**UNIT -II**

**DEFINING A SYSTEM:**

A collection of components that work together to realize some objectives forms a system. Basically there are three major components in every system, namely input, processing and output.

In a system the different components are connected with each other and they are interdependent. For example, human body represents a complete natural system. We are also bound by many national systems such as political system, economic system, educational system and so forth. The objective of the system demands that some output is produced as a result of processing the suitable inputs. A well-designed system also includes an additional element referred to as „control‟ that provides a feedback to achieve desired objectives of the system.

Term system is derived from the Greek word „Systema‟ which means an organized relationship among functioning units or components.

**Definition of System:**

"A system is an orderly grouping of interdependent components linked together according to a plan to achieve a specific objective".

**Characteristics of a System:**

* Organization
* Interaction
* Interdependence
* Integration
* Central Objective

1. **Organization**:

It implies structure and order.

1. **Interaction**:

It refers to manner in which each component functions with other components of the system.

1. **Interdependence**:

Units/parts are dependent on each other.

1. **Integration:**

The parts of a system work together within the system even though each part performs a unique function.

1. **Central Objective:**

Objective may be real or stated. All the components work together to achieve that particular objective.

**Elements of a System**

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

* Outputs and inputs.
* Processor(s).
* Control.
* Feedback.
* Environment.
* Boundaries and interface.

**1 ) Outputs and Inputs :**

A major objective of a system is to produce an output that has value to its user. Whatever the nature of the output (goods, services, or information), it must be in line with the expectations of the intended user. Inputs are the elements (material, human resources, and information) that enter the system for processing. Output is the outcome of processing. A system feeds on input to produce output in much the same way that a business brings in human, financial, and material resources to produce goods and services.

It is important to point out here that determining the output is a first step in specifying the nature, amount, and regularity of the input needed to operate a system. For example, in systems analysis, the first concern is to determine the user‟s requirements of a proposed computer system – that is, specification of the output that the computer is expected to provide for meeting user requirements.

**2) Processor(s) :**

The processor is the element of a system that involves the actual transformation of input into output. It is the operational component of a system. Processors may modify the input totally or partially, depending on the specifications of the output. This means that as the output specifications change so does the processing. In some cases, input is also modified to enable the processor to handle the transformation.

**3) Control :**

The control element guides the system. It is the decision – making subsystem that controls the pattern of activities governing input, processing, and output. In an organizational context, management as a decision – making body controls the inflow, handling and outflow of activities that affect the welfare of the business. In a computer system, the operating system and accompanying software influence the behaviour of the system. Output specifications determine what and how much input is needed to keep the system in balance.

In systems analysis, knowing the attitudes of the individual who controls the area for which a computer is being considered can make a difference between the success and failure of the installation. Management support is required for securing control and supporting the objective of the proposed change.

**4 )Feedback:**

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

Feedback may be positive or negative, routing or informational. Positive feedback reinforces the performance of the system. It is routine in nature. Negative feedback generally provides the controller with information for action. In systems analysis, feedback is important in different ways. During analysis, the user may be told that the problems in a given application verify the initial concerns and justify the need for change.

Another form of feedback comes after the system is implemented. The user informs the analyst about the performance of the new installation. This feedback often results in enhancements to meet the user‟s requirements.

**5) Environment**

The environment is the “supra system” within which an organization operates. It is the source of external elements that impinge on the system. In fact, it often determines how a system must function. For example, the organization‟s environment, consisting of vendors, competitors, and others, may provide constraints and, consequently, influence the actual performance of the business.

**6 ) Boundaries and interface**

A system should be defined by its boundaries – the limits that identify its components, processes and interrelationship when it interfaces with another system. For example, a teller system in a commercial bank is restricted to the deposits, withdrawals and related activities of customers checking and savings accounts. It may exclude mortgage foreclosures, trust activities, and the like.

Each system has boundaries that determine its sphere of influence and control. For example, in an integrated banking – wide computer system design, a customer who has a mortgage and a checking account with the same bank may write a check through the “teller system” to pay the premium that is later processed by the “mortgage loan system.” Recently, system design has been successful in allowing the automatic transfer of funds form a bank account to pay bills and other obligations to creditors, regardless of distance or location. This means that in systems analysis, knowledge of the boundaries of a given system is crucial in determining the nature of its interface with other systems for successful design.

**Types of systems**

The frame of reference within which one views a system is related to the use of the systems approach for analysis. Systems have been classified in different ways.

Common classifications are:

1. physical or abstract,
2. open or closed, and
3. “man – made” information systems.

