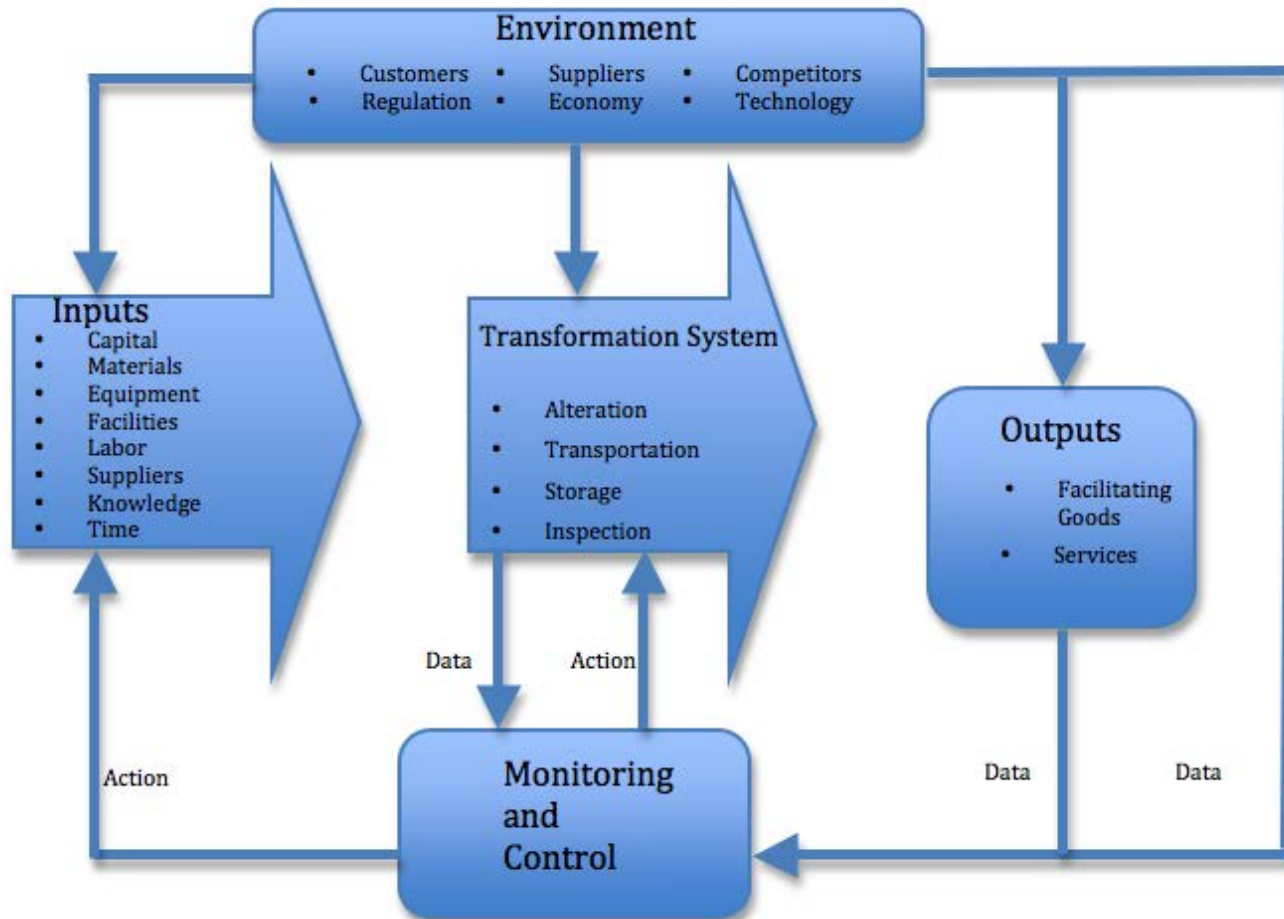


Management Information System Notes

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SYSTEM

The word system is derived from the Greek word “system” which means a organized relationship among the following unit or component. “A system is an orderly grouping of interdependent components linked together according to a plan to achieve a specific goal”.



