

INFORMATION SYSTEMS CONCEPTS

BASIC CONCEPTS

1. **System:** The term system may be defined as a set of interrelated elements that operate collectively to accomplish some common purpose or goal.
2. **Nature and types of System:** These may be broadly divided in two main categories: Manual and Automated systems.
 - 2.1 **Computer based business system:** Finance and Accounting, Marketing and Sales, Production or manufacturing, Inventory/ Stores management, Human Resource management.
 - 2.2 **Open System and Closed System:** A system which interacts freely with the environment by taking input and returning output is termed as an open system. On the other hand, the system which neither interacts with the environment nor changes with the change in environment is termed as a closed system.
 - 2.3 **Deterministic and Probabilistic System:** A deterministic system operates in a predictable manner. The probabilistic system can be defined in terms of probable behavior, but a certain degree of error is always attached to the prediction of '*what the system will do*'.
3. **Information:** Information is data that have been put into a meaningful and useful context.
 - 3.1 **Attributes of Information:** Availability, Purpose, Mode and Format, Decay, Rate, Frequency, Completeness, Reliability, Cost-benefit Analysis, Validity, Quality, Transparency, and Value of Information.
4. **Information System and its Role in Management**
 - 4.1 **Factors on which information requirements depend:** Operational Function, Types of Decision making, Level of management activity
 - 4.2 **Information Systems at different levels of management**
 - 4.3 **Types of Information:** Internal and external information

5. Types of Information Systems at different levels

5.1 Transaction Processing System (TPS): TPS at the lowest level of management is an information system that manipulates data from business transactions.

5.2 Management Information System (MIS)

5.2.1 Characteristics of an effective MIS: Management oriented, Management Directed, Integrated, Common Data Flows, Heavy Planning element, Sub System Concept, Common Database, and Computerized

5.2.2 Pre-requisites of an effective MIS: Database, Qualified System and management staff, support to top management, Control and Maintenance of MIS, Evaluation of MIS

5.2.3 Effect of using computer for MIS: Speed of processing and retrieval of data increases, Scope of use of information system has expanded, Scope of analysis widened, Complexity of system design and operation increased, Integrates the working of different information sub-system, more comprehensive information, and increases the effectiveness of Information system

5.3 Decision Support System (DSS)

5.3.1 Characteristics: Semi-structured and Unstructured Decisions, Ability to adopt the changing needs, and Ease of learning and use

5.3.2 Components of a DSS: Users, Databases, Planning Languages, Model Base

5.3.3 Tools for DSS: Database Languages, Model based decision support software, Tools for Statistics and Data Manipulation, and Display based decision support software

5.3.4 Examples of DSS in Accounting: Cost Accounting System, Capital Budgeting System, Budget Variance Analysis System, General Decision Support System

5.4 Executive Information System (EIS)

5.4.1 Executive Roles and Decision Making: Strategic Planning, Tactical Planning, Fire Fighting, and Control

5.4.2 Executive Decision Making Environment: Three main sources of information: *Environmental*, *Competitive*, and *Internal*.

5.4.4 Commercially available EIS Products: Commander EIS, Command Center, Executive Edge, and Express EIS.

Question 1

Explain the general model of a system, in brief. Also explain the terms 'Subsystem' and 'Supra-system'.

Answer

General model of a system: The term system may be defined as a set of interrelated elements that operate collectively to accomplish some common purpose or goal. One can find many examples of a system. Human body is a system, consisting of various parts such as head heart, hands, legs and so on. The various body parts are related by means of connecting networks of blood vessels and nerves. This systems has a main goal which we may call 'living'. Thus, a system can be described by specifying its parts, the way in which they are related, and the goals which they are expected to achieve. A business is also a system where economic resources such as people, money, material, machines, etc are transformed by various organizational processes (such as production, marketing, finance etc.) into goods and services. A computer based information system is also a system which is a collection of people, hardware, software, data and procedures that interact to provide timely information to authorized people who need it.

Systems can be abstract or physical. An abstract system is an orderly arrangement of interdependent ideas or constructs. For example, a system of theology is an orderly arrangement of ideas about Good and the relationship of humans to God. A physical system is a set of elements which operate together to accomplish an objective. A physical system may be further defined by examples given in the following Table:

Physical system	Description
Circulatory system	The heart and blood vessels which move blood through the body.
Transportation system	The personnel, machines, and organizations which transport goods.
Weapons system	The equipment, procedures, and personnel which make it possible to use a weapon.
School system	The buildings, teachers, administrators, and textbooks that function together to provide instruction for students.
Computer system	The equipment which functions, together to accomplish computer processing
Accounting system	The records, rules, procedures, equipment, and personnel, which operate to record data, measure income, and prepare reports.

Table: Physical Systems

The examples illustrate that a system is not a randomly assembled set of elements; it consists of elements, which can be identified as belonging together because of a common purpose, goal, or objective. Physical systems are more than conceptual construct; they display activity or behavior. The parts interact to achieve an objective.

A general model of a physical system may be given in terms of input, process and output. This is, of course, very simplified because a system may have several inputs and outputs as shown below in the Fig.:

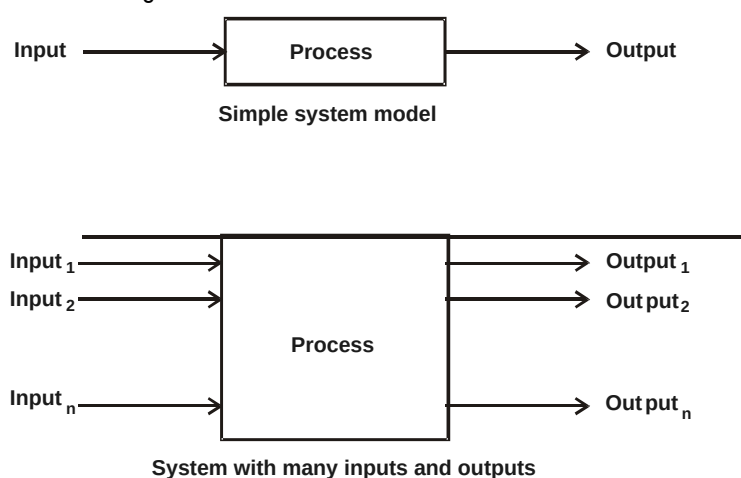


Fig.: Model of a system

Subsystem and Supra-system: A subsystem is a part of a larger system. Each system is composed of subsystems, which in turn are made up of other subsystems, each sub-system being delineated by its boundaries. The interconnections and interactions between the subsystems are termed interfaces. Interfaces occur at the boundary and take the form of inputs and outputs.