**1.6.1 Physical or abstract systems**

Physical systems are tangible entities that may be static or dynamic in operation. For example, the physical parts of the computer center are the officers, desks, and chairs that facilitate operation of the computer. They can be seen and counted; they are static. In contrast, a programmed computer is a dynamic system. Data, programs, output, and applications change as the user‟s demands or the priority of the information requested changes. Abstract systems are conceptual or non-physical entities.

They may be as straightforward as formulas of relationships among sets of variables or models – the abstract conceptualization of physical situations. A model is a representation of a real or a planned system. The use of models makes it easier for the analyst to visualize relationships in the system under study. The objective is to point out the significant elements and the key interrelationships of a complex system.

**1.6.2 Open or Closed Systems**

Another classification of systems is based on their degree of independence. An open system has many interfaces with its environment. It permits interaction across its boundary; it receives inputs from and delivers outputs to the outside. An information system falls into this category, since it must adapt to the changing demands of the user. In contrast, a closed system is isolated from environmental influences. In reality, a completely closed system is rare. In systems analysis, organizations, applications and computers are invariably open, dynamic systems influenced by their environment.

**SYSTEM LIFE CYCLE:**

System life cycle is an organizational process of developing and maintaining systems. It helps in establishing a system project plan, because it gives overall list of processes and sub-processes required for developing a system.

System development life cycle means combination of various activities. In other words we can say that various activities put together are referred as system development life cycle. In the System Analysis and Design terminology, the system development life cycle also means software development life cycle.

Following are the different phases of system development life cycle:

1. Preliminary study
2. Feasibility study
3. Detailed system study
4. System analysis
5. System design
6. Coding
7. Testing
8. Implementation
9. Maintenance.

**PHASES OF SYSTEM DEVELOPMENT LIFE CYCLE**

**(1) Preliminary System Study:**

Preliminary system study is the first stage of system development life cycle. This is a brief investigation of the system under consideration and gives a clear picture of what actually the physical system is? In practice, the initial system study involves the preparation of a „System Proposal‟ which lists the Problem Definition, Objectives of the Study, Terms of reference for Study, Constraints, Expected benefits of the new system, etc. in the light of the user requirements. The system proposal is prepared by the System Analyst (who studies the system) and places it before the user management. The management may accept the proposal and the cycle proceeds to the next stage. The management may also reject the proposal or request some modifications in the proposal. In summary, we would say that system study phase passes through the following steps:

* problem identification and project initiation
* background analysis
* inference or findings (system proposal)

**(2) Feasibility Study:**

In case the system proposal is acceptable to the management, the next phase is to examine the feasibility of the system. The feasibility study is basically the test of the proposed system in the light of its workability, meeting user‟s requirements, effective use of resource and of course, the cost effectiveness. These are categorized as technical, operational, economic and schedule feasibility. The main goal of feasibility study is not to solve the problem but to achieve the scope. In the process of feasibility study, the cost and benefits are estimated with greater accuracy to find the Return on Investment (ROI). This also defines the resources needed to complete the detailed investigation. The result is a feasibility report submitted to the management. This may be accepted or accepted with modifications or rejected. The system cycle proceeds only if the management accepts it.

**(3) Detailed System Study:**

The detailed investigation of the system is carried out in accordance with the objectives of the proposed system. This involves detailed study of various operations performed by a system and their relationships within and outside the system. During this process, data are collected on the available files, decision points and transactions handled by the present system. Interviews, on-site observation and questionnaire are the tools used for detailed system study. Using the following steps it becomes easy to draw the exact boundary of the new system under consideration:

* Keeping in view the problems and new requirements
* Workout the pros and cons including new areas of the system

All the data and the findings must be documented in the form of detailed data flow diagrams (DFDs), data dictionary, logical data structures and miniature specification. The main points to be discussed in this stage are:

* Specification of what the new system is to accomplish based on the user requirements.
* Functional hierarchy showing the functions to be performed by the new system and their relationship with each other.
* Functional network, which are similar to function hierarchy but they highlight the functions which are common to more than one procedure.
* List of attributes of the entities – these are the data items which need to be held about each entity (record)

**(4) System Analysis:**

Systems analysis is a process of collecting factual data, understand the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning.

This involves studying the business processes, gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system so as to achieve the organizational goals. System Analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes.

The major objectives of systems analysis are to find answers for each business process: What is being done, How is it being done, Who is doing it, When is he doing it, Why is it being done and How can it be improved? It is more of a thinking process and involves the creative skills of the System Analyst. It attempts to give birth to a new efficient system that satisfies the current needs of the user and has scope for future growth within the organizational constraints. The result of this process is a logical system design. Systems analysis is an iterative process that continues until a preferred and acceptable solution emerges.

