be classified as under, in terms of its application.

Planning information

Certain standards, norms and specifications are used in the planning of any activity. Hence, such information is called the planning information. The time standards, the operational standards, the design standards are the examples of the planning information.

Control information

Reporting the status of activity through a feedback mechanism is called the control information. When such information shows a deviation from the goals or the objective, it will induce a decision or an action leading to control.

Knowledge information

A collection of information through the library reports and the research studies to build up acknowledge base as a information source for decision

making is known as knowledge information. Such a collection is not directly connected to decision making, but the need of knowledge is perceived as a power or s strength of the organization.

The information can also be classified based on its usage. When the information is used by everybody in the organization, it is called the organization information. When the information has multiple use and application, it is called the database information. When the information is used in the operations of a business it is called the functional or the operational information.

Employee and pay roll information is organization information used by a number of people in a number of ways. The material specifications or the supplier information is database information stored for multiple users. Such information may need security or an access control. Information like sales or production statistics is functional, meeting the operational needs of these functions.

1.4.2. WHY INFORMATION SYSTEM ARE IMPORTANT

Why study information systems? That's the same as asking why anyone should study accounting, finance, operations management, marketing, human resource management, or any other major business function. Information systems have become a vital component of successful business firms and other organizations. They thus constitute an essential field of study in business administration and management. That's why most business majors must take a course in information systems. Since you probably intend to be manager, entrepreneur, or business professional, it is just as important to have a basic understanding of information systems as it is to understand any other functional area in business.

1.5. NEED AND SOURCES

Information System Resources and Technologies

An information system is an organized combination of people, hardware, software, communications networks, and a data resource that collects, transforms, and disseminates information in an organization (see figure 1.2). People have relied on information systems to communicate with each other using a variety of physical devices (hard ware), information processing instruction (software), communications channels (networks), and stored data (data resources) since the dawn of civilization.

Today's end users rely on many types of information systems (IS). They might include simple manual (people and pencil) hard ware devices and informal (word of mouth) communications channels. However, I this text, we

will concentrate on computer – based information systems that use computer hardware and software, telecommunications networks, computer – based data management techniques, and other forms of information technology (IT) to transform data resources into a variety of information products.

An End User Perspective

Anyone who uses an information system or the information it produces is an end user. This usually applies to most people in an organization, as distinguished from the smaller number of people who are information system specialists, such as a manager, entrepreneur, or managerial level professional who personally used information systems. So most mangers are managerial end users.

Whatever your career will be, you can increase your opportunities for success by becoming knowledgeable end users of information technology. Businesses and other organizations need people who can use networked computer workstations to enhance their own personal productivity and the productivity of their work groups, departments, and organizations. For example, you should be able to use work processing and electronic mail to communicate more effectively, spreadsheet packages to more effectively analyze decision situations, database management packages to provide better reports on organizations performance, and specialized business software to support your specific work activities. You should also be aware of the management problems and opportunities presented by the use of information technology, and how you can effectively confront such challenges. Then you can play a major role in seeing that information system resources are used efficiently and effectively to benefit your career goals and the goals of the business firms or other organizations you may work for in the future.

An Enterprise Perspective

Information systems play a vital role in business success of an enterprise. Information technology can provide the information a business needs for efficient operations, effective management, and competitive advantage. However, if information systems do not properly support the strategic objectives, business operations, or management needs of an enterprise, they can seriously damage its prospects for survival and success. So the proper management of information systems is major challenge for manager. Thus the information systems function represents.

a. A major functional area of business that is as important to business success as the functions of accounting, finance, operations management, marketing, and human resource management.

b. A major part of resource of an enterprise and its cost of doing business, thus posing a major resource management challenge.
c. An important factor affecting operational efficiency, employee productivity and morale, and customer service and satisfaction.
d. A major source of information and support needed to promote effective decision making by managers.
e. An important ingredient in developing competitive products and services that give an organization a strategic advantage in the global marketplace.
f. A vital, dynamic and challenging career opportunity for millions o men and women.

A Global society perspective

We are living in a global information society, with a global economy that is increasingly dependent on the creation, management, and distribution of information resources. So information is a basic resource in today's society. People in many nations no longer live in agricultural societies, composed primarily of farmers, or even industrial societies, where a majority of the workforce consists of factory workers. Instead, the workforce in many nations consists primarily of farmers in service occupations or knowledge workers, that is, people who spend most of their workdays creating, using and distributing information.

Knowledge workers include executives, managers and supervisor; professionals such as accountants, engineers, scientists, stockbrokers, and teachers; and staff personnel such as secretaries and clerical office personnel. Most of them are end users who make their living using information systems to create, distribute, manage, and use information resources. Thus, information systems help them manage the human, financial, material, energy, and other resources involved in their work responsibilities.

It brings up the question of what your responsibilities are in the ethical use of information technology. As a prospective managerial end user and knowledge worker, you should begin to think about what ethical responsibilities are generated by use of information systems. For example, what uses of information technology might be considered improper or irresponsible to other individuals or to society? What is proper use of organization information resources? What does it take to be a responsible end user of information technology and protect you from computer crime?

Information and information systems, then, are valuable resources for knowledge workers, their organizations, and society. A major challenge for our

global information society is to manage its information resources to benefit all members of society while meeting the strategic goals of organizations and nations. This means, for example, using information systems to find more efficient, profitable, and socially responsible ways of using the world's limited supplies of materials, energy, and other resources. Since the information systems of so many organizations are interconnected by local, regional, and global telecommunications networks, knowledge workers can now access and distribute information and manage resources all over the world. For these reasons, information systems play an increasingly vital role in our global economy.

1.6. MANAGED DECISIONS

Scott Morton defined Decision Support System (DSS)as Interactive computer based systems, which help decision makers utilize data and models solve unstructured problems.

Keen and Scott Morton stated that Decision Support System couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer based support system for management decision makers who deal with semi structured problems.

1.7 IMPORTANCE AND ROLE

There are a number of categories of systems and the readers may be confused if they are told about system behavior and characteristics without identifying and specifying the kind of system;

The classifications could by;

1. conceptual and empirical
2. Natural and manufactured
3. Social, People- Machine and Machine
4. Open and closed
5. Permanent and temporary
6. Stationary and non – stationary
7. Subsystems and super systems
8. Adaptive and non – adaptive

Conceptual systems are concerned with theoretical structures, which may or may not have any counterpart in the world. Conceptual system for organizations is composed of ideas as district from empirical organization systems made up of people. These are systems of explanation or classification. They may also appear in the form of plans, accounting system structures and classifications of policies and procedures. Empirical systems are generally

concrete operational systems made up o people, materials, machines, energy, and other physical things, although electrical, thermal, and chemical, information and other such systems involving intangibles also fall, into this category.

Natural systems are plenty in nature. The entire ecology of life is a natural system solar system, water system of the world are also examples.

Manufactured systems are formed after people gather in groups to live and hunt together e.g.; National defense and transportation system. A business organization is system with many similar systems included like production, accounting etc.

Systems made up of people are purely social systems, apart from other system's objectives and processes. E.g.; Business organizations, government agencies, political parties, social clubs etc.

Most empirical (as opposed to conceptual) systems fall into the category of people machine systems. It is difficult to think of a system composed only of people who do not utilize equipment of some kind to achieve their goals. Even philosophers write and record their views for permanency.

Pure machine systems would have to obtain their own inputs and maintain themselves. E.g.; Development of self healing machine systems would bring these systems closer to simulation of living organisms. Such systems would need to adapt to their environment. Eg; Electric power generating systems.

An open system is one that interacts with its environment. All systems containing living organisms are obviously open systems because they are affected by what is sensed by the organisms. Organizations are usually systems operating within larger systems and are therefore open systems. The company in turn is a system within the larger industry system. The company interacts with its environment, a larger system, makes that individual company an open system. The open system may be further identified by its individually small influence on its environment and inadequate feedback of information from the environment.

Industry is a part of the national economic system. Which is in turn a system, within our society? Society is a system within the world system, which is a part of solar system, finally leading at the end to an unknown system (which we attribute to the divine system creator God). What constitutes a closed system is more difficult. A closed system is one that does not interact with its environment. Whatever environment surrounds, the closed system does not change or if it does, a barrier exists between the environment and the system to prevent the system from being affected.

In research for instance, we attempt to develop models that are essentially closed models. The scientists who devise a laboratory system to measure the elasticity of a metal is assuming a closed system so that environmental changes that would affect the results are avoided. In reality, a closed system never exists. Problems in business are resolved as if a closed system existed to simplify the situation enough so that at least, a first approximation can be obtained.

People made systems are generally permanent. However, for practical purposes, systems enduring for a time span that is long relative to the operations of humans in the system may be said to be ‘permanent’.

Temporary systems are designed to last a specified period of time. These are important for the accomplishment of specific tasks in a business and for research in science.

A stationary system is one whose properties and operations either do not vary significantly or else vary in repetitive cycles, eg; the automatic factory, government agency that processes social security payments in USA, super market store operations, high school etc.

An advertising organization, a continental defense system, a research and development laboratory, and a human being are examples of non stationary systems.

Each system is nested in a larger system. The systems in the hierarchy that we are most interested in studying or controlling is usually called ‘the system’. Eg; business firm is viewed as the ‘system’, or the ‘total system’, when focus is on production, distribution of goods etc. Smaller systems within the system are called ‘subsystems’. Super system is a term that has at least two used: (i) as opposed to subsystem (ii) to denote any extremely large and complex system.

A system that reacts to its environment in such a way to improve in its functioning, achievement, or probability of survival is called an adaptive system. Eg: High level living organisms such as animals and humans use adaptation in meeting threats or changes in the physical environment or changes in their societies. Evolution theory is based heavily on the concept of an adaptive system. Successful businesses are those that adapt to changes in the environment, while many failures are attributed to businesses that respond in time to external changes.

Those that do not react or adapt to the environment are called ‘Non adaptive system’.

NOTES

UNIT – II

2.1. Characteristics of Computer Information System

2.2. Role of the computer

2.3. Software

2.4. Hardware - CPU- Mu

2.5. Types of Computer

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2.7. Applications and Operations.

2.1. CHARACTERISTICS OF COMPUTER INFORMATION SYSTEM

It should be apparent that information systems are vital to company operation. It can be said that today few, if any, enterprises can operate without information systems. The first step in understanding their potential impact on the business operation is to break through the semantic barriers. This section summarizes the pertinent characteristics of IS and underlying guidelines of managing with information.

1. Management Oriented/Directed. This is the most significant characteristic of managing with information. The system is designed from the top down. This does not mean that the system will be geared to providing information directly to top management ; rather, it means that the system development starts from an appraisal of management needs and overall business objectives. It is possible that middle management or operating management is the focus of the system, so that their needs are the cornerstone on which systems is built.

A marketing information system is an example. Basic sales-order processing, the shipment of goods to customers, and the billing of goods are fundamental operational control activities. However, if the system is designed properly, this transaction information can be tracked by sales people, sales territory, size of order, geography, and product line. Furthermore, if designed with strategic management needs in mind, external competition, market, and economic data can be created to give a picture of how well the company's products are faring in their marketing environment and to serve as a basis for introducing new products or markets. The initial applications can be geared to the operational and management control areas, but in such a way as not to preclude its integration into a strategic planning subsystem for upper management.

Because of the management orientation of IS, it is imperative that management actively direct the system development efforts. Involvement is not enough. In terms of the preceding examples, management must determine what sales information is necessary to improve its control of marketing operations.

It is rare to find an IS where managers themselves, or high-level representatives of their departments, are not spending a good deal of time in system design. It is not a one-time involvement, for continued review and participation are necessary to ensure that the implemented system meets the specifications of the system that is designed. Therefore, management is responsible for setting system specifications, and it must play a major role in the subsequent tradeoff decisions that inevitably occur in system development. An important element of effective system planning is the process for

determining the priority of application development. A company without a formal application approval cycle and a management steering committee to determine priorities will never develop an effective IS.

2. Business Driven/Justified. A fundamental tenet of meaningful and successful IS is that it be driven by the business and not the other way around. The plans of IS must be linked to the overall business plans of the enterprise. The strategies of the corporation must set the IS priorities. For example, if a major thrust of the organisation is to compress the time to introduce new products, this sets the IS priority if the major thrust is to improve customer service, this sets the IS priority; if the major thrust is to reduce cost, this sets the IS priority. The justification will be to make a significant contribution to achieving these business priorities. Certainly an IS function can make a contribution in nonstrategic areas of the business, but the big payoffs and value will come when IS is aligned with and driven by the overriding objectives and strategies of the business.

3. Integrated. Integration of information subsystems provides more meaningful management information. For example, in order to develop an effective production scheduling system, we must balance such factors as

(1) Setup costs (2) Work force

(3) Overtime rates (4) Production capacity

(5) Inventory levels (6) Capital requirements

(7) Customer service.

A system that ignores one of these elements-inventory level, e.g.-is not providing management with an optimal schedule. The cost of carrying excess inventory may more than offset the other benefits of the system. Integration, in the sense intended here, means taking a comprehensive view or a complete-picture look at the interlocking subsystems that operate within a company. One can start an IS by attacking a specific subsystem, but unless its place in the total system is realized and properly reflected, serious shortcomings may result. Thus an integrated system that blends information from several operational area is a necessary element of IS.

4. Common Data Flows. Because of the integration concepts of IS, there is an opportunity to avoid duplication and redundancy in data gathering, storage, and dissemination. System designers are aware that a few key source documents account for much of the information flow and affect many functional areas. For example, customer orders are the basis for billing the customer for goods ordered, setting up the accounts receivable, initiating production activity, making sales analyses, forecasting sales, and so on. It is prudent to capture this

data closest to the source where the occurs and use it throughout the functional areas. It is also prudent to capture it once and thus avoid the duplicate entry of source data into several systems. This concept also holds in building and using master files and in providing reports. The common data flows concept support several of the basic tenets of systems analysis – avoiding duplication, combining similar functions, and simplifying operations wherever possible.

The development of common data flows is an economically sound and logically concept, but it must be viewed in a practical and pragmatic light. Because of a company's method of operation and its internal procedures, it may be better to live with a little duplication in order to make the system acceptable and workable. IS and integration are more important for their ability to blend the relationship of several functional areas of a business and to produce more meaningful management information, than for producing that information more economically. In IS, effectiveness gets the nod over efficiency.

Given the track record and experience to date, one should look closely at the degree of integration of common data flows. Although benefits exist, the degree of difficulty is high, and many would be implementers have failed because they underemphasized the complexity and amount of time involved or did not possess the necessary system design skills. What is being questioned is not the desirability of building the concept of common data flows into the system; rather, it is the degree to which the concept is used. Building a system that cannot operate unless all data springs from a common data path is usually an unwise design concept - as many companies have discovered to their detriment.

5. Heavy planning Element. Complex, enterprise-wide information systems do not occur overnight; they take from three to five years to get fully established firmly with a company. Therefore, a heavy planning element must be present in IS development. Just as a civil engineer does not design a highway to handle today's traffic, but to handle the traffic 10 to 20 years from now, so the IS designer must have the future objectives and needs of the company firmly in mind. The designer must avoid the possibility of system obsolescence before the system gets into operation; needless to say, sound system planning is an essential ingredient in successful IS.

A phasing plan is an essential ingredient to IS planning. While an enlightened management will see the future benefits from implementing systems in an integrated fashion around a data base, it can't tolerate a complete hiatus during the transition phase. Plans must include some enhancement of existing systems concurrent with the implementation of the new IS. The practical philosophy is that IS a compass. While the final goal is never

completely reached, IS provides a meaningful direction towards which one strives. A phasing plan with intermediate benefits accruing like time capsules is an appropriate way to proceed.

6. Subsystem Concept. In tackling a project as broad and complex in scope as an enterprise-wide information system, one must avoid losing sight of both the forest and the trees. Even though the system is viewed as a single entity, it must be broken down into digestible subsystems that can be implemented one at a time. The breakdown of IS into meaningful subsystems sets the stage for a prioritized implementation. Although the functional areas of sales-order processing, material control, and so on, have been referred to as systems, in reality they are subsystems and can be broken down into additional subsystems. This subsystems analysis is essential for applying boundaries to the problem, thus enabling the designer to focus on manageable entities that can be assigned and computerized by selected systems and programming teams.

7. Flexibility and Ease of Use. Despite a careful analysis of future management information needs, it is impossible to predict what is desired three to five years hence. This is true in most industries, and especially in industries with rapid change patterns. It is naive to think that anyone possesses the omniscience to predict the future.

With this as a premise, the next best thing as IS developer can do is build in the flexibility to incorporate as many future nuances as possible. Even then, future happenings will sorely try the flexibility boundaries of the system. Building an IS on a solid data base foundation is a good starting point for flexibility. On the lighter, but realistic side, expect Murphy's law and Reilly's law both to occur. Murphy's Law states that anything that can happen will and Reilly's law states that Murphy is an optimist.

A feature that often goes with flexibility is ease of use. This means the incorporation of features that can make the system readily accessible to a wide range of users and easy to use once they are ready to try it. One of major information systems trends in broadening the base of users, consistent with evolving end-user languages and IS access methods. The IS should be able to incorporate the best of the improving user windows into the IS data base.

8. Data Base. As explained earlier, the data base is the mortar that holds the functional systems together. Each system requires access to a master file of data covering inventory, personnel, vendors, customers, general ledger, work in process, and so on. If the data is stored efficiently and with common usage in mind, one master file can provide the data needed by any of the functional systems. It seems logical to gather data once, properly validate it, and place it

on a central storage medium that can be accessed by any system. However, it is not unusual to find a company with multiple data files, one serving one functional system and another serving another system. This is obviously not the most efficient way to operate. Although it is remotely possible to achieve the basic objectives of IS without a data base, thus paying the price of duplicate storage and duplicate file updating, more often than not the data base is the sine qua non of managing with information systems.

9. Distributed Systems. The majority of companies implementing IS have a geographic network of sales offices, distribution points, manufacturing plants, divisions, subdivisions, and so on. Some of these entities are operated in a completely independent fashion and therefore may not be a part of the integrated IS. More often than not, the remote sites do have a connection with each other and with a host operation. In order to create an effective IS without arbitrary geographic boundaries, some form of distributed systems (DS) is necessary. DS means that two or more information subsystems in different locations act in a cooperative fashion — they share data over a network. This is a simple definition for a concept that is vital to effective IS. DS can be thought of as the delivery system, placing information in the hands of those who need it when they need it. Teleprocessing, networking, or just plain communication systems are an important part of DS, and DS is an important part of IS.

10. Information as a Resource. The information resource management (IRM) incept is an overriding philosophy. Pervading the entire organization must be the Incept that information is a valuable resource, particularly in the management control l strategic planning areas, and must be properly managed. This is a subtle but important change in thinking. It was common in the past to view data processing an entity unto itself doing its own thing. The new outlook is that IS is more than a support for the business; in many instances it is inextricably bound up in the business itself. One of the manifestations of IRM is that IS will have a higher reporting relationship in the organization and will become more a part of the organization's executive committee.

Most every organization will have some formed of centralized IS operation managed by a chief information officer (CIO) or equivalent. This group has among its responsibilities the establishment throughout the organization of the proper IS environment, which creates a proactive, competitive, and innovative spirit whether the functions be centralized or distributed. Following the ten guidelines described in the foregoing can be a principal step in that direction. The first two instill the proper business and management perspective into the organization. Characteristics 3, 4, & 8 ensure the proper integration & commonality for enterprise-wide applications.

Characteristics 5 & 10 are principal tenets, stressing the need to link IS planning with business planning and to view information as a valuable company resource or asset. Characteristics 6 & 7 stress systems concepts that are fundamental to success; that is, that break large applications into manageable subunits and make these units flexible and easy to use. Characteristic 9 stresses the importance of data sharing via a communications network that links supporting units across a geographical spectrum. Together, these ten characteristics form the underpinnings of an IS operation that can help a company obtain, a competitive advantaged.

2.2. ROLE OF COMPUTER

Systems fall into a number of categories, and confusion may result if we talk about systems behavior and characteristics without identifying and specifying the kind of system we are talking about.

1. Conceptual and Empirical. Conceptual systems are concerned with theoretical structures, which may or may not have any counterpart in the real world. Conceptual systems are typified by those of science, such as economic theory, non-Euclidean geometry systems, the general system of relativity, or organization theory. Conceptual systems are systems of explanation or classification. They may also appear in practical management affairs in the form of plans, accounting system structures, and classifications of policies and procedures.

Empirical systems are generally concrete operational systems made up of people, machines, energy, materials, and other physical things, although thermal, electrical, chemical, information and other such systems involving intangibles also fall into this category. Empirical systems may of course be derived from or based upon conceptual systems and thus represent the conversion of concepts into practice.

2. Natural and Manufactured. Natural systems abound in nature. The entire ecology of life is a natural system, and each organism is a unique natural system of its own. The water system of the world, at least before man affected it, was a natural system. Our own solar system is a natural system.

Manufactured systems were formed when people first gathered in groups to live and hunt together. They now appear in infinite variety all about us and extend from the manufacturing system of a company to the system of space exploration. The objectives of manufactured system may be transportation, national defense etc.

3. Social, People-Machine and Machine. Systems which are made up of people may be viewed purely as social systems. Business organizations, political parties, government agencies, social clubs, and technical societies are

examples of social systems. Although, all of these employ objects and artifacts that form physical systems, yet the most relevant aspects may be considered to be organizational structure and human behavior.

Most empirical (as opposed to conceptual) systems fall into the category of people-machine systems. It is a system composed of people who utilize certain equipments to achieve their Objectives.

Pure machine systems would have to obtain their own inputs and maintain themselves. The development of a self-heating machine system would bring these systems closer to simulation of living organisms. Such systems would need to adapt to their environment. Although some electrical power generating systems approach self-sufficiency, self-repairing and completely self-sufficient machine systems are still in the category of science fiction.

4. Closed and Open Systems. A closed system is defined in physics as a system which is self-contained. It does not exchange material, information, or energy with its environment. An example is a chemical reaction in a sealed, insulated container. Such closed systems will finally run down or become disorganized. This movement to disorder is termed an increase in entropy.

In organizations and in information processing, there are systems that are relatively isolated from the environment but not completely closed in the physics sense. These will be termed closed systems, meaning relatively closed. For example, systems in manufacturing are often designed to minimize unwanted exchanges with the environment outside the system. Such systems are designed to be as closed as possible, so the manufacturing process can operate without disturbances from suppliers, customers, etc. A computer program is a relatively closed system because it accepts only previously defined inputs, processes them, and provides previously defined outputs.

Open systems exchange information, material, or energy with the environment, including random and undefined inputs. Examples of open systems are biological systems (such as humans) and organizational systems. Open systems tend to have form and structure to allow them to adapt to changes in their environment in such a way as to continue their existence. Open systems can be further classified as adaptive and non-adaptive systems.

5. Adaptive and Non-adaptive: A system that reacts to its environment in such a way as to improve its functioning, achievement, or probability of survival is called an adaptive system. High-level living organisms such as animals and humans use adaptation in meeting threats of changes in the physical environment or changes in their societies. Organizations are adaptive systems; a critical feature of their existence is their capability to adapt in the face of changing competition, changing markets, etc.

We may associate energy source, learning and self-modification with adaptation. For example, if computers could attach themselves to a long-term source of energy, learn how to modify and heat themselves, and then actually do so, they would become adaptive systems, otherwise they are non-adaptive systems.

6. Deterministic and Probabilistic Systems: A deterministic system operates in a predictable manner. The interaction among the parts is known with certainty. If one has a description of' the state of the system at a given point in time plus a description of its operation, the next state of the system may be given exactly, without error. For example, a correct computer program is a deterministic system as it performs exactly according to a set of instructions.

2.3. INTRODUCTION TO SOFTWARE

Programs, sets of instructions and decision rules for processing are what give life to a computer. They tell the CPU how to manipulate data and the sequence of operations to be performed. Unlike the metal and circuitry of hardware that is physical, programs represent decision logic, the intellectual process for solving problems. Being the antithesis of hardware, programs are called software. The functions of software are to

(1) Manage the computer resources of the organisation.

(2) Provide tools for human beings to take advantage of these resources.

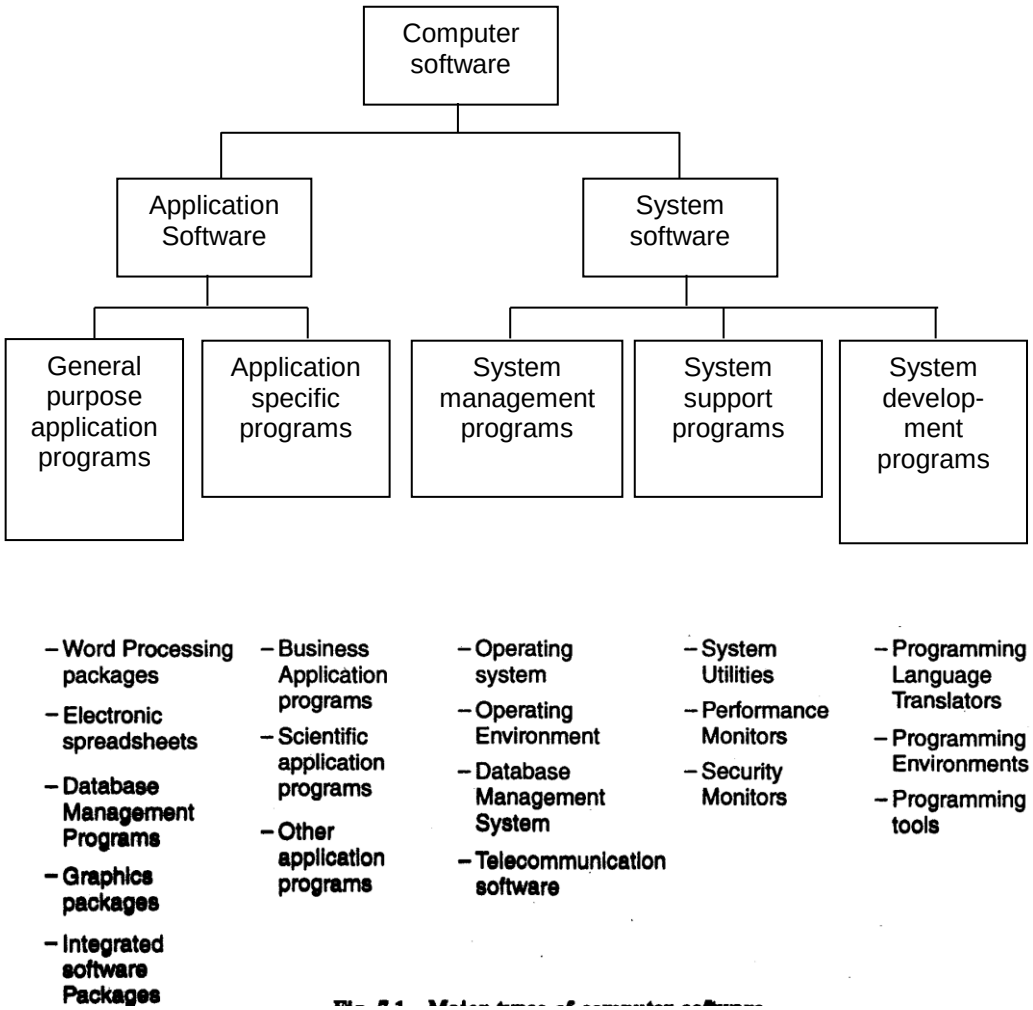
(3) Act as an intermediary between organizations and stored information.

Computer software is typically classified into two major types of programs

1. Application Software. Application software describes the programs that are written for or by users to apply the computer to a specific task. Software for processing an order or generating a mailing list is application software. Programmers who write application software are called application programmers.

2. System Software. System software is a set of generalized programs that manage the resources of the computer, such as the central processor, communication links, and peripheral devices. Programmers who write system software are called system programmers.

In this chapter we will discuss the major types of application and system software as shown below in Fig. 6.



OPERATING SYSTEM

An Operating system also called "O.S", "Supervisor", "Monitor" or "executive", is a set of routines to manage the running of the computer. Operating systems range in complexity from simple systems which manage only basic functions to very complex ones. In general, the more sophisticated the computer system, the more complex the operating system required to manage its use. The philosophy including the OS is that the computer should perform those operators tasks which it can faster and more accurately and that the computer should be kept operating as continuously and as effectively as possible.

