# Introduction to General Systems Theory

#### **System**

A system can be defined as a collection of interrelated components that work together towards a collective goal. The function of a system is to receive Inputs and transform these into outputs.

Business systems usually have multiple goals;

- profit
- Improving the quality of a product/service
- Systems are therefore a group of interrelated or interacting elements forming a unified whole.



- A university system, business organization and the human body.

The components of a university system include:

Students

**Administrators** 

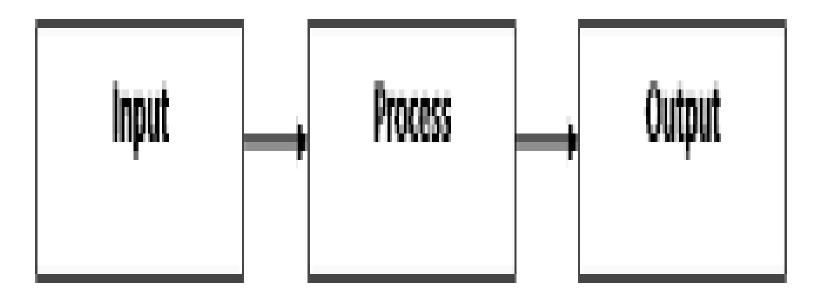
Lecturers

Support staff

All the above university system components work towards a common goal of moulding the youth into citizens who are morally upright and academically fit to meet the expectations of the community and a country at large.

# Elements of a System

Basically there are three major elements in every system, namely input, processing and output.



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#### Input

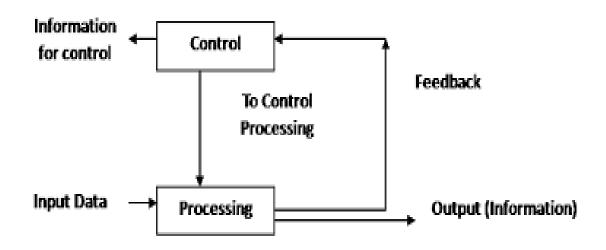
• This involves capturing and assembling elements that enter the system to be processed. For example, raw materials, energy, data, and human efforts must be secured and organized for processing.

#### **Processing**

 This involves transformation processes that convert input into output. Examples are a manufacturing process, the human breathing process, or mathematical calculations.

#### Output

 This involves transferring information that has been processed to their ultimate destination. For example, finished products, human services, and management information must be transmitted to their human users. **N/B:** A well-designed system also includes an additional element referred to as 'control' that provides a feedback to achieve desired objectives of the system.



#### **Feedback**

Feedback is data about the performance of a system. For example, data about sales performance is feedback to a sales manager.

## System Properties

• A fully integrated system consists of subsystems, each of which has, as input, the output of another sub-system so that all the sub-systems together fulfil the overall objective of the whole system.

## a) Control

 Control involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal.

## Boundary and Environment

Every system has defined boundary within which its components operate. Any entity outside the defined boundary but which interacts with the system is part of the system environment. System environment provide the inputs and receive the outputs from the system.

### Subsystem

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 subsystem being delineated by its boundaries.

#### Interfaces

The inter connections and interactions between the subsystem are termed interface. The number of inter connections if all subsystems interact is in general n(n-1)/2 each inter connections is a potential interface for communication among subsystems.

# **Types of Systems**

- Open and Closed Systems
- An open system is one that interacts with the environment. A business organization is an open system because it exchanges men, material, money and information with the environment. An open system does not provide for its own control or modification thus it does not supervise itself. It needs to be supervised by people.

 A closed system is a system which is selfcontained. It does not exchange material, information or energy with its environment. Closed systems are very rare and if they exist they will finally run down or become disorganized. A system is relatively closed if it has only well defined inputs and outputs but is not subjected to disturbances from outside the system, for example a computer system.

- Conceptual and Physical Systems
- An abstract or conceptual system is an orderly arrangement of independent ideas. Conceptual systems are concerned with theoretical structures which may or may not have counterpart in the real word. Thus conceptual systems systems of explanation or ideas or constructs, for example, accounting systems.

 Physical systems are concrete operational systems made up of people, material, machines energy and other physical things. Physical systems can display activity or behaviour. Examples include business organizations, computer systems and Management Information Systems (MIS).

### **Deterministic and Probabilistic Systems**

A deterministic system operates in a predictable manner. If one knows the state of a system at a given point of time or can predict the next state without error then it is a deterministic system but if one cannot predict the next state without an error then it is a probabilistic system.

For example, in computer systems the outputs are deterministic while economic forecasting systems an inventory system are probabilistic.

- Hard and Soft Systems
- Soft system have got no clearly defined goals and objectives hence their performance cannot be precisely measured. For example, sales tracking system where sales performance depend on human factors such the prevailing conditions (availability of money, customers, products) and human preferences.

 Hard systems are systems whose goals and objectives are clearly defined and the outcomes from the processes are predictable. For example, in a stock control system, it is possible to know exactly the stock levels, the reorder and profits can be accurately predicted if all the stock is sold.

## **Information System**

An Information system (IS) is an arrangement of people, data, processes, information presentation and information technology that interact to support and improve day-to-day operations in a business as well as support the problem solving and decision-making needs of management and users.