**(5) System Design:**

Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. It is the most crucial phase in the developments of a system. The logical system design arrived at as a result of systems analysis is converted into physical system design. Normally, the design proceeds in two stages:

* Preliminary or General Design
* Structured or Detailed Design

**Preliminary or General Design:**

In the preliminary or general design, the features of the new system are specified. The costs of implementing these features and the benefits to be derived are estimated. If the project is still considered to be feasible, we move to the detailed design stage.

**Structured or Detailed Design:**

In the detailed design stage, computer oriented work begins in earnest. At this stage, the design of the system becomes more structured. Structure design is a blue print of a computer system solution to a given problem having the same components and inter-relationships among the same components as the original problem. Input, output, databases, forms, codification schemes and processing specifications are drawn up in detail.

In the design stage, the programming language and the hardware and software platform in which the new system will run are also decided.

There are several tools and techniques used for describing the system design of the system. These tools and techniques are:

* Flowchart
* Data flow diagram (DFD)
* Data dictionary
* Structured English
* Decision table
* Decision tree

Each of the above tools for designing will be discussed in detailed in the next lesson. The system design involves:

1. Defining precisely the required system output
2. Determining the data requirement for producing the output
3. Determining the medium and format of files and databases
4. Devising processing methods and use of software to produce output
5. Determine the methods of data capture and data input
6. Designing Input forms
7. Designing Codification Schemes
8. Detailed manual procedures
9. Documenting the Design

**(6) Coding:**

The system design needs to be implemented to make it a workable system. This demands the coding of design into computer understandable language, i.e., programming language. This is also called the programming phase in which the programmer converts the program specifications into computer instructions, which we refer to as programs. It is an important stage where the defined procedures are transformed into control specifications by the help of a computer language. The programs coordinate the data movements and control the entire process in a system. It is generally felt that the programs must be modular in nature. This helps in fast development, maintenance and future changes, if required.

**(7) Testing:**

Before actually implementing the new system into operation, a test run of the system is done for removing the bugs, if any. It is an important phase of a successful system. After codifying the whole programs of the system, a test plan should be developed and run on a given set of test data. The output of the test run should match the expected results. Sometimes, system testing is considered a part of implementation process. Using the test data following test run are carried out:

* Program test
* System test

**Program test:**

When the programs have been coded, compiled and brought to working conditions, they must be individually tested with the prepared test data. Any undesirable happening must be noted and debugged (error corrections)

**System Test:**

After carrying out the program test for each of the programs of the system and errors removed, then system test is done. At this stage the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the results or output of the system is analysed.

During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are fixed and further tested for the expected output. When it is ensured that the system is running error-free, the users are called with their own actual data so that the system could be shown running as per their requirements.

**(8) Implementation:**

After having the user acceptance of the new system developed, the implementation phase begins. Implementation is the stage of a project during which theory is turned into practice. The major steps involved in this phase are:

* Acquisition and Installation of Hardware and Software
* Conversion
* User Training
* Documentation

The hardware and the relevant software required for running the system must be made fully operational before implementation. The conversion is also one of the most critical and expensive activities in the system development life cycle. The data from the old system needs to be converted to operate in the new format of the new system. The database needs to be setup with security and recovery procedures fully defined.

During this phase, all the programs of the system are loaded onto the user‟s computer. After loading the system, training of the user starts. Main topics of such type of training are:

* How to execute the package
* How to enter the data
* How to process the data (processing details)
* How to take out the reports

After the users are trained about the computerized system, working has to shift from manual to computerized working. The process is called „Changeover‟. The following strategies are followed for changeover of the system.

**(i) Direct Changeover:**

This is the complete replacement of the old system by the new system. It is a risky approach and requires comprehensive system testing and training.

**(ii) Parallel run:**

In parallel run both the systems, i.e., computerized and manual, are executed simultaneously for certain defined period. The same data is processed by both the systems. This strategy is less risky but more expensive because of the following:

* Manual results can be compared with the results of the computerized system.
* The operational work is doubled.
* Failure of the computerized system at the early stage does not affect the working of the organization, because the manual system continues to work, as it used to do.

**(iii) Pilot run:**

In this type of run, the new system is run with the data from one or more of the previous periods for the whole or part of the system. The results are compared with the old system results. It is less expensive and risky than parallel run approach. This strategy builds the confidence and the errors are traced easily without affecting the operations.