The Operating system, in general, consists of a collection of programs. These programs, of course, can only be executed when they have been loaded into computer memory. For this reason, they are loaded automatically into memory when the computer is started up, mostly from the hard disk, sometimes from diskette.

The System programs are loaded in a specific area of the working memory. This is then no longer available to applications. Many commands are stored in a chip with a permanent memory. This applies particularly to the start commands in the initial loading program. This program loads the operating system. Other elementary routines are located in the BIOS chip. (Basic input Output System)

The computer is confined to reading in the permanent memory (Read Only Memory, ROM). This is in contrast to the Random Access Memory (RAM) in which both reading and writing can take place.

Some Operating systems load only the most frequently used system programs in working memory (internal commands), other commands are then only loaded when they are requested (external commands).

As soon as the most important operating system programs are loaded, they' take control of the processes in the computer. An operating system must execute the following duties:

1. Managing and controlling the execution of a program
2. Managing the input and output of information
3. Managing files on external media
4. Managing peripheral devices
5. Implementing the instructions of the user
6. Registering errors in the devices and in the operation of these
7. Saving, adjusting and stating date and time when required
8. Making conversion and test programs accessible
9. (Sometimes) managing simultaneous usage of the computer from different workstations in a network
10. Activating utility programs to safeguard information

FUNCTIONS OF OPERATING SYSTEM

An Operating system has one major function to manage the resources of the computer system. It allocates the resources on the basis of user need and system capability. The four major functions of an operating system are:

1) File and Software management

2) Input / Output and peripherals management

3) Memory Management

4) CPU time management

Thus the operating system is responsible for directing a given computer into a batch mono programming system, a multi-programming system, a

timesharing system or a real-time sharing system. Many operating systems can handle both batch and real time applications simultaneously.

When a microcomputer is first turned on, the operating system program is transferred from floppy disk into RAM. With the operating system program in memory, various operating system commands may be given by the user to perform a wide variety of operations. As an example, let us consider the tile and software management function.

The Operating system supports a large library of typical user programs and files. The user needs only to tell the operating system which program he wishes to use. The operating system will retrieve the program from the disk and bring it into main memory for the operator to use. These programs include the editor, the assembler and a variety of high level languages. Many other programs and subroutines can be created and stored in the library, including applications programs. Files of data can also be created, stored and retrieved under this system. Input / Output and peripherals management is another function of the operating system. It also contains a variety of subroutines such as peripheral device handlers and interrupt-servicing routines. When writing programs, the user finds that most of the time and drudgery will be spent in developing the input/output routines for talking to the various peripheral devices connected to the computer. Much of any system makes this easy by providing for all of these routines. When writing programs, the user has to specify only what he wishes to do with a given peripheral and the operating system will provide the desired code. This greatly simplifies and speeds up programming.

Memory management is an important function of the Operating system. The programs in an operating system are capable of determining how much usable RAM a microcomputer has. The Operating system also decides how this RAM is used. For example, it will determine where a system or applications p1ograms will be placed in RAM. The transferring or swapping of programs and data into and out of RAM takes place automatically under the control of the operating system. The user does not have to concern him with this since the operating system does it automatically.

The Operating system also manages the empty storage space available to it on one or more external floppy disks. For example, should the user create a program that is larger than RAM, the Operating system automatically steps in the begins saving portions of the program in RAM in the external floppy disk in order not to lose it. The operating system also decides where on the disk a user created program will be stored.

The Operating system can readily create and establish files for data inputted by the programmer or for programs generated. Those files can be given a name and stored on the floppy disk. Again, the user does not have to know where on the floppy disk these programs are stored. The program or data can be retrieved by giving the name to the operating system.

Another important function of some operating system is scheduling of the CPU. The most efficient operation of any computer depends upon keeping the CPU busy. Since CPU does all of the processing required of a computer, the CPU will generally be quite busy. However, there are times when inefficient, time consuming I/O operations may be taking place and the CPU is idle.

An operating system can detect such idle periods and give the CPU something to do. The Operating system therefore schedules work for the CPU to keep it busy. This is particularly important in large computer systems that are serving many people. Such large computer systems may be operate in a time sharing mode and have many inputs from a variety of users. Typical operating system for microcomputers do not schedule CPU time since the system is basically dedicated to one user.

The operating system is probably the most powerful and important piece of software in a computer system. Along with the hardware, the operating system, and other software form a complete, versatile, efficient and easy to use system for the user.

Application Software

Application software consists of the programs that are written for or by users to apply the computer to a specific task. These programs re called application packages because they direct the processing required for a particular use, or application, that end users want accomplished. There are thousands of different jobs that end user's want computers to do. So there are thousands of application packages available.

Other Software

Software -- General Information

Computer software provides instruction that tell the computer how to operate.

(1) Software are also called programs.

(2) Programs are usually created using other software called Programming languages.

There are two (2) main types of software

(1) System Software:-

- Used by the computer to accomplish a task.

- What system software does:
    - controls the internal function of the computer
    - controls other devices connected to the CPU

(2)Application Software:-

- Used by people to accomplish a specific task.
- Some common kinds of application software
    - Word Processor software
    - Database software
    - Spreadsheet software
    - Games
    - Web Page Browsers

Kinds of Software

(1)Public Domain Software

- Has no copyright - no one owns the right to control who can make copies of the software.
- Free to use or make copies of.
- Can be copied, used in other programs, or changed by anyone.

(2)Freeware

- Has a copyright - someone owns the right to determine who can make copies of the software.
- Free to use and make copies of.
- Can only give away exact copies of the software.
- Cannot be changed or used in another program without the copyright holder's permission.

(3)Shareware

- Has a copyright.
- Allowed to use the software before paying for it.
    - Can be a demo - which limits some major features like the Save command.
    - Can set an amount of time you can use the software.
    - Can trust that you will pay for it if you like the software.
- Can only give away exact copies of the software.
- Cannot be changed or used in another program without the copyright holder's permission.

(4)**Commercial Software**

- Has the most resistive copyright.
- Have to buy the software before you can use it.
- Can usually make one copy of the software as a backup copy.
  - A backup copy is used in case something goes wrong with the original software.
  - Cannot give away or sell the backup copy.
- Cannot copy, look at the program's code, change, or use the software in another program without the copyright holder's permission.
- Commercial Software is the best software in the world.

How Software is Inputted into Computer

1. Built into the computer's circuits, the ROM chips.

2. Loaded into the computer from a secondary storage device, like a floppy disk or hard disk drive.

3. Typed in from the keyboard.

- Usually need to use a programming language to create the software.
- Rarely done by most computer users today.

System Software

System software is a type of program that acts like a conductor in an orchestra. It directs all the activities and sets all the rules for how the hardware and software work together. MS DOS and Microsoft Windows are examples of system software or operating system software.

Some System Software is built into the computer.

1. ROM chips and BIOS.

2. Helps to setup the computer and start it.

Operating Systems

1. The operating system is usually located on a disk.
    - Can be on the hard disk drive, a floppy disk, or CD-ROM disk.
    - Must be loaded into RAM before it can be used.
2. Used by the computer's hardware to work with its parts.
    - Tells the computer how to:
        - Display information on the screen.
        - Use a printer.
        - Store information on a secondary storage device.
    - The system software that controls peripherals are called drivers.
3. An operating system works with application software.
    - Does basic tasks, like printing a document or saving a file
    - The operating system starts (launches) the application software so that it can be used.

User Interfaces

1. The user interface is how the computer's operating system presents information to the user and the user gives instructions (commands) to the computer.

2. There are two kinds of User Interfaces
    - ❖ Text Interface
        - Presents information to the user in the form of text.
        - Have to type in commands or select commands from a menu displayed as text on the screen.
        - Hard to use or learn, because the user must memorize and type in commands.
        - Examples:
            - MS-Dos (Microsoft Disk Operating System)
            - Pro Dos (Professional Disk Operating System)
        - Many of the Text Interfaces had shells placed over them.
            - A shell was more of a Graphic User Interface.
            - Made using the Text Interface easier to use.

- ❖ Graphic User Interface (GUI)
  - ➢ Presents information to the use in the form of pull-down menus and icons.
    - Pull-down menus the user clicks on to display the menu
    - Icons are small pictures that stand for something, like a file, volume, trash, or program
  - ➢ The user gives commands to the computer by selecting items from a menu or by clicking on an icon when using a pointing device.
  - ➢ GUIs are easy to learn and use
  - ➢ Examples:
    - Windows 98
    - Windows 2000
    - Mac OS

Application Software

Application software programs work with the operating system software to help you use your computer to do specific types of work such as word processing to type a letter.

1. Used by people to solve general problems
   - ➢ Can be used to do more than one thing - adapted to a wide variety of tasks
   - ➢ Some common tasks done by general purpose application software
     - Planning
     - Writing
     - Record keeping
     - Calculating
     - Communicating
     - Drawing
     - Painting
   - ➢ What can be done with general purpose application software is only limited by the imagination of the user.

2. Examples of general purpose application software

- Word Processing Software

- Database Software

- Spreadsheet Software :-

- Desktop Publishing Software :-

- Paint and Draw Software :-

Utilities

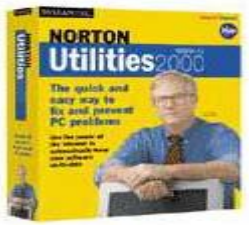
Utilities allow you to complete certain tasks on your computer. Examples of some of these tasks are file organizations.

- Specific purpose application software used to help a computer work better or to avoid problems.
- Some utility programs are built into the operating system

- Scandisk in the Windows operating system
- Disk formatting software

➢ Examples of utility programs
- Anti-virus software
- Disk maintenance software

➢ File management programs
➢ Security software



2.4. INTRODUCTION TO COMPUTER HARDWARE

Why do you care how computer work? After all, it is easy to use a photocopy machine without understanding how it works. Automobiles cost more than most computers, yet you can buy an automobile without knowing the difference between a manifold and a muffler. You can also make telephone calls without understanding fibre optic cables and digital transmissions.

On the other hand, when you buy an automobile you need to decide if you want options such as power windows, a turbo charger, or a sun roof. Similarly, many options are available for telephone services. If you do not understand the options, you might not end up with the car, telephone service, photocopier, or computer that you need. Or, you could end up paying extra money for services that you will not use. To choose among the various options, you need to know a little about how computer work. Many features are particularly important when evaluating computers to use as Web servers in e-business.

A computer is more than a high-powered collection of electronic devices performing a variety of information processing chores. A computer is a system, an interrelated combination of components that performs the basic system functions of input, processing, output, storage and control, thus providing end users with a powerful information processing tool.

The Central Processing Unit

The central processing unit is the most important hardware component of a computer system. It is also known as CPU, the central processor or instruction processor, and the main microprocessor in a microcomputer. Conceptually, the CPU can be subdivided into two major subunits

1. The arithmetic logic — unit

2. The control unit

The CPU also includes specialized circuitry and devices such as registers for high-speed, temporary storage of instruction and data elements, and various subsidiary processors such as those for arithmetic operations, input/output, and telecommunications support. (Sometimes a computer's primary storage unit or memory is shown as part of a CPU.)

The control unit obtains instructions from those stored in the primary storage unit and interprets them. Then it transmits directions to the other components of the computer system, ordering them to perform required operations.

The arithmetic-logic unit performs required arithmetic and comparison operations. A computer can make logical changes from one set of program instructions to another (e.g. overtime pay versus regular pay calculations) based on the results of comparisons made in the ALU during processing.

Computer Generations

As informed business end users, it is important that you recognize several major trends in computer systems. These trends have developed in the past during each major stage - or generation - of computers, and they are expected to continue into the future. The first generation of computers began in the early 1950s; the second generation in the late 1950s; the third generation in the mid-1960s; and the fourth generation began in the 1970s and continue to the present. A fifth generation of computers is expected to evolve by the next few years.

First generation computers (1951-1958) used hundreds or thousands of vacuum tubes for their processing and memory circuitry. These computers were quite large and generated enormous amounts of heat; their vacuum tubes had to be replaced frequently. Thus, they had large electrical power, air conditioning, and maintenance requirements. First-generation computers had main memories of only a few thousand characters and millisecond processing speeds. They used magnetic drums or tape for secondary storage and punched cards or paper tape as input and output media.

Second generation computers (1959—1963) used transistors and other solid-state, semiconductor devices that were wired to circuit boards. Transistorized circuits were much smaller and much more reliable, generated little heat, were less expensive, and required less power than vacuum tubes. Tiny magnet cores were used for the computer's memory, or internal storage. Many second-generation computers had main memory capacities of less than

100 kilobytes and micro second processing speeds. Removable magnetic disk packs were introduced, and magnetic tape emerged as the major input, output, and secondary storage medium for large computer installations

Third generation computers (1964— 1979) began using integrated circuits, in which thousands of transistors and other circuit elements are etched on tiny chips of silicon. Main memory capacities increased to several megabytes and processing speeds jumped to millions of Instructions per second (MIPS) as telecommunications capabilities became common. This made it possible for operating system programs to come into widespread use that automated and supervised the activities of many types of peripheral devices and processing of several programs at the same time, sometimes from networks of users at remote terminals. Integrated circuit technology also made possible the development and widespread use of small computers c led minicomputers in the third computer generation.

Fourth generation computers (1979 to the present) uses LSI (large-scale integration) and VLSI (Very-large-scale integration) technologies that cram hundreds of thousands or millions of transistors and other circuit elements on each chip. Main memory capacities ranging from a few megabytes to several gigabytes can be achieved by the memory chips that replaced magnetic core memories. LSI and VLSI technologies also allowed the development of microprocessors, in which all of the circuits of a CPU are contained on a single chip with processing speeds of millions of instructions per second. Microcomputers, which use microprocessor CPUs and a variety of peripheral devices and easy-to-use software packages to form small personal computer systems (PCs) or networks of linked PCs, are a hallmark of the fourth generation of computing.

2.5. TYPES of Computers

Today's computer systems display striking differences as well as basic similarities. Differing end user needs and technological discoveries have resulted in the development of several major categories of computer systems with a variety of characteristics and capabilities. Some computers solve only a few types of numerical or logical problems; some are dedicated to a specific purpose, while others are employed for a wide class of problems.

The computer systems are classified as -

1. Microprocessors. A microprocessor processes data, but has limited input/output capability. Whether a microprocessor should be classified as a computer or not is in dispute. Although some glossaries define a microprocessor as a small, simple computer, most computer professionals disagree with this definition because a microprocessor is not suitable for

general processing purposes. They define a microprocessor as a computer component. The CPU of all types of computer manufactured today is built around microprocessors.

Microprocessors are also found embedded in products for specialized computing tasks, such as controlling the mixture of petrol and air in the engine of a car to maximize mileage per gallon. There are microprocessors in video games, cash registers, microwave ovens, petrol pumps, pacemakers, and burglar alarms.

2. Microcomputers. Microcoml3uters are the smallest but most important category of computer systems for end users. Such computers can be constructed on a silicon chip or chips, and may be smaller than a fingertip.

Microcomputers come in a variety of sizes and shapes for a variety of purposes. Microcomputers categorized by size include handheld, notebook, laptop, portable, desktop, and floor-standing microcomputers. Or, based on their use, they include home, personal, professional, workstation, and multiuser computers.

Examples of special-purpose application categories include handheld microcomputer devices known as personal digital assistants (PDAs), designed for convenient mobile communications, and computing, and network computers (NCs) that are designed primarily for "surfing" the Internet. However, the classifications of desktop versus portable are widely used distinctions. That is because most microcomputers are designed either to fit on top of an office desk, transforming it into an end user workstation, or to be conveniently carried by end users such as by sales persons or consultants who do a lot of travelling. Their low cost, power and ease of use coupled with the availability of off-the-shelf software for large numbers of tasks make them indispensable tools for people in business.

3. Workstations. Workstations are high-performance microcomputers commonly used by engineers, scientists and technical professionals, particularly those in need of graphics for tasks such as computer aided design (CAD) in engineering, or investment and portfolio analysis in the securities industry. One of the fastest growing microcomputer application categories is network servers. They are usually more powerful microcomputers that coordinate telecommunications and resource sharing in local area networks (LANs) of inter-connected microcomputers and other computer system devices.

4. Minicomputers, also called midrange computers have been on the market since the late 1960s. They are larger and more powerful than most microcomputers but are smaller and less powerful than most large mainframe computer systems. However; this is not a precise distinction. High-end models

of microcomputer systems (super micros) are more powerful than some midrange computers, while high-end models of midrange systems (super minis) are more powerful than some smaller models of mainframe computers. In addition, midrange system cost less to buy and maintain than mainframe computers. They can function in ordinary operating environments, and do not need special air conditioning or electric wiring.

Uses. Midrange computers are being used for many business and scientific applications. They first became popular as minicomputers for scientific research, instrumentation systems, engineering analysis, and industrial process monitoring and control. Minicomputers could easily handle such uses because these applications are narrow in scope. Thus, midrange computers serve as industrial process-control and manufacturing plant computers, and they play a major role in computer-aided manufacturing (CAM). They can also take the form of powerful technical workstations for computer — aided design (CAD) applications. Midrange computers are often used as front-end computers to help mainframe computers control data communications networks with large number of data entry terminals.

Midrange computers have also become popular s powerful network servers to help manage large interconnected local area networks that tie together many end user microcomputer workstations, and other computer devices in departments, offices, and other work sites. In addition, some midrange systems are used as departmental or office computers because they can provide large departments or offices more processing power and support more users at the s tie time than networked microcomputers.

5. Mainframe Computer. Mainframe computers that are physically larger than micros and mini usually have one or more Central processors with faster instruction processing speeds. For example, they typically process hundreds of million instructions per second (MIPS). Mainframes have large primary storage capacities. For example, their main memory capacity can range from about 64 megabytes to several gigabytes of storage. Many mainframe models have the ability to service hundreds of users at once. For example, a single large mainframe can process hundreds of different programmes and handle hundreds of different peripheral devices (terminals, disk and tape drives, printers, etc.) for hundreds of different users at the same time.

Mainframe computers are designed to handle the information processing needs of major corporations and government agencies with many employees and customers or with complex computational problems. For example, large computers are necessary for organizations processing millions of transactions each day, such as major international banks, airlines, oil

companies, and the national stock exchanges. They can also handle the processing of thousands of customer inquiries, employee-paychecks, student registrations, sales transactions, and inventory changes, to give a few examples. Large mainframes can handle the great volume of complex calculations involved in scientific and engineering analysis and simulations of complex design projects, such as analyzing seismic data from oil field exploration, or designing aircraft. Mainframes are also becoming popular as super servers and corporate database servers for the large interconnected telecommunications networks of major corporations.

7. Supercomputer. The term supercomputer describes a category of extremely powerful mainframe computer systems specially designed for high-speed numeric computation (they are commonly called number crunchers). A small number of large supercomputers are built each year for government research agencies, military defense systems, national weather forecasting agencies, large time-sharing networks, and major corporations.

The leading maker of supercomputers is Cray Research, along with NEC, Fugitsu, and a few others. These models can process hundreds of millions of instructions per second (MIPS). Expressed another way, they can perform arithmetic calculation at a speed of billions of floating-point operations per second (gigaflops). Teraflop (1 trillion floating - point operations per second) supercomputers, which use advanced massively parallel designs, are becoming available.

However, the use of supercomputers in industry is on the increase. Commercial sectors targeted for supercomputer sales are aerospace, oil and gas exploration and automobile manufacture. Chemical, semiconductor and bio-medical concerns are also expected to be in the forefront of industrial supercomputer use. In the 1990s supercomputers may also be purchased for large-scale transaction processing in business. People may begin to use them for financial analysis, stock portfolios, large inventory billing, and economic modeling.

A major drawback in supercomputer use is cost which places the machines beyond the budget range of most companies. However, the use of massively parallel processing (MPP) designs of thousands of interconnected microprocessors has spawned a breed of mini supercomputers with price less than supercomputers. Thus, supercomputer continues to advance the state of the art for the entire computer industry.

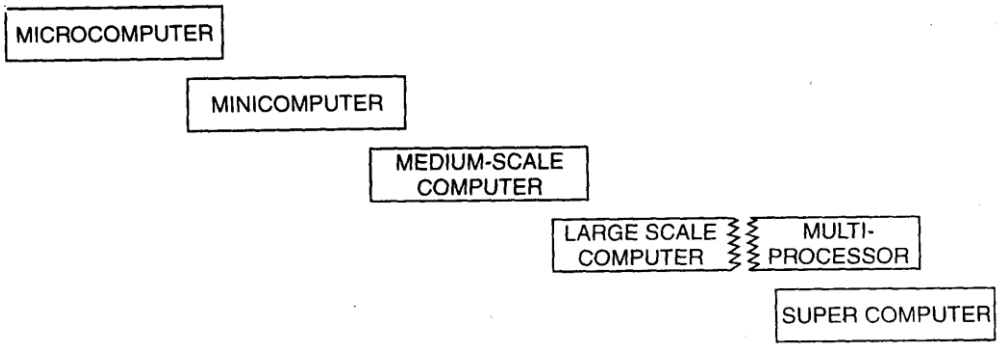


Fig 11 Relative Positions for Processing Power of Computer Systems

The classes of computers are approximate, and they overlap in various dimensions of speed, cost, etc.

2.6. INPUT/OUTPUT DEVICES

A computer is just a high-powered "Processing box" without peripherals.

PERIPHERALS are the generic name given to all input, output, and secondary storage devices that are part of computer system. All computers need peripheral devices to support the central processing unit (CPU), equipment to get data into and out of CPU, called input/output devices, and external storage devices to supplement the internal memory of the computer. In many systems, peripheral equipment represents a major share of hardware costs- as high as 90 per cent in some operations. Sometimes corporate managers participate in committees that select peripherals; sometimes they

Merely approve or (disapprove) acquisition requests. If installed in departments under r jurisdiction, managers also supervise peripheral use. All of these rules require an understanding of the capabilities and limitations of input/output and storage equipment. The major types of peripherals and media that can be part of a computer system are discussed in this chapter.

Input/Output Hardware Trends

There are many technologies for input and output at the user interface between computer systems and end users.

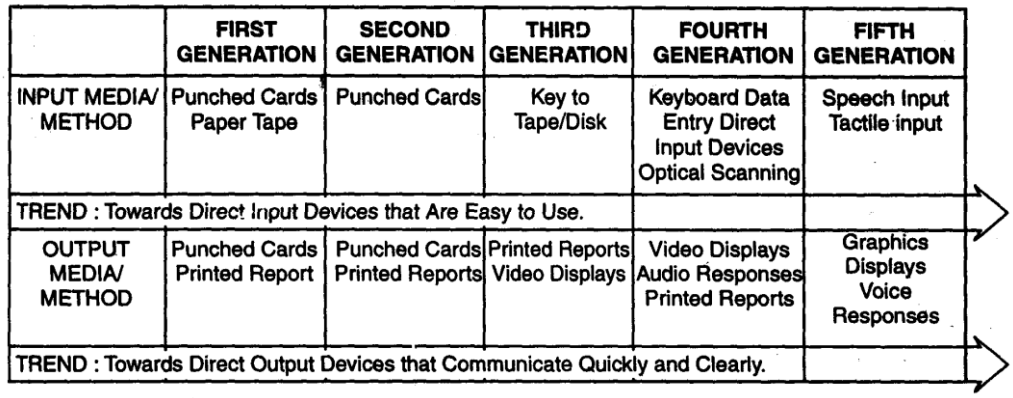


Fig. 11 Input/Output hardware trends

Fig. 11 shows you the major trends in input/output media and methods that have developed over four generations of computers and are expected to continue a future fifth generation.

Fig. 11 emphasizes that there is a major trend toward the increased use of a variety of direct input/output devices to provide a more natural user interface. More and more, data and instructions are entered into a computer system directly, through input devices such as keyboards, electronic mice, pens, touch screens, and optical scanning wands. These direct input/output devices drastically reduce the need for paper source documents and their conversion to machine-readable media. Direct output of information through video displays of text and graphics and voice response devices is increasingly becoming the dominant form of output for end users.

Computer Terminal Trends

The most common user interface method still involves a keyboard for entry of data and a video display screen for output to users. Computer terminals of various types are widely used for input and output. Technically, any input/output device connected by telecommunications links to a computer is called a terminal. However, most terminals use a keyboard for input and a TV like screen for visual output, and are called visual (or video) display terminals (VDTs) or CRT (Cathode ray tube) terminals. They allow keyed-in data to be displayed and edited before entry into a computer system.

There is a trend away from dumb terminals, which have no processing capabilities themselves toward intelligent terminals, which have their own microprocessors and memory circuits. Many intelligent terminals are really desktop or portable microcomputers used as telecommunications terminals to larger computers. Therefore, they can perform data entry and other information processing tasks independently. Another trend is the widespread use of transaction terminals in banks, retail stores, factories, and other work sites.

Examples are automated teller machines (ATMs), factory production recorders, and retail point-of-sale (POS) terminals. These terminals use a variety of input/output methods to capture data from end users during a transaction and transmit it over telecommunications networks to a computer system for processing.

INPUT DEVICES

Input equipment both records data in a form that is machine readable and channels the machine-readable code into the CPU for processing. When an off-line peripheral is used for the first step, a second piece of equipment is necessary to complete the input device to capture and enter data in one operation.

Off-line data capture:

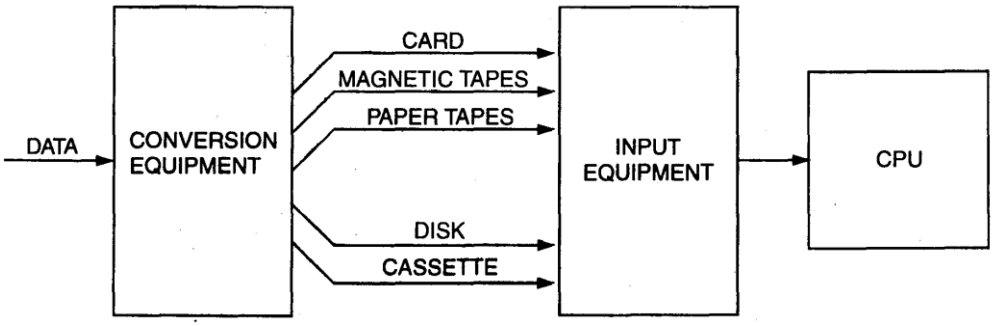


Fig. 12. INPUT CONVERSION TO MACHINE-READABLE FORM

Fig. 12 shows equipment that will change data into machine- readable code, called conversion equipment, and sample media for storing machine-readable data. In the early days of computing, cards with coded holes were used to represent data. These holes were punched by a device called a keypunch. Today, key-to-tape and key-to-disk devices that record data as magnetic spots on tape or disk are commonly used for off-line data capture. A second device, a magnetic tape reader or disk drive is subsequently used to sense the magnetic deposits, interpret the deposits as bits and input the data bits into the CPU.

On-line data entry: On-line data entry may be keyed on a terminal, optically scanned, entered by voice or drawn on a screen or data tablet.

Pointing devices

(a) Keyboard : Data can be entered on a terminal keyboard through key stroking (Pressing Keys). The Keyboard usually resembles that of a type-writer, although some key devices have push-buttons, such as the point-of-sale terminals found in many retail stores.

Many key terminals include a video screen resembling that of a television where input is displayed as it is entered. Such visual display

terminals (VDTs) allow the user to sight-check input before processing begins. When an input error is sighted, the user presses a key (or keys) on the keyboard to move a pointer (called a cursor) to the position on the screen where the mistake occurs. The correction (the addition, replacement or deletion of a character) is then keyed.

(b) The Computer Mouse: The electronic mouse is a pointing device used to move the cursor on the screen, as well as issue commands and make icon (pictures that identify processing choices) and menu selections. Some mice contain a roller ball that moves the cursor in the direction the ball is rolled. Other use an optical sensing technology that recognizes points on a special pad. By moving the mouse on a desktop or pad, you can move the cursor onto an icon displayed on the screen. Pressing a bottom on the mouse begins the activity represented by the icon selected.

How a mouse works: Mice are available in mechanical, optical, opt mechanical and wheel forms. Movement of the mouse by the user's hand generates signals that the CPU understands and translates into cursor movements. For example, a mechanical mouse has a ball in its base that turns pressure rollers connected to encoder disks, which signal the CPU which direction the cursor should move when the cursor is located in the desired position, the user signals this information by pressing one or more buttons on the mouse. An optical mouse uses a special pad with the reflective surface and grid lines to detect motion and transform it into cursor movement.