A supra-system refers to the entity formed by a system and other equivalent systems with which it interacts. For example, an organization may be subdivided into numerous functional areas such as marketing, finance, manufacturing, research and development, and so on. Each of these functional areas can be viewed as a subsystem of a larger organizational system because each could be considered to be a system in and of itself. For example, marketing may be viewed as a system that consists of elements such as market research, advertising, sales, and so on. Collectively, these elements in the marketing area may be viewed as making up the marketing supra-system. Similarly the various functional areas (subsystems) of an organization are elements in the same supra- system within the organization.

Question 2

Define the following terms briefly:

- (a) *Open system*
- (b) *Closed system*
- (c) *Deterministic System*
- (d) *Probabilistic system*
- (e) *Transaction Processing System (TPS)*
- (f) *Decision Support System (DSS)*
- (g) *Executive Information System (EIS)*

Answer

- (a) **Open System:** A system that interacts freely with its environment by taking input and returning output is termed as an open system.
- (b) **Closed System:** A system that does not interact with the environment or does not change with the changes in environment is termed as a closed system.
- (c) **Deterministic System:** A deterministic system operates in a predictable manner. The interaction among the parts is known with certainty. If one has a description of the systems at a given point in time plus a description of its operation, the next state of the system may be given exactly, without error.
- (d) **Probabilistic System:** It can be described in terms of probable behaviour, but a certain degree of error is always attached to the prediction of what the system will do.
- (e) **Transaction Processing System (TPS):** It manipulates data from business transactions. Any business activity such as sales, purchase, production, delivery, payments or receipts involves transaction and these transactions are to be organized and manipulated to generate various information products for external use.
- (f) **Decision Support System (DSS):** It is a system that provides tools to managers to assist them in solving semi-structured and unstructured problems in their own, somewhat personalized way. That is, a DSS supports the human decision-making process, rather than providing a means to replace it.
- (g) **Executive Information Systems (EIS):** It is a tool that provides direct on-line access to relevant information in a useful and navigable format. Relevant information

Information Systems Control and Audit

is timely, accurate and actionable information about the aspects of a business that are of particular interest to the senior manager.

Question 3

Identify and justify the type of each one of the following systems based on how they perform within an environment and/or certainty/ uncertainty:

- (i) Marketing system
- (ii) Communication system
- (iii) Manufacturing system
- (iv) Pricing system
- (v) Hardware-Software system.

Answer

System	System Type	Justification
(i) Marketing system	Open System	The marketing system plays a pivotal role in the running of a business in the competitive environment. The objective of the system is to maximize customer satisfaction by providing a free interactive environment. The system takes input/feedbacks and facilitates the outcomes as products of the company and to create new customers.
(ii) Communication System	Open System	The communication system in an organization is a point of contact to balance the external influence and render its services to the customers. The system interacts freely with its environment by taking input and returning output.
(iii) Manufacturing System	Closed System	This system is in place to meet a particular objective. It neither interacts with the environment nor changes with the change in the environment. A manufacturing unit is completely isolated from its environment for its operation.
(iv) Pricing System	Probabilistic and Open System	The system has a probable behavior and interacts freely with its environment by taking inputs and returning outputs. The pricing system is a dynamic one which

		influences the form of profit and goodwill of an organization.
(v) Hardware-Software System	<i>Closed Deterministic System</i>	The interaction among the various parts of the system is known with certainty and it does not interact with the environment and does not change with the change in the environment. Here the requirements of the hardware and software inventory are known with certainty. The operational state of these systems is predictable.

Question 4

Explain the limitations of MIS.

Answer

Limitations of MIS: The main limitations of MIS are as follows:

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

MIS effectiveness decreases due to frequent changes in top management, organizational structure and operational team.

Question 5

Differentiate between open and closed systems.

Answer

A Closed System is self-contained and does not interact or make exchange across its boundaries with its environment. Closed systems do not get the feedback they need from the external environment and tend to deteriorate. A Closed System is one that has only controlled and well defined input and output. Participant in a closed system become closed to external feed back without fully being aware of it. Some of the examples of closed systems are manufacturing systems, computer programs etc.

Open System actively interact with other systems and establish exchange relationship. They exchange information, material or energy with the environment including random and undefined inputs. Open systems tend to have form and structure to allow them to adapt to changes in their external environment for survival and growth. Organizations are considered to be relatively open systems.

Question 6

What are the characteristics of a business system?

Answer

Characteristics of a business system: A business system is an organized grouping of interdependent functioning units or components, linked together according to a plan, to achieve a specific objective. All systems have some common characteristics. These are as follows:

- (i) All systems work for predetermined objectives and the system is designed and developed accordingly.
- (ii) In general a system has a number of interrelated and interdependent sub-systems or components. No subsystem can function in isolation; it depends on other sub-systems for its inputs.
- (iii) If one sub-system or component of a system fails, in most cases the whole system does not work. However, it depends on how the sub-systems are interrelated.
- (iv) The way a subsystem works with another sub-system is called interaction. The different sub-systems interact with each other to achieve the goal of the system.
- (v) The work done by individual sub-systems is integrated to achieve the central goal of the system. The goal of individual sub-system is of lower priority than the goal of the entire system.

Question 7

Explain, in brief, the human resource management system.

Answer

Human resource management system: Human resources are the most valuable asset for an organization. Utilization of these resources in most effective and efficient way is an important function for any enterprise. Human resource management system aims to achieve this goal. Skill database maintained in HRM system, with details of qualifications, training, experience, interests etc., helps management for allocating manpower to right activity at the time of need or starting a new project. This system also keeps track of employees' output or efficiency. Administrative functions like keeping track of leave records or handling other related functions are also included in HRM system. An HRM system may have the following modules.

- Personal administration
- Recruitment management
- Travel management
- Benefit administration
- Salary administration
- Promotion management.

An ideal HR development emphasizes on optimal utilization of human resources by introducing a consistent and coherent policy aiming at promoting commitment to the enterprise. The HRM system assists to achieve this goal.

Question 8

What is information? Briefly discuss its attributes.

Answer

Information: Information is data that have been put into a meaningful and useful context. It has been defined by Davis and Olson as-"information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or progressive decision". For example, data regarding sales by various salesmen can be merged to provide information regarding total sales through sales personnel. This information is of vital importance to a marketing manager who is trying to plan for future sales.

Attributes of Information: The important attributes of useful and effective information are as follows:

- **Availability:** This is a very important property of information. If information is not available at the time of need, it is useless. Data is organized in the form of facts

and figures in databases and files from where various information is derived for useful purpose.

- **Purpose:** Information must have purposes at the time it is transmitted to a person or machine, otherwise it is simple data. Information communicated to people has a variety of purposes because of the variety of activities performed by them in business organizations. The basic purpose of information is to inform, evaluate, persuade, and organize.
- **Mode and format:** The modes of communicating information to humans are sensory (through sight, hear, taste, touch and smell) but in business they are either visual, verbal or in written form.