- ▶ In MIS we are usually concerned with man-made system involving input, process and output, as represented in figure. A system may have multiple inputs and multiple outputs.
- ▶ All systems operate in an environment. The environment may influence the system in its design and performance. When a system is designed to achieve certain objective, it automatically sets the boundaries for itself. The understanding of boundaries of the system is essential to bring clarity in explaining the system components and their arrangement.

Types of the System in the Management Information Systems

- ▶ 1. Conceptual Systems
- ▶ 2. Empirical Systems
- ▶ 3. Open Systems
- ▶ 4. Closed Systems
- ▶ 5. Natural Systems
- ▶ 6. Artificial Systems
- ▶ 7. Probabilistic Systems
- ▶ 8. Deterministic System

1. Conceptual Systems

- a. Are theoretical and explanatory in the nature.
- b. Provide the much needed clarification.
- c. Provide theoretical framework for which there may or may not be any real life counterpart.
- d. E.g. of such systems can be philosophy, theology etc.

2. Empirical Systems

- a. Are very practical, specific and also very operational in the nature.
- b. Can be based on the conceptual system.
- c. Examination system, surgery act as very good examples of the empirical systems.

3. Open Systems

- a. Involve continuous interaction with the environment.
- b. So exchanges the information, material, energy with the environment.
- c. Is open and also self organizing in the nature.
- d. Is also adoptive or adaptive to the changing environment as it is flexible.

4. Closed Systems

- a. Shuns any kind of the exchange with the environment.
- b. Is rigid in nature.
- c. Is not at all amenable to the change.
- d. Is also self contained.
- e. Is somewhat isolated in the nature.
- f. Is having a well defined boundary.
- g. Is not at all adaptive in the nature.

5. Natural Systems

- a. Such Systems exist and also abound in the nature.
- b. Are also not at all the results of the human endeavors.
- c. Rivers, mountains, minerals etc. are the major examples of the natural Systems.

6. Artificial Systems

- a. Are manufactured (man made).
- b. Examples of such Systems are dams, canals, roads, machines, factories etc.

7. Probabilistic Systems

- a. Based on the predictability of the behavior or the outcome.

8. Deterministic Systems

- a. In such Systems, the interaction of the elements is known.
- b. As the behavior of the elements is pre determined, it becomes possible to work upon the reaction well in the advance.

Abstract and Physical systems

- ▶ An abstract or conceptual system is an orderly arrangement of interdependent ideas or constructs, which may or may not have any counterpart in the real world.
- ▶ On the other hand, physical systems are generally concrete operational systems made up of people, materials, machines, energy and other physical things; Physical systems are more than conceptual constructs.

Deterministic and Probabilistic Systems

- ▶ A deterministic system is one in which the occurrence of all events is known with certainty. A probabilistic system is one in which the occurrence of events cannot be perfectly predicted. Though the behavior of such a system can be described in terms of probability, a certain degree of error is always attached to the prediction of the behavior of the system.

Open and Closed Systems

- ▶ An open system is one that interacts with its environment and thus exchanges information, material, or energy with the environment, including random and undefined inputs. Open systems are adaptive in nature, as they tend to react with the environment in such a way, so as to favor their continued existence. Such systems are 'self organizing', in the sense that they change their organisation in response to changing conditions.
- ▶ A closed system is one, which does not interact with its environment. Such systems in business world, are rare, but relatively closed systems are common. Thus, the systems that are relatively isolated from the environment but not completely closed, are termed closed system.

What is MIS?

- ▶ MIS is the use of information technology, people, and business processes to record, store and process data to produce information that decision makers can use to make day to day decisions.
- ▶ MIS is the acronym for **Management Information Systems**. In a nutshell, MIS is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information

The need for MIS

- ▶ The following are some of the justifications for having an MIS system
- ▶ **Decision makers need information to make effective decisions.** Management Information Systems (MIS) make this possible.
- ▶ **MIS systems facilitate communication within and outside the organization** – employees within the organization are able to easily access the required information for the day to day operations. Facilitates such as Short Message Service (SMS) & Email make it possible to communicate with customers and suppliers from within the MIS system that an organization is using.
- ▶ **Record keeping** – management information systems record all business transactions of an organization and provide a reference point for the transactions.

