

The brief intro about the subject....

Information systems auditing is a function that has been developed to assess whether computer systems **safeguard assets, maintain data integrity**, and allow the goals of an organization to be achieved effectively & efficiently.

Due to concerns about the privacy of the data we exchange with organizations such as tax department, credit granting institutions etc.

Factors influencing an organization towards control & audit of computers...

1. Organizational cost of data loss.
2. Cost of incorrect decision making
3. Cost of computer abuse.(like hacking, abuse of privileges)
4. Value of hardware, software, personnel
5. High cost of computer error
6. Maintenance of privacy
7. Controlled evolution of computer use

Chapter – 1 Information Systems Concepts

1. WHAT IS 'SYSTEM'?

A System **may** be defined as “A set of interrelated & interdependent elements that operate collectively to accomplish some common purpose or goal.”

Parts, their inter-connectivity and goal for which they work describe System.

System	Elements	Interdependency	Purpose
Human Body	Heart, Head and so on	If any body part does not work, all body is affected	Living
Information System (Computerised)	Hardware, Software, Human ware, data and related things	Hardware cannot work without software and vice versa.	<u>Provide useful information to authorized users in time</u>

2. GENERAL MODEL OF SYSTEM

A general model of a physical system is Input, processing and output */* sometimes storage is also considered as part of system */*. A system may have several I/O components.

A brief intro about each element is as under...

2.1 Input is the data flowing into the system/subsystem from outside or other subsystem.

2.2 Processing is the action of manipulating the input into a more useful form or performing instruction given by user.

2.3 Output is the information flowing out of a system. It is final result shown to end user.

2.4 Storage is the means of holding information for use in future.

2.5 Feedback occurs when the outcome has an influence on the input. */* more about this topic in Chapter – 2 */*

3. SYSTEM ELEMENTS

3.1 Interfaces: Interconnections/interaction between subsystem or system components.

3.2 Environment: in simple terms, all those elements which are not within system but has influence over it or influenced by it, constitutes Environment. For example Govt. policies, economic indicators.

3.3 System Boundary: the features that define and delineate a system from its Environment. All systems may be identified by its boundary that depicts or define their scope of activity.

3.4 Sub-System: It is a part or building block of a System, which again is a group of components having own boundaries.

Characteristics of Subsystem: principles which dictate how systems are built from subsystems-

[A] **Decomposition / Factoring into subsystems:**

- “A complex system is difficult to comprehend when considered as a whole therefore; system is decomposed (broken) into smaller parts/subsystems.”
- Decomposition is used to analyze an existing system and to design and implement a new system
- This process is continued until the smallest subsystems with manageable size are found.

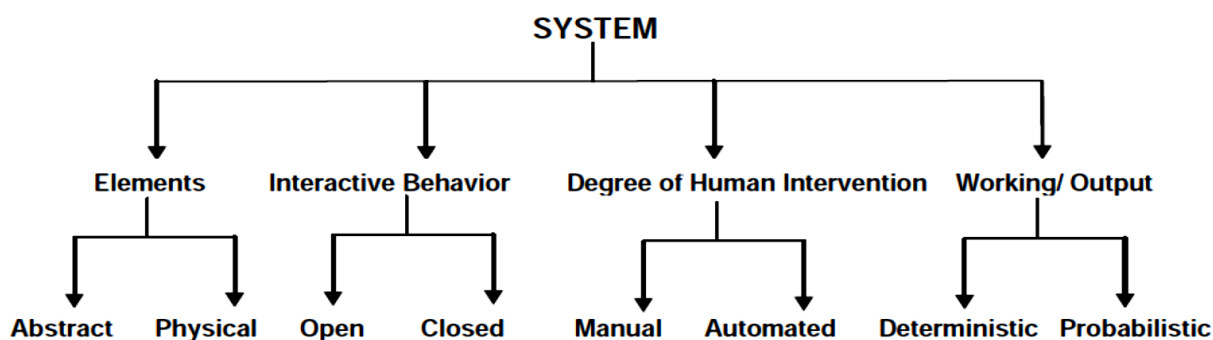
- The subsystems resulting from this process generally form hierarchical structure.
- Decomposition leads to large no. of subsystem interfaces, resulting in large no. of interconnections which may be computed as $\frac{1}{2} \times n (n-1)$ [ASSUMING ALL SUBSYSTEMS INTERACT] where n = no. of subsystems.

[B] Simplification: “process of organising subsystems so as to reduce the number of interconnections.” which is a potential interface for communication among subsystems. It is done by clustering (i.e. Group systems having similar functions or nature)

[C] Decoupling: If two different subsystems are connected very tightly, very close coordination between them is required. For example raw material system's delivery must be precisely timed in order to avoid delays or early delivery of the raw material in production system. Decoupling allows one subsystem to be independent of other subsystem. This can be achieved by;

- i. Inventories, buffer or waiting lines – to compensate different rates of input & output. {like spooling software}
- ii. Slack & Flexible resources – The existence of slack (extra)/flexible resources allows subsystems to be somewhat independent (when output of one system is input to another) and yet allows each to respond to the demands of the other system. {the same process we studied in PERT/CPM}
- iii. Standards – Standards also a subsystem to plan & organise with reduced need to communicate with other subsystems.

4. TYPES OF SYSTEM



4.1 According to Elements / Visibility

{A} **Abstract System:** An orderly arrangement of interdependent ideas or thoughts. Like Moral Values.