Format of information should be so designed that it assists in decision making, solving problems, initiating planning, controlling and searching. Therefore, all the statistical rules of compiling statistical tables and presenting information by means of diagram, graphs, curves, etc., should be considered and appropriate one followed. The reports should preferably be supplied on an exception basis to save the manager from an overload of information. Also, the data should only be classified into those categories, which have relevance to the problem at hand.

- **Decay:** Value of information usually decays with time and usage and so it should be refreshed from time to time. For example, we access the running score sheet of a cricket match through Internet sites and this score sheet is continually refreshed at a fixed interval or based on status of the state. Similarly, in highly fluctuating share market a broker is always interested about the latest information of a particular stock/s.
- **Rate:** The rate of transmission/reception of information may be represented by the time required to understand a particular situation. Quantitatively, the rate for humans may be measure by the number of numeric characters transmitted per minute, such as sales reports from a district office. For machines the rate may be based on the number of bits of information per character (sign) per unit of time.
- **Frequency:** The frequency with which information is transmitted or received affects its value. Financial reports prepared weekly may show so little changes that they have small value, whereas monthly reports may indicate changes big enough to show problems or trends.

Frequency has some relationship with the level of management also it should be related to an operational need. For example, at the level of foreman it should be on a daily or weekly basis but, at the management control level, it is usually on monthly basis.

- **Completeness:** The information should be as complete as possible. The classical ROI or Net Present Value (NPV) models just provide a point estimate and do not give any indication of the range within which these estimates may vary. Hartz's model for investment decisions provides information on mean, standard deviation and the shape of the distribution of ROI and NPV. With this complete information, the manager is in a much better position to decide whether or not to undertake the venture.
- **Reliability:** It is just not authenticity or correctness of information; rather technically it is a measure of failure or success of using information for decision-making. If information leads to correct decision on many occasions, we say the information is reliable.
- **Cost benefit analysis:** The benefits that are derived from the information must justify the cost incurred in procuring information. The cost factor is not difficult to establish. Using costing techniques, we shall have to find out the total as well as the marginal cost of each managerial statement but benefits are hard to quantify, i.e., they are usually intangibles. In fact, the assessment of such benefits is very subjective and its conversion into objective units of measurement is almost impossible. However, to resolve this problem, we can classify all the managerial statements into many categories with reference to the degree of importance attached, say, (a) absolutely essential statements, (b) necessary statement, (c) normal statements, (d) extra statements. The statements falling in the first category cannot be discontinued whatever be the cost of preparing them. The second category statements may have a high cost but may be discontinued only in very stringent circumstances. The normal statements may include those, which can be discontinued or replaced if their costs are too high. In the last category we may list those statements which may be prepared only if the benefits arising out of them are substantially higher than the costs involved.
- **Validity:** It measures the closeness of the information to the purpose which it purports to serve. For example, some productivity measure may not measure, for the given situation, what they are supposed to do e.g., the real rise or fall in productivity. The measure suiting the organization may have to be carefully selected or evolved.
- **Quality:** A study conducted by Adams a management expert, about management attitude towards information system, reveals that 75% of managers treated quantity investments as nearly identical in terms of job performance; yet given a choice, 90% of them preferred an improvement in quality of information over an increase in quantity. Quality refers to the correctness of information. Information is likely to be spoiled by personal bias. For example, an over-optimistic salesman may give rather too high estimates of the sales. This problem, however, can be circumvented by

maintaining records of salesman's estimates and actual sales and deflating or inflating the estimates in the light of this. Errors may be the result of:

- ◆ Incorrect data measurement and calculation methods.
- ◆ Failure to follow processing procedure, and,
- ◆ Loss or non-processing of data, etc.,

To get rid of the errors, internal controls should be developed and procedure for measurements prescribed. Information should, of course, be accurate otherwise it will not be useful; but accuracy should not be made a fetish, for example, the sales forecast for groups of products can well be rounded off to thousands of rupees.

- **Transparency:** If information does not reveal directly what we want to know for decision-making, it is not transparent. For example, total amount of advance does not give true picture of utilization of fund for decision about future course of action; rather deposit-advance ratio is perhaps more transparent information in this matter.

Value of information: It is defined as difference between the value of the change in decision behavior caused by the information and the cost of the information. In other words, given a set of possible decisions, a decision-maker may select one on basis of the information at hand. If new information causes a different decision to be made, the value of the new information is the difference in value between the outcome of the old decision and that of the new decision, less the cost of obtaining the information.

Question 9

Define an information system. What are the factors on which information requirements depend?

Answer

Information System: An *information system* can be considered as an arrangement of a number of elements that provides effective information for decision-making and / or control of some functionalities of an organization. Information is an entity that reduces uncertainty about an event or situation. For example, correct information about demand of products in the market will reduce the uncertainty of production schedule. Enterprises use information system to reduce costs, control wastes or generate revenue. Hence onwards we will focus our discussions only to computer-based information system. In modern business perspective the information system has far reaching effects for smooth and efficient operations.

Factors on which information requirements depend: The factors on which information requirements of executives depend are:

- **Operational function:** The grouping or clustering of several functional units on the basis of related activities into sub-systems is termed as operational function. For

example, in a business enterprise, marketing is an operational function, as it is the clustering of several functional units like market research, advertising, sales analysis and so on. Likewise, production finance, personnel etc. can all be considered as operational functions. Operational functions differ in respect of content and characteristics of information required by them.

Information requirement depends upon operational function. The information requirement of different operational functions varies not only in content but also in characteristics. In fact, the content of information depends upon the activities performed under an operational function. For example, in the case of production, the information required may be about the production targets to be achieved, resources available and so on. Whereas in the case of marketing functions, the content of information may be about the consumer behavior, new product impact in the market etc.

The characteristics which must be possessed by particular information too are influenced by an operational function. For example, the information required by accounts department for preparing payroll of the employees should be highly accurate.

- **Type of decision making:** Organizational decisions can be categorized follows:
 - (i) **Programmed decisions:** Programmed decisions or structured decisions refer to decisions made on problems and situations by reference to a predetermined set of precedents, procedures, techniques and rules. These are well-structured in advance and are time-tested for their validity. As a problem or issue for decision-making emerges, the relevant pre-decided rule or procedure is applied to arrive at the decision. For example, in many organizations, there is a set procedure for receipt of materials, payment of bills, employment of clerical personnel, release of budgeted funds, and so on.

Programmed decisions are made with respect to familiar, routine, recurring problems which are amenable for structured solution by application of known and well-defined operating procedures and processes. Not much judgment and discretion is needed in finding solutions to such problems. It is a matter of identifying the problem and applying the rule. Decision making is thus simplified.