(c) Icons : Icons are small figures that look like familiar devices such as file folder (for accessing a file), a waste basket (for deleting a file), or scissors (for cut and paste operations), and so on. Using icons helps simplify computer use since they are easier to use with pointing devices than menus and other text-based displays.

Touch sensitive screens : Touch sensitive screens are devices that allow you to use a computer by touching the surface of its video display screen. Such screens emit a grid of infrared beams, sound waves, or a slight electric current that is broken when the screen is touched. The computer sense the point in the grid where the break occurs and responds with an appropriate action. With colorful graphics, sound, and simple menus, touch screens allow the user to make selections by touching specified parts of the screen. Touch screens are proliferating in retail stores, restaurants, shopping malls.

Pen-based Computing

End users can write or draw directly on a video screen or on other surfaces using a variety of pen like devices. One example is the light pen. This pen-shaped device uses photoelectric circuitry to enter data into the computer

through a video screen. A user can write on the video display because the light-sensitive pen enables the computer to calculate the coordinates of the points on the screen touched by the light pen. A graphics tablet is a form of digitizer that allows you to draw or write on its pressure-sensitive surface with a pen-shaped stylus. Your handwriting or drawing is digitized by the computer, accepted as input and displayed on its video screen.

Light pen and graphics pad technologies are being used in a new generation of pen-based personal computers and personal digital assistants (PDAs) that recognize handwriting. These notebook PCs and PDAs are portable tablet-style micro-computers that contain software that recognizes and digitizes handwriting, hand printing, and hand drawing. They have a pressure-sensitive layer like a graphics pad under their slate like liquid crystal display (LCD) screen. So instead of writing on a paper form fastened to a clipboard, inspectors, field engineers, and other mobile workers can use a pen to enter hand-written data directly into a computer.

Optical Characters Recognition (OCR) j

Optical scanning devices read text or graphics and convert them into digital input for a computer. They include optical character recognition (OCR) equipment that can read special purpose characters and codes into digital form. Optical scanning of pages of text and graphics is especially popular in desktop publishing applications. Thus, optical scanning provides a method of direct input of data from source documents into a computer system.

There are many types of optical readers, but they all employ photoelectric devices to scan the character being read. Reflected light patterns of the data are converted into electronic impulses that are then accepted as input into computer system. Devices can currently read many types of printing and graphics. Progress is continually being made in improving the reading ability of scanning equipment.

The credit card billing operations of credit card companies, banks, and oil companies use OCR-based optical scanning systems extensively. They also process utility bills, insurance premiums, airline tickets, and cash register machine tapes. OCR scanners can automatically sort mail, score tests, and process a wide variety of forms in business and government.

Optical scanning devices such as handheld wands read data on merchandise tags and other media. This frequently involves reading bar coding, a code that utilizes bars to represent characters. Thus, Universal Product Code (UPC) bar coding on packages of food items and other products has become common place. For example, the automated checkout scanners found in many supermarkets read UPC bar coding. Supermarket scanners emit laser beams

that are reflected off a UPC bar code. The reflected image is converted to electronic impulses that are sent to the in-store minicomputer, where they are matched with pricing information. Pricing information is returned to the terminal, visually displayed, and printed on a receipt.

Magnetic Ink Character Recognition (MICR)

The computer systems of the banking industry can magnetically read checks and deposit slips using magnetic ink character recognition (MICR) technology. Computers can thus sort, tabulate and post checks to the proper checking accounts. Such processing is possible because the identification numbers of the bank and the customer's account are preprinted on the bottom of the checks with an iron oxide-based ink. The first bank receiving a check after it has been written must encode the amount of the check in magnetic ink on the check's lower right-hand corner. The MICR system uses 14 characters (the 10 decimal digits and 4 special symbols) of a standardized design.

MICR character can be either preprinted on documents or encoded on documents using a keyboard-operated machine called a proof-inscriber. Equipment known as MICR reader-sorters read a check by first magnetizing the magnetic ink characters and then sensing the signal induced by each character as it passes a reading head. In this way, data are electronically captured by the computer system. The check is then sorted by directing it into one of the pockets of the reader-sorter. Reader-sorters can read more than 2400 checks per minute, with a data transfer rate of over 3000 characters per second. However, several larger banks have begun replacing MICR technology with optical scanning systems.

Another familiar form of magnetic data entry is the magnetic stripe technology that helps computers read credit cards. The dark magnetic stripe on the back of credit and debit cards is the same iron oxide coating as on magnetic tape. Customer account numbers can be recorded on the stripe so it can be read by bank ATMs, credit card authorization terminals, and other magnetic stripe readers.

Digital Scanners

These are input devices that translate images such as pictures or documents into digital form and are an essential component of image processing systems.

Sensors

Sensors are devices that collect data directly from the environment for input a computer system. For example, sensors are being used in General motors car with onboard computers and screens that display the map of the

surrounding area and the driver's route. Sensors in each wheel and magnetic compass information to the computer for determining the car's location. The South Coast Air quality Management District's system uses sensors in smokestacks to supply data for monitoring pollution emissions. The sensors continuously measure emissions and are linked to microcomputers at the site of each smokestack, which send the data are linked to microcomputers at the site of each smokestack, which send the data collected by the sensors to the district's central computer for analysis.

Voice Recognition and Response

Voice recognition and Voice response promise to be the easiest method of providing a user interface for data entry and conversational computing, since speech is the easiest, most natural means of human communication. Voice input and output of data have now become technologically and economically feasible for a variety of applications. A voice recognition capability can be added to a microcomputer by acquiring a voice recognition circuit board and software. The circuit board contains a digital signal processor (DSP) microprocessor and other circuitry for voice recognition processing, and a vocabulary in ROM ranging from several hundred to more than 30,000 words.

For example, personal dictation systems for word processing (including a circuit board and software) are now available.

Voice recognition systems analyze and classify speech or vocal tract patterns and convert them into digital codes for entry into a computer system. Most voice recognition systems require training the computer to recognize a limited vocabulary of standard words for each user operators train the system to recognize their voices by repeating each word in the vocabulary about 10 times. Trained systems regularly achieve a 99 percent plus word recognition rate. Speaker-Independent Voice recognition systems, which allow a computer to understand a voice it has never heard before, are used in a limited number of applications.

Voice recognition devices in work situations allow operators to perform data entry without using their hands to key in data or instructions and to provide faster and more accurate input. For example, manufacturers use voice recognition systems for the inspection, inventory, and quality control of a variety of products ; and airlines and parcels delivery companies use them for voice-directed sorting of baggage and parcels. Voice recognition is also available for software packages like spreadsheets and database managers for voice input of data and commands. In addition, voice input for word processing is becoming a popular application of voice recognition technology.

Voice response devices range from mainframe audio-response units to voice-messaging minicomputers to speech synthesizer microprocessors. Speech microprocessors can be found in toys, calculators, appliances, automobiles, and a variety of other consumer, commercial and industrial products.

Voice-messaging minicomputer and mainframe audio-response units use voice-response software to verbally guide an operator through the steps of a task in many kinds of activities. They may also allow computers to respond to verbal and Touch-Tone input over the telephone. Examples of applications include computerized telephone call switching, telemarketing surveys, bank pay-by- phone bill-paying services, stock quotations services, university registration systems, and customer credit and account balance inquiries.

Output devices

Computer output is information that has been processed by a computer.

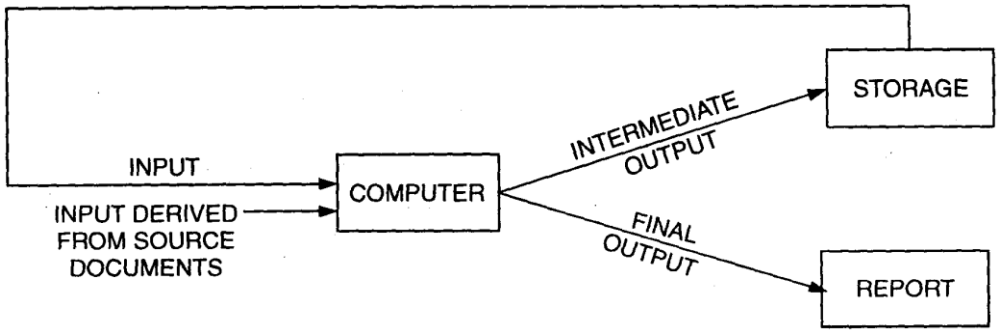


Fig. 3 Intermediate and Final Output

As Figure 13 shows, this processed information may be either intermediate output (output that is stored and used as input for later processing) or final output delivered to users. Output devices are pieces of equipment that provide for this storage or delivery. Output devices may be on or off-line depending on whether they are under the control of the CPU or not.

Final Output is delivered to the user whereas intermediate output is stored. A monthly report of sales processed by computer and delivered to management is an example of final output. The result of processing inventory records to incorporate recent sales data is an example of intermediate output since these records must be placed in storage for subsequent updating. Tape or disk can be used for both intermediate and final output.

Printers

Printed output is the most common form of visual output for the user interface. Most computer systems use printers to produce permanent (hard copy) output in human-readable form. End users need printed output if they want to take copies of output away from the computer to share with others.

Hard copy output is also frequently needed for legal documentation. Thus, computers can usually produce printed reports and documents, such as sales invoices, payroll checks and bank statements, as well as hard copy of graphics displays.

There are two categories of printers

(1) Impact printer

(2) Non impact printer

(1) Impact printers: Many printers are impact printers. Impact printers produce hard-copy output by pressing print elements against paper when the printer is activated by signals from the CPU. Imp act printing may use either formed or don't matrix characters.

(a) A daisy-wheel printer: It has formed characters at the tips of spokes of a wheel that spins the characters into position for impact with the paper. Daisy wheel printers are a popular choice for high-quality print requirements (e.g., correspondence to customers) but they cannot print graphics and they work at a fairly slow speed. Other kinds of impact printers place character sets on a revolving chain or in rows on a metal drum.

(b) Dot matrix printer: Another impact printer selects specific pins within a matrix and then hammers the pins against a ribbon. Since such printers can arrange dots in a vast array of patterns, they can produce graphics as well as text and numbers. Many dots printed close together form dark lines and shaded areas when a graphic image is printed, whereas dots more widely spaced are used in the lighter areas of the image. Dot-matrix Printers are faster than formed-character printers, less expensive and known for their durability and reliability. Until recently, their weakness has been an inability to produce letter-quality print. But new dot-matrix technology incorporates more and finer print wires in the print head (24 pins), creating more precise and detailed characters, improving the quality of the print as a result.

(c) Thermal Printers: They either melt an image onto paper with precision heating elements or heat print heads to burn an image directly onto paper. Their biggest drawback is that some of these printers require special heat-sensitive paper that is expensive.

(2) Non-Impact printers: They are quieter than impact printers, since the sound of printing element striking paper is eliminated. However, they do not produce multiple copies like impact printers.

Non impact printers use a variety of techniques to print hard copy, but r touches the print elements to the paper and all bring peace and quiet to the office. Non-impact printer further consists of four types.

(a) Electrostatic printers: It sends an electrical charge through the pins in a dot matrix. The paper is then passed through a toner containing ink particles the opposite charge. These stick to the paper in the charged areas to create the desired image.

(b) Xerographic printers: It uses processes similar to photocopying.

(c) Ink-jet printers: It produces hard copy by controlling ink drops with an electric charge or by shooting ink from nozzles contained in the print head.

(d) Laser printers: It uses a laser beam to trace characters or images on the photo conducting drum of a photocopier mechanism where the pattern picks up toner particles for transfer to paper. Its disadvantage could be higher cost for a good laser printer.

(d) Laser printers: It uses a laser beam to trace characters or images on the photo conducting drum of a photocopier mechanism where the pattern picks up toner particles for transfer to paper. Its disadvantage could be higher cost for a good laser printer.

Video display terminal (VDT)

The major data output devices are video display terminals or VDTs also called cathode ray tube (CRT).

Video displays are the most popular form of information output in modern computer system. It works much like a television picture tube, with an electronic “gun” shooting a beam of electrons to illuminate the pixels on the screen. The more pixels per screen, the higher the resolution. Usually the clarity of the display and the support of monochrome or color displays depend on the type of video monitor used and the graphics circuit board, or video adapter, installed in the microcomputer. These can provide a variety of graphics modes of increasing capability. A high level of clarity is especially important to support the more complex graphical displays of many current software packages. These packages provide a graphical user interface (GUI), which uses icons and a variety of screen images and typically splits the screen into multiple window displays.

Liquid crystal displays (LCDs), such as those used in electronic calculators and watches, are also being used to display computer output. Their biggest use is to provide a visual display capability for portable microcomputers and terminals. Advances in technology have improved the clarity of such displays that were formerly hard to see in bright sunlight and artificial light. LCD displays need significantly less electric current and provide a thin, flat display. Full-color LCD displays are now available.

Plasma display devices have replaced CRT devices in a limited number of applications where a flat display is needed. Plasma displays are generated by electrically charged particles of gas (Plasma) trapped between glass plates. Plasma display units are significantly more expensive than CRT and LCD units. However, they use less power, provide faster display speeds, and produce clearer displays that are easier to see from any angle and in any lighting conditions.

Storage Trends

Data and information need to be stored after input, during processing, and before output. Even today, many organizations still rely on paper documents stored in filing cabinets as a major form of storage media. However, computer-based information systems rely primarily on the memory circuits and secondary storage devices of computer systems to accomplish the storage function. Fig. 14. Illustrates major trends in primary and secondary storage.

	FIRST GENERATION	SECOND GENERATION	THIRD GENERATION	FOURTH GENERATION	FIFTH GENERATION
PRIMARY STORAGE	Magnetic Drum	Magnetic Core	Magnetic Core	LSI Semiconductor Memory	VLSI Semiconductor Memory
TREND : Towards Large Capacities Using Smaller Microelectronic Circuits.					
SECONDARY STORAGE	Magnetic Tape Magnetic Drum	Magnetic Tape Magnetic Disk	Magnetic Disk Magnetic Tape	Magnetic Disk Optical Disk	Optical disk Magnetic Disk
TREND : Towards Massive Capacities Using Magnetic and Optical Media.					

Fig.14. Major trends in primary and secondary storage methods

Continued developments in very-large-scale integration (VLSI), which packs millions of electronic circuit elements on tiny semiconductor memory chips, are responsible for a significant increase in the main memory capacity of computers. Secondary storage capacities are also expected to escalades into the billions and trillions of characters, due primarily to use of optical media.

There are many types of storage media and devices. Fig. 6.5 illustrates the speed, capacity, and cost relationships of several alternative primary and secondary storage media.

Note the Lost/speed/capacity trade offs as or4 moves from semiconductor memories to magnetic media, such as magnetic disks and tapes, to optical disks. High-speed storage media cost more per byte a id provide lower capacities. Large-capacity storage media cost less per byte but are slower. This is why we have different kinds of storage media.

Note in Fig. 15 that semiconductor memories are used mainly for primary storage, though they are finding increasing use as high- speed secondary storage devices. Magnetic disk and tape and optical disk devices, on the other hand, are used as secondary storage devices to greatly enlarge the storage capacity of computer systems. Also, since most primary storage circuits use RAM (random access memory) chips, which lose their contents when electrical power is interrupted, secondary storage devices provide a more permanent type of storage media for storage of data and programs.

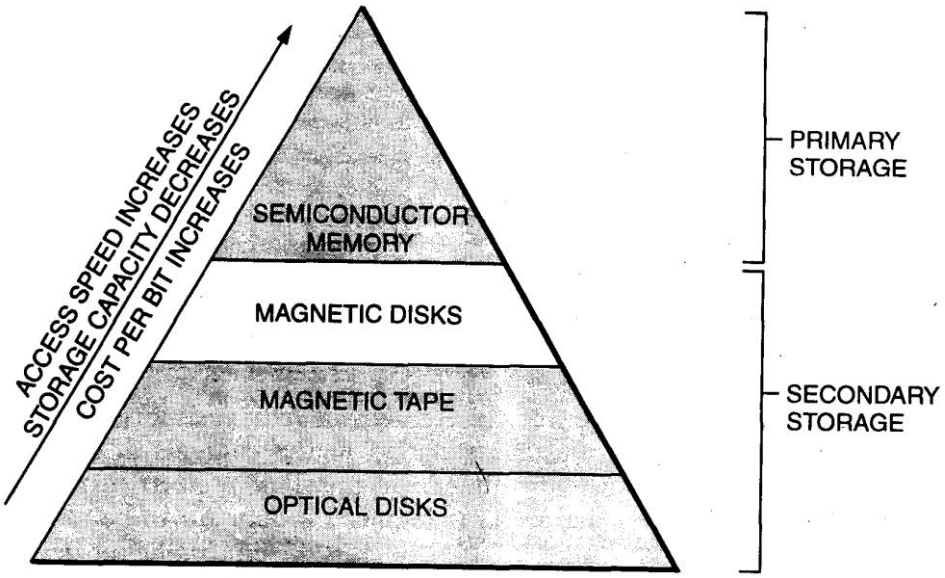


Fig. 15. Store media cost, speed and capacity trade-offs

Direct and Sequential Access

Primary storage media such as semiconductor memory chips are called direct access or random access memories (RAM). Magnetic disk devices are frequently called direct access storage devices (DASDs). On the other hand, media such as magnetic tapes are known as sequential access devices.

The terms direct access and random access describe the same concept. They mean that an element of data or instructions (such as a byte or word) can be directly stored and retrieved by selecting and using any of the locations on the storage media. They also mean that each storage position (1) has a unique address and (2) can be individually accessed in approximately the same length of time without having to search through other storage positions. For example, each memory cell on a microelectronic semiconductor RAM chip can be individually sensed or changed in the same length of time. Also any data record stored on a magnetic or optical disk can be accessed directly in approximately the same time period. See fig. 16.

The primary storage (main memory) of most modern computers consists of microelectronic semiconductor memory circuits. Memory chips with capacities of 256 K bits, 1 million bits, 4 megabits and 16 megabits are now used in many computers.

Some of major attractions of semiconductor memory are small size, great speed, shock and temperature resistance, and low cost due to mass production capabilities.

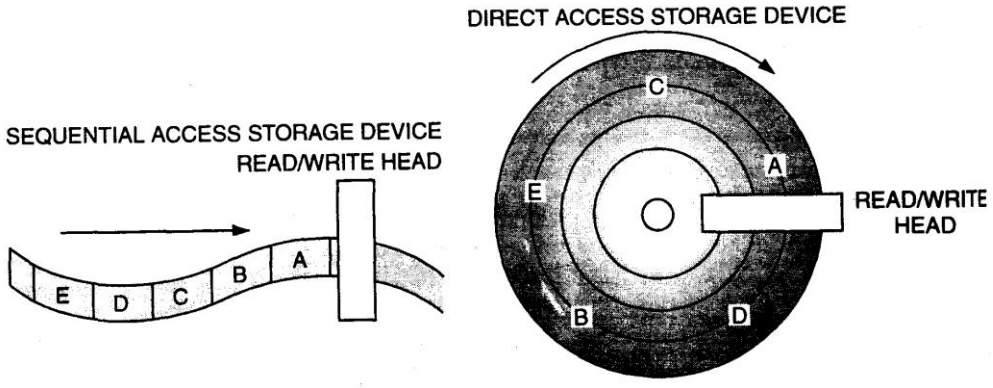


Fig. 16. Sequential Versus direct access storage.

One major disadvantage of most semiconductor memory is its volatility. Uninterrupted electric power must be supplied or the contents of memory will be lost. Therefore, emergency transfer to other devices or standby electrical power (through battery packs or emergency generators) is required if data are to be saved. Another alternative is to permanently "burn in" the contents of semiconductor devices so that they cannot be erased by loss of power.

There are two types of semiconductor memory

(1) Random access memory (RAM) : These memory chips are the most widely used primary storage medium. Each memory position can be both sensed (read) and changed (written), so it is also called read/write memory. This is a volatile memory.

(2) Read only memory (ROM) : Non volatile random access memory chips are used for permanent storage. ROM can be read but tot erased or overwritten. Frequently used control instructions in the control unit programs in primary storage (such as parts of the operating system) can be permanently burned in to the storage cells during manufacture. This, is sometimes called firmware.

Semiconductor Secondary Storages

Semiconductor memory chips serve as direct access primary and secondary storage media for both large and small computers. Plug- in memory circuit boards containing up to several megabytes of semiconductor memory

chips (RAM cards) can be added to a microcomputer to increase its memo y capacity. These provide additional primary storage, but they can also be used for secondary storage. A computer's operating system program can be instructed to treat part RAM as if another disk drive has been added to the system. This provides a very ugh-speed semiconductor secondary storage capability sometimes called a RAM disk Semiconductor secondary storage devices also include removable credit-card-size "flash memory" RAM cards. They provide up to 40 megabyte of erasable direct access storage for some notebook or handheld PCs. Peripheral devices consisting of semiconductor memory chips are also marketed as high-speed alternatives to magnetic disk units for mainframe computers.

Magnetic Disk storage

Magnetic disks are the most common form of secondary storage for modern computer systems. They provide fast access and high storage capacities at a reasonable cost.

Magnetic disks are thin metal or plastic disks that are coated on both sides with an iron oxide recording material. Several disks may be mounted together in a vertical cylinder on a vertical shaft, which typically rotates the disks at speeds of 2,400 to 3,600 revolutions per minute (rpm). Electromagnetic read/write heads are positioned by access arms between the slightly separated disks to read and write data on concentric, circular tracks. Data are recorded on tracks in the form of tiny magnetized spots to form binary digits arranged in serial order in common computer codes. Thousands of bytes can be recorded on each track, and there are several hundred data tracks on each disk surface, each of which is subdivided into a number of sectors. See Fig. 17.

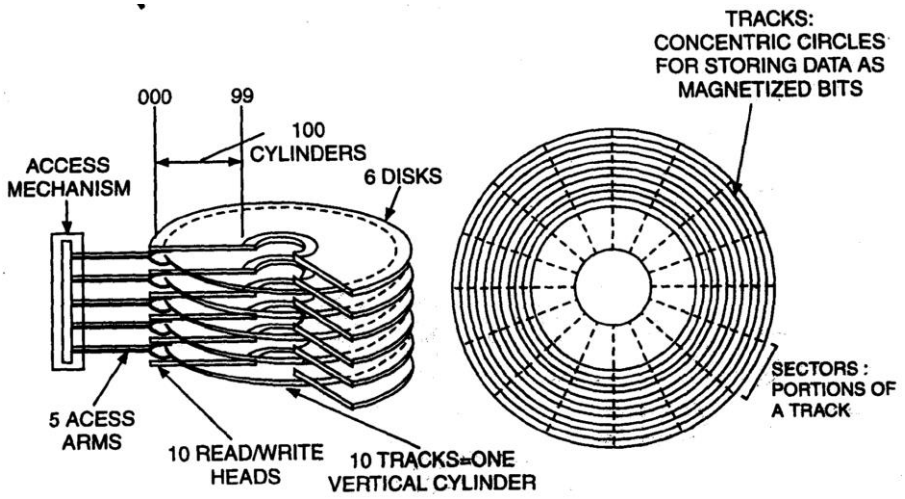


Fig. 17. Characteristics of magnetic disks.

Types of magnetic Disks:

There are several types of magnetic disk arrangements, including removable disk packs and cartridges as well as fixed disk units. The removable disk devices are popular because they can be used interchangeably in magnetic disk units and stored offline for convenience and security when not in use.

(a) Floppy disks or magnetic diskettes are disks that consist of polyester film covered with an iron oxide compound. A single disk is mounted and rotates freely inside a protective flexible or hard plastic jacket, which has access openings to accommodate the read/write head of a disk drive unit. The 3½ inch floppy disk, with capacities of 720 Kilobytes and 1.44 or 2.8 megabytes, has rapidly replaced most of the older 5¼ inch size,

(b) Hard disk drives combine magnetic disks, access arms, and read/write heads into a sealed module. This allows higher speeds, greater data-recording densities and closer tolerances within a sealed, more stable environment. Fixed or removable disk cartridge versions are also available. Capacities of hard drives typically range from 120 megabytes to several gigabytes of storage.

(c) RAID Disk arrays of interconnected microcomputer hard disk drives are challenging large-capacity mainframe disk drives to provide many gigabytes of online storage. Known as RAID (redundant arrays of independent disks), they combine from 6 to more than 100 small hard disk drives and their control microprocessors into a single unit. RAID units provide large capacities with high access speeds since data are accessed in parallel over multiple paths from many disks. RAID units also provide a fault tolerant capability, since their redundant design offers multiple copies of data on several disks. If one disk fails, data can be recovered from backup copies automatically stored on other disks.

Magnetic Tape

It is another widely used secondary storage medium. The read/write heads of magnetic tape drives record data in the form of magnetized spots on the iron oxide coating of the plastic tape. Magnetic tape usually has horizontal tracks to accommodate recording bits into common computer codes. Blank spaces, known as gaps, separate individual data records and blocks of grouped records. These gaps allow for such mechanical operations as the start/stop time of a magnetic tape unit. Most devices group records into blocks to conserve storage space instead of leaving gaps between each record.

Magnetic tape comes in the form of tape reels and cartridges for mainframes and minicomputers, and small cassettes or cartridges for microcomputers. Mainframe magnetic cartridge are replacing tape reels and can

hold over 200 megabytes. Small cartridges can store more than 100 megabytes and are a popular means of providing backup capabilities for microcomputer hard disk drives.

Optical Disks

Optical disks are a fast-growing storage medium. Mainframe and midsize computer versions use 12-inch plastic disks with capacities of several gigabytes, with up to 20 disks held in "Jukebox" drive units. The version for use with microcomputers is called CD-ROM (Compact disk-read only memory). CD-ROM technology uses 12-cm (4.7 inch) compact disks (CDs) similar to those used in stereo music systems, and CD-ROM drives for microcomputer systems. Each disk can store more than 600 megabytes. That's the equivalent of over 400 1.44 megabyte floppy disks or more than 300,000 double-spaced pages of text. A laser records data by burning permanent microscopic pits in a spiral track on a master disk from which compact disks can be mass produced. Then CD-ROM disk drives use a laser device to read the binary codes formed by those pits.

Other optical disk technologies produce WORM (Write once, read many) and CD-R (Compact disk-recordable) disks. This allows computers with the proper optical disk drive units to record their own data once on a optical disk, then be able to read it indefinitely.

The major limitation of CD-ROM, CD-R, and WORM disks is that recorded data cannot be erased. However erasable optical disk systems have now become available. This technology records and erases data by using a laser to heat a microscopic point of the disk's surface. In some versions, a magnetic coil changes the spot's reflective properties from one direction to another, thus recording a binary one or zero. A laser device can then read the binary codes on the disk by sensing the direction of reflected light.

One of the major uses of optical disks in mainframe and midrange systems is in image processing, where long term archival storage of historical files of document images must be maintained. Financial institutions, among others, are using optical scanners to capture digitized document images and store them on WORM optical disks as an alternative to microfilm media. One of the major uses of CD-ROM disks is to provide companies with fast access to reference materials in a convenient, compact form. This includes catalogs, directories, manuals, periodical abstracts, part listings, and statistical databases of business and economic activity.

Interactive multimedia applications in business, education and entertainment are another major use of CD-ROM disks. Multimedia is the use of a variety of media, including text and graphics displays, voice, music, and

other audio, photographs, animation, and video segments. Multimedia has large storage requirements. For example, it takes one megabyte for a color picture, 2.4 megabytes for a four-minute song, and over 1 gigabyte for a minute of full motion video, though this can be reduced by video compression technologies. Thus, the large storage capacities of CD-ROM are a natural choice for computer video games, educational videos, multimedia encyclopedias, and advertising presentation.

Optical disks have emerged as a popular storage medium for image processing and multimedia applications and they appear to be a promising alternative to magnetic disks and tape for very large (mass) storage capabilities for enterprise and end user computing systems. However, erasable optical technologies are still being perfected. Also, optical disk devices are significantly slower and more expensive (per byte of storage) than magnetic disk devices. So optical disk systems are not expected to displace magnetic disk technology in the near future.

Fig. 18 A summary of important Input/output methods.