{B} **Physical System:** Set of Tangible/physical elements. Like Microprocessor, motherboard and supporting chips and I/O devices makes computer system.

4.2 According to Interactive Behaviour:

{A} **Open System:** Open systems actively interact with environment and are affected by changes in the environment & to some extent, affect its environment. An open system must change to suit the environment and must continually adopt so as to keep up to date in order to ward off competitors and to survive. Business organization is an example of open system.

{B} **Closed System:** A closed system does not interact with its environment. They are self-contained & self-maintained because they do not interact across its boundaries with its

INFORMATION SYSTEMS CONTROL & AUDIT (CA FINAL – PAPER 6) [FOR MAY 2014 EXAMS]

environment. They do not take needed feedback from external environment and tend to deteriorate eventually. These are generally mechanical in nature, like once it is set, it works

Here it is to be noted that, it is nearly impossible to have a fully closed system since every system has certain properties of open system also. Therefore, system shall be classified in terms of the degree to which it is open or closed. Also, Closed systems are designed for efficiency, whereas open system for survival.

{C} **Relatively Closed System / Isolated System**: It is relatively isolated (disconnected) from its environment, but not completely closed in a physical sense. They are designed to prevent unwanted influence from environment and have only controlled & well-defined inputs & outputs [For ex security systems]

4.3 According to degree of human intervention

{A} **Manual system**: Where data collection, manipulation, maintenance and final reporting are carried out absolutely by human efforts.

{B} **Automated System**: Systems where computers are used to carry out all the tasks mentioned above. However, none of the business system is 100% automated; rather, to some extent, it depends on manual intervention, even may be in negligible way.

4.4 According to working/output/predictive behaviour

{A} **Deterministic**: System that works in a predictable manner, interactions pattern among the parts in known in advance e.g. Computer program because only correct input program will produce correct result.

{B} **Probabilistic**: The System that operates with uncertainty, as certain degree of error is always attached to the prediction of what the system will do. For example, inventory control system in which the average demand or the average stock may be predicted, but the exact value of its factors cannot be predicted. Most business systems are regarded as 'Probabilistic'.

5. SOME OTHER IMPORTANT TERMS RELATED TO SYSTEMS

5.1 System Stress: System stress means force transmitted by system's supra/parent system that causes subsystem to change so that supra system can better achieve its goals. It may be due to change in existing goals or change in desired achievement level for existing goals.

5.2 System Change: System change take place when they undergo 'stress'. As a result of system stress, subsystem will deviate from normal condition, and finally decay and terminate.

5.3 System Entropy: It means tendency of system towards disorder. It refers to decay in system's health, if no maintenance is provided or error is removed. It needs to be cured by 'Negative Entropy'.

5.4 Negative Entropy: it means 'Maintenance Input'. This maintenance input prevents the system from dying out. Open systems requires more negative entropy than relatively closed systems. It can only increase the life (longevity) of system, but it cannot make it immortal.

System	Sign of entropy	Negative Entropy
Automobile	Engine won't start	Tune/Adjust engine
Software	Error	Debug/ repair program

6. **WHAT IS INFORMATION???** [NOV 2011]

1. Information is data that has been organized into a meaningful & useful context.
2. Defined by Davis & 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.”
3. Information is substance on which business decision are based.
4. 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.

7. **ATTRIBUTES OF INFORMATION:** [NOV 2011]

Some important attributes of useful & effective information are as follows:

1. **Availability:** If information is not available at the time of need, it is useless.
2. **Purpose:** Information must have purpose at the time it is transmitted to a person or machine, otherwise it is simple data. The basic purpose of information is to inform, evaluate, persuade and organize.
3. **Mode & Format:** The mode of communicating information in business is either visual, verbal or in written form. Format of information should be so designed that it assists in decision-making, solving problems, planning, controlling and searching.
4. **Decay:** Value of information usually decays with time and usage and so it should be refreshed from time to time.
5. **Rate:** Useful information is the one which is transmitted at a rate which matches with the rate at which the recipient wants to receive.
6. **Frequency:** The frequency with which information is transmitted or received affects its value. Frequency has some relationship with the level of management and with operational needs.
7. **Completeness:** No piece of information essential to a decision making should be missing.
8. **Reliability:** If information leads to correct decision on many occasions, we say the information is reliable.
9. **Validity:** It should meet the purpose for which it is being collected.
10. **Quality:** Quality refers to the correctness of the information. Personal bias can taint information. Strong internal controls can help to improve quality.
11. **Transparency:** Information must reveal directly what we want to know for decision-making.
12. **Value of Information:** It can be understood as Cost-Benefit Analysis. Benefits derived from the information must justify the cost incurred in procuring it.
13. **Adequacy:** Information must be adequate so that the desired actions can be initiated.

8. **TYPES OF INFORMATION (INTERNAL & EXTERNAL)**

Information, broadly, can be divided into 2 different types –

8.1 **Internal Information –**

8.1.1 It is a generated from the operations of the organization at various functional areas.

8.1.2 It gets processed & summarized from junior to top most level of management.

8.1.3 Examples – production figures, sales figures, accounts etc.

8.2 External Information –

8.2.1 It is collected from the external environment of the business organization.

8.2.2 It affects the organizational performance from outside the organization.

8.2.3 Examples – Govt. policies, competitors' data, economic status, RBI's monetary policy etc.

9. INFORMATION SYSTEM & ITS ROLE IN MANAGEMENT: [MAY 2010]

An Information System can be considered as set of elements (people, procedure and resources) that provides effective information for decision-making and/or control of some functionalities of an organization.