Organizations evolve a repertory of procedures, rules, processes and techniques for handling routine and recurring situations and problems, on which managers have previous experience and familiarity. One characteristic of programmed decisions is that they tend to be consistent over situations and time. Also managers do not have to lose much sleep in brooding over

them. However, programmed decisions do not always mean solutions to simple problems. Decision-making could be programmed even to complex problems-such as resource allocation problems for example-by means of sophisticated mathematical/statistical techniques.

- (ii) **Non-programmed decisions or unstructured decisions:** These decisions are those which are made on situations and problems which are novel and non-repetitive and about which not much knowledge and information are available. They are non-programmed in the sense that they are made not by reference to any pre-determined guidelines, standard operating procedures, precedents and rules but by application of managerial intelligence, experience, judgment and vision to tackling problems and situations, which arise infrequently and about which not much is known. There is no simple or single best way of making decisions on unstructured problems, which change their character from time to time, which is surrounded by uncertainty and enigma and which defy quick understanding. Solutions and decisions on them tend to be unique or unusual-for example, problems such as a sudden major change in government policy badly affecting a particular industry, the departure of a top level key executive, drastic decline in demand for a particular high profile product, competitive rivalry from a previously little known manufacturer etc. do not have ready-made solutions.

It is true that several decisions are neither completely programmed nor completely non-programmed but share the features of both.

- **Level of management activity:** Different levels of management activities in management planning and control hierarchy are as follows:
 - (i) **Strategic Level or Top level:** Strategic level management is concerned with developing of organizational mission, objectives and strategies. Decisions made at this level of organization to handle problems critical to the survival and successes of the organization are called strategic decisions. They have a vital impact on the direction and functioning of the organization-as for example decisions on plant location, introduction of new products, making major new fund-raising and investment operations, adoption of new technology, acquisition of outside enterprises and so on. Much analysis and judgment go into making strategic decisions.

In a way, strategic decisions are comparable to non-programmed decisions and they share some of their characteristics. Strategic decisions are made under conditions of partial knowledge or ignorance.

- (ii) **Tactical Level or middle level:** Tactical level lies in middle of managerial hierarchy. At this level, managers plan, organize, lead and control the activities of other managers. Decisions made at this level called the tactical decisions (which are also called operational decisions) are made to implement strategic decisions. A single strategic decision calls for a series of tactical decisions, which are of a relatively structured nature. Tactical decisions are relatively short, step-like spot solutions to breakdown strategic decisions into implementable packages. The other features of tactical decisions are: they are more specific and functional; they are made in a relatively closed setting; information for tactical decisions is more easily available and digestible; they are less surrounded by uncertainty and complexity; decision variables can be forecast and quantified without much difficulty and their impact is relatively localized and short-range. Tactical decisions are made with a strategic focus.

The distinction between strategic and operational decisions could be highlighted by means of an example. Decisions on mobilization of military resources and efforts and on overall deployment of troops to win a war are strategic decisions. Decisions on winning a battle are tactical decisions.

As in the case of programmed and non-programmed decisions, the dividing line between strategic and tactical decision is thin. For example, product pricing is tactical decision in relation to the strategic decision of design and introduction of a new product in the market. But product pricing appears to be a strategic decision to down-line tactical decisions on dealer discounts.

- (iii) **Supervisory or operational Level:** This is the lowest level in managerial hierarchy. The managers at this level coordinate the work of others who are not themselves managers. They ensure that specific tasks are carried out effectively and efficiently.

Question 10

Explain different levels of management activities in management planning and control hierarchy.

Answer

Different Levels of Management activities: Management at different levels take decisions matching to their position or hierarchy in the organization and different types of information systems are designed and developed for them, i.e. an information system for a departmental manager will be characteristically different from one designed for a corporate manager.

If we consider an organization having a pyramidal management structure with the corporate level managers at the top and operational managers at the bottom we will observe that typical categories of data are manipulated at different levels.

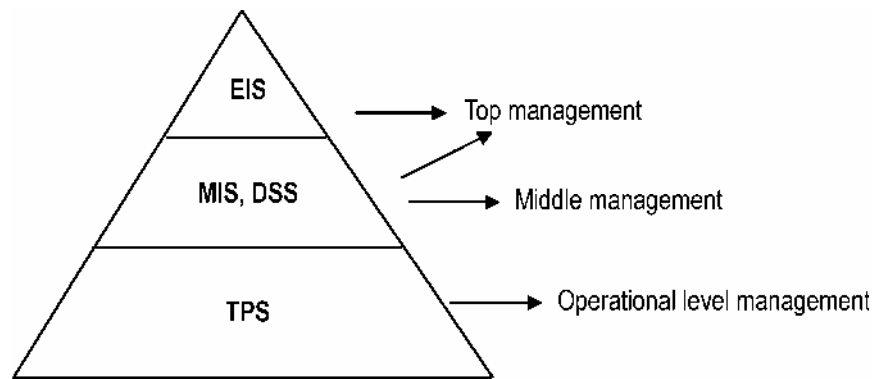


Fig.: Different Levels of Management

The above figure exhibits data available at different functional areas of an organization for management. At the lowest level that is managed by operational level managers (like supervisor, section in-charge), all types of inputs available from various sources are collected. The routine office work, like maintaining inward register and public interaction are mostly done at this level. However, no decision-making process is carried out at this level.

At the middle level of management the decision making – process starts. Inputs from different internal and external information sources are collected (normally passé from operational level managers) and processed for strategic decisions. Middle level managers who are expected to contribute significantly towards development of the organization are the key personnel to carry out the processing activities of the strategic data. They use various tools of analysis and typical software products to report to the higher level with options and possible effects. This job is very critical and important as well because tactical decisions by the top management are dependent on the information passed from middle management.

Question 11

System analysts develop various categories of information systems to meet a variety of business needs. Discuss any three such systems briefly.

Answer

Systems analysts develop the following types of information systems to meet a variety of business needs:

- (i) Transaction processing systems

- (ii) Management information systems
- (iii) Decision support systems
- (iv) Executive information systems
- (v) Expert systems.

Three of the above categories are discussed largely below:

- (i) **Transaction Processing Systems:** These systems are aimed at expediting and improving the routine business activities that all organizations engage. Standard operating procedures, which facilitate handling of transactions, are often embedded in computer programs that control the entry of data, processing of details, search and presentation of data and information. Transaction processing systems if properly computerized, provide speed and accuracy and can be programmed to follow routines without any variance.
- (ii) **Management Information Systems (MIS):** Transaction processing systems are operations oriented. In contrast, MIS assist managers in decision making and problem solving. They use results produced by the transaction processing systems, but they may also use other information. In any organization, decisions must be made on many issues that recur regularly and require a certain amount of information. Because the decision making process is well understood, the manager can identify the information that will be needed for the purpose. In turn, the information systems can be developed so that reports are prepared regularly to support these recurring decisions.
- (iii) **Decision Support Systems:** Not all decisions are of a recurring nature. Some occur only once or recur infrequently. Decision support systems (DSS) are aimed at assisting managers who are faced with unique (non-recurring) decision problems. In well structured situations, it is possible to identify information needs in advance, but in an unstructured environment, it becomes difficult to do so. As information is acquired, the manager may realize that additional information is required. In such cases, it is impossible to pre-design system report formats and contents. A DSS must, therefore, have greater flexibility than other information systems. Finally, we can say that DSS is of much more use when business are of an unstructured or semi-structured in nature. A decision support system is an integrated piece of software incorporating data base, model base and user interface. While the decision-support system can be of use at the tactical level, it is the strategic level that could make best use of it.