The documentation of the system is also one of the most important activity in the system development life cycle. This ensures the continuity of the system. There are generally two types of documentation prepared for any system. These are:

* User or Operator Documentation
* System Documentation

The user documentation is a complete description of the system from the users point of view detailing how to use or operate the system. It also includes the major error messages likely to be encountered by the users. The system documentation contains the details of system design, programs, their coding, system flow, data dictionary, process description, etc. This helps to understand the system and permit changes to be made in the existing system to satisfy new user needs.

**(9) Maintenance:**

Maintenance is necessary to eliminate errors in the system during its working life and to tune the system to any variations in its working environments. It has been seen that there are always some errors found in the systems that must be noted and corrected. It also means the review of the system from time to time. The review of the system is done for:

* l knowing the full capabilities of the system
* l knowing the required changes or the additional requirements
* l studying the performance.

If a major change to a system is needed, a new project may have to be set up to carry out the change. The new project will then proceed through all the above life cycle phases.

**Types of System**

**1. Physical or Abstract System**

Physical – These are tangible entities that may be static or dynamic in operation. For example- parts of a computer center are the desks, chairs etc. that facilitate operation of the computer. They are static and a programmed computer is dynamic.

Abstract System – These are conceptual or non physical entities. For example- the abstract conceptualization of physical situations. A model is a representation of a real or planned system. A model is used to visualize relationships.

**2. Deterministic or Probabilistic** System

Deterministic System – It operates in a predictable manner and the interaction between parts is known with certainty. For example: Two molecules of hydrogen and one molecule of oxygen makes water.

Probabilistic System – It shows probable behavior. The exact output is not known. For example: weather forecasting, mail delivery.

**3. Social, Human Machine, Machine System**

Social System- It is made up of people. For example: social clubs, societies

Human Machine System- When both human and machines are involved to perform a particular a particular task to achieve a target. For example:- Computer.

Machine System- Where human interference is neglected. All the tasks are performed by the machine. Natural and Manufactured

Natural System- The system which is natural. For example- Solar system, Seasonal System.

Manufactured System- System made by man is called manufactured system. For example- Rockets, Dams, Trains. Permanent or Temporary System

Permanent System- Which persists for long time. For example- policies of business.

Temporary System- Made for specified time and after that they are dissolved. For example- setting up DJ system.

**4. Adaptive and Non Adaptive System**

Adaptive System- respond to change in the environment in such a way to improve their performance and to survive. For example- Human beings, animals.

Non Adaptive System-The system which doesn‟t respond to the environment. For example- Machines Continued…

Open System – It has many interfaces with its environment. It interacts across its boundaries, it receives inputs from and delivers outputs to the outside world. It must adapt to the changing demands of the user.

Closed System – It is isolated from the environmental influences. A completely closed system is rare.

**Characteristics of Open Systems**

Input from outside- Open systems are self adjusting and self regulating. When functioning properly open system reaches a steady state or equilibrium.

Entropy- Dynamic systems run down over time resulting in loss of energy or entropy. Open systems resist entropy by seeking new input or modifying the processes to return to a steady state.

Process, output and cycles- Open system produce useful output and operate in cycles, following a continuous flow path.

Differentiation- They have a tendency toward an increasing specialization of functions and a greater differentiation of their components. For example the role of machines and people tend toward greater specialization and greater interaction.

Equifinality- Goals are achieved through differing courses of action and a variety of paths.

**5. Man Made Information Systems**

Information System may be defined as a set of devices, procedures, and operating systems designed around user based criteria to produce information and communicate it to the user for planning, control and performance.

**Formal Information Systems**

It is based on the organization represented by organization chart.

The chart is a map of positions and their authority relationships, indicated by boxes and connected by straight lines.

**Categories of Information**

**Strategic Information:**

relates to ling range planning policies that are direct interest to upper management and for long range goals. For example- population growth, trends in financial investment, human resources.

This information is achieved with the aid of DSS.

Managerial Information- It is of direct use to middle management and department heads for implementation and control. For example- sales analysis, cash flow projections, and annual financial statements.

This information is of use in short and intermediate range planning- i.e. months rather than years.

It is maintained with the help of MIS.

Operational Information- It is short term, daily information used to operate departments and to enforce the day to day rules and regulations of the business. For example- daily employee absence sheets, overdue purchase orders, current stock.

It is established by data processing systems. Informal Information Systems

It is an employee based system designed to meet personnel and vocational needs and to help solve, work related problems.

**Computer Based Information System**

It relies on computer for handling business applications.