MIS – Introduction

- ▶ To the managers, Management Information System is an implementation of the organizational systems and procedures. To a programmer it is nothing but file structures and file processing. However, it involves much more complexity.
- ▶ The three components of MIS provide a more complete and focused definition, where **System** suggests integration and holistic view, **Information** stands for processed data, and **Management** is the ultimate user, the decision makers.
- ▶ Management information system can thus be analyzed as follows –

Management

- ▶ Management covers the planning, control, and administration of the operations of a concern. The top management handles planning; the middle management concentrates on controlling; and the lower management is concerned with actual administration.

Information

- ▶ Information, in MIS, means the processed data that helps the management in planning, controlling and operations. Data means all the facts arising out of the operations of the concern. Data is processed i.e. recorded, summarized, compared and finally presented to the management in the form of MIS report.

System

- ▶ Data is processed into information with the help of a system. A system is made up of inputs, processing, output and feedback or control.
- ▶ Thus MIS means a system for processing data in order to give proper information to the management for performing its functions.

Definition

- ▶ Management Information System or 'MIS' is a planned system of collecting, storing, and disseminating data in the form of information needed to carry out the functions of management.

Objectives of MIS

The goals of an MIS are to implement the organizational structure and dynamics of the enterprise for the purpose of managing the organization in a better way and capturing the potential of the information system for competitive advantage.

- ▶ Following are the basic objectives of an MIS –
- ▶ **Capturing Data** – Capturing contextual data, or operational information that will contribute in decision making from various internal and external sources of organization.
- ▶ **Processing Data** – The captured data is processed into information needed for planning, organizing, coordinating, directing and controlling functionalities at strategic, tactical and operational level. Processing data means –
 - making calculations with the data
 - sorting data
 - classifying data and
 - summarizing data
- ▶ **Information Storage** – Information or processed data need to be stored for future use.
- ▶ **Information Retrieval** – The system should be able to retrieve this information from the storage as and when required by various users.
- ▶ **Information Propagation** – Information or the finished product of the MIS should be circulated to its users periodically using the organizational network.

Characteristics of MIS

Following are the characteristics of an MIS –

- ▶ It should be based on a long-term planning.
- ▶ It should provide a holistic view of the dynamics and the structure of the organization.
- ▶ It should work as a complete and comprehensive system covering all interconnecting sub-systems within the organization.
- ▶ It should be planned in a top-down way, as the decision makers or the management should actively take part and provide clear direction at the development stage of the MIS.
- ▶ It should be based on need of strategic, operational and tactical information of managers of an organization.
- ▶ It should also take care of exceptional situations by reporting such situations.
- ▶ It should be able to make forecasts and estimates, and generate advanced information, thus providing a competitive advantage. Decision makers can take actions on the basis of such predictions.
- ▶ It should create linkage between all sub-systems within the organization, so that the decision makers can take the right decision based on an integrated view.
- ▶ It should allow easy flow of information through various sub-systems, thus avoiding redundancy and duplicity of data. It should simplify the operations with as much practicability as possible.
- ▶ Although the MIS is an integrated, complete system, it should be made in such a flexible way that it could be easily split into smaller sub-systems as and when required.