Question 12

What is MIS? Discuss characteristics of an effective MIS in brief.

Answer

MIS: Many experts have defined MIS in different languages. But the central theme of all these definitions is same. A Management Information System has been defined by Davis and Olson as '*an integrated user-machine system designed for providing information to support operational control, management control and decision making functions in an organization*'.

Characteristics of an effective MIS: Important characteristic for an effective MIS are eight in number and are briefly discussed below:

- **Management oriented:** It means that effort for the development of the information system should start from an appraisal of management needs and overall business objectives. Such a system is not necessarily for top management only; it may also meet the information requirements of middle level or operating levels of management as well.
- **Management directed:** Because of management orientation of MIS, it is necessary that management should actively direct the system's development efforts. Mere one time involvement is not enough. For system's effectiveness, it is necessary for management to devote their sufficient time not only at the stage of designing the system but for its review as well, to ensure that the implemented system meets the specifications of the designed system. In brief, management should be responsible for setting system specifications and it must play a key role in the subsequent trade off decisions that occur in system development.
- **Integrated:** Development of information should be an integrated one. It means that all the functional and operational information sub-system should be tied together into one entity. An integrated information system has the capability of generating more meaningful information to management. The word integration here means taking a comprehensive view or a complete look at the inter locking sub-systems that operate within a company.
- **Common data flows:** It means the use of common input, processing and output procedures and media whenever possible is desirable. Data is captured by system analysts only once and as close to its original source as possible. They, then, try to utilize a minimum of data processing procedures and sub-systems to process the data and strive to minimize the number of output documents and reports produced by the system. This eliminates duplication in data collections and documents and procedures. It avoids duplication, also simplifies operations and produces an efficient information system. However, some duplication is necessary in order to insure effective information system.

- **Heavy planning element:** An MIS usually takes 3 to 5 years and sometimes even longer period to get established firmly within a company. Therefore, a heavy planning element must be present in MIS development. It means that MIS designer should keep in view future objectives and requirements of firm's information in mind. The designer must avoid the possibility of system obsolescence before the system gets into operation.
- **Sub system concept:** Even though the information system is viewed as a single entity, it must be broken down into digestible sub-systems which can be implemented one at a time by developing a phasing plan. The breaking down of MIS into meaningful sub-systems sets the stage for this phasing plan.
- **Common database:** Database is the mortar that holds the functional systems together. It is defined as a 'superfile' which consolidates and integrates data records formerly stored in many separate data files. The organization of a database allows it to be accessed by several information sub-systems and thus, eliminates the necessity of duplication in data storage, updating, deletion and protection. Although it is possible to achieve the basic objectives of MIS without a common database, thus paying the price of duplicate storage and duplicate file updating, database is a definite characteristic of MIS.

Computerized: It is possible to have MIS without using a computer. But use of computers increases the effectiveness of the system. In fact, its use equips the system to handle a wide variety of applications by providing their information requirements quickly. Other necessary attributes of the computer to MIS are accuracy and consistency in processing data and reduction in clerical staff. These attributes make computer a prime requirement in management information system.

Question 13

Explain the concept of decomposition with the help of an example.

Answer

A computer system is difficult to comprehend when considered as a whole. Therefore, it is better that the system is decomposed or factored into sub systems. The boundaries and interfaces are defined, so that sum of the sub systems constitutes the entire system. This process of decomposition is continued with sub systems divided into smaller sub systems until the smallest sub systems are of manageable size. The sub systems resulting from this process generally form hierarchical structure as shown in the figure given below:

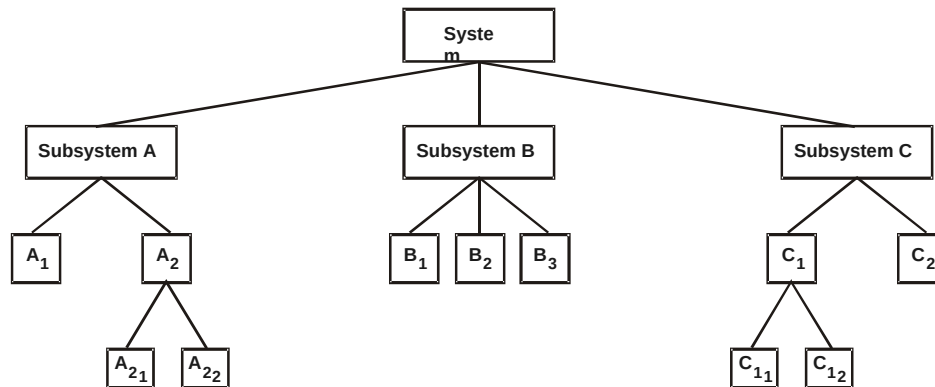


Fig.: Hierarchical relations of subsystems

An example of decomposition is the factoring of an information processing system into sub systems. One approach to decomposition might proceed as follows:

1. Information system divided into sub system such as:
 - Sales and order entry
 - Inventory
 - Production
 - Personnel and payroll
 - Purchasing
 - Accounting and control
 - Planning
 - Environmental intelligence
2. Each sub system is divided further into sub systems. For example, the personnel and payroll sub system might be divided into the following smaller sub systems:
 - Creation and update of personnel pay roll records.
 - Personnel reports
 - Payroll data entry and validation
 - Hourly payroll processing
 - Salaried payroll processing
 - Payroll reports for management
 - Payroll reports for Government

3. If the task is to design and program a new system, the sub systems (major applications) defined above might be further sub divided into smaller sub systems or modules. For example, the hourly payroll processing sub system might be factored into modules for the calculation of deductions and net pay, payroll register and audit controls preparation, cheque printing and register and controls output as shown below:

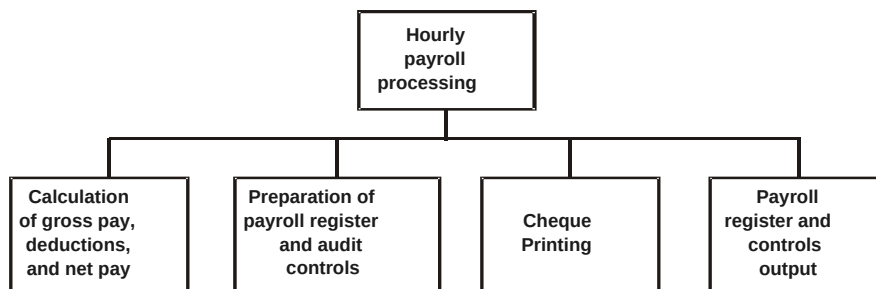


Fig.: Payroll Processing

Decomposition into sub systems is used to analyze an existing system and to design and implement a new system. In both the cases, the designer must decide how to factor i.e. where to draw the boundaries.