Some of important implications of information systems in business are as follows:

1. Effective decision-making to achieve the organizational goals.
2. Gain of competitive edge.
3. Knowledge gathered through information system may be utilized by managers in unusual situations.
4. If information system is viewed as process it can be integrated to formulate a strategy of action or operation.
5. Innovative ideas for solving critical problems.
6. Take right decision at right time.

9.1 Factors on which Information requirement depends (Determinants of Management's Information need):

9.1.1 Operational Function/Area:

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 clustering of several functional units like market research, advertising, sales analysis and so on. The characteristics which must be possessed by particular information are influenced by an operational function (in our example it is 'Marketing')

9.1.2 Type of Decision: Decisions having different characteristics are taken at different level of management. Broadly decisions can be divided into 2 categories:

<u>Programmed Decision (Structured Decision)</u>	<u>Non- Programmed Decision (Unstructured Decision)</u>
These are well-defined decisions	These cannot be defined in advance.
Such decision is made by reference to pre-decided guidelines, procedures, rules, standard operating procedures.	Such decision requires managerial judgment, intelligence, vision, experience.
Decision-making situations are known in advance	Decision-making situations are NOT known in advance
Characteristics- (i) Routine, (ii) Repetitive, (iii) often automated.	Characteristics- (i) Non-routine, (ii) Novel, (iii) high degree of uncertainty.
Usually involve machines/computer resources.	Always involve people and may involve machines/computer resources
Delegation to lower authorities possible	Delegation to lower authorities NOT possible

9.1.3 Managerial Level – Information need at different level of management is different

- I. Strategic or Top level management needs information to make long-term plans and strategic policies.
- II. Tactical level or Middle level management wants tactical information to implement strategy and make tactical decision.
- III. Operational or Lower level of management needs information that will help them to implement operational plans, making short-term decisions and conducting day-to-day business.

Source of information used by each level is also different. But after detailed analysis, we can conclude that each type of information is required at each level but degree of information is different at each level.

10. COMPUTER BASED INFORMATION SYSTEMS (CBIS) & IT'S COMPONENTS:

10.1 CBIS is an Information System in which computers play a major role.

10.2 It consists of the following 5 elements (components):

- I. Hardware – All physical equipment used in the system, such as CPU, storage devices, I/O devices etc.
- II. Software – Computer programs & the manuals (if any) that support them.
- III. Data – Facts that are used by programs to produce useful information.
- IV. Procedures – Policies that govern operations of a computer system. Procedures often specify the actions that people should take in a step-by-step manner.
- V. People – Such as users, programmers, system analysts & DBA, operate the IS and influence the success or failure of the IS the most.

10.3 Characteristics of CBIS-

[MAY 2011]

- I. All systems are designed & developed for pre-determined objectives.
- II. Interrelated & interdependent system components/subsystem.
- III. Different subsystems interact with each other to achieve system's goal.
- IV. Each sub-system has individual objectives, but objectives of the system as a whole have a higher priority than the objectives of individual subsystem.
- V. If one system component fails, in most cases entire system does not work.

10.4 Major areas of computer-based applications –

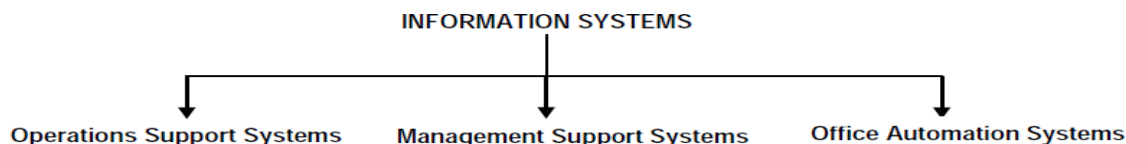
- I. **Finance & Accounting** – To ensure financial viability, to enforce financial discipline and 'plan & monitor' budgets. It also helps in forecasting revenues and managing financial resources.
Typical sub-application area includes (i) Financial accounting, (ii) General ledger, (iii) Assets accounting, (iv) Investment management, (v) Cash management, (vi) Balance sheet etc.
- II. **Marketing & Sales** – to maximize sales and to ensure customer satisfaction. It also helps in creating new customers & market and advertising the product.
Typical sub-application includes (i) Order processing, (ii) Billing, (iii) After-sales services etc.
- III. **Production or manufacturing** – to optimally deploy man, machine & material to maximize production of goods or supply of services. It also helps in production scheduling, material requirement planning [MRP], quality control & cost control {same as discussed in costing}
Typical sub-application includes Computer Aided Design & Manufacturing.
- IV. **Inventory/Stores management** – To keep track of materials in the stores & to regulate Max. & Min. stock levels. It also facilitates various queries about inventories.

Typical sub-applications include (i) Inventory management system, (ii) EOQ, (iii) ABC analysis.

- V. **Human Resources management** - To utilize manpower in most effective & efficient manner. It also keeps tracks of employees' output efficiency; allocate manpower to the right activity at the time of need.

Typical sub-application includes (i) Recruitment, (ii) Payroll system management, (iii) Training, (iv) Administration of staff welfare activities.

Categories of Information Systems



11. OPERATIONS SUPPORT SYSTEM (OSS)

The objective of OSS is to improve the operational efficiency of the enterprise. These are further classified into 3 sub-categories viz. (i) Transaction Processing System [TPS], (ii) Management Information System [MIS], (iii) Enterprise Resource Planning [ERP].