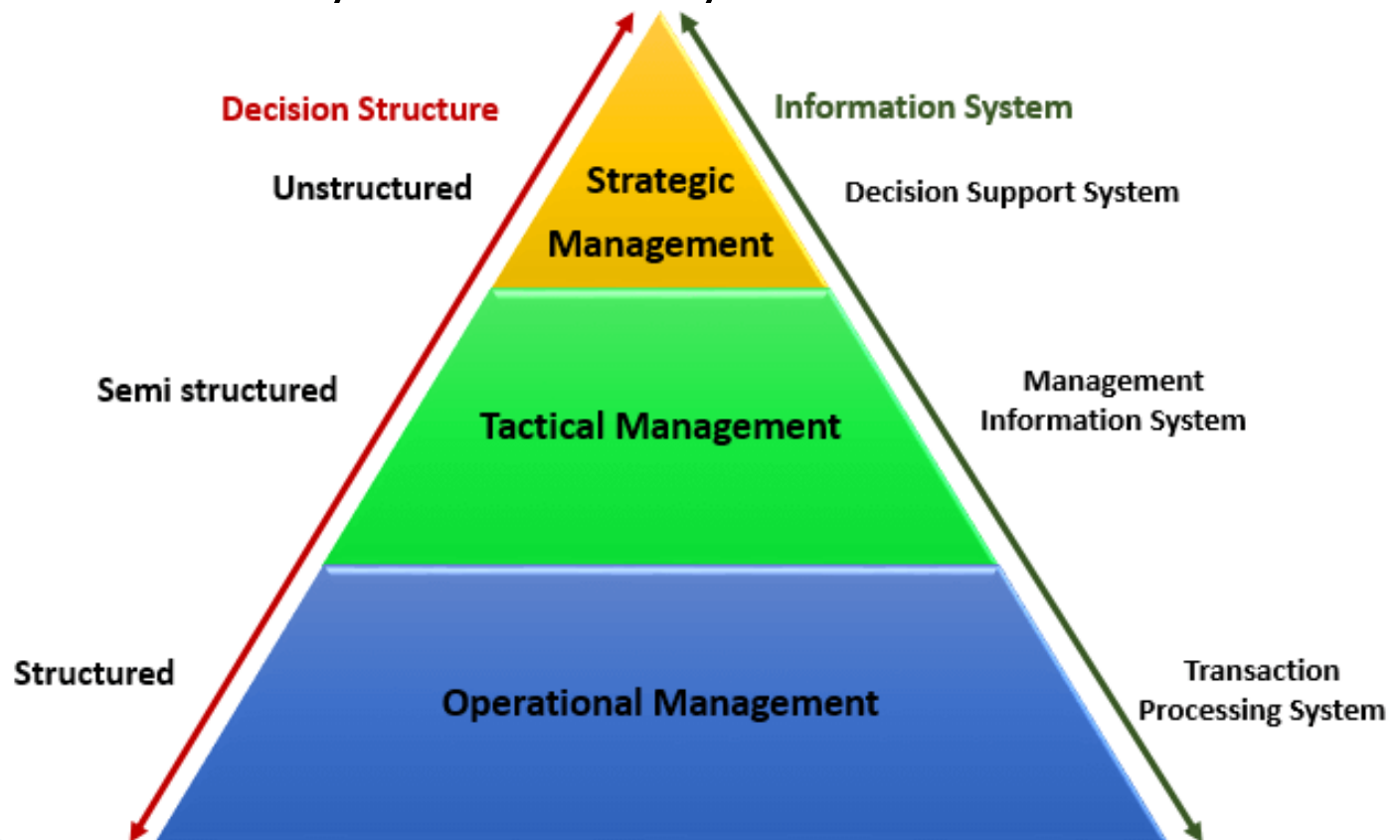
A central database is the backbone of a well built MIS.

Components of MIS

- ▶ The major components of a typical management information system are;
- ▶ **People** – people who use the information system
- ▶ **Data** – the data that the information system records
- ▶ **Business Procedures** – procedures put in place on how to record, store and analyze data
- ▶ **Hardware** – these include servers, workstations, networking equipment, printers, etc.
- ▶ **Software** – these are programs used to handle the data. These include programs such as spreadsheet programs, database software, etc.

Types of Information Systems

- ▶ The type of information system that a user uses depends on their level in an organization. The following diagram shows the three major levels of users in an organization and the type of information system that they use.



Volume of Information	Type of Information	Information Level	Management Level	System Support
Low Consensed	Unstructured	Strategic Information	Upper	DSS
Medium Moderately Processed	Moderately Structured	Management Control Information	Middle	MIS
Large Detail Reports	Highly Structured	Operational Information	Lower	DPS

▶ **Transaction Processing Systems (TPS)**

This type of information system is used to record the day to day transactions of a business. An example of a Transaction Processing System is a Point of Sale (POS) system. A POS system is used to record the daily sales.

▶ **Management Information Systems (MIS)**

Management Information Systems are used to guide tactic managers to make semi-structured decisions. The output from the transaction processing system is used as input to the MIS system.

▶ **Decision Support Systems (DSS)**

Decision support systems are used by top level managers to make semi-structured decisions. The output from the Management Information System is used as input to the decision support system. DSS systems also get data input from external sources such as current market forces, competition, etc.