The general principle in decomposition, which assumes that system objectives dictate the process, is functional cohesion. Components are considered to be part of the same sub system if they perform or are related to the same function. The boundary then needs to be clearly specified, interfaces simplified and appropriate connections established among the subsystems.

Question 14

Explain the concept of MIS in terms of its three elements.

Answer

MIS comprises of three elements viz., **management, information and system**. These are given as follows:

Management: A manager may be required to perform following activities in an organization:

- (i) Determination of organizational objectives and developing plans to achieve them.
- (ii) Securing and organizing human beings and physical resources so as to achieve the laid down objectives.
- (iii) Exercising adequate controls over the functions performed at the lower level.

- (iv) Monitoring the results to ensure that accomplishments are proceeding according to plans.

Thus, management comprises of the processes or activities that describe what managers do while working in their organization. They in fact plan, organize, initiate, and control operations. In other words, management refers to a set of functions and processes designed to initiate and co-ordinate group efforts in an organized setting directed towards promotion of certain interests, preserving certain values and pursuing certain goals. It involves mobilization, combination, allocation and utilization of physical, human and other needed resources in a judicious manner by employing appropriate skills, approaches and techniques.

Information: Information is data that have been organized into a meaningful and useful context. It has been defined by Davis and Olson - "Information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or progressive decision". For example, data regarding sales by various salesmen can be merged to provide information regarding total sales through sales personnel. This information is of vital importance to a marketing manager who is trying to plan for future sales.

Information is the substance on which business decision are based. Therefore, the quality of information determines the quality of action or decision. The management plays the part of converting the information into action through the familiar process of decision-making. Information has come to occupy a very important position in the survival of a business.

System: System may be defined as a composite entity consisting of a number of elements which are interdependent and interacting, operating together for the accomplishment of an objective. One can find many examples of a system. Human body is a system, consisting of various parts such as head, heart, hands, legs and so on. The various body parts are related by means of connecting networks of blood vessels and nerves. This system has a main goal which we may call "living". Thus, a system can be described by specifying its parts, the way in which they are related, and the goals which they are expected to achieve. A business is also a system where economic resources such as people, money, material, machines, etc. are transformed by various organization processes (such as production, marketing, finance, etc.) into goods and services.

Thus, MIS can be defined as a network of information that supports management decision making. The role of MIS is to recognize information as a resource and then use it for effective and timely achievement of organizational objectives.

Question 15

Discuss the potential impact of computers and MIS on different levels of management.

Answer

Potential impact of computers and MIS on different levels of management

The potential impact of computers on top level management may be quite significant. An important factor which may account for this change is the fast development in the area of computer science. It is believed that in future computers would be able to provide simulation models to assist top management in planning their work activities. For example, with the help of a computer it may be possible in future to develop a financial model by using simulation technique, which will facilitate executives to test the impact of ideas and strategies formulated on future profitability and in determining the needs for funds and physical resources. By carrying sensitivity analysis with the support of computers, it may be possible to study and measure the effect of variation of individual factors to determine final results. Also, the availability of a new class of experts will facilitate effective communication with computers. Such experts may also play a useful role in the development and processing of models. In brief, potential impact of computers would be more in the area of planning and decision making.

Futurists believe that top management will realize the significance of techniques like simulation, sensitivity analysis and management science. The application of these techniques to business problems with the help of computers would generate accurate, reliable, timely and comprehensive information to top management. Such information will be quite useful for the purpose of managerial planning and decision making. Computerized MIS will also influence in the development, evaluation and implementation of a solution to a problem under decision making process.

Potential impact of Computers and MIS on middle management level will also be significant. It will bring a marked change in the process of their decision making. At this level, most of the decisions will be programmed and thus will be made by the computer, thereby drastically reducing the requirement of middle level managers. For example, in the case of inventory control system; computer will carry records of all items in respect of their purchase, issue and balance. The reorder level, reorder quantity etc. for each item of material will also be stored in computer after its predetermination. Under such a system, as soon as the consumption level of a particular item of material will touch reorder level, computer will inform for its purchase immediately. The futurists also foresee the computer and the erosion of middle management as the vehicles for a major shift to recentralization. The new information technology will enable management to view an operation as a single entity whose effectiveness can only be optimized by making decisions that take into account the entity and not the individual parts.

The impact of Computers and MIS today at supervisory management level is maximum. At this level managers are responsible for routine, day-to-day decisions and activities of the organization which do not require much judgement and discretion. In a way, supervisory manager's job is directed more towards control functions, which are highly receptive to

computerization. For control, such managers are provided with accurate, timely, comprehensive and suitable reports. A higher percentage of information requirements of executives is met out at this level.

Potential impact of Computers and MIS on supervisory level will completely revolutionize the working at this level. Most of the controls in future will be operated with the help of computers. Even the need of supervisory managers for controlling the operations will be substantially reduced. Most of the operations/activities now performed manually will be either fully or partially automated.

Question 16

Describe the main pre-requisites of a Management Information System, which makes it an effective tool.

Answer

Pre-requisites of an MIS: The following are pre-requisites of an effective MIS:

- (i) **Database:** It is a superfile which consolidates data records formerly stored in many data files. The data in database is organized in such a way that access to the data is improved and redundancy is reduced. Normally, the database is subdivided into major information sub-sets needed to run. The database should be user-oriented, capable of being used as a common data source, available to authorized persons only and should be controlled by a separate authority such as DBMS. Such a database is capable of meeting information requirements of its executives, which is necessary for planning, organizing and controlling the operations of the business.
- (ii) **Qualified System and Management Staff:** MIS should be manned by qualified officers. These officers who are experts in the field should understand clearly the views of their fellow officers. The organizational management base should comprise of two categories of officers (i) System and Computer experts and (ii) Management experts. Management experts should clearly understand the concepts and operations of a computer. Their whole hearted support and cooperation will help in making MIS an effective one.
- (iii) **Support of Top Management:** An MIS becomes effective only if it receives the full support of top management. To gain the support of top management, the officer should place before them all the supporting facts and state clearly the benefits which will accrue from it to the concern. This step will certainly enlighten the management and will change their attitude towards MIS.
- (iv) **Control and Maintenance of MIS:** Control of the MIS means the operation of the system as it was designed to operate. Sometimes users develop their own procedures or shortcut methods to use the system, which reduces its effectiveness.