Peripheral Equipment	Media	Primary Functions	Major Advantages and/or Disadvantages
Video display terminals	None	Keyboard input and video output	Conventional and inexpensive, but limited display capacity and no hard copy
Printers	Paper	Printed output of paper reports and documents	Hard copy, but inconvenient and bulky ; many printers are relatively slow
Pointing devices	None	Input by mouse, trackball, pointing stick, pen, touch screen, and graphics pad. Video output.	Input devices are easy to use and inexpensive, but may have limited applications and software support
Voice input/output devices	None	Voice input and output	Easiest I/O but is slow, has limited vocabulary, and has accuracy problems
Optical scanners	Paper documents	Direct input from written or printed documents	Direct input from paper documents, but some limitations on input format
Magnetic ink character recognition (MICR) readers	MICR-paper documents	Direct input of MICR documents	Fast, high-reliability reading, but documents must be preprinted and the character set is limited

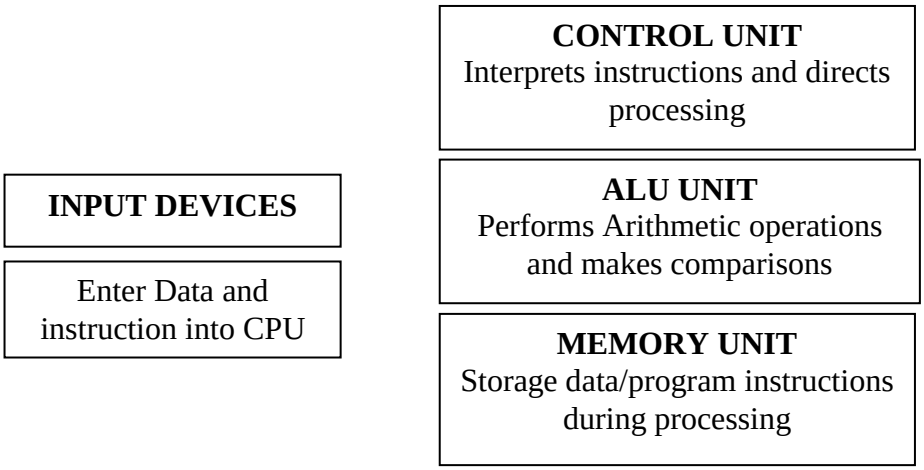
2.7. HARDWARE, SOFTWARE AND OTHER DEVICES IN A COMPUTER SYSTEM

HARDWARE

The physical components of the computer, such as electrical, electronic and mechanical units are known as the hardware of the computer. That is, the input units, output units and CPU are called hardware. Thus hardware is the equipment involved in the function of a computer. It consists of the components that can be physically handled.

The function of these components is typically divided into three main categories connect to microprocessors, specifically, the computer's central processing unit (CPU), the electronic circuitry that provides the computational ability and control of the computer , via wires or circuitry called a bus.

HARDWARE



Function	Types of Equipments Used
Data Preparation	Key driven data entry machines, Key-driven data verifier Paper tape punch Magnetic tape encoder Magnetic ink inscriber Optical Character inscriber Data collection devices with keyboard Plastic card sensor, etc. to transcriber On to some machine –readable medium Devices to prepare of another operation

	Conversion devices, such as floppy disk To Magnetic taper converter.
Input	Magnetic tape unit Paper tape reader Magnetic ink-character reader Optical scanner Floppy disk drives Keyboard Terminals Modem Microphone Light pen Mouse Joystick
Computation, control and primary storage	Central processing unit (CPU)
Secondary storage	Magnetic tape Magnetic disk Floppy disks Magnetic drum Magnetic card or strip
Output	Printer Paper tape punch Floppy disks Terminals Graph plotter. Micro film (COM)

Hardware Connection

To function, hardware requires physical connections that allow components to communicate and interact. A computer bus consists of two channels one that CPU uses locate data, called the address bus and other one data bus.

A serial connection is a wire or set of wires used to transfer information from the CPU to an external device such as a mouse, keyboard, modem, scanner, and some types of printers. This type of connection transfers only one piece of data at a time. The advantages to using a serial connection are that it

provides effective connection over long distances.

Input Devices

An input device lets you communicate with a computer. You can use input devices to enter information and issue commands. A keyboard, mouse, scanner, digital camera, touch pads and joystick are examples of input devices. Some Common Computer Input Devices:

Keyboard

Used to type data into the computer Most common input device today Has special keys for giving the computer commands tell the computer to do something, like save the file. These special keys are called command or function keys

Pointing Devices

Pointing devices move some object on the screen and can do some action Common pointing devices. Mouse - most common pointing device

Track ball - basically an upside down mouse

Joystick

Game controller

Scanner

A scanner allows you to scan documents, pictures, or graphics and view them on the computer. You can also use software to edit the items you scan. Used to put printed pictures and text into a computer Converts an image into dots that the computer can understand. To scan text, optical character recognition (OCR) software is needed

Microphone

Used to put sound into a computer, need sound recording software

CD-ROM/DVD-ROM

Can be used to put both sound and images into a computer. Use a laser to read a Compact Disk (CD) or a DVD disk.

Video Capture Card

Usually place inside the computer's case Use to put video into a computer Need a video source, either a video camera or video recorder

Output Devices

An output device displays information on a screen, creates printed copies or generates sound. A monitor, printer, and speakers are examples of output devices.

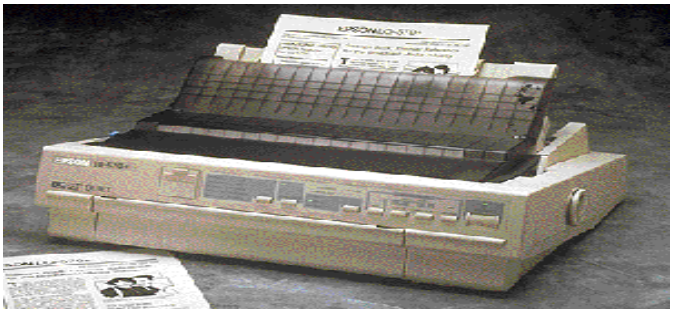
Some Common Output Devices

Monitors and Displays

Shows the processed information on a screen A monitor uses a Picture Tube like a television with the image displayed on the front of the tube, which is called the screen. Displays are flat and use plasma, LCD, active-matrix, or some other technology. Monitors used to be called Cathode Ray Tubes (CRTs) because of the picture tube, which is a large vacuum tube. A monitor or display produces a soft copy. When the device is turned off the information goes away. Monitors are slowly being replaced by flat panel displays.

Printers

Printers produce a hard copy The information is printed on paper and can be used when the device is off. It is also called printout Dot-matrix printers (impact printer) Uses metal pins to strike an inked ribbon to make dots on a piece of paper. Can see the dots that make up the letters or images. Lowest print quality of all of the printers. Very low in cost per page to use. Rarely used today because of the poor print quality, but still used in business to print multi-part forms.



Ink jet printers (non-impact printer)

Use drops of magnetic ink to produce dots on a page to produce text or images. The print quality is almost the same as laser printers. Problems with the ink The ink is very expensive The ink is water soluble and will run if the paper gets wet Highest cost per page of all the printers For producing color documents, it has the highest quality at a reasonable price. Laser printers (non-impact printer)

Speakers

Used to output sound

NOTES

UNIT – III

3.1. System classifications
3.2. Concepts Characteristics
3.3. Elements
3.4. Feedback Control
3.5. Implementation
3.6. System Design
3.7. Functions of System analyst
3.8. Evaluation and maintenance of MIS.

3.1. SYSTEMS CLASSIFICATION

System analysis may be understood as a process of collecting and interpreting facts, identifying problems and using the information to recommend improvements in the system. In other words, system analysis means identification, understanding and examining the system for achieving pre-determined goals/objectives of the system. System analysis is carried out with the following two objectives.

(i) To know how a system currently operates, and

(ii) To identify the users' requirements in the proposed system.

Basically, system analysis is a detailed study of all important business aspects under consideration and the existing system, and thus, the study becomes a basis for the proposed system (may be a modified or an altogether new system). System analysis is regarded as a logical process. The emphasis in this phase, is on investigation to know how the system is currently operating and to determine what must be done to solve the problem.

The system analysis phase is very important in the total development efforts of a system. The user may be aware of the problem but may not know how to solve it. During system analysis, the developer (system designer) works with the user to develop a logical model of the system. A system analyst, because of his technical background, may move too quickly to program design to make the system prematurely physical, which is not desirable and may affect the ultimate success of the system. In order to avoid this, the system analyst must involve the user at this stage to get complete information about the system. This can be achieved if a logical model of the system is developed on the basis of a detailed study. Such a study (analysis) should be done by using various modern tools and techniques, such as data flow diagrams, data dictionary and rough descriptions of the relevant algorithms. The final product of the system analysis is a set of system requirements of a proposed information system. The following pages will discuss determination of system requirements and system analysis tools.

3.2. CONCEPTS CHARACTERISTICS

Structured analysis tools help the system analyst to document the system specification of a system to be built. The main tools which are used for the purpose are given below.

(i) Data Flow Diagram (DFD)

(ii) Data Dictionary

(iii) Structured English

(iv) Decision Trees

(v) Decision Tables

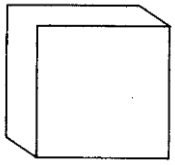
Data Flow Diagram (DFD)

Data Flow Diagram (DFD) is a graphical representation of the logical flow of data. It helps in expressing the system's requirements in a simple and understandable form.

It is also known as a bubble chart. Its aim is to clarify the system requirements and identify major transformations that will become programs in system design. It decomposes the requirement specifications down to the lowest level of details.

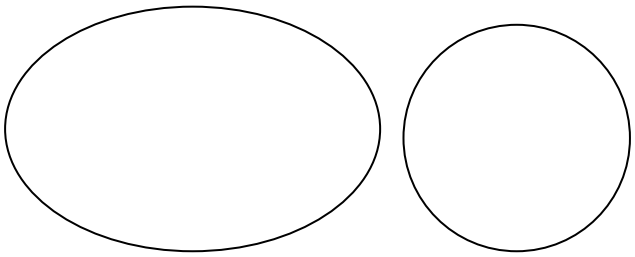
A DFD consists of a series of bubbles joined by lines representing data flow in the system. There are four main symbols used in a DFD, which are depicted below.

(i) Square: It represents source/destination of system data.



(ii) Arrow: It identifies data flow; it is a pipeline through which the data flows.

(iii) Circle/Bubble: It represents a process that transforms incoming data flow into outgoing data flow. A process can be represented by a circle or an oval bubble.



(iv) Open Rectangle: It represents a data store.

A number of rules are to be followed in drawing a DFD:

(i) Processes should be named and numbered. Name should represent the process.

(ii) The direction of flow is from top to bottom and from left to right.

(iii) 'When a process is exploded into lower levels, they are numbered properly, e.g. the process obtained from the explosion of process number 5, should be numbered as 5.1, 5.2, etc.

(iv) The name of data stores, sources and destinations are written in capital letters. Process and data flow names have the first letter capitalised.

A DFD should have no more than 10-12 processes, as having even 12 will make a DFD complex and difficult to understand.

A DFD shows the minimum contents of a data store. Each data store should contain all the elements that flow in and out of it.

DFD is very effective, when the required design is not clear and the user and the analyst require some symbolic representation for communication.

The main disadvantage of a DFD is that a large number of iterations are often required to arrive at an accurate and complete solution.

For example, consider the case of a payroll system to prepare salary statements for each employee of an organisation. Data flow for such a system can be represented, as shown in Fig.31.

Employees data originate from accounts departments (source), gets processed, salary statements are received by employees (sink) and updated data on employees (e.g. total tax deducted, provident fund contribution, etc.) is stored in an intermediate file (data store), which is required for processing in the subsequent months.

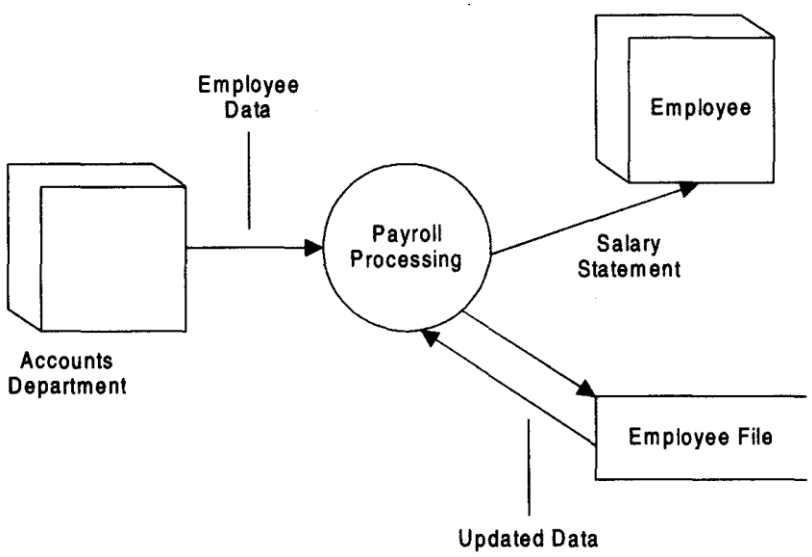


Fig. 31 A DFD for Payroll Processing: Macro View

A DFD displays data flow in a top-down approach. To draw a DFD, start with a macro DFD and then explode it into micro DFDs. Figure 32 illustrates the method.

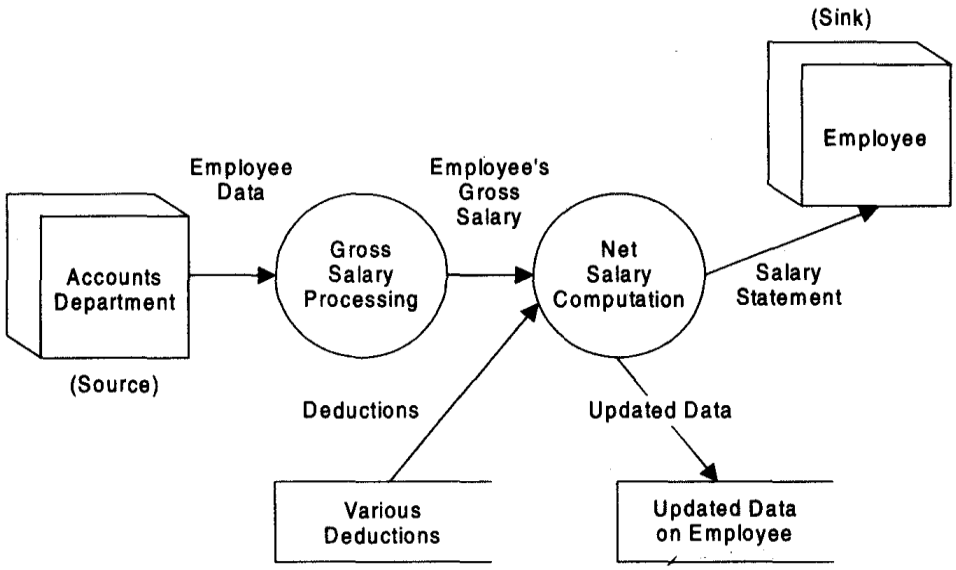


Fig. 32 A DFD for Payroll Processing: Exploded View

While exploding a DFD into lower levels, continuity and linkage is maintained between a DFD and its member DFDs. This is achieved by numbering each circle (processing step) by adopting the numbering system, e.g. 1, 2, 3,. . ., each further numbered as 1.1, 1.2, 1.3, . . ., and still further numbered as 1.1.1, 1.1.2, . . . Figure 11.3 illustrates the point.

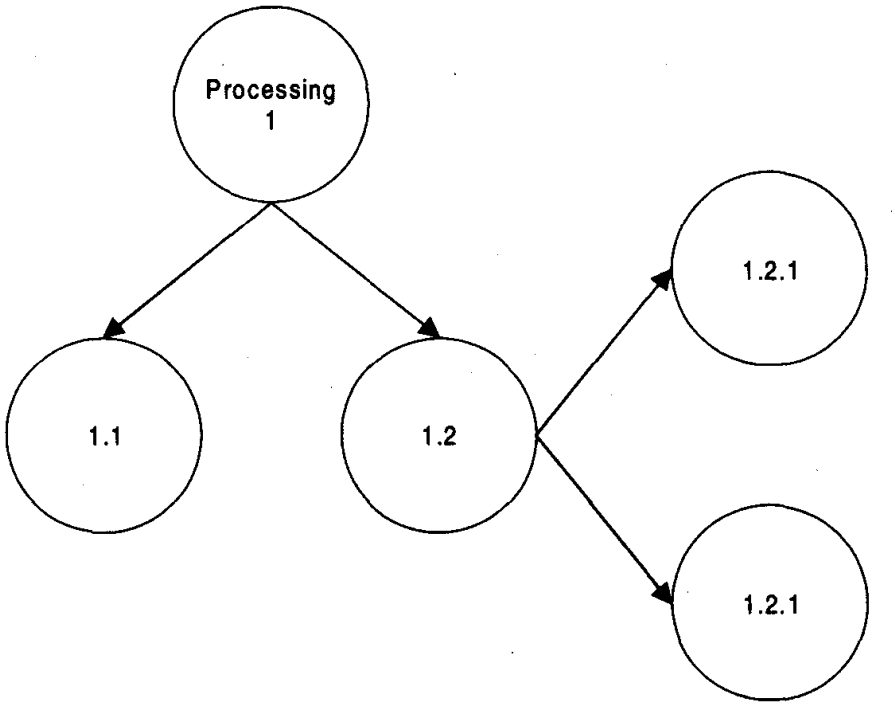


Fig. 33 Explosion of a DFD

Data Dictionary

A data dictionary is a structured repository of data, about data. In other words, it is a set of precise and accurate definitions of all DFDs, data elements and data structures.

It supports documentation in a better way. It also improves communication between the user and analyst as it provides precise and consistent definitions for various data elements, terms and procedures. It can also serve as a common database for programmers and can also be used for control purposes. Most databases have data dictionary as a desirable feature.

There are mainly three items of data present in a data dictionary.

(i) Data Element: It is the smallest unit of data and cannot be decomposed further.

(ii) Data Structures: It is a group of data elements handled as a unit. A data structure contains a number of data elements as its fields.

(iii) Data Flows and Data Stores: Data flows are nothing but data structures in motion, whereas data stores are data structures at rest. In other words, data stores are locations where data structures are temporarily stored, Data dictionary is an integral part of the structured specifications.

The following rules are followed in constructing a data dictionary.

(i) The terms used to describe data structures are always in capital letters.

(ii) Multiple word names are hyphenated.

(iii) Assigned names should be straightforward and user-oriented.

(iv) There should be names for every data flow, data store, data structure and data element.

(v) Consistency checks should be performed.

(vi) Identification numbers of the processes and their names should be mentioned in the data dictionary.

(vii) Aliases must be discouraged.

Various symbols, which are used in the data dictionary are explained in following Table.

Symbols Used in Data Dictionary

Symbol	*Meaning*
=	is equivalent to
+	add
[Option 1 Option 2 : :]	only one of the options is used at a given time.
max {Component}	Iteration of the component min = lowest possible number of iterations. max = highest possible number of iterations.
min (COMPONENT)	Component is an optional one.
Comment	Words within asterisks are comments.

An Example:

VENDOR – INVOICE

= INVOICE-NUMBER + VENDOR-NAME + TOTAL-INVOICE-AMOUNT + INVOICE-DUE-DATE+(SHIPPING-DATA)

30

(ITEM-DETAIL-LINE)

1

One extra copy may be kept

Data dictionary and DFD are correlated and data should be present in a specification. However, a DD does not provide functional details and thus is not very acceptable among non-technical users.

Decision Tree and Structured English

The logic of the process, which may not be very clear through DD, can easily be represented using a graphic representation, which looks like the branches of a tree, called decision tree. A decision tree has as many branches as there are logical alternatives. It is easy to construct, read and update. For example, a policy can be shown through a decision tree (see Fig. 33)

The example illustrates the following discount policy.

Computer dealers get a trade discount of 35 per cent if the order size is 6 or more PCs, whereas for orders from educational institutions and individuals, 15 per cent discount is allowed on orders of 6—19 PCs, per PC type; 20 per cent on orders for 20—49 PCs; 30 per cent on orders for 50 PCs or more, per PC type.

Alternatively, the logic can be represented by using Structured English. It uses logical construction and imperative sentences designed to carry out

instructions for actions. Decisions are made through IF-THEN-ELSE statements.

Structured English can be made compact by using terms defined in the data dictionary. However, its sentences should be clear, concise and precise in wording and meaning. For example, the process ORDER may have the data element ORDER-SIZE, which defines the following values.

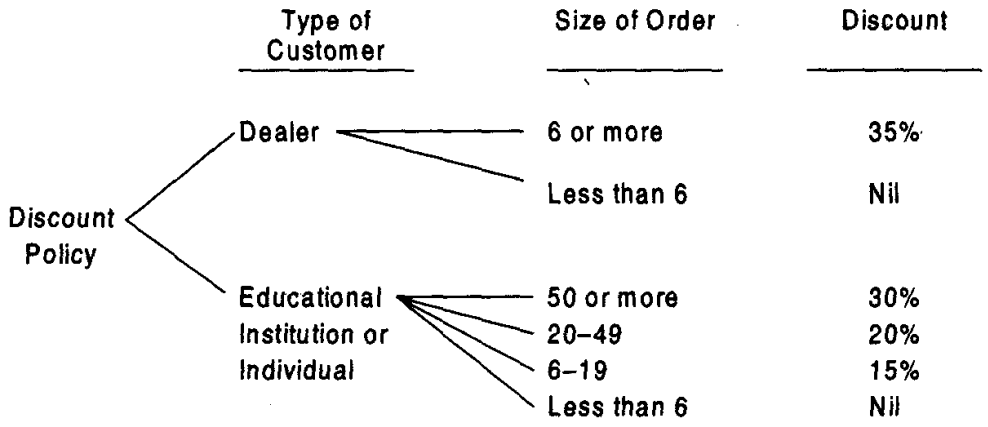


Fig. 34 A Decision Tree - An Example

MINIMUM: S or less Personal Computers, per PC type

SMALL: 6 to 19 PCs

MEDIUM: 20 to 49 PCs

LARGE 50 or more PCs

DISCOUNT-POLICY

Add up the number of PCs per PC type

If order is from a dealer

And—If ORDER-SIZE IS SMALL OR MEDIUM OR LARGE

THEN: Discount is 35%

ELSE (ORDER-SIZE IS MINIMUM)

So: no discount is allowed

ELSE (ORDER is from educational institution or individual customers)

SO—IF ORDER-SiZE IS LARGE

Discount is 30%

ELSE IF ORDER-SIZE IS MEDIUM

Discount is 20%

ELSE IF ORDER-SiZE IS SMALL

Discount is 15%

ELSE (ORDER-SIZE IS MINIMUM)

So: no discount is allowed.

Fig.35 Structured English - An Example

Using these values, structured English would read as shown in Fig 11.5.

Decision trees can be used to verify logic in problems that involve few complex decisions, resulting in a limited number of actions. However, its biggest limitation is the lack of information due to its structure.

Decision Table

Decision table is a matrix of rows and columns that shows conditions and actions. Decision rules state the procedure to be followed when certain conditions exist.

Decision tables are best-suited for dealing with complex branching routines, e.g. inventory control, etc.

A decision table consists of four sections.

A condition stub at the upper left, a condition entry at the upper right, an action stub at the lower left, and an action entry at the lower right (see Fig. 36).

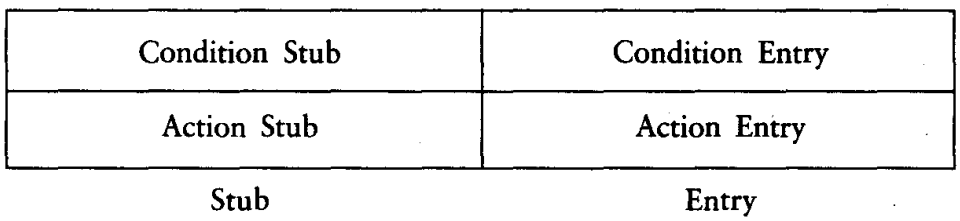


Fig.36 A Decision Table

Questions are listed in the condition stub and the action stub outlines the action to be taken to meet each condition.

The condition entry part contains the answers to questions asked in the condition stub and the action entry part indicates the appropriate1 action resulting from the answers to the conditions in the condition entry quadrant.

In constructing a decision table, the following rules are observed.

(i) A decision should be given a name to be written at the top left of the table.

(ii) The logic should be independent of the sequence in which the condition rules were written, but the actions take place in the order in which the events occur.

(iii) Consistent and standardized language should be used.

(iv) Duplication of terms should be avoided to the maximum extent.

A decision table of the earlier problem is constructed in Fig. 37.

Condition Stub	*Condition Entry*					
	1	2	3	4	5	6
Is the customer a dealer?	Y	Y	N	N	N	N
Is the order size 6 PCs or more?	Y	N	N	N	N	N
Is the customer educational institution or inidividual?			Y	Y	Y	Y
Is the order size 50 or more PCs?			Y	N	N	N
Is the order size 20 to 49 PCs?				Y	N	N
Is the order size 6 to 19 PCs?					Y	N
Action Stub	*Action Entry*					
Allow 35% discount	X					
Allow 30% discount			X			
Allow 20% discount				X		
Allow 15% discount					X	

Fig. 37 Decision Table — An Example

3.3. ELEMENTS

System design is another important step in the system development process. This phase starts after the system analysis phase is over. In other words, the output of the system analysis phase, i.e. requirement specifications becomes an input in the design phase. Data requirements are worked out on the basis of user requirement estimates. The identification of data requirements includes identifying data sources, the nature and type of data that is available and data gaps. For example, for designing a salary system, a system designer would consult the input documents (data sources) such as attendance, leave account, deductions to be made, etc. so that he may understand what kind of data is available, in what form, when it is supplied and by whom.

3.4. FEED BACK AND CONTROL

The system concepts can be made more useful by including two additional components, ‘feedback’ and ‘control’. A system with feedback and control components is sometimes called a ‘cybernetic’ system that is a self – monitoring, self – regulating system.

Feedback is data about the performance of a system. Control is a major system function that monitors and evaluates feedback to determine whether the system is moving towards the achievement of its goals. It then makes necessary adjustments if any, to the input to ensure that proper output is produced.

3.5. Implementation

After a system is designed, it has to be installed and placed it in operation. This phase of the systems development life cycle is called implementation. We shall now study implementation, such as acquiring

hardware and software from an external vendor. As you will see, this is only one of the many choices that must be made during the implementation phase.

After a system has been implemented, it must be maintained and reviewed. These are the final steps of systems development. In some cases, a systems review calls for a completely new system or major modifications to an existing system. In these cases, the review process will likely initiate new systems development cycle, starting with systems investigation.

When once the information system has been designed, a number of takes must be completed before the system is installed and ready to operate. This process is called systems implementation, includes hardware acquisition, software acquisition or development, user preparation hiring and training of personnel, site and data preparation, installation, testing, startup, and user acceptance. The typical sequence of these systems implementation activities is shown in Figure

There are choices and tradeoffs to be made at each step shown in Figure 37. Which involve analyzing the benefits of the various choices in terms of performance, cost control, and complexity? Many organizations do not take full advantage of these steps or carefully analyses the tradeoffs, and hence never realize the full potential of new or modified systems. The hassles and carelessness that often cause these steps to be overlooked must be avoided if organizations are to maximize their return on their information systems resource investment.

3.6 SYSTEM DESIGN

A system is designed with the following main objectives.

Practicality

The system should be designed in such a way that it may be learnt and operated with ease by the users. Thus, the design should be user-oriented.

Flexibility

The business organizations are dynamic in nature. Therefore, a system must be responsive to the change inevitably requested by its users.

Efficiency

A system must be efficient, i.e. it should perform jobs within their specified time. The efficiency of a system may be measured in terms of the following parameters.

(i) Throughput: It is the ability to handle a specified number of jobs per unit of time.

(ii) Response time: The ability to respond to a request made by the user within a given time limit.

(iii) Run time: It is the ability to undertake the complete job within a given time limit.

Security

This aspect relates to hardware reliability, physical security of data and the detection and prevention of fraud and abuse of data.

System design is carried out at two levels, namely conceptual level and physical level, known as conceptual design and physical design, respectively. These two phases are also called external design or general design and internal design or detailed design.