Manual Information Systems VS Computerized Information Systems (MIS)

- ▶ Data is the bloodstream of any business entity. Everyone in an organization needs information to make decisions. An information system is an organized way of recording, storing data, and retrieving information.
- ▶ In this section, we will look at manual information systems vs. computerized information systems.

Manual Information System

- ▶ A manual information system does not use any computerized devices. The recording, storing and retrieving of data is done manually by the people, who are responsible for the information system.

The following are the major components of a manual information system

- ▶ **People** –people are the recipients of information system
- ▶ **Business Procedures** –these are measures put in place that define the rules for processing data, storing it, analyzing it and producing information
- ▶ **Data** –these are the recorded day to day transactions
- ▶ **Filing system** – this is an organized way of storing information
- ▶ **Reports** –the reports are generated after manually analyzing the data from the filing system and compiling it.

- ▶ The following diagram illustrates how a typical manual information system works



Advantages and Dis-advantages of a manual information system

- ▶ **Advantages:**
- ▶ The following are the advantages of manual information systems
- ▶ **Cost effective** – it is cheaper compared to a computerized system because there is no need to purchase expensive equipment such as servers, workstations, printers, etc.
- ▶ **Flexible** –evolving business requirements can easily be implemented into the business procedures and implemented immediately

Disadvantages:

- ▶ **Time consuming** –all data entries need to be verified before filing, this is a time consuming task when done by humans. Retrieving data from the filing system also takes a considerable amount of time
- ▶ **Prone to error** – the accuracy of the data when verified and validated by human beings is more prone to errors compared to verification and validation done by computerized systems.
- ▶ **Lack of security** – the security of manual systems is implemented by restricting access to the file room. Experience shows unauthorized people can easily gain access to the filing room
- ▶ **Duplication of data** –most departments in an organization need to have access to the same data. In a manual system, it is common to duplicate this data to make it easy to accessible to all authorized users. The challenge comes in when the same data needs to be updated
- ▶ **Data inconsistency** – due to the duplication of data, it is very common to update data in one file and not update the other files. This leads to data inconsistency
- ▶ **Lack of backups** – if the file get lost or mishandled, the chances of recovering the data are almost zero.

Computerized information system(MIS)

- ▶ Computerized systems were developed to address the challenges of manual information systems. The major difference between a manual and computerized information system is a computerized system uses a combination of software and hardware to record, store, analyze and retrieve information.

Advantages and Disadvantages of MIS

The following are some of the disadvantages of a computerized information system.

▶ **Advantages:**

- ▶ The following are the advantages of computerized information systems
- ▶ **Fast data processing and information retrieval** – this is one of the biggest advantages of a computerized information system. It processes data and retrieves information at a faster rate. This leads to improved client/customer service
- ▶ **Improved data accuracy** – easy to implement data validation and verification checks in a computerized system compared to a manual system.
- ▶ **Improved security** – in addition to restricting access to the database server, the computerized information system can implement other security controls such as user's authentication, biometric authentication systems, access rights control, etc.
- ▶ **Reduced data duplication** – database systems are designed in such a way that minimized duplication of data. This means updating data in one department automatically makes it available to the other departments
- ▶ **Improved backup systems** – with modern day technology, backups can be stored in the cloud which makes it easy to recover the data if something happened to the hardware and software used to store the data
- ▶ **Easy access to information** – most business executives need to travel and still be able to make a decision based on the information. The web and Mobile technologies make accessing data from anywhere possible.

- ▶ **Disadvantages:**
- ▶ **It is expensive to set up and configure** – the organization has to buy hardware and the required software to run the information system. In addition to that, business procedures will need to be revised, and the staff will need to be trained on how to use the computerized information system.
- ▶ **Heavy reliance on technology** – if something happens to the hardware or software that makes it stop functioning, then the information cannot be accessed until the required hardware or software has been replaced.
- ▶ **Risk of fraud** – if proper controls and checks are not in place, an intruder can post unauthorized transactions such as an invoice for goods that were never delivered, etc.