To check such habits of users, the management at each level in the organization should device checks for the information system control.

Maintenance is closely related to control. There are times when the need for improvements to the system will be discovered. Formal methods for changing and documenting changes must be provided.

(v) **Evaluation of MIS:** An effective MIS should be capable of meeting the information requirements of its executives in future as well. The capability can be maintained by evaluating the MIS and taking appropriate timely action. The evaluation of MIS should take into account the following points:

- Examining the flexibility to cope with future requirements;
- Ascertaining the view of the users and designers about the capabilities and deficiencies of the system ; and
- Guiding the appropriate authority about the steps to be taken to maintain effectiveness of MIS.

Question 17

Describe the main prerequisites of a MIS which makes it an effective tool. Explain the major constraints in operating it.

Answer

Please refer the answer of question No. 16 for the answer of the first part of this question.

Constraints in operating MIS:

Major constraints which come in the way of operating an information system are:

- Non-availability of experts, who can diagnose the objectives of the organization and provide a desired direction for installing an operating system.
- Experts usually face the problem of selecting the sub-system of MIS to be installed and operated upon.
- Due to varied objectives of business concerns, the approach adopted by experts for designing and implementing MIS is a non-standardized one.
- Non-availability of cooperation from staff in fact is a crucial problem. It should be handled tactfully. Educating the staff by organizing lectures, showing films, training on system and utility of the system may solve this problem.
- There is high turnover of experts in MIS. Turnover in fact arises due to several factors like pay packet, promotion chances, future prospects, behaviour of top ranking managers etc.

- Difficulty in quantifying the benefits of MIS, so that it is easily comparable with cost.

Question 18

What is Decision Support System? Briefly explain three characteristics of Decision Support System.

Answer

The Decision Support System (DSS) is considered as more flexible and adaptable to changing decision making requirements than traditional Management reporting system. This system emerged from the developments of interactive display technology, micro computing and easy-to-use software tools. It handles unstructured and partially structured problems giving rise to unpredictable and unstructured information needs.

DSS can be defined as a system providing tools to the decision making managers to address unstructured/ partially structured problems in their own personalized manner. It empowers the managers in decision making process. A DSS does not require any high technology.

There are three characteristics of a Decision Support System namely:

- (i) Semistructured or unstructured decision-making.
- (ii) Adaptable to the changing needs of decision makers, and
- (iii) Ease of learning and use.

Each of these are briefly discussed below:

- (i) *Semistructured and Unstructured Decisions*: Unstructured decisions and semistructured decisions are made when information obtained from a computer system is only a portion of the total knowledge needed to make the decision. DSS is well adapted to help with semistructured and unstructured decisions. A well-designed DSS helps in decision making process with the depth to which the available data can be tapped for useful information.
- (ii) *Ability to adapt to changing needs*: Semistructured and unstructured decisions often do not conform to a predefined set of decision-making rules. DSS provides flexibility to enable users to model their own information needs. Rather than locking the system into rigid information producing requirements, capabilities and tools are provided by DSS to enable users to meet their own output needs.
- (iii) *Ease of Learning and Use*: DSS software tools employ user-oriented interfaces such as grids, graphics, non-procedural fourth – generation languages (4GL), natural English, and easily read documentation. These interfaces make it easier for users to conceptualize and perform the decision-making process.

Question 19

What is DSS? Explain the components of a DSS in brief.

Answer

DSS: A decision support system (DSS) can be defined as a system that provides tools to managers to assist them in solving semi structured and unstructured problems in their own, somewhat personalized, way. Often, some type of modeling environment perhaps a very simple environment such as the one accompanying a spreadsheet package is involved. A DSS is not intended to make decisions for managers, but rather to provide managers with a set of capabilities that enables them to generate the information required by them in making decisions. In other words, a DSS supports the human decision-making process, rather than providing a means to replace it.

Components of a DSS: A decision support system has four basic components: the user, one or more databases, a planning language, and the model base, as given in Fig.:

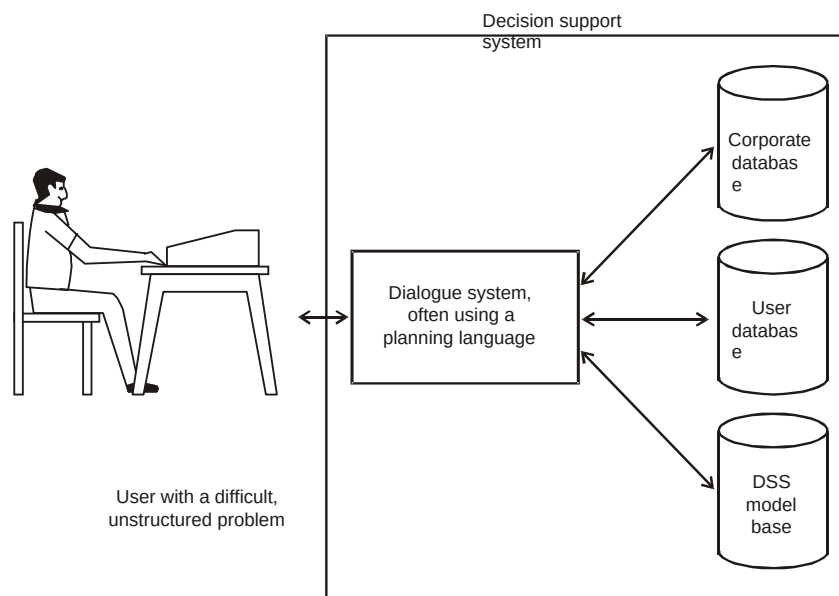


Fig.: The Components of a decision support system

- (i) **The users:** The user of a decision support system is usually a manager with an unstructured or semi-structured problem to solve. The manager may be at any level of authority in the organization (e.g., either top management or operating management). Typically, users do not need a computer background to use a decision support system for problem solving. The most important knowledge is a thorough understanding of the problem and the factors to be considered in finding a solution. A user does not need extensive

education in computer programming in part because a special planning language performs the communication function within the decision support system. Often, the planning language is nonprocedural, meaning that the user can concentrate on what should be accomplished rather than on how the computer should perform each step.

- (ii) **Databases:** Decision support systems include one or more databases. These databases contain both routine and non-routine data from both internal and external sources. The data from external sources include data about the operating environment surrounding an organization – for example, data about economic conditions, market demand for the organization's goods or services, and industry competition.

Decision support system users may construct additional databases themselves. Some of the data may come from internal sources. An organization often generates this type of data in the normal course of operations – for example, data from the financial and managerial accounting systems such as account, transaction, and planning data. The database may also capture data from other subsystems such as marketing, production, and personnel. External data include assumptions about such variables as interest rates, vacancy rates, market prices, and levels of competition.