11.1 TRANSACTION PROCESSING SYSTEM [TPS]

11.1.1 TPS operates at the lowest level of management.

11.1.2 It is an IS that record & manipulate data from business transaction (e.g. transactions regarding sales, purchase, payments, receipts etc.) into useful information.

11.1.3 People involved in TPS usually do not take any management decisions.

11.1.4 Typically, a TPS involves the following activities:

I. **Capturing (recording)** data to organise in files or databases.

II. **Processing** of files/ databases using application software.

III. **Current activity processing** e.g. stock warnings, issue notes, replenishment orders.

IV. **Report processing** e.g. material reports, scrap reports, pareto analysis.

V. **Inquiry/query processing** in relation to orders processing, stock turnover, orders outstanding etc.

11.1.5 A transaction processing system may follow periodic data preparation and batch processing (as in payroll application) or on-line processing (as in inventory control application).

11.1.6 **Features** of TPS –

I. **Large volume of Data** – As TPS is ‘transaction-oriented’, it generally handles large volume of data, thus fast and correct data capturing with greater storage capacity is needed.

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

III. **Benefits are easily measurable** – TPS reduces the workload of the people associate with the operations and improve their efficiency by automating some of the operations. Most of the benefits of TPS are tangible & easily measurable.

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

11.1.7 **Components** of TPS –

- I. *Input* – Source document like Customer order, Employee time card
- II. *Processing* – Permanent & chronological recording of inputs. Journals record financial accounting transactions; Registers record other type of data.
- III. *Output* – Result by TPS like Operational report, pay cheque, invoice
- IV. *Storage* – Storage for future use in form of Files & Ledgers. In DBMS files are of 2 types viz. (i) Transaction file, (ii) Master file

11.2 MANAGEMENT INFORMATION SYSTEM (MIS)

- ✓ MIS has been defined by Davis & Olson as “An integrated user-machine system designed for providing information to support operational control, management control and decision making functions in an organisation”.
- ✓ MIS is designed to provide accurate, relevant & timely information to managers.

11.2.1 Characteristics of an Effective MIS

- I. *Management Oriented* – It means that the efforts for the development of the information system should start by conducting as appraisal of management needs and overall business objectives.
- II. *Management Directed* – Because of management orientation of MIS, it is necessary that management should direct the system’s development efforts. Mere one time involvement is not enough.
- III. *Integrated* – Development of information system should be integrated one. And integrated information system has the capability of generating more meaningful information to management.
- IV. *Common Database* – Development/creation of ‘common database’ allows it to be accessed by several information sub-systems and thus, eliminates the necessity of duplication in data storage, updating, deletion & protection.
- V. *Computerised* – It is possible to have MIS without computer, but use of computers increases effectiveness of MIS. In fact, its use equips the system to handle a wide variety of applications by providing their information requirements quickly.
- VI. *Sub-system concept* – Even though the information system is viewed as single entity, it must be broken down into manageable sub-system which can be implemented one at a time by developing a phasing plan. The breaking down of MIS into meaningful subsystems sets the stage for this phasing plan.
- VII. *Heavy Planning Element* – An MIS usually takes 3 to 5 years and sometimes even longer period to get establish firmly within a company. Therefore, a heavy planning element must be presented in MIS development.

11.2.2 Misconception or Myths about MIS

Myths	Facts/ Truths
<u>Reporting Accuracy</u> is of Vital Importance	✓ This statement is <u>True</u> at <u>Operation level</u>. ✓ But high accuracy will lead to higher cost. ✓ Higher or <u>top management</u> takes their <u>decision</u> on the <u>basis of rules, policies</u>, etc. so for top management, <u>a fairly, correct</u> presentation of relevant <u>data</u> is more important than accuracy.
Use of <u>Computer</u> is	✓ This statement is not true, as MIS may or may not be

must	computer based. ✓ But use of computer <u>makes</u> MIS more <u>effective & efficient</u> .
<u>More data</u> in reports means more information for managers	✓ This information is also <u>not true</u> , because the quantity of data does not matter as quality matters. ✓ <u>Too much</u> quantity will lead to <u>confusion</u> .

11.2.3 **Pre-Requisites** of an Effective MIS

- I. **Database** – The data in Database is organised in such a way that access to the data is improved and redundancy is reduced. The database should be user-oriented, capable of being used as a common data source, available to authorised persons only and should be controlled by a separate authority namely DBA.
- II. **Control & Maintenance of MIS** – Control of the MIS means the operation of the system as it was designed to operate. Sometimes users develop their own procedure or shortcut method to use the system, which reduces its effectiveness. To check such habits of users, the management in each level in the organisation should device or implement check for the Information System control.
- III. **Evaluation of MIS** – An effective MIS should be capable of meeting the information requirement of its executives in future as well. The capabilities can be maintained by evaluating the MIS and taking appropriate timely action.
- IV. **System & Management staff should be Qualified** – MIS should be manned by qualified officers. These officers who are expert in the field should understand clearly the views of their fellow officers. The organisational management base should comprise of two categories of officers (i) System & Computer experts, and (ii) Management experts.
- V. **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 officers should place before them all the supporting facts and states clearly the benefits which will accrue from it to the concern.

[MAY 12]

11.2.4 **Constrains** in Operating a MIS

Constraints are Limitations or difficulties which restrict MIS to achieve its objective.