CONCEPTUAL DESIGN

It is in the conceptual design stage that alternative overall MIS designs are conceived and the best one is selected by the system analyst in consultation with the top management. In the conceptual design, the feasibility of meeting the management objectives for the MIS is assessed and a broad-brush picture of the system is painted. That is why, conceptual design is also known as gross design, high-level design or an overall MIS design, which becomes a basis for the detailed MIS design. In other words, a conceptual design is a prerequisite for the detailed design. Conceptual design involves the following steps.

(i) Define problem

(ii) Set system objectives

(iii) Identify constraints

(iv) Determine information needs

(v) Determine information sources

(vi) Develop various designs

(vii) Document the conceptual design

(viii) Prepare report

A brief discussion of these steps will make the concept clearer.

Define Problem

The first step in conceptual MIS design is to clearly understand and define the problem to be solved. It should be noted here that these are not only the current problems, which are of concern; rather MIS design should be related to long-range planning for the organisation so as to solve future problems. Further, MIS function is supposed to solve the problems relating to information needs for the business organisation. Thus information needs of the organisation are to be identified and understood in this step, which can be determined by understanding the mission, objectives, and strategic and operating plans for the business.

Set System Objectives

Having defined and understood the problem to be solved, the system analyst, in consultation with the user, must set the system objectives. While setting system objectives, it must be kept in mind that the value of an information system lies in the benefits to its users. Thus, mere efficiency of the system would not serve the purpose. However, it is very difficult to set the real objectives of an information system. Quite often the objectives of an information system are set in vague terms, for example, 'keep accurate records', 'have maximum efficiency', 'reduce costs', 'provide quality information', 'pay salary to employees by due date'. No doubt, setting of specific objectives is difficult, but it is very important, so that system objectives may provide a measure of performance of the system or to design an information system to help achieve its objectives. Therefore, system objectives should be stated, as far as possible, in quantitative rather than qualitative terms. For example, some of the already given objectives may be restated as 'pay salary to 100 per cent employees by the last day of the month', 'pay 100 per cent of invoices before due date', etc.

Identify Constraints

System constraints are also known as problem boundaries or restrictions. Knowledge of the constraints is essential, as it helps the designer to consider the limitations that restrict the design of the system. In other words, constraints limit freedom of action in designing a system to achieve the objective. In the light of the constraints, a constant review of objectives is necessary. Thus, establishing constraints will help ensure that the design is realistic.

(i) External constraints, and

(ii) Internal constraints.

System constraints may be classified under two categories, namely:

External constraints, as the name indicates, are external to the organisation. For example, constraints posed by customers, the government and suppliers. Whereas internal constraints are posed from within the organisation, for example, non-cooperation and lack of support from top management; organizational policy; resource constraints like manpower, time and money, etc.

Determine Information Needs

For a good design of information system, it is very important to know the real information needs of management (users) in a clear statement. Thus, information needs which can really help the management in discharging their

functions are identified. For determination of information needs, users should specify.

(i) What they want out of an information system; and

(ii) Items of information that are needed to achieve the pre-determined objectives.

But, user-managers are rarely specific on the above points, since getting them to be specific about their information needs is a challenging job for the system analyst. A system analyst, thus depending on the situation, has to adopt either a direct or an indirect approach for eliciting information needs. In the direct approach, the system analyst would ask four or five major responsibilities of the user-manager, followed by one or two specific items of information that are required to carry out each of the responsibilities. Indirect approach stresses on the avoidance of direct questions. Instead, the system analyst asks the user to describe his/her decision-making process. This is found an easy way as the user-manager is well-familiar with the operation/job and thus can describe clearly his/her decision-making process.

As already discussed in system analysis, there are several approaches like interviewing the user managers, using questionnaires, record review and observation, etc., but the system analyst has to take a judicious decision regarding an approach or a combination of approaches to understand clearly the information needs of user-managers in an organization.

3.7. FUNCTIONS OF SYSTEM ANALYST:

System analysis may be understood as a process of collecting and interpreting facts, identifying problems and using the information to recommend improvements in the system. In other words, system analysis means identification, understanding and examining the system for achieving pre-determined goals/objectives of the system. System analysis is carried out with the following two objectives.

(i) to know how a system currently operates, and

(ii) to identify the users' requirements in the proposed system.

Basically, system analysis is a detailed study of all important business aspects under consideration and the existing system, and thus, the study becomes a basis for the proposed system (may be a modified or an altogether new system). System analysis is regarded as a logical process. The emphasis in this phase, is on investigation to know how the system is currently operating and to determine what must be done to solve the problem.

The system analysis phase is very important in the total development efforts of a system. The user may be aware of the problem but may not know

how to solve it. During system analysis, the developer (system designer) works with the user to develop a logical model of the system. A system analyst, because of his technical background, may move too quickly to program design to make the system prematurely physical, which is not desirable and may affect the ultimate success of the system. In order to avoid this, the system analyst must involve the user at this stage to get complete information about the system. This can be achieved if a logical model of the system is developed on the basis of a detailed study. Such a study (analysis) should be done by using various modern tools and techniques, such as data flow diagrams, data dictionary and rough descriptions of the relevant algorithms. The final product of the system analysis is a set of system requirements of a proposed information system. The following pages will discuss determination of system requirements and system analysis tools.

3.8. EVALUATION AND MAINTANENCE OF MIS

Management information system is generally defined as an integrated user machine system for providing information to support operations management and decision making function in an organization. The system utilizes computer hardware and software, manual procedure, models for analysis. Information is viewed as a resource much like land, labor and capital. It is not a free good. It must be obtained; processed, stored, received, manipulated and analyzed, distributed etc. an organization with a well – defined information system will generally have a competitive advantage over organization with poor systems.

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

For an effective MIS design a proper framework is desired. A proper frame work would take into account the following key questions

What are the essential economic and technical characteristics of the industry in which the company participates? What trends suggesting future changes in the economic and technical characteristics are apparent? What is the nature of competition both within the industry and across the industry? Given technical, economic, social and political developments. What is the range of the strategies available to any company in the industry?

NOTES

UNIT – IV

5.5. Transactions Processing Information Systems
5.6. Information systems for managers
5.7. Intelligence system
5.8. Decision support systems
5.9. Data collection and preparation
5.10. Data base components
5.11. Utility of the operation of the Data Base Technology.
5.12. Summary

4.1. TRANSACTION PROCESSING SYSTEM

Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. A transaction processing system is a computerized system that performs and records the daily routine transactions necessary to the conduct of the business. Examples are sales' order entry, hotel reservation systems, client information, and shipping.

Transactions are events that occur as part of doing business, such as sales, purchases, deposits, withdrawals, refunds and payments. Think e.g. of the data generated whenever a business sells something to a customer on credit. Data about the customer, product, salesperson, and store and so on, must be captured and processed. This is turn causes additional transactions, such as credit checks, customer billing, inventory changes, and increases in accounts receivable balances that generate even more data. Thus, transaction processing activities are needed to capture and process such data, or the operations of a business would grind to a halt. Therefore, transaction processing systems play a vital role in supporting the operations of an organization.

Transaction Processing Cycle

Transaction processing system captures and process data describing business transactions. Then they update organizational files and data bases, and produce a variety of information products for internal and external use.

Fig. 44 illustrates in the transaction processing cycle systems go through a five-stage cycle of:

1. Data entry activities
2. Transaction processing activities
3. File and database processing activities
4. Document and report generation
5. Inquiry processing

Data entry process. The input activity in transaction processing system involves a data entry process. In this process, data re captured or collected by recording, coding, and editing activities. Data may then be converted to a form that can be entered up to a computer system. It has always been a problem getting data into computers accurately and quickly enough to match their awesome processing speeds. Thus manual methods are replaced by direct automated methods which are more efficient and reliable and known as data automation.

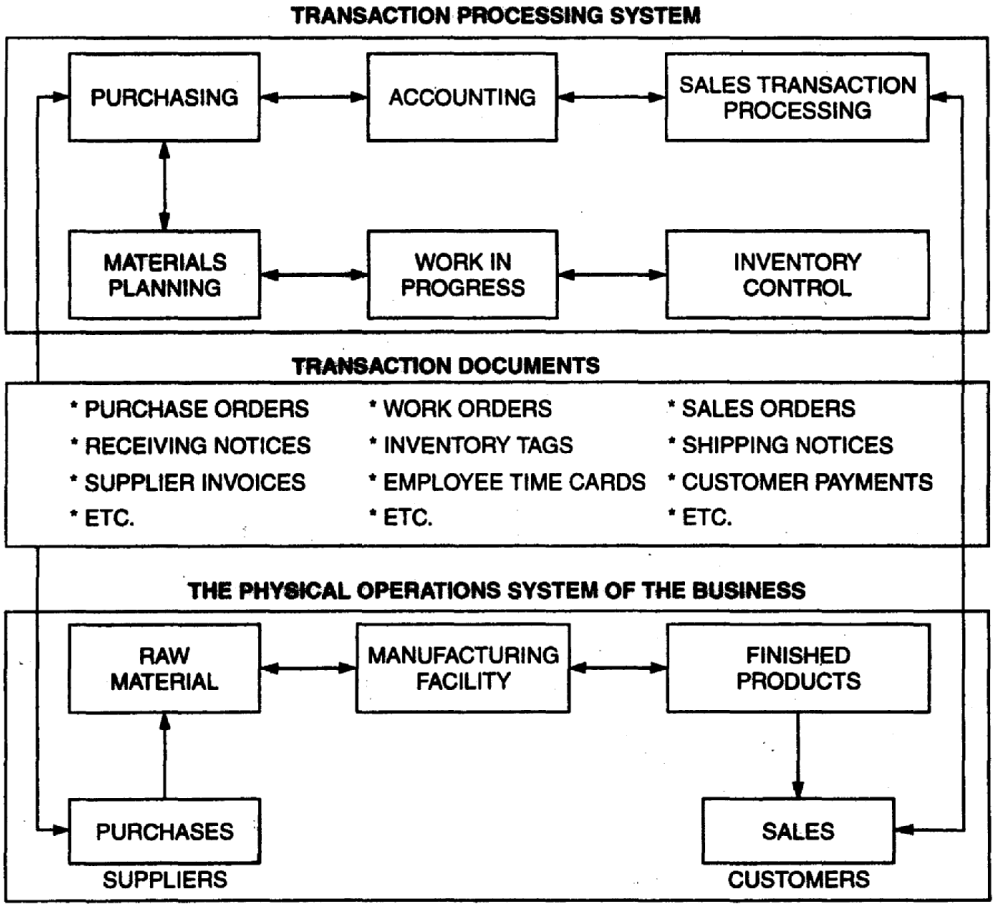


Fig.44 the Role of Transaction Processing System in a Business

Fig. 44 shows how business transactions such as sales to customers and purchases from suppliers are generated by the physical operations systems of this manufacturing firm. Documents describing such transactions are subsequently processed by the firm's transaction processing system resulting in updated database and a variety of information products.

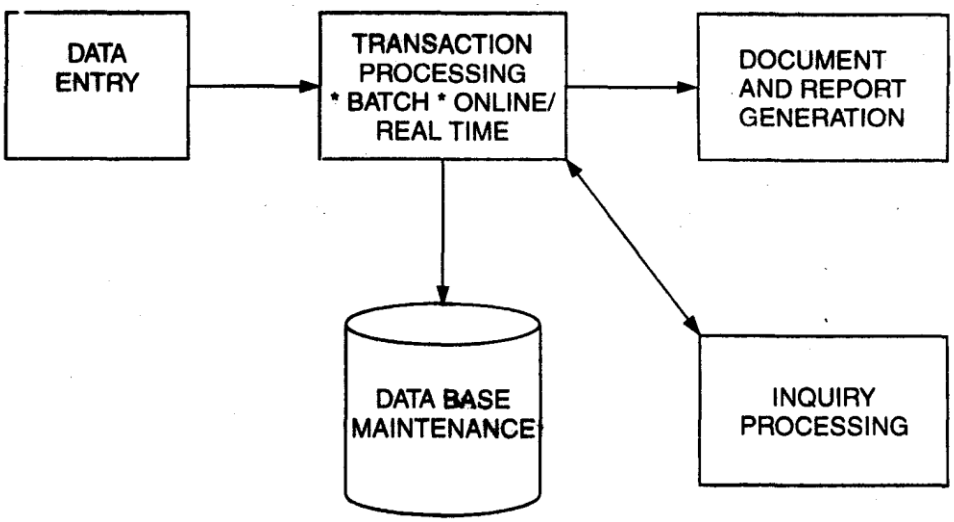


Fig.45 Transaction Processing Cycle

Fig. 45 shows that transaction processing systems use a five- stage cycle of data entry, transaction processing database maintenance, document and report generation, and inquiry processing activities. Many companies have found that real time or online transaction processing systems, which capture and process transactions immediately can help them provide superior service to customers. This capability adds value to their products and services, and thus gives them an important way to differentiate themselves from their competitors.

All organizations have these five kinds of TPS. It is difficult to imagine a modern organisation without a transaction processing system. These systems are often so central to a business that in the 1960s it was estimated that organizations might survive for only a day without functioning computer systems. In the 1990s, TPS failure for a few hours can spell the demise of a firm and perhaps other firms linked to it.

Two features of TPS are noteworthy.

1. Many TPS span the boundary between the organisation and its environment. They connect customers to the firm's, warehouse, factory and management. If TPS do not work well, the organisation fails either to receive input from the environment (orders) or to deliver outputs (assembled goods).

2. TPS are major producers of information for the other types of systems. Because TPS track relations with the environment, they are the only place where managers can obtain both up-to-the minute assessments or organizational performance and long-term records of past performance. TPS can be viewed as "organizational message processing systems", informing managers about the status of internal operations and about the firm's relations

with the external environment, and supporting other information systems that facilitate management decision making.

4.2. INFORMATION SYSTEM FOR MANAGEMENT

The word 'information' is used commonly in our day to day working. In MIS, information has a precise meaning and it is different from data. The information has a value in decision making while data does not have. Information brings clarity and creates an intelligent human response in the mind,

In MIS a clear distinction is made between data and information. Data is like raw materials while the information is equivalent to the finished goods produced after processing the raw material. Information has certain characteristics. These are: Information

- improves representation of an entity
- updates the level of knowledge.
- has a surprise value.
- reduces uncertainty.
- Aids in decision making.

The quality of information could be called good or bad depending on the mix of these characteristics. A sales report shows in Table will highlight this point.

It can be noted in the above example that sales data is processed with the budget data and further some results are computed, providing information of an exceptional nature, that is, the sale of new product in the total sales. The sales data progressively becomes information when processed with other data such as the budget and the new product sales.

Davis and Olson defines information as a data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in the current or the prospective actions or decisions of the recipient. Data is defined as groups of non-random symbols in the form of text, images or voice representing quantities, actions and objects.

Particulars of sales data	**(Rs. Lakhs)**	**Characteristics**
Sales	10/day	Represents sales / day.
Budgeted sales	15/day	Represents budget! Day.
Cumulative sales	510/60 days	Updates the knowledge about sales as on date.

Cumulative budget	600/60 days	Makes the information meaningful by a comparison with budgets and has a surprise value as it is significantly below the budget.
Ratio of sales performance to the budget.	85%	15 percent less than budget. Represents performance of Sales vs. Budget.
Sales of new products	80/60 days	Reduces the uncertainty of sales of new product as expected sales were only Rs 70 Laths.

Whether an entity is a data or information, it must be transferred through communication from the 'Source' to the 'Destination' without loss of content. The general model for such communication is given in Fig. 1.5.

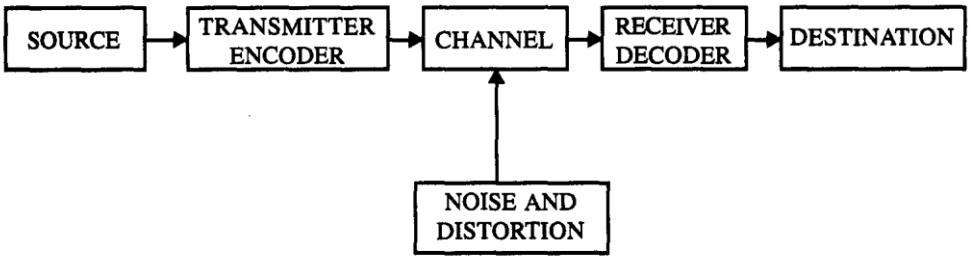


Fig. 1.5 conceptual Model of Communication

The above model of communication is used in the MIS. The MIS is equivalent to the transmitter which provides information and sends through reports (channel) to the various receivers, which is decoded or interpreted by the receiver at the destination. The poor quality of information due to various factors would create confusion and misunderstanding, which is equivalent to a 'Noise' and a 'Distortion' in the communication model. A good MIS communicates the information without a noise and a distortion to the user.

The utility dimension has four facets—the form, the time, the access and the possession. If the information is presented in the form the manager requires, then its utility increases. If it is available when needed, the utility is optimized. If the information is easily and quickly accessible through the Online Access System, its utility gets an added boost. Lastly, if the information is possessed by the manager who needs it, then its utility is the highest. Many of the organizations suffer from the possessive nature of the managers making an access difficult for the other users of the information. Improving the quality through increasing a utility means an increase in the cost. The balance, therefore, is to be maintained between the cost and the utility.

The concept of the utility of the information is subjective to the individual manager, at least in terms of the form, time and access. Since in the organisation there are many users of the same information, the subjective ness would vary. Therefore, the one common key for measuring the quality could be the satisfaction of the decision maker. The degree of satisfaction would determine the quality of the information. If the organisation has a high degree of satisfaction, then one can be safe in saying that the information systems are designisioned properly to meet the information needs of the managers at all the levels.

An error is the third dimension of the quality of the information. The errors creep in on account of various reasons, namely:

1. An incorrect data measurement
2. An incorrect collection method
3. Failure to follow the prescribed data processing procedure
4. Loss of data or incomplete data
5. Poor application of data validation and control systems
6. A deliberate falsification

Erroneous information is a serious problem because the decision maker cannot make the adjustments as he is not aware of it in terms of the location and the quantum of error. To control errors, it is necessary to follow the methods of systems analysis and design. The approach should be that the errors should be prevented, failing that they should be detected, and if not, they should be controlled.

The processing of data for the information processing should be allowed only after a thorough validation of the transactions and the contents, as a whole, on a logical plane. Care should be taken that the information is processed after ensuring the correctness of the data in terms of the time and the number of documents, and the transactions in the period. The data should be checked against the master data wherever possible and the balance should be controlled through logical processing by using rules, formulae, the principles, etc., which will ascertain the correctness of the contents.

If the information is processed out of a biased data it will have a bias. The procedure of communicating the information should be such that the system is able to detect the degree and the nature of the bias and correct the information accordingly.

The computer system and programmes are prone to errors because of the corrections, modifications and changes required by the decision makers. These errors lead to wrong processing. A systematic effort should be made to

keep the computer system document up-to-date, for guidance to the user of the system.

The measures of auditing, the use of the test data and conducting a physical audit of the record versus the reality would help considerably to control the errors arising out of wrong processing.

VALUE OF THE INFORMATION

The decision theory suggests the methods of solving the problems of decision making under certainty, risk and uncertainty. A decision making situation is of certainty when the decision maker has full knowledge about the alternatives and its outcomes. This is possible when perfect information is available. Therefore, the information has a perceived value in terms of decision making. The decision maker feels more secured when additional information is received in case of decision making under an uncertainty or a risk. The information is called a perfect information, if it wipes out uncertainty or risk completely. However a perfect information is a myth.

The decision theory stipulates that the value of the additional information is the value of the change in the decision behavior, resulted by the information, less the cost of obtaining the information. If the additional information does not cause any change in the decision behavior then the value of the additional information is zero. The value of the additional information making the existing information perfect (VPI) is:

$$VPI=(V2-V1) - (C2-C1)$$

Where V is the value of the information and C is the cost of obtaining the information. V1 and C1 relate to one set of information and V2. C2 relate to the new set. If the VPI is very high, then it is beneficial to serve the additional information need.

The Methods of Data and In formation Collection

Method	Example	Comment
Observation	The first hand knowledge avoids a response bias. An accuracy of observation will decide the response. It is dependent on the observer and is influenced by the bias.	Visit to the customer for assessing the customer complaints. A visit to assess the accidental damage.
Experiment	The information on a specific parameter can be	Assessing the yield of a new fertilizer by a design of the

Method	Example	Comment
	obtained through a control over variables. The quality of information depends on the design of the experiment.	control experiment. Assessing the market response to a new packaging through test marketing.
Survey	One time. Enables to cover the interested population on specific aspects. The quality of questionnaire will decide the quality of information.	Market survey, opinion polls, census.
Subjective estimation	In the absence of all the three above, the expert opinions may be called to collect the information.	Data pertaining to future like the alternate source of energy, the life style in the 21st century.
Transaction Processing	The data exists but needs a processing and integration for reporting.	Ledgers, payroll, stock statements sales reports.
Purchased from outside	Easily available at a price. May be expensive and may have a bias depending on the source.	Databases on the specific subject, research studies. Market and technology studies.
Publications	Low cost but may project or emphasize one view or the other. Information may be lopsided.	The government publications, the industry publications, the institutional publications such as NCL, NCACER, BANKS, UNO, the various public forums.
Government agencies	Available but may not be directly useful not knowing the details of collection analysis and is usually not the latest.	The Reserve Bank of India publications. The Tax publications, the reports and findings.

A manager is faced with the problem of decision making under uncertainty or risk conditions, if he does not know the perfect information about the decision situation. Further, his ability to generate decision alternatives owing to the imperfect information of the situation, and also the expected

events in the future, is limited. In other words, given a set of possible decisions, a decision maker will select one on the basis of the available information. If the new information causes a change in the decision, then the value of the new information is the difference in the value between the outcome of the old decision and that of new decision, less the cost of obtaining the new information.

It may be noted that the information has a value only to those who have the background knowledge to use it in a decision. The experienced manager generally uses the information most effectively but he may need less information as experience has already reduced uncertainty for him, when compared to a less experienced manager.

In MIS, the concept of the value of information is used to find out the benefit of perfect information and if the value is significantly high, the system should provide it. If the value is insignificant, it would not be worth collecting the additional information. The decisions at the operational and the middle management level are such that the value of the additional or new information is low, while at the higher levels of the management, the decision being mainly strategic and tactical in nature, the value of additional information is very high.

Apart from the monetary value of information, it has a value which is to be measured as strength in promoting the functions of the management. Some information has the strength of motivating the manager to think in futuristic terms. Some information has the strength of confirming the beliefs or understanding the business process. It also reinforces the right and wrong of a decision making process that the manager is following.

4.3. INTELLIGENCE DATA SYSTEMS

Certain types of data systems are used to support intelligence operations. Special teleprocessing systems are used for surveillance purposes. This is to keep track of the data and to inspect. For example, the data systems to suit market research will include statistical analysis capabilities. Generally, whenever data re in large quantities, DBMS and files of microfiches are useful for accumulation.

This system is designed to keep track that has been collected on certain subjects. Instead of interest profiles, a set of data items are defined that specify the subjects on which data can be retrieved. For example; for a system to manage reports received from sales people and others regarding markets, the data items would include;

1. customer name
2. Location

3. Product feature code
4. Competitor
5. Complaint type
6. Government constraint code etc

A coding system is to be established for each of the data items that concern the same subject (same customer, same complaint type). If the record occurrences on one location is Mumbai and in another New Delhi, the system will not retrieve reliably by location. Refer Fig shown below.

A call report is shown entering the system at the top. This report was prepare by a salesperson after visiting the customer and already reviewed by the concerned supervisor. The first step was to prepare an encoded record on the document. This record will be stored in a market report index file (on line) and managed by DBMS. The data items are as shown above. The encoder assigns code values to identify the customer, location and for other information of interest. The data items define the types of data that are of interest. The document is also assigned an identification number and sent to be micro filmed and stored on microfiche. The index record occurrence is entered at a terminal by the encoder and stored within the market report index file by the DBMS. This system may also be used to capture data for supervisory and planning purpose. Hence, the index update program updates another file, the salesperson file, which contains data on the salesperson's performance and pointers to the customer report index and other files containing data relevant to the individual salesperson. The file key is employee number (same as it is in employee file).

4.4. DECISION SUPPORT SYSTEM

Scott Morton defined Decision Support System (DSS)as Interactive computer based systems, which help decision makers utilize data and models solve unstructured problems.

Keen and Scott Morton stated that Decision Support System couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer based support system for management decision makers who deal with semi structured problems.

Earliest definition by Gerrity is one who described DSS as an effective blend of human intelligence, information technology, and software which interact closely to solve complex problems.

Other definitions are:

DSS is an interactive computer based system which facilitates the solution of unstructured problems.

A DSS is an interactive, flexible and adaptable computer based

information system that utilizes decision rules, models and model base coupled with a comprehensive database and the decision maker's own insights. Using the DSS leads to specific, implantable decisions in solving problems that would not be amenable to management since optimization models parse. Thus, DSS supports complex decision making and increases its effectiveness.

A information system that utilizes decision models, a database, and a decision maker's own insights in an ad hoc, interactive analytical modeling process to reach a specific decision by a specific decision maker.

A system that allows for a human machine interface whereby the decision maker retains control throughout the decision making process.

ARCHITECTURE OF A DSS

Data from the organizations, TPS and MIS applications are input to the DSS models data. As stated, the DSS model data. As stated, the DSS may store and later reprocess its own model data as well. The user interacts with the DSS online, requests are made, models are created or adjusted and data is manipulated etc. The outputs of the DSS program can be either text, structured reports or graphics.

A variety of programs supported by the DSS include spreadsheet programs, personal database management systems, model base management systems (MBMS), word processing packages, graphics generators, statistical packages and other special purpose programs.

Decision support systems (DSS) are better viewed as facilities having data and data manipulation tools than as formalized systems. DSS are often used to respond on an ad hoc basis to problems and opportunities as they develop. As such, flexibility and adaptability are crucial. DSS often involves models of business activity. Sometimes DSS users build models as they use the system. Technology to support DSS is evolving.

CHARACTERISTICS OF A DSS

1. Ability to support the solution of complex problems
2. Fast response to unexpected situations that result in changed inputs
3. Designed to help support decisions that are formulated as semi structured, complex problems
4. May be constructed to support one time decisions
5. DSS is typically designed for either a particular decision marker or a group of decision markers
6. Allows the decision maker to interact in a natural manner due to the careful design of the interface

7. DSS generator (software) can be used
8. It is a way to organize information intended for use in decision making

COMPONENTS OF A DECISION SUPPORT SYSTEM (DSS)

DSS is a coordinated collection of data, systems, tools and techniques with the necessary software and computer hardware through which an organization gathers and interprets relevant information from the business and environment and turns into information that can be acted upon.

Three distinct elements of DSS are:

1. DSS tools
2. DSS generators
3. Specific DSS

DSS tools are programs or codes which are the foundations used to create the DSS generators and in turn specific DSS. These are the building blocks of the DSS which as a user interface e.g. Electronic Spread Sheets, GLS, and RDBMS etc. The combination of DSS tools in the computer hardware is known as DSS generators.

1. Database
2. Decision models
3. Statistics and manipulation
4. Display

Components of DSS programs:

1. Dialogue management
2. Model management
3. Database management

Classical and contemporary models of managerial activities and roles:

Classical model of management describes what managers do, which was largely unquestioned from along time. Henri Fayol and other early writers described the five classical functions of managers as

1. Planning
2. Coordinating
3. Organizing
4. Deciding and
5. Controlling

Behavior models:

1. High volume, high speed, work
2. Variety, fragmentation, brevity
3. Issue preference current, ad hoc, specific
4. Complex web of interaction, contacts
5. Strong preference for verbal media
6. Control of the agenda

Managerial roles

These are expectations of the activities that managers should perform in an organization. Mint berg classified managerial activities into ten roles that falls into three categories:

1. Interpersonal roles
2. Information roles
3. Decision roles

Decision models and tables:

There are three ways to get early feedback on the viability of the MIS just designed:

1. Modeling
2. Simulation
3. Test planning

4.5. METHODS OF DATA AND INFORMATION COLLECTION

Several methods are available for the collection of data. The choice of method will have an impact on the quality of information. Similarly the design of data collection method also decides the quality of data and information. The methods of data collection and processing become a part of the MIS. The various methods of data collection are explained in Table 2.