- (iii) **Planning Languages:** Two types of planning languages that are commonly used in decision support systems are: general –purpose planning languages and special-purpose planning languages. General-purpose planning languages allow users to perform many routine tasks – for example, retrieving various data from a database or performing statistical analyses. The languages in most electronic spreadsheets are good examples of general-purpose planning languages. These languages enable user to tackle a broad range of budgeting, forecasting, and other worksheet-oriented problems. Special-purpose planning languages are more limited in what they can do, but they usually do certain jobs better than the general-purpose planning languages. Some statistical languages, such as SAS, SPSS, and Minitab, are examples of special purpose planning languages.

- (iv) **Model base:** The planning language in a decision support system allows the user to maintain a dialogue with the model base. The model base is the 'brain' of the decision support system because it performs data manipulations and computations with the data provided to it by the user and the database. There are many types of model bases, but most of them are custom-developed models that do some types of mathematical functions-for example, cross tabulation, regression analysis, time series analysis, linear programming and financial computations. The analysis provided by the routines in the model base is the key to supporting the user's decision. The model base may dictate the type of data included in the database and

the type of data provided by the user. Even where the quantitative analysis is simple, a system that requires users to concentrate on certain kinds of data can improve the effectiveness of decision making.

Question 20

Discuss various examples of DSS in accounting.

Answer

Examples of Decision Support Systems (DSS) in accounting: Decision support systems are widely used as part of an organization's AIS. The complexity and nature of decision support systems vary. Many are developed in-house using either a general type of decision support program or a spreadsheet program to solve specific problems. Below are several illustrations of these systems.

- **Cost Accounting system:** The health care industry is well known for its cost complexity. Managing costs in this industry requires controlling costs of supplies, expensive machinery, technology, and a variety of personnel. Cost accounting applications help health care organizations calculate product costs for individual procedures or services. Decision support systems can accumulate these product costs to calculate total costs per patient. Health care managers many combine cost accounting decision support systems with other applications, such as productivity systems. Combining these applications allows managers to measure the effectiveness of specific operating processes. One health care organization, for example, combines a variety of decision support system applications in productivity, cost accounting, case mix, and nursing staff scheduling to improve its management decision making.
- **Capital Budgeting System:** Companies require new tools to evaluate high-technology investment decisions. Decision makers need to supplement analytical techniques, such as net present value and internal rate of return, with decision support tools that consider some benefits of new technology not captured in strict financial analysis. One decision support system designed to support decisions about investments in automated manufacturing technology is AutoMan, which allows decision makers to consider financial, nonfinancial, quantitative, and qualitative factors in their decision-making processes. Using this decision support system, accountants, managers, and engineers identify and prioritize these factors. They can then evaluate up to seven investment alternatives at once.
- **Budget Variance Analysis System:** Financial institutions rely heavily on their budgeting systems for controlling costs and evaluating managerial performance. One institution uses a computerized decision support system to generate monthly variance reports for division comptrollers. The system allows these comptrollers to

graph, view, analyze, and annotate budget variances, as well as create additional one-and five-year budget projections using the forecasting tools provided in the system. The decision support system thus helps the comptrollers create and control budgets for the cost-center managers reporting to them.

- **General Decision Support System:** As mentioned earlier, some planning languages used in decision support systems are general purpose and therefore have the ability to analyze many different types of problems. In a sense, these types of decision support systems are a decision-maker's tools. The user needs to input data and answer questions about a specific problem domain to make use of this type of decision support system. An example is a program called *Expert Choice*. This program supports a variety of problems requiring decisions. The user works interactively with the computer to develop a hierarchical model of the decision problem. The decision support system then asks the user to compare decision variables with each other. For instance, the system might ask the user how important cash inflows are versus initial investment amount to a capital budgeting decision. The decision maker also makes judgments about which investment is best with respect to these cash flows and which requires the smallest initial investment. Expert Choice analyzes these judgments and presents the decision maker with the best alternative.

Question 21

Explain Executive Information System (EIS). What purpose does it serve?

Answer

An Executive Information System (EIS) is a tool that provides direct on-line access to relevant information in a useful and navigable format. The relevant information is timely, accurate, and actionable information about aspects of a business that are of particular interest to the senior manager. An EIS is easy to navigate so that managers can identify broad strategic issues, and then explore the information to find the root causes of those issues.

EIS serves the following purpose:

- (i) The primary purpose of an Executive Information System is to support managerial learning about an organization, its work processes, and its interaction with the external environment.
- (ii) A secondary purpose is to allow timely access to information so that based on the answers to questions, strategic decisions could be taken by a manager in time.
- (iii) It directs the attention of the management to specific areas of the organization or specific business problems. It makes managers and subordinates to work together to determine the root causes of issues highlighted by EIS

Question 22

Explain various purposes of an Executive Information System (EIS).

Answer

Purposes of an EIS: These are stated below:

- (i) **The primary purpose** of an Executive Information System is to support managerial learning about an organization, its work processes, and its interaction with the external environment. Informed managers can ask better questions and make better decisions.
- (ii) **A secondary purpose** for an EIS is to allow timely access to information. All of the information contained in an EIS can typically be obtained by a manager through traditional methods. However, the resources and time required to manually compile information in a wide variety of formats, and in response to ever changing and even more specific questions usually inhibit managers from obtaining this information.
- (iii) **A third purpose** of an EIS is commonly misperceived. An EIS has a powerful ability to direct management attention to specific areas of the organization or specific business problems. Some managers see this as an opportunity to discipline subordinates. Some subordinates fear the directive nature of the system and spend a great deal of time trying to outfit or discredit it. Neither of these behaviors is appropriate or productive. Rather, managers and subordinates can work together to determine the root causes of issues highlighted by the EIS.

EXERCISE

Question 1

In the context of a business organization, explain the following:

- (a) Attributes of Information, and*
- (b) Types of information.*

Question 2

As a member of the system development team, explain the process of decomposition of an organization into various functional blocks to comprehend the information processing system with the help of an example.

Question 3

Briefly describe the executive roles at the strategic level of management.

Question 4

Identify and justify the need for an information system that is designed to meet the special business needs of the strategic level of management in an organization.

Question 5

State the pre-requisites for an effective MIS in brief.

Question 6

Identify the tools of a Decision Support System.

Question 7

“A decision support system supports the human decision-making process rather than providing a means to replace it”. Justify the above statement by stating the characteristics of decision support system.

Question 8

“Decision support systems are widely used as part of an Organization’s Accounting Information system”. Give examples to support this statement.

Question 9

Describe various software tools used in Decision support system.

Question 10

How does an Executive Information System (EIS) differ from a traditional information system?

Question 11

Briefly explain the principles to guide the design of measures and indicators to be included in EIS.

Question 12

Write short notes on the following:

- (a) Decision Support System*
- (b) Executive Information System.*
- (c) Expert systems*