Types of Systems

- Impact of systems implementation on organization change?
 - Transaction Processing Systems (TPS)
 - Management Information Systems (MIS)
 - Decision Support Systems (DSS)
 - Expert Systems (ES)
 - Enterprise Resources Planning Systems (ERP)
 - E-commerce or M-commerce systems
 - Customer Relationship management systems (CRM)
 - Supply chain management system

Management Information System

Management is the practice of shaping organizations and its people to achieve its goal/s and mission.

Management generally involves the following activities or techniques,

- ▶ **Planning:** Making informed decisions about what to do in the future.
- ▶ **Organizing:** Making arrangements to fulfill the plan requirements.
- ▶ **Staffing:** Employing the right people for the right job.
- ▶ **Leading:** Influencing the members of the organization to move towards the common goal of the organization.
- ▶ **Controlling:** Making checks to find the deviations/hold ups and taking corrective action/s.



Levels of Management



Top Level of Management

It consists of board of directors, chief executive or managing director. The top management is the ultimate source of authority and it manages goals and policies for an enterprise. It devotes more time on planning and coordinating functions. The role of the top management can be summarized as follows

- ▶ Top management lays down the objectives and broad policies of the enterprise.
- ▶ It issues necessary instructions for preparation of department budgets, procedures, schedules etc.
- ▶ It prepares strategic plans & policies for the enterprise.
- ▶ It appoints the executive for middle level i.e. departmental managers.
- ▶ It controls & coordinates the activities of all the departments.
- ▶ It is also responsible for maintaining a contact with the outside world.
- ▶ It provides guidance and direction.
- ▶ The top management is also responsible towards the shareholders for the performance of the enterprise.

Middle Level of Management

The branch managers and departmental managers constitute middle level. They are responsible to the top management for the functioning of their department. They devote more time to organizational and directional functions. In small organization, there is only one layer of middle level of management but in big enterprises, there may be senior and junior middle level management. Their role can be emphasized as –

- ▶ They execute the plans of the organization in accordance with the policies and directives of the top management.
- ▶ They make plans for the sub-units of the organization.
- ▶ They participate in employment & training of lower level management.
- ▶ They interpret and explain policies from top level management to lower level.
- ▶ They are responsible for coordinating the activities within the division or department.
- ▶ It also sends important reports and other important data to top level management.
- ▶ They evaluate performance of junior managers.
- ▶ They are also responsible for inspiring lower level managers towards better performance.

Lower Level of Management

Lower level is also known as supervisory / operative level of management. It consists of supervisors, foreman, section officers, superintendent etc. According to *R.C. Davis*, "Supervisory management refers to those executives whose work has to be largely with personal oversight and direction of operative employees". In other words, they are concerned with direction and controlling function of management. Their activities include –

- ▶ Assigning of jobs and tasks to various workers.
- ▶ They guide and instruct workers for day to day activities.
- ▶ They are responsible for the quality as well as quantity of production.
- ▶ They are also entrusted with the responsibility of maintaining good relation in the organization.
- ▶ They communicate workers problems, suggestions, and recommendatory appeals etc to the higher level and higher level goals and objectives to the workers.
- ▶ They help to solve the grievances of the workers.
- ▶ They supervise & guide the sub-ordinates.
- ▶ They are responsible for providing training to the workers.
- ▶ They arrange necessary materials, machines, tools etc for getting the things done.
- ▶ They prepare periodical reports about the performance of the workers.
- ▶ They ensure discipline in the enterprise.
- ▶ They motivate workers.
- ▶ They are the image builders of the enterprise because they are in direct contact with the workers.