An awareness of these methods is essential to the manager. Further, he should also understand the potential problems of bias, currency, the fact versus the opinion in the various types of methods. The observation, the experiment, the survey and the subjective estimation are the methods chosen for data collection and information about a specific problem, while the remaining methods are chosen to collect data on a routine basis without any particular problem whatsoever.

4.6. DATABASE COMPONENTS

INTRODUCTION

Data is a vital organizational resource which is an important input in an information system. This data resource is traditionally called the database. It is from this database that data is processed and converted into information to satisfy information needs of the organisation. Nowadays we find that the internal and external information resources available to organizations are increasing at a rapid rate, due to which databases are becoming larger and larger in size. At the same time, business environment has forced the businesses to take quick and right decisions for which databases are required to be queried frequently. Queries may be varied, e.g. one manager may be interested to know the names of all those products for which sales in the current year exceed that of the previous year, one may require information on the total amount outstanding, or one may require the list of products having a market share greater than 30 per cent and so on. To correctly process varied types of queries and to ensure a fast response time the use of computer-based information systems have become a necessity of any business.

To meet the objective of fast retrieval of data, computer-based information system should be able to organize, store and manage data effectively and efficiently. There are two main methods to organize data on computer media, which are known as files and databases. Before we discuss the two approaches, let us look at the concept of a file and a database, popularly known as database hierarchy.

DATABASE HIERARCHY

Anything of interest to the user about which data is to be collected or stored is called an entity. An entity may be a tangible object, such as an employee, a part or a place. It may also be non-tangible, such as an event, a job title, a customer account, a profit centre or an abstract concept. An entity has a number of attributes, which one may be interested to record, such as name, age, designation, etc. In order to know the entity, a user has to collect data about its characteristics or attributes. Generally, in data processing, one is interested in collecting similar entities, such as employees and would be interested in recording information about the same attributes of each of them. Each attribute is termed as ‘data item’ or ‘data element’. Data item, the smallest unit in the database, is a combination of one or more bytes. Sometimes data item is also called a ‘field’.

Actually a field is a physical space on the storage device, whereas a data item is the data stored (value) in the field. For example, an employee of the organisation may be regarded as an entity of interest. The various attributes of

this entity may be employee name, age, sex, address, etc. Thus, employee name is one of the data fields, age is the second data field and soon. The values of these fields, say Sandeep, 26 years, respectively are data items of the entity employee. All the data items related to an object are combined in a record. Thus, Mr.Sandeep with all its data items is referred to as one record. Similarly, there may be many employees in an organisation and all would have individual records representing that employee. A collection of related records is known as a file. The employee file may contain one or more than one records. Similarly, in an application, there may be several related files. For example, in a salary processing system, the files may be employee file, provident fund file, income tax file, etc. All these files are combined in a database. Thus, database is a set of interrelated files which can be used by several users accessing data concurrently. The data hierarchy, along with another example has been shown in Fig. 19.

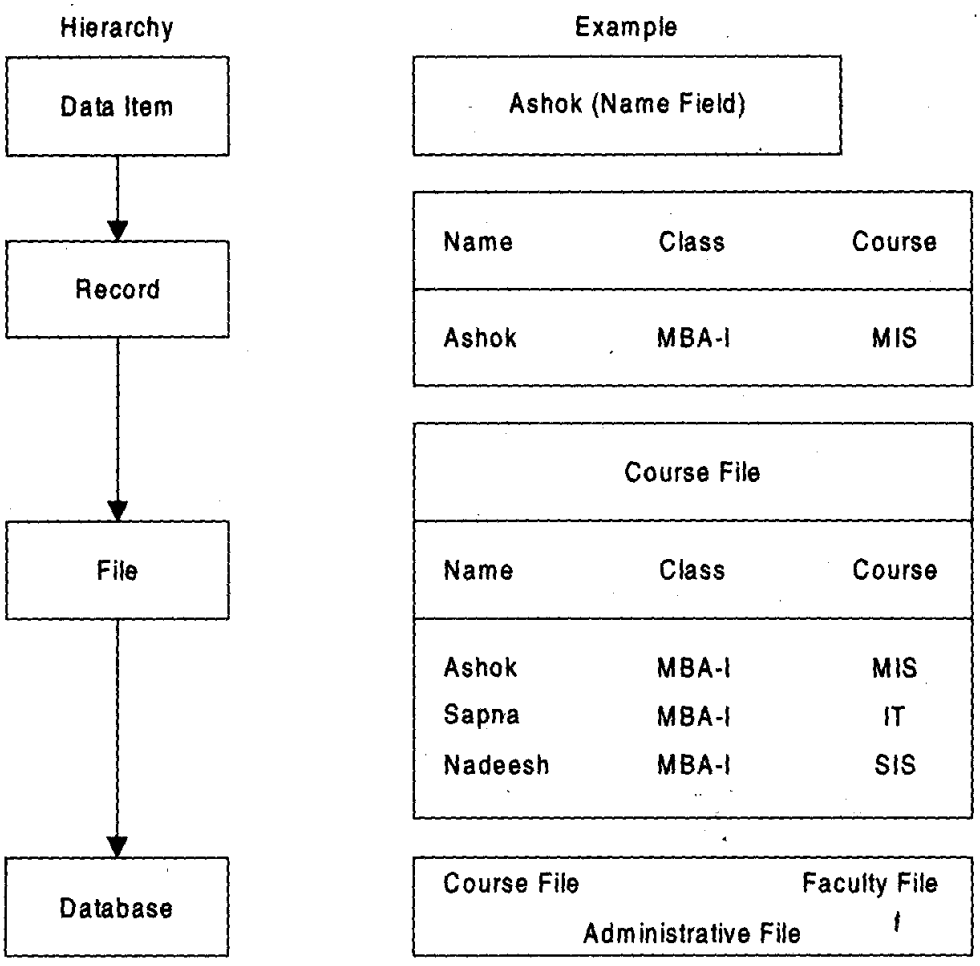


Fig. 19 The Data Hierarchy

FILES - THE TRADITIONAL APPROACH

Traditionally, data files were developed and maintained separately for individual applications. Thus, the file processing system relied on the piecemeal approach of data across the organisation where every functional unit like marketing, finance, production, etc., used to maintain their own set of application programs and data files.

No doubt such an organisation was simple to operate and had better local control but the data of the organisation is dispersed throughout the functional sub-systems.

This approach was rendered inadequate, especially when organisations started developing organisation-wide integrated applications. The major drawbacks of file processing system may be outlined due to the following reasons.

(i) Data duplication,

(ii) Data inconsistency,

(iii) Lack of data integration,

(iv) Data dependence, and

(v) Program dependence.

Data Duplication

Since each applications its own data file, the same data may have to be recorded and stored in several files. For example, payroll application and personnel application both will have data on employee name, designation, etc. This results in unnecessary duplication/redundancy of common data items.

Data Inconsistency

Data duplication leads to data inconsistency especially when data is to be updated. Data inconsistency occurs because the same data items which appear in more than one file do not get updated simultaneously in all the data files. For example, employee's designation, which is immediately updated in the payroll system may not necessarily be updated in the provident fund application. This results in two different designations of an employee at the same time.

Lack of Data Integration

Because of independent data files, users face difficulty in getting information on any ad hoc query that requires accessing data stored in more than one file. Thus, either complicated programs have to be developed to retrieve data from each independent data file or users have to manually collect the required information from various outputs of separate applications.

Data Dependence

The applications in file processing systems are data dependent, i.e. the file organisation, its physical location and retrieval from the storage media are dictated by the needs of the particular application. For example, in order processing application, the file may be organized on customers records sorted on their last name, which implies that retrieval of any customer's record has to be through his/her last name only.

Program Dependence

The reports produced by the file processing system are program dependent, which implies that if any change in the format or structure of data and records in the file is to be made, a corresponding change in the programs have to be made. Similarly, if any new report is to be produced, a new program will have to be developed.

It is because of these drawbacks in the traditional files approach of organizing data that led to the development of databases.

DATABASES - THE MODERN APPROACH

An alternative approach to the file processing system is the modern approach, known as the database approach. A database is an organised collection of records and files which are related to each other. In a database system, a common pool of data can be shared by a number of applications as it is data and program independent. Thus, unlike a file processing system, data redundancy and data inconsistency in the database system approach are minimized. The user is free from the detailed and complicated task of keeping up with the physical structure of the data. Figure 6.2 presents a simplified view of a database system. Ad hoc queries from the user are accepted and standard outputs (reports) may be changed or reformatted as per the information needs of the users.

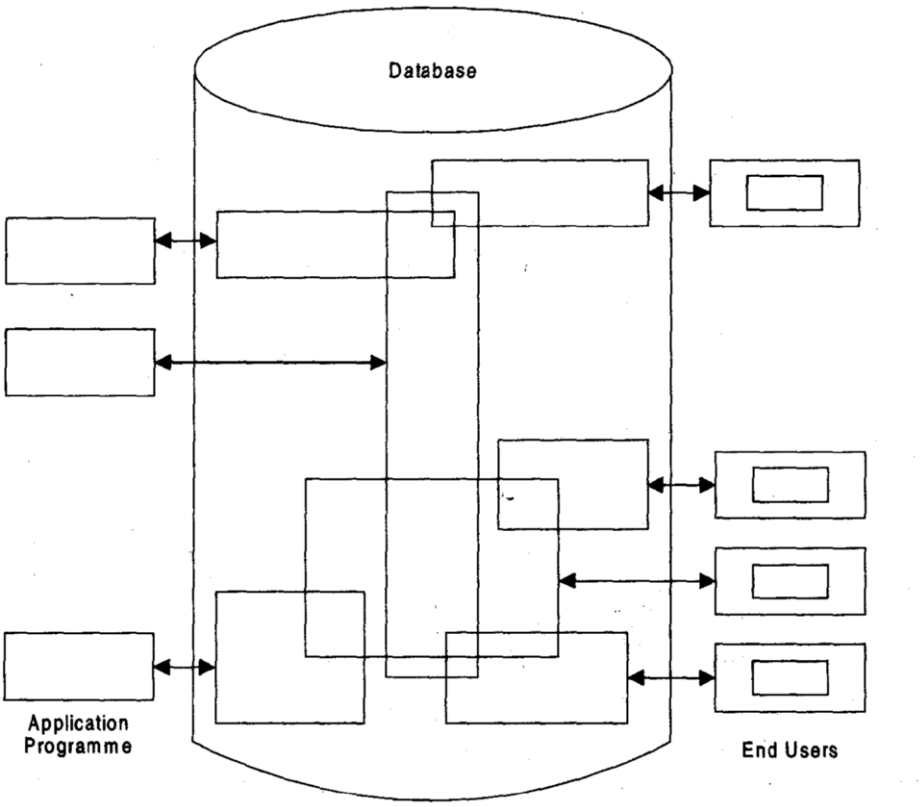


Fig. 20 Simplified View of a Database System

The software (set of programs) that provides access to a database is known as a database management system (DBMS). A clear-cut distinction between traditional file system and database system is illustrated in Fig. 21.

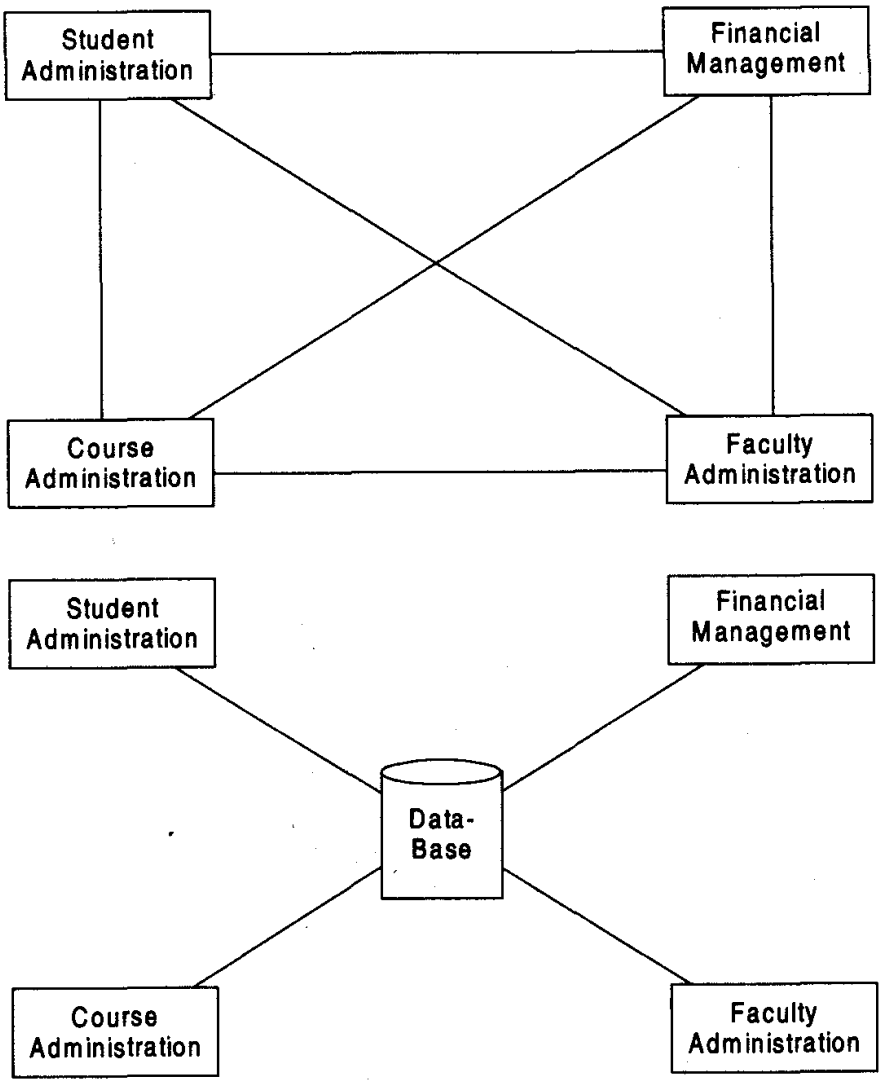


Fig. 21 (a) File System Approach, (b) Database Approach

Objectives of a Database

Broadly, the objectives of the database approach are to make information access easy, fast, relatively inexpensive and flexible for the user. The specific objectives may be listed as follows.

(i) Controlled data redundancy,

(ii) Enhanced data consistency,

(iii) Data independence,

(iv) Application independence,

(v) Ease of use,

(vi) Economical, and

(vii) Recovery from failure.

Advantages of Database Systems

Database approach provides the following benefits over the file management systems.

Redundancy Control

In a file management system, each application has its own data, which causes duplication of common data items in more than one file. This data duplication needs more storage space as well as multiple updations for a single transaction. This problem is overcome in database approach where data is stored only once.

Data Consistency

The problem of updating multiple files in file management system leads to inaccurate data as different files may contain different information of the same data item at a given point of time. In database approach, this problem of inconsistent data is automatically solved with the control of redundancy.

Thus, in a database, data accuracy or integrity and accessibility of data is enhanced to a great extent.

Management Queries

The database approach, in most of the information systems, pools the organisation-wide files at one place known as central database and thus is capable of answering queries of the management, relating to more than one functional area. Also as the related data is centralized and the relationship structure among entities is designed into the database, it is a convenient approach to handle even unstructured queries.

Data Independence

Most of the file management systems are data dependent, which implies that data organisation and access strategies are dictated by the needs of the specific application and the application programs are developed accordingly. However, the database approach provides independence between the file structure and program structure. This gives flexibility to the application programs in Database Management System (DBMS) environment. Such a system provides an interface between the programs and the database and takes care of the storage, retrieval and updation of data in the database. It allows applications to be written as general programs to operate on files whose structures can be made available to the program. In simple words, DBMS may be called a generalized file processing system.

Enforcement of Standards

In the database approach, data being stored at one central place, standards can easily be enforced. This ensures standardized data formats to facilitate data transfers between systems.

Disadvantages of a Database

In contrast to the many advantages of the database approach, there are a few disadvantages as well. The disadvantages of a database approach are given below.

Centralized Database

The data structure may become quite complex because of the centralized database supporting many applications in an organisation. This may lead to difficulties in its management and may require a professional/an experienced database designer and sometimes extensive training for users.

More Disk Space

Database approach generally requires more processing than file management system and, thus, needs more disk space for program storage.

Operationality of the System

Since the database is used by many users in the organisation, any failure in it, whether due to a system fault, database corruption, etc. will affect the operationality of the system as it would render all users unable to access the database.

Security Risk

Being a centralized database, it is more prone to security disasters. Besides the above-mentioned disadvantages, sometimes the database approach may not be cost- effective for smaller organization. This is because of the reason that as with other complex software systems, the cost in terms of software, hardware and operating / administrative personnel also increases.

DATABASE STRUCTURE

Data is structured on the basis of one of the several data models. A data model refers to the logical structures of data and the relationships among them. In database approach, relationships between entities may also be defined and, stored. For example, a user may store a teacher record, a subject record and a third record which defines the relationship between the two, i.e. the teacher and the subject. There may be three types of relationships which exist among entities, namely, one-to-one; one-to-many; and many-to-many.

A one-to-one (1:1) relationship is an association between two entities. For example, a relationship between husband and wife, where the husband is

allowed one wife at a time and vice versa (see Fig. 23).

A one-to-many (1 : M) relationship represents an entity that may have two or more entities associated with it. For example, father may have many children and a state may have many districts but each child has only father and each district has only one state (see Fig. 24).

A many-to-many (M : M) relationship describes entities which may have many relationships both ways. For example, teachers and students where a teacher teaches many students and a student attends the classes of many teachers (see Figs 25).

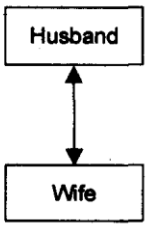


Fig. 23

1:1 Relationship

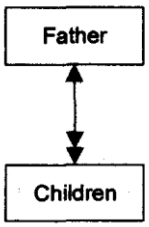


Fig. 24

1 : M Relationship

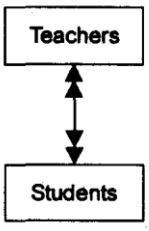


Fig. 25

M : M Relationship

The database concept clearly distinguishes between logical and physical views of data. The logical view is the representation of data as it would appear to an application programmer or end user, whereas the physical view shows how data is actually organised and structured on the physical storage media. To illustrate this, Fig. 26 depicts a programmer who requires a five-record file in a particular order (A, D, C, B, S). The programmer, in this database approach, does not know about the physical 'map' on the storage media.

The structure of the database, defining the records of entities and the relationships among entities in the database is called 'schema'. Users of the database may view only a portion of the database known as sub-schema. It is not necessary for the user to know the complete structure of the database. Thus, various sub-schemas may represent the external view (see Fig. 27).

DATABASE MANAGEMENT SYSTEM

Database Management System is software that facilitates flexible management of data. It is generally composed of three sub-systems which are described as follows.

Database Definition

In this sub-system, the complete database (schema) is described with the help of a special language known as the data description language (DDL). However, in the case of database in different files, one file at a time may be defined as that would give maximum flexibility.

Database Manipulation

After the database is defined, elements of data can be stored. The stored data may either be retrieved or updated later through data manipulation language (DML). The manipulation sub-system can retrieve the required elements of data (the sub-schema) in a variety of sequences.

Database Support

This sub-system performs database utility or service functions that include functions like list files, change file passwords, change file capacities, print file statistics, unlock files, etc.

A database management system performs a wide variety of functions, which are discussed as follows.

Data Organisation

DBMS organises data items as per the specifications of the data definition language. Database administrator decides about the data specifications that are most-suited to each application.

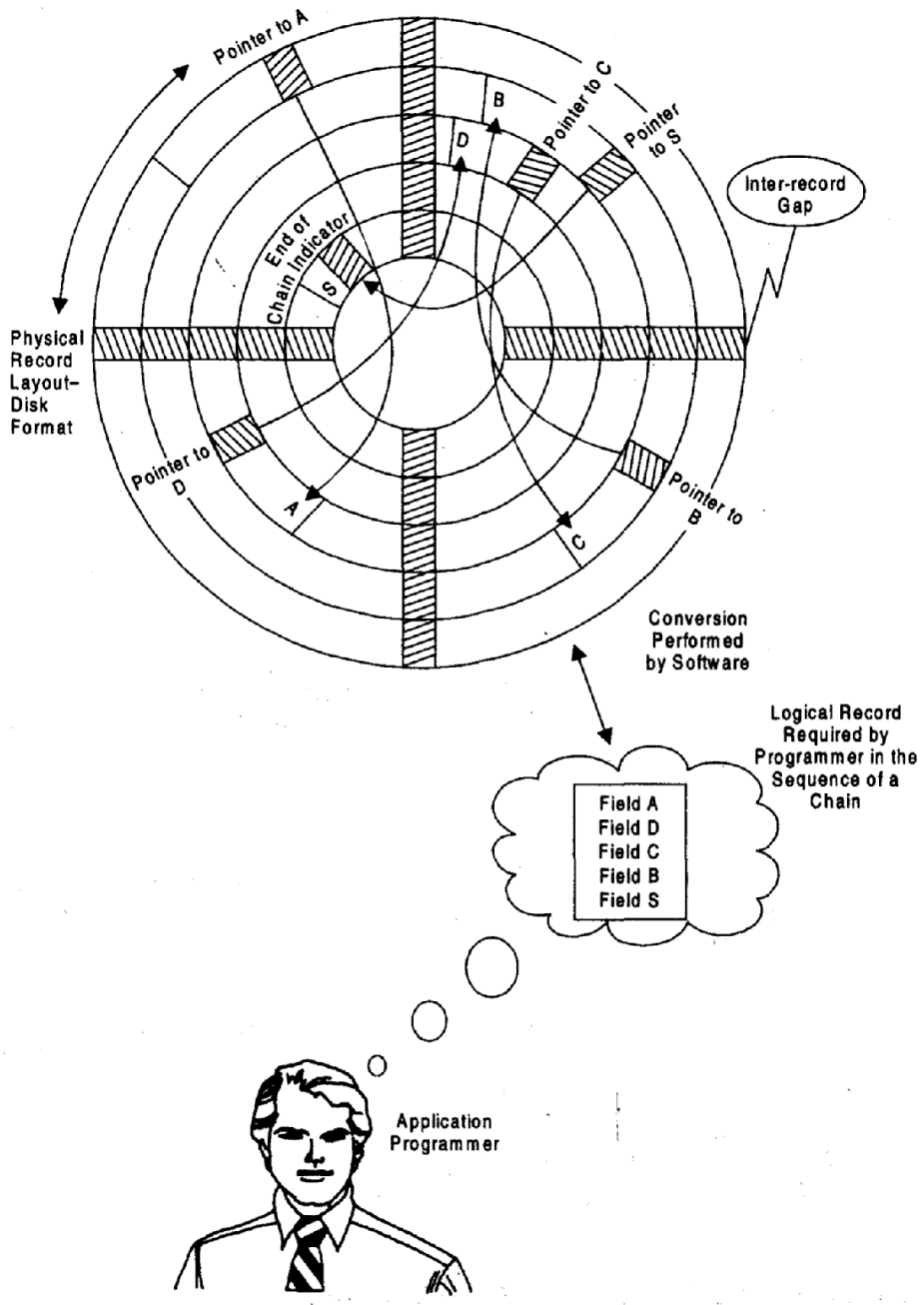


Fig. 26 Physical and Logical Records — A Contrast

Data Integration

Data is inter-related together at the element level and can be manipulated in many combinations during execution of a particular application program. DBMS facilitates collection, combination and retrieval of the required data to the user.

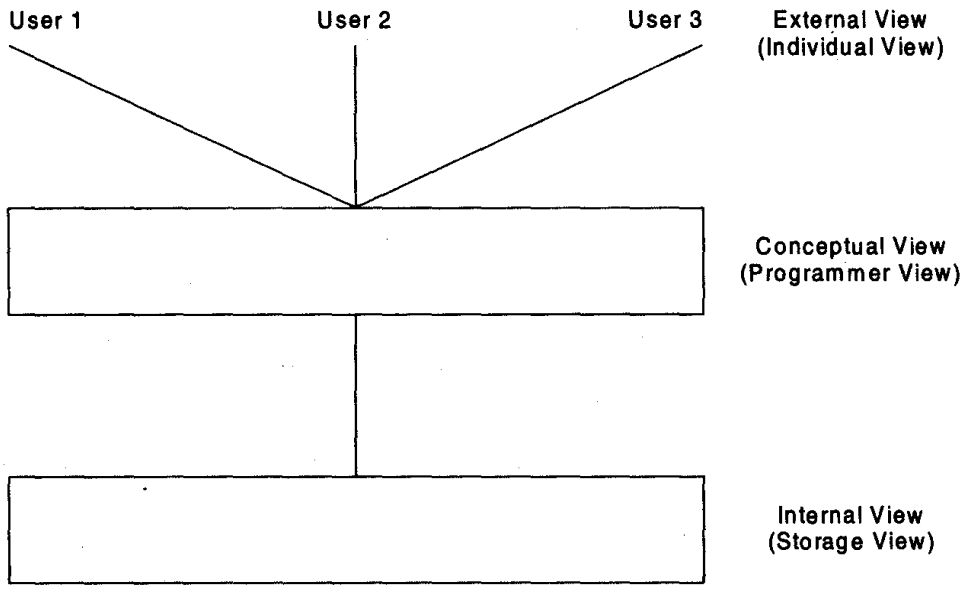


Fig. 27 Three Levels (Views) of DBMS

Physical/Logical Level Separation

DBMS separates the logical description and relationships of data from the way in which the data is physically stored. It also separates out application programs and their associated data. This adds data security in view of the data access by different programs that describe data in different ways.

Data Control

DBMS receives requests for storing data from different programs. It controls how and where data is physically stored. Similarly, it locates and returns requested data to the program.

Data Protection

Data protection and security is one of the major concerns in a database. DBMS protects the data against access by unauthorized users, physical damage, operating system failure, simultaneous updation, etc. It also protects and secures the content of a database as well as the relationships of data elements. DBMS is equipped with a facility to backup data and restore it automatically in the case of any system failure. Concurrent access control is ensured by the provision of 'locks'. Other security features implemented in the system include password protection and sophisticated encryption schemes.

4.7. UTILITY OF OPERATION OF THE DATABASE TECHNOLOGY

Object-Oriented Databases

Object-oriented database is an approach to data management that stores both data and the procedures (functions) acting on the data as objects that can be automatically retrieved and shared. While traditional database management

systems are designed for homogeneous data that can be structured into pre-defined data fields and records, object-oriented databases are capable of manipulating heterogeneous data that include drawings, images, photographs, voice and full-motion video. Object-oriented approach also enables to overcome the limitations of the relational database management system. No doubt, the relational model is powerful but its abstraction level is low and the manipulation of the relationships of tables is captured by the programs and not by the model itself. On the other hand, an object-oriented database, stores the data and procedures as objects that can be automatically retrieved and shared.

Distributed Databases

A distributed database, as the name indicates, is stored in more than one physical location. The database is stored partly in one location while it is partly stored and maintained in other locations. In other words, a distributed database coordinates data access from various locations. In this approach, databases are designed as an entity and are linked through communication networks. Distributed database approach is an alternative to the central database approach that advocates concentration of all databases at a central place. However any breakdown in the central database approach leads to system-wide breakdown and it also causes undue congestion of traffic at the central hub. On the other hand, distributed systems overcome these problems. They also allow increases in the system's processing power by installing smaller, less expensive minicomputers thereby increasing the responsiveness to local users. Nowadays, many databases are distributed across geographical areas. For example, networks of libraries, networks of banks, transactions of credit in one or more countries and networks of offices of organisations across the world are a reality. These systems are growing rapidly. The advent of microcomputers and powerful telecommunication systems will further boost the growth of distributed systems.

Client-Server Systems

These systems are closely related to the concept of distributed database. In the client/server model, the database and processing power are distributed over the organisation rather than having a centralized database. This model splits processing between 'clients' and 'servers' on a network, assigning these functions to the machine that it is most able to perform.

Servers, in general, are high performance machines that support heavy transaction processing known as server processes, whereas the clients are low-end microcomputers with rich graphical user interface (GUI). Client-servers are growing in popularity these days and are being used by a large number of organisations.