- I. **Non-availability of Experts** – Experts, who can diagnose the objectives of the organisation and provide a desired direction for 'installing & operating' system. This problem may be overcome by grooming internal staff, which should be preceded by proper selection and training.
- II. **Selection of Sub-System** – Experts usually face the problem of selecting the sub-system of MIS to be installed & operated upon. The criteria, which should guide the experts, depend upon the need and importance of a function for which MIS can be installed first.
- III. **Non-Standardised System** – Due to varied objectives of business concern, the approach adopted by experts for designing & implementing MIS is a non-standardised one.
- IV. **Non-Cooperative Staff** – this is a very crucial problem. It should be handled carefully and tactfully. This problem may be solved by educating the staff about the utility of MIS and also by including some person in 'development & implementation' of System.

11.2.5 *Effect of using Computer* for MIS

- I. **High speed data processing / retrieval** – results in time saving & better decision making. Wide ranging data may be refined using simple computer command [through Filter].
- II. **Integration of working of different information system** – Each of the subsystems is required to provide information for MIS purposes. Such information may be available from a common database.
- III. **Increases the effectiveness of MIS** – The use of computer technology has overcome the problem of providing relevant information to business executives on time, by providing timely, accurate & desired information for the purpose of decision-making
- IV. **Scope of use of information system has expanded** – System experts in business organisation have developed areas & functions, where computerised MIS could be used to improve working of the concern. These types of applications are not feasible under the manual system.
- V. **Complexity of System ‘design & operation’ increased** – The need for highly processed & sophisticated information based on multitudes [very large no.] of variables has made the designing of the system quite complex. At Operational level, remembering commands/shortcuts requires more time & practice.
- VI. **Comprehensive information** – The use of computer for MIS enabled system experts to provide more comprehensive information to executives on business matters.
- VII. **Analysis widens** – The use of computer can provide multiple type of information accurately and in no time to decision makers.

11.2.6 *Limitations* of MIS

[MAY 12]

- I. Quality of output of MIS is basically governed by the quality of input & process.
- II. MIS is a tool that provides information for decision-making; it is not a substitute of managerial judgement.
- III. MIS may not be flexible enough to update itself, especially fast changing & complex environment.
- IV. MIS cannot provide tailor-made information packages to meet every decision making requirement of executives.
- V. MIS takes into account mainly quantitative factors, every user has a home in ingenuity, bias & certain assumption which have an important bearing on the decision making process of executives.
- VI. MIS is less useful for making Non-Programmed decisions.
- VII. Culture of information hoarding & not sharing may reduce the effectiveness of MIS.
- VIII. MIS’s effectiveness decreases due to frequent changes in top management, organisational structure & operational team.

11.3 *ENTERPRISE RESOURCE PLANNING [ERP]*

{Here we have only small discussion about ERP, full discussion will be in Chapter -7}

- I. An ERP system is ***fully integrated*** business management system – covering functional areas of an enterprise like Logistics, Production, Finance, and Accounting & Human Resources etc.

- II. It organises & integrates - operation processes and information flows, to make optimum use of resources such as men, material, money & machines.
- III. ERP aims at one database, one application, and one user interface for the entire enterprise.
- IV. It absorbs information from every function and that assists employees and managers to plan, monitor and control the entire business.
- V. ERP is a global tightly integrated closed loop business solution package and is multifaceted [*बहुमुखी]

11.3.1 Objectives of ERP

- I. Provide support for adopting best business practices.
- II. Implement these practices with a view towards enhancing productivity.
- III. Empower the customers and suppliers to modify the implemented business processes to suit their needs.

11.3.2 Misconception / Myths about ERP

- I. There is a misconception that ERP is a computer system. Even though computers and Information Technology are integral parts of an ERP system, ERP is primarily an 'Enterprise-Wide System' which encompasses corporate mission, objectives, attitudes, beliefs, value, operating style and people who makes the organisation.
- II. There is a misconception that ERP is relevant for manufacturing organisations only. In contrast, ERP system is not limited to any particular industry segment but is relevant for all types of business activities which include manufacturing as well as services.

{For detailed discussion refer Chapter – 7}

12. MANAGEMENT SUPPORT SYSTEM (MSS)

Management Support System (MSS) focus on the managerial uses of information resources and provide information to managers for planning and decision making. There are 3 types of MSS viz. (i) Decision support system (DSS), (ii) Executive Information System (EIS), (iii) Expert System

[MAY] 12.1 DECISION SUPPORT SYSTEM (DSS) [Nov. 08]

A DSS can be defined as a system that provides tools to managers to assist them in solving semi structured & unstructured problems in their own, somewhat in a personalized way. 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.

Typical information that a DSS application might gather and present would be:

- ❖ An inventory of all current information assets of an organisation;
- ❖ Comparative sales figures between one week & next;
- ❖ Projected revenue figures based on new product sales assumption;

12.1.1 Programmed Decision System:

Systems that replace human decision making rather than support it are sometimes called Programmed Decision System. These systems are used to make routine, structured decisions. In programmed decision systems, the focus is on doing something more efficiently, whereas in DSS, the focus is on helping decision makers becomes more effective.