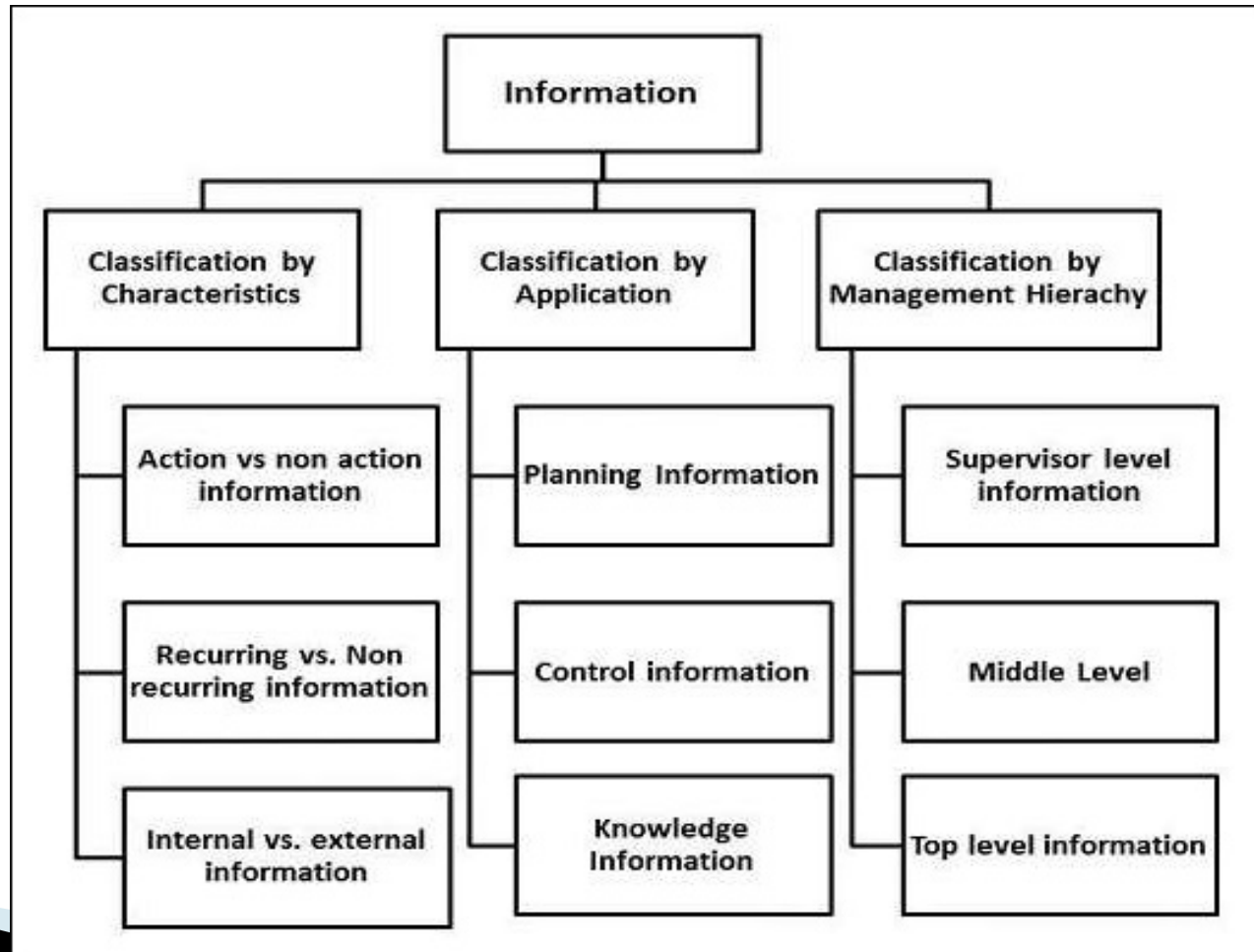
Characteristics of Different Levels of Management

- ▶ The different levels of management have different roles and responsibilities. Each such level works within its own boundary but with the objective of attaining the overall corporate goal.

Characteristics	Top Management	Middle Management	Operating Management
Planning activity	Heavy	Moderate	Low
Control activity	Low	Heavy	Heavy
Organizing activity	Low	Heavy	Heavy
Leading activity	Heavy	Moderate	Low
Decision-making Complexity	Heavy	Moderate	Low
Problems handled	Unstructured and semi structured	Semi structured/ structured	structured
Type of information required for decision making	Strategic information, unstructured/semi structured from both within the organization and outside organization environment	Tactical and structured/semi structured information from within the organization	Operational and structured information from within the organization
Impacts and outcomes	Long-term and organization wide	Medium term	Short-term
Understanding of the line of business	High	Very high	Medium to low
Understanding on the business environment	High	High to medium	Low
Understanding on the Competition	High	High to medium	Low

MIS – Classification of Information

- ▶ Information can be classified in a number of ways and in this chapter, you will learn two of the most important ways to classify information.