# Components of an Information System

- People Resources
- People are required for the operation of all information systems. The people resource includes end users and IS specialists.
- **End users** (also called users or clients) are people who use an information system or the information it produces. They can be accountants, salespersons, engineers, clerks, customers, or managers.
- **IS Specialists** are people who develop and operate information systems. They include systems analysts, programmers, computer operators, and other managerial technical, and clerical IS personnel. Systems analysts design information systems based on the information requirements of end users.

#### Hardware Resources

 The concept of Hardware resources includes all physical devices and materials used in information processing. Specially, it includes not only machines, such as computers and other equipment, but also all data media, that is, all tangible objects on which data is recorded, from sheets of paper to magnetic disks.

## Software Resources

• The concept of **Software Resources** includes all sets of information processing instructions. This generic concept of software includes not only the sets of operating instructions called programs, which direct and control computer hardware, but also the sets of information processing instructions needed by people, called procedures.

- The following are the examples of software resources:
- **System Software,** such as operating system programs, which control and support the operations of a computer system.
- Application Software, which are programs that direct processing for a particular use of computers by end users. Examples are a sales analysis program, a payroll program, and an examination analysis program.
- **Procedures**, which are operating instructions for the people who will use an information system. Examples are instructions for filling out a paper form or using a software package.

#### Data Resources

Data is more than the raw material of information systems. The concept of data resources has been broadened by managers and information systems professionals. They realize that data constitutes a valuable organization resource. Thus, you should view data as data resources that must be managed effectively to benefit all end users in an organization.

- The data resources of information systems are typically organized into:
- Database that hold processed and organized data.
- Knowledge bases that hold knowledge in variety of forms such as facts, rules, and case examples about successful business practices.

#### Network Resources

 Telecommunications networks like the Internet, intranets, and extranets have become essential to the successful operations of all types of organizations and their computer-based information systems. Telecommunications networks consist of computers, communications processors, and devices interconnected communications media and controlled communications software.

# Types of Information Systems

- Information Systems are constantly changing and evolving with technological innovations and growth.
- Information Systems can be classified in many ways such as on the basis of the mode of processing, on the system objectives, on the nature of interaction of the system with its environment and on the type of function the system supports.

# Classification by Mode of Processing

## **Batch Processing Systems**

In batch processing system, the transactions are collected as they occur but processed periodically as a group, for example, once a week or once a month. An example of a batch system is payroll system.

### **Online Systems**

In online processing system the transactions are captured by the online data entry devices (devices under the control of the CPU) and can be processed immediately.

#### Real time Systems

In real time systems transactions, data capture as well as their processing in order to update records and possibly generate reports is carried out in real time as the transaction is taking place. An example of real time systems includes airline reservation system.

#### **Distributed Systems**

Distributed systems refer to any computer systems that use more than one computer, or processor, to run an application. This includes parallel processing, in which a single computer uses more than one CPU to execute programs.

# Classification by System Objectives

## **Transaction Processing Systems(TPS)**

 These are information systems that capture and process data about business transactions. Their objective is to process transactions in order to update records and generate reports. Examples include payroll systems, electricity billing systems, stock control systems and airline reservation systems.

#### Office Systems

 Office Systems are now a way of life in organisations. They are used by everyone and include word processing, spreadsheets, databases, email. They can be classified as knowledge-level systems.

#### Knowledge Work Systems

 Knowledge Work Systems are again often classified at the knowledge level. They are used by technical and professional staff, and include modeling and simulation software, computer-aided design, sophisticated desktop publishing applications and other technicallyoriented systems.

- Management Information Systems (MIS)
- These are information systems that condense and convert Transaction Processing Systems' data into information for monitoring performance and managing organizations. They provide management oriented reports which are usually generated on a predetermined schedule and appear in a prearranged format. Examples include Trading Profit and Loss Accounts, Income and Expenditure Accounts and Bank Statements.

- Decision Support Systems (DSS)
- These are information systems that provide the users with decision oriented information whenever a decisionmaking situation arises. Their objective is to support managerial decisions and is usually based on a model of decision making domain. These systems are also often used for attention directing purposes especially for problematic aspects of operations. Examples include spreadsheet programs such as Microsoft Excel and Lotus 1-2-3

#### Executive Information Systems (EIS)

These are information systems that aid to executives of organizations to make highly unstructured decisions in support of organizational strategy or mission.

#### Expert Systems (ES)

These are programmed decision making information systems that capture and reproduce the knowledge and expertise of an expert problem solver or decision maker and then simulates the 'thinking' or 'actions' of that expert. These systems are implemented with artificial intelligence technology that capture, store and provide access to the reasoning of experts. They initiate the reasoning and the logic of a human expert in a given field such as the medical field, banking and legal field.

# Classification Based On the Functions the System Supports

- Finance and Accounting Systems
- These are systems that maintain records concerning the flow of funds in the firm and produce financial statements such as income statements, general ledger, billings and balance sheets. Examples include Cash management systems, Loan management Systems, Credit Card Repayment Systems and Cheque Processing Systems.

#### Human Resource Systems

These systems deal with recruitment, placement, performance evaluation, and compensation and career developments of the firm's employees. Examples include Personnel Record Keeping Systems and Applicant Tracking Systems.

#### Sales and marketing systems

These systems are responsible for **selling the products or services.** Marketing is concerned with the customers for the firm's products, determining the customer needs and advertising and promoting the product accordingly. Sales are concerned with contacting customers, selling the products, taking orders and follow up the sales.

Manufacturing and Production systems

These systems are responsible for actually producing the firm's goods and services. It deals with the planning, development and maintenance of production facilities. It keeps track of the production at various levels.