5.8. Summary

In order to support decision-making, strong databases are essentially maintained in organisations. The complexity of the database as well as the variety of queries is ever increasing. To elicit quick responses, there is a need to organize data in the most effective and efficient manner. Data is organised in a hierarchy where data elements or fields are at the lowest level of hierarchy. A collection of related data elements is termed as a record, related records are combined into a file and related files in a database. Traditionally data as stored and maintained separately for individual applications in the organisation. This had many disadvantages like data duplication, data inconsistency, data dependence and program dependence. An alternative approach to the traditional file processing system was developed and is known as the Database approach. In database approach common pool of data can be shared by a number of users concurrently. Moreover, database approach provides more flexibility and ease of use. Unstructured queries can also be handled with this approach. In the database, data is structured on the basis of one of the three data models, namely, hierarchical, network and relational model. In the hierarchical structure, entities are related by parent/child or superior/subordinate relationships. This model allows one to one and one to many relationships. The network model is also similar to the hierarchical model, except that in this approach an entity can have more than one parent. The relational data model which is based on a two-dimensional table known as relation is currently the most popular data model.

NOTES

UNIT – V

5.1. Functional Management Information system

5.2. Production, Marketing, Accounting, Personnel, Financial and their Relationship

5.3. Impact and their role in the Managerial Decision Marking.

5.1. FUNCTIONAL MANAGEMENT SYSTEMS INTRODUCTION

The role of information systems in organisational productivity has been extremely challenging. This is partially because the benefits of information systems are often intangible, manifesting themselves in areas such as improved customer service and greater organizational responsiveness. Hence, organizations are developing new measures, such as 'reduce cycle times' and 'delighting the customer', to better measure the impact of information systems on organizational productivity.

The various functional areas in business, including manufacturing, marketing, finance and accounting, quality control and human resources have all been influenced by information systems. Earlier the emphasis was on developing standalone functional systems and to create customer-oriented systems. In this chapter, these functional areas, using information systems, to capture new markets, achieve a competitive edge in existing markets and provide effective customer service are discussed. Today, most organizations are planning to develop cross-functional systems. Examples of some of them are given.

There are many different types of information systems, transaction processing system MIS, and intelligent support systems, consisting of decision support systems, expert system, executive information system, and office automation systems. All of this play a supportive role in business function and functional information systems often consist of one or more of the aforementioned systems.

FUNCTIONAL AREAS OF BUSINESS

Every business consists of several well-defined functions. These functions are other organized into areas or departments. These areas are known as the functional areas of business. In each functional area, a set of business functions is performed.

In order to study the impact of information systems on each of the function area, following six, functional areas in an organisation are detailed.

- Manufacturing
- Quality Control
- Marketing
- Accounting and Finance
- R&D
- Human Resources

Truly successful systems that have a lasting impact on the organizations are those that are cross-functional, i.e., systems that are not narrowly defined by

functional boundaries, but instead address the broad information needs of managers, regardless of their functional specifications.

In each of the functional area, a data flow model portrays the local decision making environment. Figure 5.1 shows the data flow diagram, which consists of the following components:

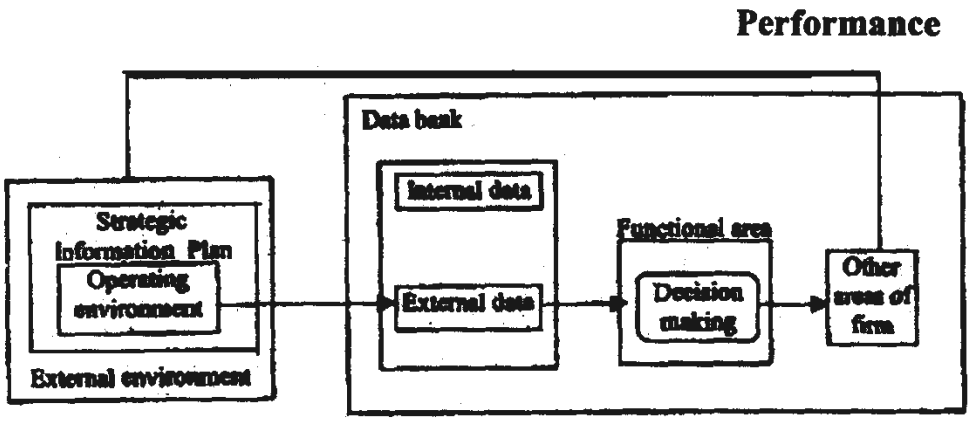


Fig. 5.1 Data Flow Diagram in Basic Functional Areas

External Environment. The external environment contains two components; the operational environment, which consists of consumers, suppliers, competitors, distributors, and the labor supply; and the remote environment, which consists of economics, social, political, technological and industry concerns. These, environmental sources generate key external information that flows into the firm, at times informally.

Data Bank. The term ‘data bank’ is used gene to describe the generally storage of data. A data bank can include data existing in files and in computer databases. An organization’s data bank consists of internal data, such as those generated from the firm’s transaction processing system or from internal forecasts, and external data, which are collected from monitoring the external environment. Both types of data have information potential.

Decision Making. Decision making is the key of each functional data flow model. This process consists of selecting those data needed to make a decision and then making the decision.

(Fig. 5.2). Product design is the starting point of the manufacturing process. It is the step in which the design and technical specifications for the product are finalized increasingly, product design and engineering are becoming more computerized through approaches such as computer aided design (CAD), computer aided engineering (CAE) and, robotics. After a product is designed, the facilities to manufacture must be planned. This design may be as simple as changing a few manufacturing stations on the production

floor or as complex as designing an entirely new has been used since 1950s to address certain facility layout problems sometimes with substantial success. Production is the process of making new product from raw materials. Generally, the production process consists of many interrelated activities. There are two basic types of production methods: job shop and process. Most production, however, is of the process type. Many computerized approaches are used by firms to model the production process as an integrated system. One successful process production approach, which has been a staple in the automated factory since the early 1980s, is called manufacturing resources planning (MRP 11). It integrates all the resources required to make a product: personnel, machines and equipment, plant capacity, pricing, distribution and cost accounting.

Some firms are trying to integrate CAD, CAM and other manufacturing activities, a concept known as computer-integrated manufacturing (CIM). Ideally, with CIM, all concerned with information processing, storage, collection, and distribution are related in a way that optimizes performance of the entire enterprise. Integration allows organizations the efficiently manage (and control) manufacturing and engineering information by eliminating barriers across departments and functions- possibly even across organizations. CIM increase a firm's compatibility for planning productivity, responsiveness, control and innovation.

5.2. Production, Marketing, Accounting, Personnel, Financial and their Relationship

Agile manufacturing refers to manufacturing environments that are dynamic and flexible enough to instantaneously produce customized goods and services in varying quantities and to effortlessly switch the manufacturing process from one product to another. Agile manufacturing has five main characteristics.

1. The ability to thrive on constant change.
2. Recognition by the organisation that people re its main asset.
3. lncorporation of the virtual company idea through the use of telecommunications.
4. A focus on creating products and services with real added value.
5. Agile manufacturing will also help firms to better integrate their information systems.

Quality Control relates to activities which ensure that e final product is of standard quality. Its function is concerned with detecting existing quality deficiencies, as well as with preventing future product quality problem. Quality

control is, therefore, both an important area of expense and an important area of opportunity. One group of computerized quality control techniques that has helped in manufacturing operations is known as statistical process control (SPC). The objective of SPC is to closely monitor production units at various stages of the production process, identifying potential problems before they result in defects and adjusting the production process accordingly through observations. Another promising role for the computer in quality control is in the area of vision inspection systems, where robotic eyes' replace humans in the quality control inspection process.

Sources of Manufacturing Information

Information needed for manufacturing decisions stems from a variety of data sources as shown in Fig. 5.2, and are described as follows:

- **Production Data.** By using, terminals around the production floor, data on production processes can be quickly gathered and processed. These data are used for billing and in almost every aspect of production control.
- **Inventory Data.** Inventory data include inventories of raw materials, good-in-process, and finished goods. Accurate raw material data are especially important can shut down production lines, leaving workers idle.
- **Vendor data.** Vendor data show sources and prices for raw materials. Often, vendor data are maintained by the purchasing department, although sometimes the manufacturing area will personally buy certain items. In any case, manufacturing personnel must be constantly aware of the origination of their raw materials, what new types of products are offered by vendors1 and current prices.
- **Personnel data.** Personnel data show various statistics on current manufacturing personnel. Often, in the course of production, people switch assignments, so personnel skills must be reviewed to fit the right person for the right job.
- **Union data.** Many types of Iabour today are unionised production shops usually have strict regulations regarding such items as pay scales, hiring and firing, promotion, and working conditions.
- **Labour Data.** Raw materials and people are at the core of manufacturing a product. While vendors are the source of raw materials, the labour market is the source of people. Data must be kept regarding where new personnel may be obtained as labour shortage occur in the firm.

- **Engineering Specifications.**Engineering specifications data indicate whether something can be built and how. Engineering specifications contain such facts as sizes of screws; whether a certain drill bit is suitable for wood, metal, or masonry; how to build a sub-assembly of a certain type; and so on. Massive libraries of such specifications are often assembled on magnetic media for retrieval by database management systems. Such technology applications as CD-ROM, hypertext, multimedia, object-oriented databases, and screen publishing (Published materials in screen form) have great potential in this area.
- **Internal marketing data.** Marketing ends where manufacturing begins so marketing output is manufacturing input. Marketing specified the number of units of goods that must be produced in each time periods in order to meet consumer demand. Marketing data are also useful to production personnel as part of the engineering design process.

Advantages of Manufacturing Information Systems

Manufacturing goods and services is the main function of a business. The information generated from the shop-floor (or service floor) drives the rest of the organization. Hence, the firms that have will-integrated manufacturing information systems are bound to reap significant benefits.

In late 1990, an. India-based multinational firm started replacing its PC-based manufacturing system with a new manufacturing information system called Integrated Information System Architecture. The main objectives was reducing manufacturing costs and cutting down cycle times. The new systems which uses databases, networks, GUIs, and off-the-shelf software, allows 1800 employees distributed throughout the firm to easily access enterprise-wide manufacturing data by integrating a number of core business systems (such as general ledger, accounts payable, and manufacturing). Embedded with decision support capabilities the system allows managers to be decision makers instead of data collectors.

Marketing Information Systems

Marketing strategies consists of a mixture of ingredients that has been named the marketing mix: products, promotion, place and price Collectively they are known as the four Ps. Product is what the customer buys to satisfy a perceived want or need. Promotion is concerned with all the means of encouraging the sale of the product, including advertising and personal selling. Place deals with the means of physically distributing the product to the customer through a channel of distribution. Price consists of all the elements relating to what the customer pays for the product.

- Kotler (1966) identified three types of marketing information.
- Marketing intelligence - information that flows into the firm form the environment.
- Internal marketing information – information collected within the firm.
- Marketing communications - information that flows from the firm outward to the environment.

A marketing information system can be defined as' a computer-based system that works in conjunction with other functional information systems to support the firm's management in solving problems that relate t marketing the firm's products. Two element in the definition make key points. First, all of the functional information systems m.ist work together, and second, the problem-solving support is not limited to marketing managers. Thus, a marketing information system is a system that meets the information needs of an organisation in sales, distribution, advertising, market analysis, market intelligence, product research, service management, customer profile, and other marketing functions.

Since marketing information system are primarily customer-oriented information systems, the systems work towards realising the strategic sales plan and the marketing plan of an organisation.

Inputs of Marketing Information Systems

Information used for marketing, decisions arrived at from different data sources, the most important of which are shown in Fig. 5.2, and are explained.

- **Transaction processing data.** Transaction processing data show the sales that result from specific mixes of the four Ps. Thus, they provide feedback Of the effectiveness of past marketing, strategies. They are also useful for appraising performance and controlling marketing expenditure.

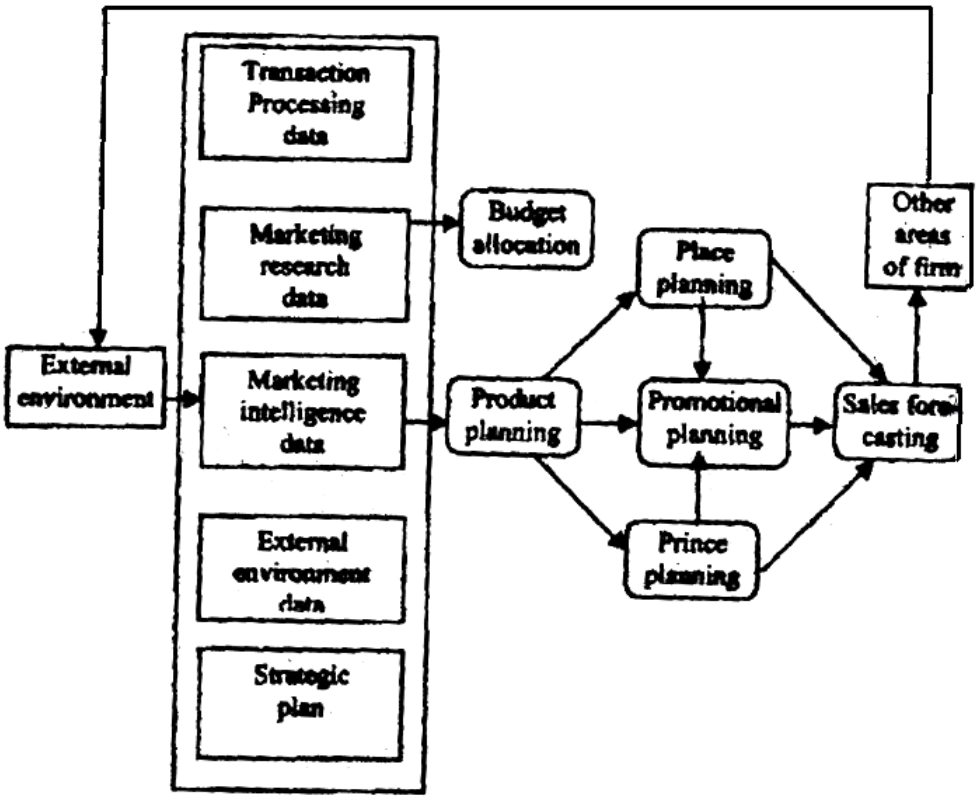


Fig. 5.2 : Data flow representing of the marketing Information system

Marketing Research Data. Marketing research is the marketing are responsible for gathering consumer related data that can be used support marketing decisions; for example personal interviews, phone interviews, and mail surveys. Statistical packages are often used by the marketing research staff to analyze these data and to provide useful facts about a product that could not otherwise be obtained, from analyzing raw sales figures. Often, tests determine if the research findings are statistically significant or if they should be attributed, instead, to chance.

Marketing Intelligence Data. Marketing intelligence refers to information about the /strategies of competitors. The term "intelligence" is a carryover from the military, which uses, the term to describe data gathered about enemy activities. Most marketing intelligence information is collected in an unstructured or semi-structured manner: through word-of-mouth interaction or through observing statistics available in the media and commercial data-base services.

Strategic Plan. The strategic plan is really the starting point of all marketing decisions. It contains the types of products that the firm plans to supply to the consumer marketplace. These broad guidelines define the direction of the marketing effort. The tactical marketing plan addresses what,

how, when and where questions; that are appropriate to the implementation of the strategic plan.

Output of Marketing Information Systems

Each output subsystem provides information about its part of the marketing mix (four Ps.). These are discussed to have the principal decision areas.

Product Planning. Product planning is often complicated unstructured decision. A number of factors contribute to a product's success of failure. Complicating these product planning decisions are the facts that the choice of consumers constantly change and that competitors always develop new products. Most products follow a product life cycle. As its name implies, the product life cycle traces the sales of a product from its introduction to its withdrawal from the market. The four stages in the life cycle are introduction, growth, maturity and decline. A number of techniques have been developed to provide the manager with the information needed for making product-oriented decisions.

Place Planning. Place planning refers to the channels of distribution that a firm uses to get its products to the consumer. The resources flowing through a channel includes a supplier, manufacturer, wholesaler, retailer, and consumer. The material flow originates with the supplier and ends with the consumer. They money flow is just the reverse; and an information conduit provides a two-way flow that connects all participants; Information that flow in the direction opposite to the material flow is called feedback information, and the flow of information toward the consumer is called feed forward information. This includes announcement of new products, sales and promotion aids, and forecasts of new' products, sales and promotion aids, and forecasts of demand to the wholesaler and retailer. Peed forward information to. the consumer can include instructions for use, safety tips, and warranties.

Promotion. Promotion is composed of two principal areas: Personal selling and advertising. Technology is vital to the selling effort in several ways: (a) Tying in customers arid suppliers; (b) Increasing selling time; (c) increasing effectiveness of the client site; (d) Identifying selling opportunities; and (e) Making sales people more efficient.

Price. Depending on the firm's pricing policies, the price area can run close to promotion in term of decision support difficulty. Some firms engage in cost-based pricing by determining their costs and then adding a desired mark-up. This approach is a rather cautious one. A less cautious pricing policy is demand-based pricing, which establishes a price compatible with the value that the consumer places on the product. They key to this approach is correctly

estimating demand. This requires a good understanding of the consumer and also of the market, including the state of the economy and competition.

Budget allocation. Two other important decision making areas, in addition to four Ps, are the allocation of the marketing budget and sales forecasting. Marketing does not have an unlimited source of funds. Thus, a budget must limit the overall size of expenditures. Some computerized allocated models can estimate desirable mixes in this area, but success is limited. This decision is still made largely through manual means and personal judgement.

Sales Forecast. The sales forecast reflects estimate by the marketing personnel on future product sales. Since it is the main source of firm's revenue, sales forecast is an important part of the financial plan. Many technology tools are used in sales forecasting.

The database created for input and output, marketing information system should provide answers to the following:

- What is the optimal way to capture data at the point-of-sale?
- How can ne ensures that marketing operations are run smoothly and efficiently?
- What ate the goods and services that customers want?
- How do customers define customer service?
- What kinds of services are important to customers?
- Are customers interested in and willing to use information technology?
- How much are customers willing to pay for higher quality service?
- What impact would higher quality customer service lave on the profits of the firm?
- Flow can customers be attracted and retained?

Advantages of Marketing Information Systems

A good marketing system provides employees with information that helps firms capture niche markets in highly competitive industries. Marketing information system has a deep and direct influence on the quality of customer service. Hence, it is seen that competitive intelligence is of interest to the firm as a whole. Although the name of a functional information system implies that it is only for managers and executives as well. Hence, marketing information systems play a vital and critical role in helping an organisation to achieve its goals.

Quality Information System

Quality information systems are standalone systems or embedded systems that help an organisation to achieve its quality goals. The quality plan is derived from the strategic information plan.

Figure 5.4 shows how the strategic quality plan is derived from the strategic information plan. In some cases, a firm has no separate quality plan, but instead makes quality a components of the other plans, such a marketing, manufacturing, and so on. Table 6.1 provides some do's and don'ts for executives involved in TQM efforts.

The information systems (IS) department plays a major role in ensuring the success of TQM efforts in an organization. An information system can promote. quality and provide tools and techniques to help the firm achieve its quality goals. Information, systems also help firms achieve quality certification. There are many institutions and agencies that certify the quality efforts of an organization and provide guidelines to firms that plan to install quality in all aspects of their operations.

The role of IS may vary from one organisation to the next, or even from one program to the next, but there are four major areas where IS plays an important role in certification process. They are; Partial systems overhaul, full systems overhaul, training, and oversight.

In a partial system overhaul, existing system are partially revamped in. order to update them and make them more responsive to the changing needs of decision makers. Partial systems overhaul may include providing users with better interfaces, better end-user support, or better integration of existing systems.

In a full system overhaul, the old system is replaced with a new system. This may sometimes be necessitated by outdated equipment of systems that can no longer be updated or maintained.

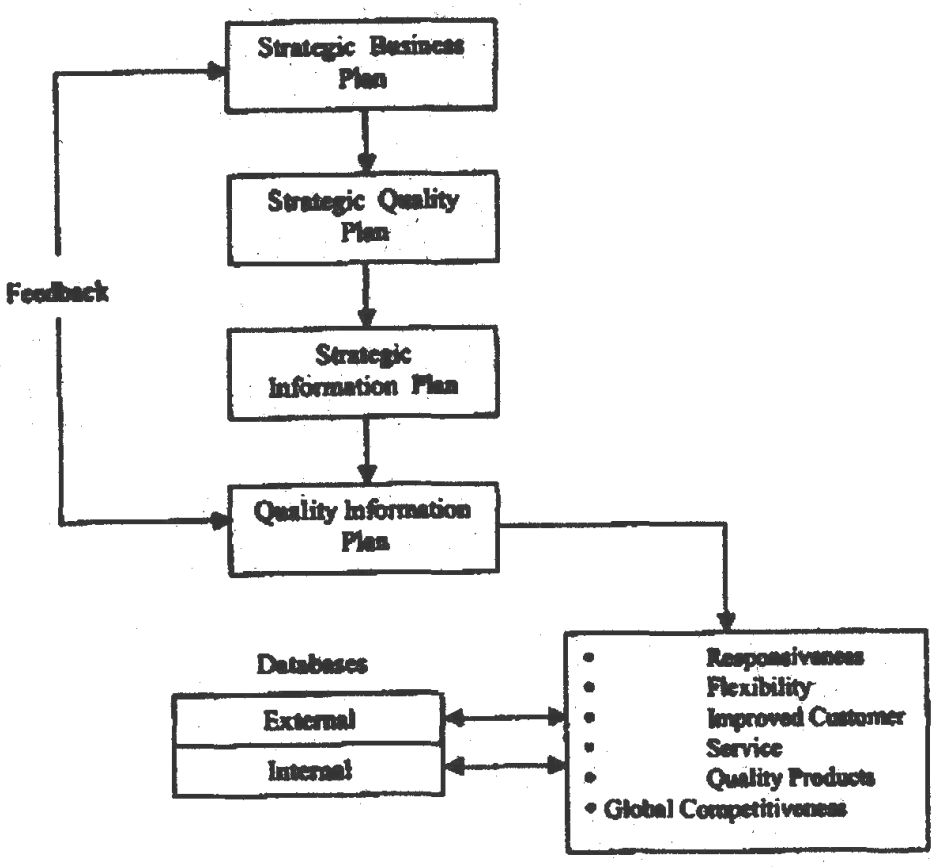


Fig. 5.4. Quality Control Information System in an Organization

Training is another area where IS a play an important role in quality certification. Users must be well-trained in systems that are partially or fully overhauled; because this has a direct impact both on quality and on productivity. More important, good data come form well trained users and good data from the basis of good decisions.

Finally; is should oversee the entire quality certification process; this is often a time consuming task. It requires co-ordination among departments; IS. can play a facilitating role by ensuring the free flow of information between decision makers, Often, organizational data and information have to be sent to external agencies and IS plays a critical role in getting the right data to the right people all the right time.

Table 6.1. Some do's and don'ts followed by information Specialists In an Enterprise-wide Quality effort.

Good Moves

- Help provide an enterprise-wide perspective to the TOM efforts.
- Volunteer at the outset. Don't wait for someone to ask you to be involved.

- Be a consensus builder in the corporate effort, a catalysts rather than a driver.
- Be a leader for the IS staff. They will be watching to see if you really supported the process or just give it lip service.
- Become a resource for the quality teams in resolving cross-functional conflicts.
- Get the IS staff (your people) trained in the quality process. Many of the skills used in systems analysis will translate well.
- Be realistic with the time frame that you set. People will lose interest if a task can't be accomplished in six months or less.

Bad Moves

- Don't try to control information production and use. Encourage end-user access to information, off-the-shelf software, etc.
- Don't allow IS to be a bottleneck at the implementation phase. Anticipate recommendations to re-engineer systems or support streaming efforts.
- Don't be an obstacle to the TQM effort. Look, for opportunities to change "can't be done" to "can do".
- Don't promise more than you can deliver.
- Don't permit the over involvement of just on or two individuals in the IS department.

Source : David Loebig, ClO, Owen Healthcare, Inc. Houston: Charles M. Jones, ClO, Charleston Area Medical Centre, charleston, W.VA; College of Healthcare Information Systems Executive, Arm Arbor Mich.

Advantages of Quality Information Systems

The aim of most firms all over the world is to produce high-quality goods and services; information is essential to achieve this goal accurate, timely, and reliable information. Achieving quality also involves being able to develop strategic alliances with suppliers and customers, and information is again essential to this process. A high-quality car manufacturing firm in India has developed a quality information management system (QIMS) to achieve its quality goals. The system highly integrates information generated on the shop-floor, for instance about defective auto parts, so that decision makers can, take immediate action to correct 'the situation. Mangers have changed from data collectors to quality enforcers, since now they can take proactive action to keep the firm on the quality track.

Financial and Accounting Information System

Financial and accounting information systems' (FAIS) is a system that provides information related to the accounting and financial activities in an organisation. It includes budgeting, cash and asset management, capital budgeting, portfolio, analysis, general ledger, accounts receivable, inventory control, and payroll systems. Other systems include record keeping, account analysis, cash management, financial analysis, leasing options, insurance, claims processing, and investment management. Financial institutions, such as banks, use specialized FAIS, 'such as commercial loan analysers, credit approval systems, commercial account rating systems, credit application systems, automated teller control, and securities trading. Other institutions and firms may have their own specialized FAIS subsystems work together to create, record, generate and disseminate financial and accounting information vital to good decision making.

Figure 5.5 shows how the financial information plan is derived from the strategic information plan and the strategic business plan. Although most financial. and accounting managers operate under the 'tyranny of the urgent', a strategic financial plan and an integrated set of information systems that support the plan are a necessity for the survival and growth of any organisation.

Types of Financial and Accounting Information Systems

Various- functions of FAIS are explained briefly.

General Ledger Systems generated the firm's income statements and balance sheets and are responsible for managing new and old accounts in the firm. Asset management systems, maintain an inventory of the firm's long-term assets and ensure that accounting practices for firm 'assets comply with regulatory, standards. The output of this system often becomes input to the general ledger system. Order entry systems capture and manage different kinds of data relating to a transaction, such as number of units sold, customer 'billing, credit history, sales tax, and inventory levels. The output of this system is input to a number of other' systems, such as accounts receivable and inventory management. Accounts receivable and accounts payable capture and process data, such as creditor and customer billing information, payments received and owed, credit terms, account balances, and payment schedules. The inventory, such as items in inventory, inventory levels and costs, accounting practices related to inventory maintenance,' stock balance, and data on lost, damaged, or returned goods. Finally, payroll systems capture and process data related to wages and salaries, including central and state taxes, other payroll deductions, employee 'benefits, overtime, and related data.