12.1.2 Characteristics of DSS:

[Nov. 08]

- I. **Support Semi-structured/unstructured Decision Making** – Structured decisions are those that are made from a given set of inputs. Unstructured decisions and semi-structured decisions are decisions for which information obtained from a computer system is only a portion of the total knowledge needed to make the decision. The DSS is particularly well adapted to help with semi-structured / unstructured decisions.
- II. **Ease of Learning & Use** – Since DSS are often built and operated by users rather than by computer professionals. Therefore, the accompanying tools/models should be easy to learn & use, like (i) GUIs, (ii) Tables, (iii) Graphs, (iv) Non-procedural 4GL, (v) Natural English, (vi) ‘Easy read’ documentation.
- III. **Ability to adapt to changing needs** – Semi-structured/unstructured decisions often do not conform to a predefined set of decisions-making rules. Because of this, their DSS must provide for enough flexible to enable users to model their own information needs.

12.1.3 **Components** of DSS:

- I. **Users** – The user of DSS is usually a manager with un-structured or semi-structured problem to solve. Users do not need to be expert of computers/computer programming to use DSS rather must have a thorough understanding of problem, and the factors to be considered in solving the problem.
 - **Managers:** These are the users who have basic computer knowledge and want the DSS to be very user friendly.
 - **Staff Specialist (Analysts):** These are the people who are more details oriented & willing to use complex system in their day to day work.
- II. **Databases** – DSS includes one or more databases which contain both routine and non-routine data from both internal and external sources.

Implementation of Database

[Nov. 10]

(A) **Physical level:** It involves implementation of database on the hard disk i.e. storage of data in the hard disk. The management of storage and access is controlled by operating system and DBMS too.

(B) **Logical Level:** It is designed by professional programmers, who have through knowledge of DBMS. It deals with nature of data stored; the schema of data storage, which is logically divided into various tables having rows & columns and the techniques for defining relationships with indexes.

(C) **External Level:** The logical level defines schema which is divided into smaller units known as sub-schemas and given to the managers. Each sub-schema contains all relevant data needed by one manager.

- III. **Planning language** – There are two types of planning languages that are commonly used in DSS:

(A) **General-purpose planning languages** that allow users to perform many routine test for example spread-sheets, they allow budgeting, forecasting and other worksheets oriented problems.

(B) **Special-purpose planning languages** are used for specified purposes such as PERT, CPM, SAS, SPSS etc.

- IV. **Model Base** – The model base is the **“Brain”** of the DSS because it performs data manipulation 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 type of mathematical functions & financial computations too.

12.1.4 **Examples** of DSS in Accounting

Schema =
योजना / खाका

Many DSS are developed in-house as a decision support program or a spread-sheet program to solve specific problems. Below are several illustrations of these systems:

- I. **Cost Accounting System** – For example, Cost accounting decision applications help Health-care organisations to calculate cost of different services.
- II. **Capital Budgeting System** – Companies require new tools to evaluate high-technological investment decisions, for example:
 - (A) Decision support tools that can consider non-financial factors (e.g. new technology benefits) can be used with techniques like NPV and IRR.
 - (B) One DSS known as **AutoMan** supports decisions about investment in automated manufacturing technology; it considers financial, non-financial, quantitative, and qualitative factors in the decision-making process.
- III. **Budget Variance Analysis System** – Financial institutions can use a computerised DSS to generate monthly variance reports for division comptrollers [लेखानियंत्रक], which further allows comptrollers to graph, view, analyse, & annotate budget variances, thus the comptrollers can create & control budgets for cost-centre managers reporting to them.
- IV. **General Decision Support System** – In this, the user inputs data & the DSS asks the user to answer questions about specific problem domain. DSS analyses decision variables and present the decision maker with the best alternative.
For example a program called Expert choice supports a variety of problems requiring decisions. The user only needs to work interactively with the computer to develop a hierarchical model of the decision problem.

12.2 EXECUTIVE INFORMATION SYSTEM (EIS) [Nov. 08]

- ✓ An EIS or is a DSS that is designed to meet the special needs of top level managers. ESSs are likely to incorporate additional capabilities such as E-Mail.
- ✓ It provides direct online access to relevant information in a useful & navigable format.

EXECUTIVES: An executive can probably best be described as a manager who exerts a strong influence on the course taken by the organization.

12.2.1 Characteristics of EIS:

[Mav 11. NOV 12]

- I. EIS is a computer based Information System that serves the information need of top executives.
- II. It enables executives to extract summary data from database & solve model Complex Problems, without learning computer languages or high computer skills.
- III. EIS provides rapid access to timely information and directly access to management reports.
- IV. EIS is capable of assessing both internal & external data.
- V. EIS provides extensive online analysis tools like trend analysis, market conditions etc.
- VI. EIS can easily be given a DSS support for decision making.

12.2.2 Purposes served by EIS:

[Nov. 08]

- 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 manger 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

12.2.3 Role of Executive in Decision Making:

- I. **Strategic Planning** – Strategic planning involves determining the general, long-range direction of the organisation, typically, the CEO is ultimately responsible for the development of strategic plans.
- II. **Tactical Planning** – It refers to operational plans to carry out strategic plans. It is the job of middle executive level.
- III. **Fire-Fighting** – Major problems arise sometimes that must be resolved by someone at an executive level. For example, if a company is involved in a big lawsuit that threatens its financial solvency, an executive must get it solved. Such problems may require alteration of organisational plans.
- IV. **Control over the organisation** – It is also required in addition to planning to ensure that organisation is proceeding according to the plans. It may involve review of key performance indicators like Variance Analysis.

[May 10]

12.2.4 The Executive Decision-Making Environment:

Executives make strategic plans for organisation success. To a large extent, executives take decision based on their intuition rather than on the sophisticated analytical skills. Five characteristics of the type of information used in executive decision making are:-

- I. **Lack of structure** – Many of the decisions made by executives is relatively unstructured. For instance, what general direction should the company take? Or what type of advertising campaign will best promote the new product line?
- II. **High Degree of Uncertainty** – Executives work in a decision space that is often characterised by lack of precedent. Executives also work in a decision space where results cannot be scientifically predicted.
- III. **Future Oriented** – Strategic-planning decisions are made in order to shape future events. As conditions change, organisation must also change. It is the executive's responsibility to make sure that the organisation keeps pointed towards the future.
- IV. **Informal Sources** – Executives rely heavily on informal sources for key information. For example, lunch with colleague in another form might reveal some important competitors' strategies.
- V. **Low level of Detail** – Most important executive decisions are made by observing broad trends. This requires the executives to be more aware of the large overviews than the tiny items. However, some decisions can be made only by going through the details.

VI.

12.2.5 EIS Vs. Traditional Information Systems

[MAY 13]

Dimension of Difference	Executive Information System	Traditional Information System
Level of Management	For top or near top executives.	For lower staff
Nature of Information Access	Specific issues/problems and aggregate reports	Status reporting
Nature of information provided	Online tools & analysis	Offline status reporting
Information Sources	More external, less internal	Internal
Drill down facility to go	Available	Not available

through details at successive

Information format	Text with graphics	Tabular
Nature of interface	User-friendly	Computer-operator generated

EIS differs from Traditional Information System in the way it presents information to top-level managers in summary by pictorial & graphical means.

12.2.6 Contents of EIS:

- I. EIS implementations begin with just a few measures that are clearly of interest to senior managers and then expand in response to questions asked by those managers as they use the system.
- II. Following is a practical set of principles to guide the design of measures and indicators to be included in an EIS:
 - (1) EIS measures must be easy to understand and collect and if possible should be collected naturally as part of the work process.
 - (2) EIS measures must be based on a balanced view of the organization's objectives. Data in the system should reflect organization's objectives.
 - (3) Performance indicators in EIS must reflect every ones contribution in a fair and consistent manner.
 - (4) EIS must encourage management and staff to share ownership of the organization's objective.
 - (5) EIS information must be available to everyone in the organization BUT confidential information should not be part of EIS .
 - (6) EIS measures must evolve to meet changing needs of the organization.

12.3 EXPERT SYSTEM (ES)

[MAY 13]

An Expert system is highly developed DSS that utilises knowledge which is generally possessed by an expert to solve a problem. Expert systems are software systems that imitate the reasoning processes of human experts and provide decision makers with the type of advice they would normally receive from such expert system.

A characteristic of expert systems is the ability to declare or explain the reasoning process that was used to make decisions.

12.3.1 Some of the business applications of Expert System are as follows:

- I. **Accounting & Finance** – e.g. tax advice, credit-authorisation decisions, selecting forecasting models, investment advice.
- II. **Marketing** – e.g. establishing sales quotes, responding to customer enquiries, assisting marketing timing decisions, determining discount policies.
- III. **Manufacturing** – e.g. determining whether a process is running correctly, analysing quality & providing corrective measures, maintaining facilities, scheduling job-shop tasks, selecting transportation routes, assisting with product design.
- IV. **Personnel** – e.g. accessing applicant qualification, giving employees in filling various forms.
- V. **General Business** – e.g. assisting project proposal, recommending acquisition strategies, educating trainees, evaluating performance.

12.3.2 Need for Expert System:

- I. Expert labour is expensive & scare; moreover/and
- II. No matter how bright/knowledgeable certain people are, they often can handle only a few factors at a time.

12.3.3 Benefits of Expert System:

[Nov 10. May 11]

- I. Expert system preserves knowledge that might be lost through retirement, resignation or death of an acknowledged company expert.
- II. Expert systems put information into an active-form so it can be summoned almost as a real-life expert might be summoned.
- III. Expert system assist novices in thinking the way experienced professional do.
- IV. Expert systems are not subject to human feelings like fatigue, being too busy, or being emotional.
- V. Expert system can be effectively used as a strategic tool in the areas of marketing products, cutting costs and improving products.

12.3.4 Properties to Qualify as Expert System:

[MAY 13]

- I. **Availability** – One or more experts are capable of communicating how they go about solving the problems to which the Expert System will be applied.
- II. **Complexity** – Solution of the problems for which the Expert Systems will be used is a complex task that requires logical inferences processing, which would not be easily handled by conventional information processing system.
- III. **Domain** – the domain/subject area, of the relatively small and well defined to a relatively well-defined problem area.
- IV. **Expertise** – Solution to the problem require the efforts of experts. That is, only a few possess the knowledge, techniques, and intuition needed.
- V. **Structure** – The solution process must be able to cope with ill-structured, uncertain, missing, and conflicting data, and a dynamic problem-solving situation.