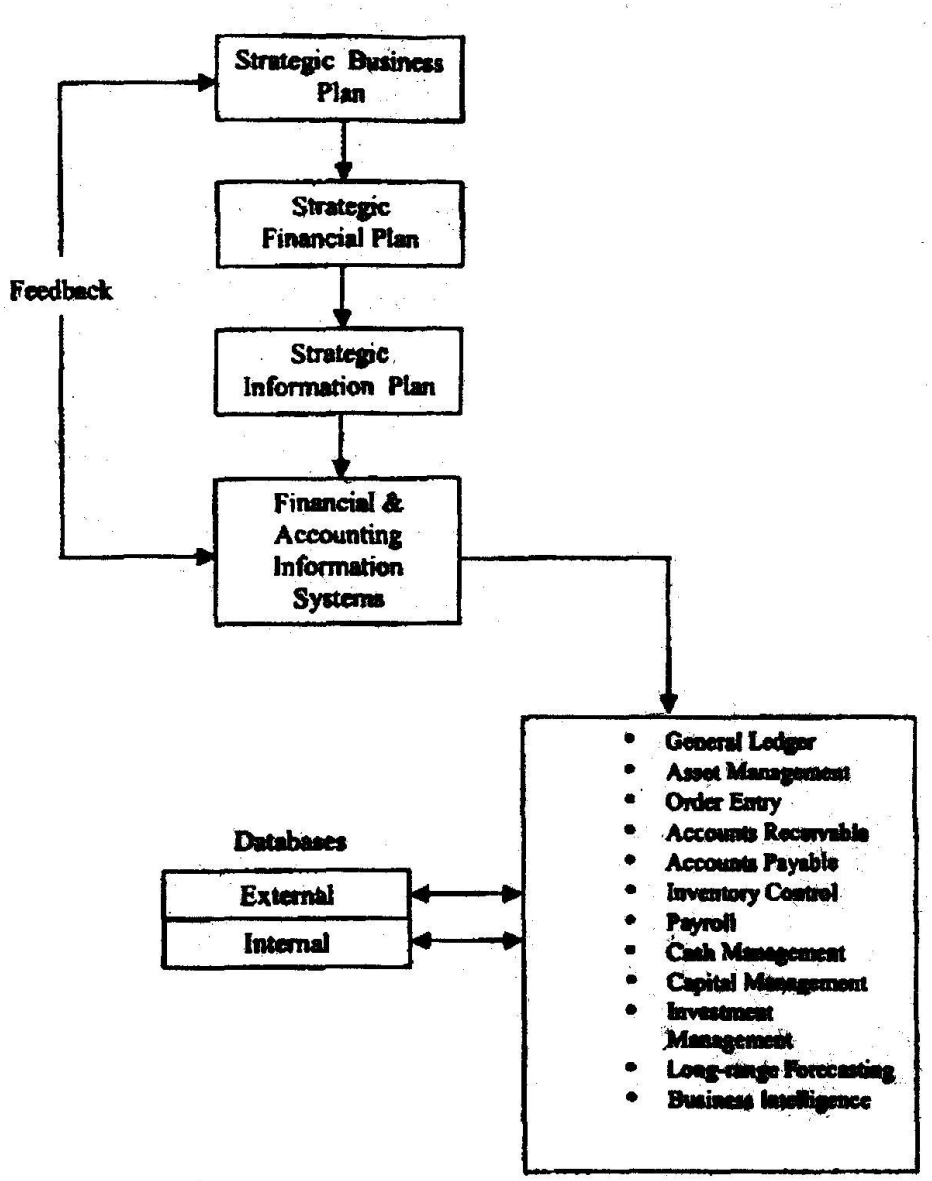


Fig. 5.5. : Financial and Accounting Information System with Its Subsystem

These systems are designed to support mostly operational decisions. There are other kinds of FAIS to support tactical and strategic decision making in the organisation, such as the following:

Cash management system. Systems that ensure that the organisation has enough cash to conduct normal business, to receive the best possible return on its short-term cash deposits, and to leverage its cash flow to achieve good ratings in financial markets.

Capital budgeting systems. Systems that ensure the acquisition and disposal of capital assets, such as land, buildings, and so on.

Investment management systems. Systems that ensure that the organisation gets the best possible returns on its long-term investments.

Integrated Financial and Accounting Systems

FAIS are often integrated with other functional systems in the organisation to facilitate data sharing and team decision making. After all, financial decisions are not made in vacuum; they often involve marketing, manufacturing, and human resources. Thus, a free flow of information among these functional units is vital for good decision making. A radically different form of accounting, called ABC accounting, is helping firms integrate financial information with other systems. The activity-based costing (ABC) accounting system assigns overhead costs based on actual consumption of resources. A key benefit of ABC is that is allows a firm to determine the true of a product and the cost of serving business as a collection of salaries and machines, ABC views it as a collection of processes by integrating information from - different sources, such as the firm's general ledger and time-keeping systems. Determining the true cost of a product 'is the first step toward increasing profits and a FAIS can help a firm achieve this goal.

For global and multinational firms, integrated financial and accounting systems are simply a necessity.

Research and Development (R & D) Information Systems

Advances in information technology have spawned specialized information systems in many other business areas. The significant areas receiving as an information intensive activity that is usually responsible for evolving a steam of new products and production process innovations for the organisation R & D is responsible for creating and developing new products or services in order to capitalize on recognized opportunities. R & D may also be responsible for overcoming recognized weaknesses in current organizational production and operation processes in order to make them more efficient, cost-effective, and competitive. Because of this mandate and the potential of R & D to provide the organisation with competitive advantage, many researchers suggest that R & D information systems should be considered to be strategic information systems.

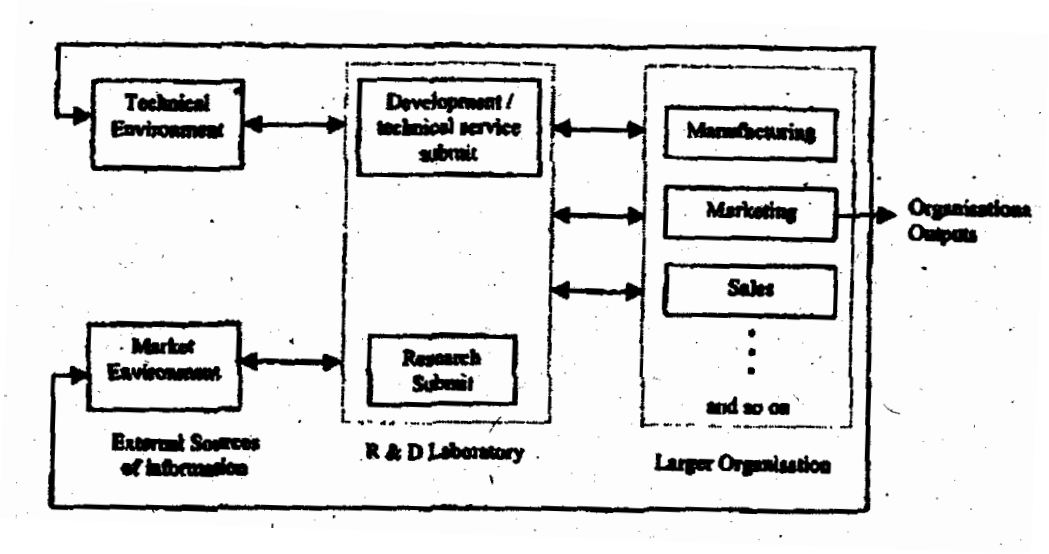


Fig. 5.6 : Information flow In R & D

Like many other organizational systems, R & D is an open system that has important information and communications exchange with the external environment and other organizational subunits. Figure 5.6 depicts the major information flows crucial for R & D effectiveness. This figure suggests that strong linkages should exist between R & D and the marketing / production subsystems of the organisation.

In most organizations1 the proportion of spending on information technology for R & D is increasing and that integrated laboratory information management systems are gaining in popularity. The productivity of R & D professionals has increased because of these changes, resulting in reduced product development times. Also, the access to external databases and to other sources of external Information has increased dramatically over the past' few years. However, linkage between R & D subunits that have on-line access to marketing or production databases is far from the expected level.

PRODUCTION MANAGEMENT

The objectives of the production Management are to provide manufacturing services to the organization. The main objectives of the production management are.

- Manufacturing capacity
- Minimal rejections
- Minimize the cost
- Meeting the delivery promise
- The main function of the production management is planning and control

- Material management function
- Control the lab our

The following are the important input transaction of the production management

- Production programme
- Production schedule
- Job status advice
- Quality assurance details
- Completed product details
- Breakdown services
- Material requirements
- Customer order

The production management is performed through production planning and control, it accounts for the following entities

- Quantity of production with respect to fine period
- Material requirements and its usage
- Machine and facilities usage
- Labor covers
- Use of power and consumable

MATERIAL MANAGEMENT

The objectives of materials management is to provide materiel for production , maintains and services at economical prices , in an appropriate quantity and quality with least stocks and with no extra cost of carrying the inventory. The scope of materials management function is procurement, stocking and controlling of inventory.

The following are the important input transaction of the material management.

- Purchase requirement
- Purchases order
- Receipt of goods
- Return of goods to supplier
- Issue for production
- Return from production
- Certification of bill for payment

Application

- Forecasting and planning
- Procurement
- Purchase ordering

- Goods receipt
- Inspection
- Bills passing and control

Reports and display

- Purchase Quantity
- Stocks Details
- Average or standard rate of accounting
- Performance

MARKETING MANAGEMENT

A marketing information system is a continuing and interacting structure of people, equipment and procedures to gather, sort, analyses, evaluate, and distribute pertinent, timely and accurate information for use by marketing decision makers to improve their marketing planning, implementation, and control.

The following are the important input transaction of the material management

- Customer order
- Order acceptance
- Delivery note
- Invoice
- Credit and debit information

This transaction may place at various locations and the consolidation data are stored in the database. The main accounting entities used for the marketing system are

- Production sale
- Production family
- Sales value
- Sales tax
- Dealer and distribution details
- Customer details
- Exercise duty
- Area
- Inventory
- Receivable
- Complaints
- Returns

The marketing function number of decision, number of choices and the alternative solution is taken marketing management.

ACCOUNTING MANAGEMENT

The primary objective of the finance management is the financial needs of the business from time to time, providing working capital long-term loans to run. The business with capital at minimum. The secondary objective of the financial management to prepare at results, submit all the reports to the govt.

The following are the important input transaction of the Accounting management

- Break even analyses
- Cost analysis
- Cash Flow
- Financial Modeling
- Expenses Analysis
- Auditing and controlling
- Ratio analysis
- Capital budgeting
- Management accounting

It accounts for the following

- Sales
- Purchase
- Salary and wages
- Inventory
- Tax details accounts
- Budget

The important decision analysis in the financial management

- Cash flow analysis
- Budget analysis
- Cost analysis of various production inputs and alternatives

5.3. Impact and their role in the Managerial Decision Marking.

Human Resource Information Systems

Human resource information system (HRIS) is system that supports the planning, control, co-ordination, and management of an organisation's human resources.

Table 5.2. Guidelines, for Selection at a HRIS

Get advice	Help from a reputable HR consulting from minimizes the risk. These specialists have been through the process before.
Tests the payroll	High-volume transaction processing is the toughest job for client-server systems. Ask prospective human resources vendors to run your payroll for you.
Play the numbers	Don't ignore the benefits of outside service bureaus especially in hte areas of payroll. Tax, retirement, and other legal conditions change. If you've got more than 500 employees, run a cost-benefits analysis.
Get it in writing	Don't be afraid to ask your vendor for a guarantee.
Train, train, train	Provide plenty of project staffing and technology education for your HR staff on the new system.
Be prepared	A merger or acquisition can affect your business at any time. A firm might need to add 5,000 employees to benefits and payroll systems within 30 days.
Act like traditional IS	Today's human resources departments must worry about security and data integrity, taking over that responsibility in some case from information systems departments.
Source. Winkler,	"The New Line on Managing People." Information Week, May 23, 1994. p.68.

FIRIS also includes a large number of subsystems that address the information needs of various human resource functions. They provide managers with information, policies and procedures concerning recruiting, layoffs, employee evaluation, promotion termination, transfer, salary equity monitoring, job descriptions and responsib1liti training, Affirmative Action Plan (PAP), and equal employment opportunities (EEO). Since HRIS also facilitate vital information on matters such as payroll, central and state taxes, health benefits, child care, grievance procedures and other personal information that affects employees' personal and professional lives, it is imperative that these systems be highly responsive to employ needs. Figure 5.7 illustrates the variety of HRIS applications.

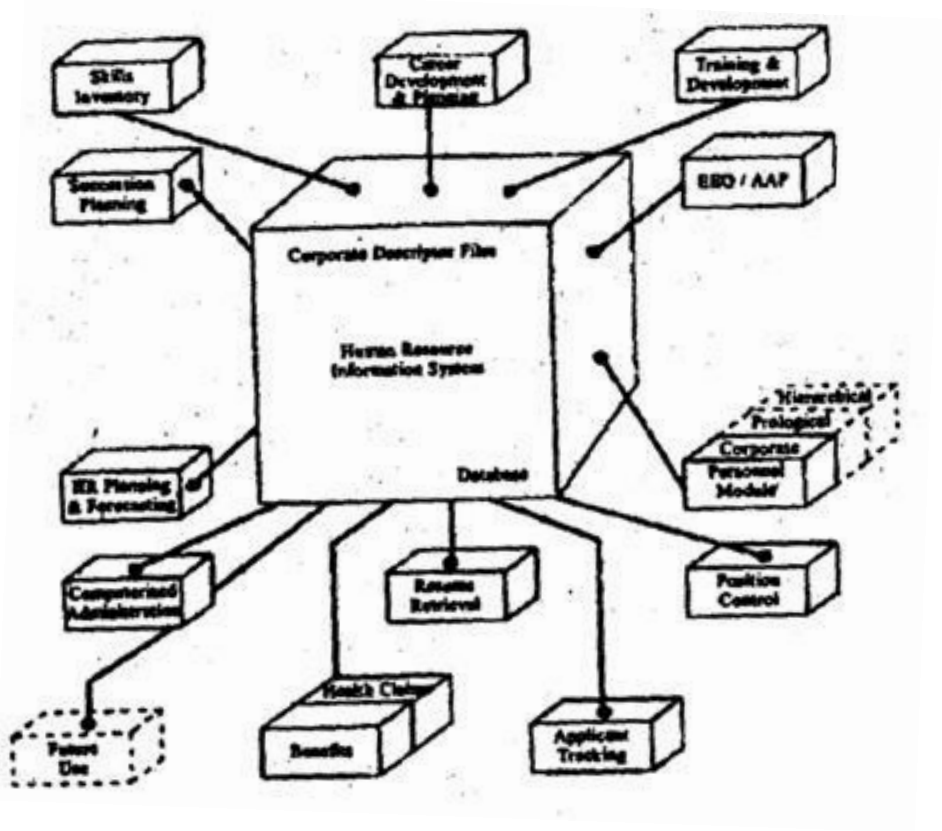


Fig. 5.7. : Human Resource Information System Applications Network

Human, resource systems were slow to be computerized in 1960s. However, in 1990s, many organizations began to realize the importance of HRIS> It is estimated that by the year 2003, HRIS will be necessity for most of the big giants if they are to keep up with increasing government regulations and respond to personal information queries about employees. Table 5.2 gives some guidelines for selecting and HRIS.

Although many people believe that HRIS can be used only to enhance HR decisions, in .fact they can be used to cut costs', increase efficiency, and achieve a competitive edge in the market place. For example, finance and human resource managers of an India-based multinational, firm jointly developed a 'I-IRIS that determines how hiring a training decisions made by the personnel department can increase sales revenues. Also, the system links the performance of an individual to items such as past training, educational background, are work history, so that managers can be better equipped to make such decisions.

Competitive Strategies and HRIS

The human resource information system can shape, and be shaped by, the competitive strategies of a firm. Three competitive firm-based strategies were' identified by Broderick and Boudreau (1987) that influence the objectives and design of the HRIS-cost leadership, customer satisfaction strategy focuses on enhancing customer services to gain market share; innovation emphasizes differentiation through new products, services, and technologies. Table 5.3 shows how the human' resource function can be linked directly to the competitive strategy of the business.

Table 5.3. Competitive Strategies of a Firm influencing the Objectives of HRIS

Firm-level Competitive Strategies			
	Cost Leadership	Quality/Customer Satisfaction	Innovation
HR Competitive Ob jectives	People Working Harder	People Working Smarter	People Working with Vision
HR Decisions and Actions	* Streamline * Standardise * Decrease Production time/head count * Reduce costs (e.g., increase accuracy)	* Educate line managers and other "clients" * Delegate/share decisions * Use customer-driven performance criteria * Increase flexibility	* Define vision * Attract creative talent * Reward risk * Provide opportunities / tools for exploration

Source : Broderick, Renae and John W. Boudreau. "HUman Resources Management Information Technology and the Competitive Edge", Academy of Management Executives. 1992, Vol.6, No.2.; P.10.

Regardless of the strategy that drives the firm, HRIS must be integrated with other systems in the organisation. This helps the entire organisation to better plan its manpower and to explore employee related cost-benefit relationships.

Human Resource information System Development

HRlS is devices from the strategic business plan, the strategic human resources plan, and the strategic information plan (Fig.5.8). Some sub-systems

within the HRIS are personnel data, payroll, benefits, administration, equity monitoring processing job applications monitoring Positions, training and development, safety, workers' compensation union negotiations and collective bargaining.

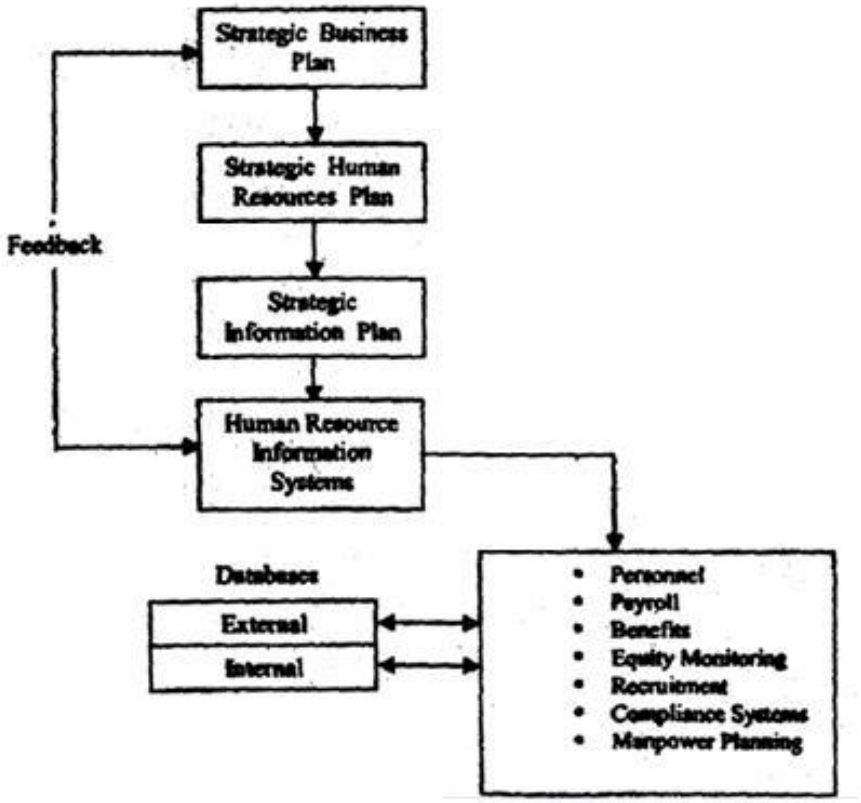


Fig. 5.8. : HRIS and Its Subsystems

The core of an HRIS is a database that contains detailed personal and professional information about each employee in the organisation Personal data include name, age, gender, address, and social security number professional data include educational level, job title, job description, department code, years of employment, number of promotions, performance evaluations, and so on. All other human resource sub-systems derive their information from this core database.

An important subsystem of the HRIS is the compliance system, which closely tracks and monitors the organisation's record of compliance with government laws and regulations, such as affirmative action, equal employment opportunities, and others. In the last two decades, the amount of regulatory paperwork has increased manifold and organisations are actively looking for ways to cut down the time and money they spend on these activities. One way to achieve this objectives is through compliance subsystems.

Another vital HRIS sub-system manages records and generates information regarding recruitment, transfer, promotion, layoff, and information termination of employees, Often, when any of the above situations occur, a large amount of information is generated and the organisation needs a system that processes it. As the number of lawsuits for improper hiring, promotion, and firing policies increases, accurate and timely record keeping becomes even more important.

Other sub-systems of the HRIS include systems that develop and maintain job titles and job descriptions for all jobs in the firm, compensation and benefits information systems, and manpower planning systems. A performance appraisal system that provides employees with real-time information or corporate performance measurements, thus making continuous performance improvement a way of corporate life rather than an annual chore, is another important subsystem in an HRIS. Pre-testing compensation policies, ensuring that employees meet certification requirements, identifying problem areas in employee turnover, and ‘providing training and employee empowerment programs are some other functions of an HRIS.

Today, many organisational are using PC-based kiosks to share vital 1-IR information with employees.

GEOGRAPHICAL INFORMATION SYSTEM

A geographical information system (GIS) is a computer-based system that stores and manipulates ‘data that are viewed from a geographical point of reference. This system has four main capabilities : data input,’ data storage and retrieval, data manipulation and analysis, and data output. Although there are many manual GIS, only computer-based systems are focused ‘here. A GIS is one of the powerful and versatile tools as it can create information by integrating different data, sometimes from different sources, and display the data in different ways to the end-user.

Geography plays an important role in many business’ decisions, since 85% of corporate data, involve a number of business decisions, such as a store locations, sales territories, sales promotions, and regulatory compliance rely heavily on geographical data. Awareness of this has led many ‘software vendors, such as Lotus, to embed mapping technology in their products so that users can produce maps easily.

The number of business applications of GIS has grown significantly in the last few years. For example, a GIS allows a bank to compare deposits with loan approvals in a given area and show that loan approvals meet regulatory standards in areas with deposits. In essence, GIS is an excellent decision making tool that integrates geographical data with other business data. For

organisations with a customer focus, a GIS provides. Clear profiles of customers and their needs; hence these tools can be integrated with any of the functional areas of the business already discussed. The ability to integrate different data, analyze their impact on the customer, and integrate the findings in organizational decision making is one of the key factors of GIS.

CROSS FUNCTIONAL SYSTEM

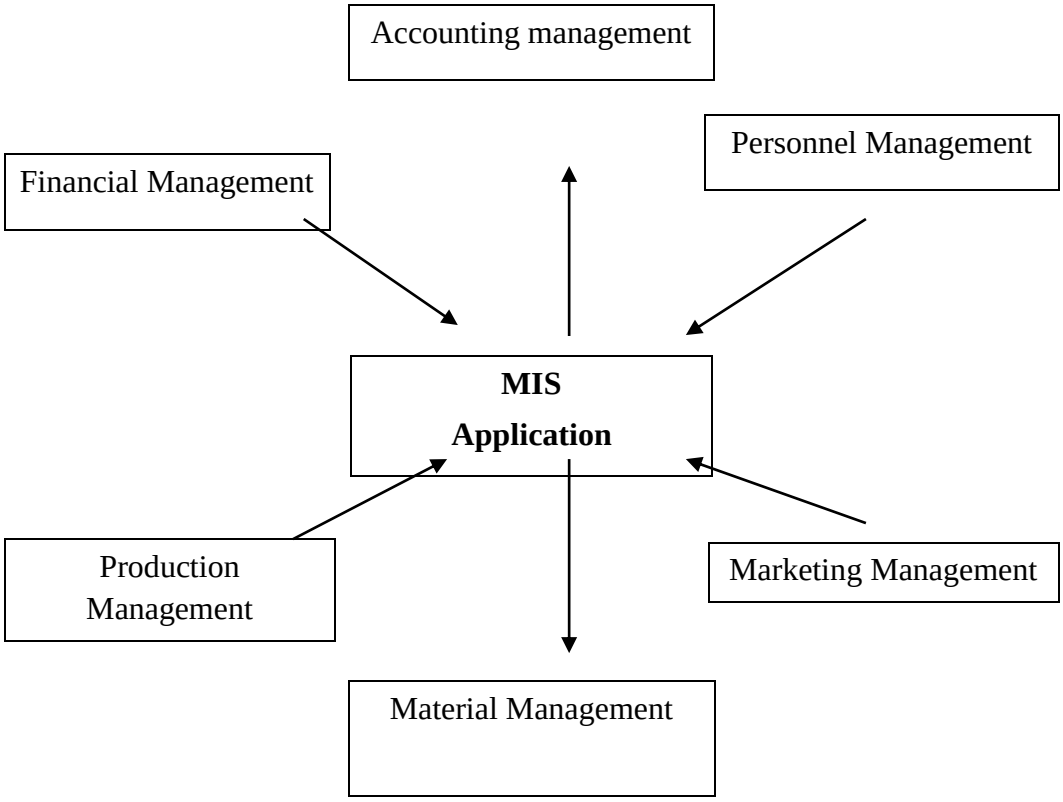
Nowadays, emphasis is given on building cross- functional systems that facilitate the flow of information among all units in an organisation: Decision-making should not be compartmentalized in functional areas, but should instead be viewed in the context of the entire organisation. The close link between information systems and the various functional units in the organisation emphasizes the fact that students, regardless of their area of specialization, should be well grounded in information systems and technologies. In the coming years, computer skills will be grouped with the basic skills of reading, writing, and arithmetic, and computer-literate individuals with a good understanding of information systems will be eagerly sought after by employers.

What is the relationship between the functional systems and the different types of information systems, namely, TPS, MIS, DSS, EIS, ES and OAS? The various types of information systems form the backbone of the functional information systems. The type of functional system depends on the nature, scope, and complexity of the task. If the task is routine, structured, involves transactional data, and is related to operational decisions; whether in finance, accounting, marketing, manufacturing, or human resources, the system is likely to be a transaction processing system. Summary and exception reports for different functional areas are likely to be generated by a management information last month (human resources) or the number of machines operated during the night shift last month (manufacturing) are often the output of an MIS.

If a problem is semi-structured or unstructured, requires internal and external data, and is related to tactical decisions, the system is likely to be a decision support system. Strategic decisions made by senior managers that require data and information to be presented in a succinct manner are likely to be supported by an Els. Capturing and disseminating knowledge in various functional areas of a business often requires an expert system. For example, experience associated with loan approvals in a bank is often modeled by an expert system. Finally, office automation systems facilitate the flow of oral and written communications in the entire organisation, and hence are used by all the functional areas.

The major areas of MIS applied in the business are

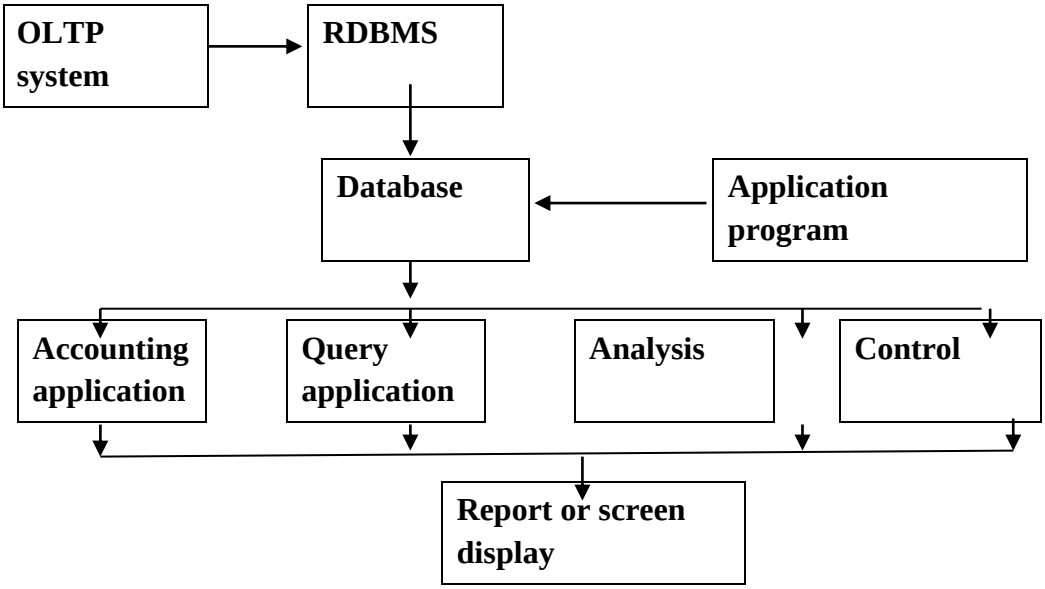
1. Production Management
2. Material Management
3. Marketing Management
4. Accounting Management
5. Financial Management
6. Personnel Management



Structural Relationship between the Management information system

1. The online transaction processing system is used to be process the input
2. The database is used to store all the information about the inputs of the various departments and information about material, human beings Production details etc.
3. The query system is used to analyses the status of the record, results or documents.
4. The system provides the report about stock of the item, accounts details, purchases order and personal details etc.

5. The analysis provides information at all the level for planning and controlling of business operation
6. It provides controlling information for business plan, direction to achieve the plan and progress of each activity.
7. The report generation is based on knowledge update, operation management, decision analysis, control and action. The control information is generated by standards, targets and budgets.



PERSONNEL MANAGEMENT

The primary objectives of the personnel management are to provide suitable man power with ability, knowledge and business organization demands from time to time. The following are the techniques to increases the man power.

1. Human resources Development though training upgrading the skills.
2. Motivation though leadership.
3. Promotion and reward through performance
4. Structuring the organization

The following are the important input transaction of the Personnel management

- Personnel application form
- Appointment order
- Attendance and leave records
- Bio-data about person and family
- Production and proclivity data on the job

- Wages and salary agreement
- Record of complaints and accidents
- Industrial data of man power and skill

The following are the important analysis:

- Analysis of attendance a class of employees
- Analysis of leave record
- Analysis of accident and its types
- Analysis of salary and wages structure
- Analysis of over time details
- Projection of man power needs and recruitment and training
- Projection of personnel man power increases.

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