12.3.5 Components of Expert System:

- I. **Knowledge base (KB)** – The knowledge base stores the rules, data & relationships that are used to solve problems and contains specific facts about the expert area. The knowledge acquired from the expert has to be represented formally that deals with the structuring of information, how to manipulate it to infer additional data, and knowledge acquisition. The power of a system tends to be related to the depth and breadth of the knowledge in the knowledge base.
For instance, the example where an insurance agent needs both expert tax and financial advice is a good candidate for an Expert System with two knowledge bases.
- II. **Inference Engine** – The inference engine is the main processing element consisting of system of programs that requests data from the user, manipulates the knowledge base and provides a decision to the user. It performs this task in order to deduct/find new facts, which are then used to draw further conclusions. The inference engine is the active component of an expert system since it steers through knowledge and progresses the whole interaction. Various techniques which model different reasoning methods:
 - a. A **forward-chaining mechanism** first examines the KB and the problem at hand; then, it attempts to discover a solution.
 - b. In a **backward-chaining mechanism**, the inference engine starts with hypothesis or a goal, which it then checks against the facts and rules in the knowledge base for consistency.
- III. **Knowledge Acquisition Subsystem (KAS)** – The KAS is the software component of an Expert System that enables the Knowledge Engineer, a specialised system analyst responsible for designing and maintaining the expert system, to build and refine an expert system's knowledge base. The KE works with the knowledge acquisition subsystem to model decision logic, derive industries and update the knowledge base.

- IV. **User Interface** – It is a method by which an expert system interacts with a user. These can be through dialog boxes, command prompts, forms, or other input methods. The user interface for an Expert System is highly interactive.

12.4 OFFICE AUTOMATION SYSTEM (OAS) [Nov 10]

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

1. **Document Capture** – Documents originating from outside sources like incoming mails, notes, hand-outs, charts, graphs etc. need to be preserved.
2. **Document Creation** – This consists of preparation of documents, dictation, editing of texts etc. and takes up major part of the secretary's time.
3. **Receipts & Distribution** – This basically includes distribution of correspondence to designated recipients.
4. **Filling, Search, Retrieval & Follow up** – This is related to filling, indexing, searching of document, which takes up significant time.
5. **Calculations** – These include the usual calculator functions like routine arithmetic, operations for bill passing, interest calculations, working out the percentages and the like.
6. **Recording Utilization of Resources** – This includes, where necessary, record keeping in respect to specific resources utilized by office personnel.

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

12.4.1 Benefits of Office Automation System:

- I. Ensures accuracy of communication flows.
- II. Improves communication within an organisation and between organisations.
- III. Reduce the cycle time between preparation of messages and receipt of messages at the recipients' end.
- IV. Reduce the cost of office communication both in terms of time spent by executives and cost of communication links.

12.4.2 Categories of Computer-Based Office Automation System:

- I. **Text Processors & Related System** –
 1. Text processing systems automate the process of development of documents such as letters, reports, memos etc. they use standard stored information to produce personalised documents.
 2. Text processor may be simple word processing system or desktop publishing system. The desktop publishing systems help in quality printing. The desktop publishing systems are often supported with laser printers, inkjet printers, scanners and other such devices for producing good quality documents.
- II. **Electronic Document Management System (EDMS)** –
 1. EDMSs capture the information contained in documents and store this for future reference and communicate it to the users as and when required.
 2. EDMSs are linked to OASs such as text processors, electronic message communication systems etc.
 3. These systems are very useful in remote access of documents that is almost impossible with manual document management system. For example, sanctioning office at the head office, can access the loan application form filed in a branch for scrutiny of the loan proposals.

III. Electronic Message Communication System -

These systems are used for sending & receiving messages such as telephone, mail & facsimile (fax), etc. they offer a lot of economy in terms of reduced time in sending or receiving the message, reliability of the message and cost of communication.

There are three components of Message Communication System:

1. **Electronic Mail (Email)** – Various features of electronic mail are stated below;

[MAY 12]

- (1) High speed electronic transmission with quick delivery: messages are transmitted and delivered quickly (confirmation of transmission and delivery is also quick).
- (2) Online development, editing & storage of messages on magnetic media. No need to use paper in communication and it also offers space to store message on magnetic media.
- (3) Broadcasting & Rerouting: Email messages can be sent/forwarded to a large number of target recipients.
- (4) Integration with other information system (like mobiles, tablets, ESSs), so that information required for the message can be accessed quickly.
- (5) Portability: Email can be accessed from any computer equipped with the relevant communication hardware (like LAN card), software (like Internet Explorer) & link facilities (like broadband connection).
- (6) Economical: It is the most economical mode of sending messages.

2. **Facsimile (Fax)** –

- (1) Facsimile (Fax) transmits documents as image over telephone lines.
- (2) Computer Based fax technology automates fax communication & permits sharing of fax facilities. It uses special software & fax servers to send and receive fax messages. These servers have the ability to receive fax messages and automatically reroute/forward them to the intended recipient.

3. **Voice Mail** –

- (1) It is the variation of the email in which messages are transmitted as digitized voice.
- (2) The recipient of the voice mail has to dial a voice mail service number or access the e-mail box using equipped equipment and he can hear the spoken message in the voice of sender.

Note: In case of secure voice mail service, the recipient has to enter identification code to access the stored information.

IV. **Teleconferencing & Video-conferencing Systems** –

1. Teleconferencing is used to conduct a business meeting involving more than 2 persons located at two or more different places.
2. The teleconferencing helps in reducing the time & cost of meeting as the participants do not have to travel to attend the meeting.
3. Teleconferencing may be audio or video conferencing with or without use of computer system.
4. The computer based teleconferencing has the flexibility in terms of pre-recorded presentations and integration with other information system. These systems are based on Personal computers featuring a digital camera and run on visual communication software.
5. The communication links are still quite expensive making desktop video conferencing useful for selected applications only.