Classification by Characteristic

- ▶ Based on Anthony's classification of Management, information used in business for decision-making is generally categorized into three types –
- ▶ **Strategic Information** – Strategic information is concerned with long term policy decisions that defines the objectives of a business and checks how well these objectives are met. For example, acquiring a new plant, a new product, diversification of business etc, comes under strategic information.
- ▶ **Tactical Information** – Tactical information is concerned with the information needed for exercising control over business resources, like budgeting, quality control, service level, inventory level, productivity level etc.
- ▶ **Operational Information** – Operational information is concerned with plant/business level information and is used to ensure proper conduction of specific operational tasks as planned/intended. Various operator specific, machine specific and shift specific jobs for quality control checks comes under this category.

Classification by Application

In terms of applications, information can be categorized as –

- ▶ **Planning Information** – These are the information needed for establishing standard norms and specifications in an organization. This information is used in strategic, tactical, and operation planning of any activity. Examples of such information are time standards, design standards.
- ▶ **Control Information** – This information is needed for establishing control over all business activities through feedback mechanism. This information is used for controlling attainment, nature and utilization of important processes in a system. When such information reflects a deviation from the established standards, the system should induce a decision or an action leading to control.
- ▶ **Knowledge Information** – Knowledge is defined as "information about information". Knowledge information is acquired through experience and learning, and collected from archival data and research studies.
- ▶ **Organizational Information** – Organizational information deals with an organization's environment, culture in the light of its objectives. Karl Weick's Organizational Information Theory emphasizes that an organization reduces its equivocality or uncertainty by collecting, managing and using these information prudently. This information is used by everybody in the organization; examples of such information are employee and payroll information.
- ▶ **Functional/Operational Information** – This is operation specific information. For example, daily schedules in a manufacturing plant that refers to the detailed assignment of jobs to machines or machines to operators. In a service oriented business, it would be the duty roster of various personnel. This information is mostly internal to the organization.
- ▶ **Database Information** – Database information construes large quantities of information that has multiple usage and application. Such information is stored, retrieved and managed to create databases. For example, material specification or supplier information is stored for multiple users.

MIS – Quality of Information

- ▶ Information is a vital resource for the success of any organization. Future of an organization lies in using and disseminating information wisely. Good quality information placed in right context in right time tells us about opportunities and problems well in advance.
- ▶ Good quality information – Quality is a value that would vary according to the users and uses of the information.
- ▶ According to Wang and Strong, following are the dimensions or elements of Information Quality –
- ▶ **Intrinsic** – Accuracy, Objectivity, Believability, Reputation
- ▶ **Contextual** – Relevancy, Value-Added, Timeliness, Completeness, Amount of information
- ▶ **Representational** – Interpretability, Format, Coherence, Compatibility
- ▶ **Accessibility** – Accessibility, Access security

- ▶ Various authors propose various lists of metrics for assessing the quality of information. Let us generate a list of the most essential characteristic features for information quality –
- ▶ **Reliability** – It should be verifiable and dependable.
- ▶ **Timely** – It must be current and it must reach the users well in time, so that important decisions can be made in time.
- ▶ **Relevant** – It should be current and valid information and it should reduce uncertainties.
- ▶ **Accurate** – It should be free of errors and mistakes, true, and not deceptive.
- ▶ **Sufficient** – It should be adequate in quantity, so that decisions can be made on its basis.
- ▶ **Unambiguous** – It should be expressed in clear terms. In other words, it should be comprehensive.
- ▶ **Complete** – It should meet all the needs in the current context.
- ▶ **Unbiased** – It should be impartial, free from any bias. In other words, it should have integrity.
- ▶ **Explicit** – It should not need any further explanation.
- ▶ **Comparable** – It should be of uniform collection, analysis, content, and format.
- ▶ **Reproducible** – It could be used by documented methods on the same data set to achieve a consistent result.

MIS – Information Need & Objective

- ▶ Information processing beyond doubt is the dominant industry of the present century. Following factors states few common factors that reflect on the needs and objectives of the information processing –
- ▶ Increasing impact of information processing for organizational decision making.
- ▶ Dependency of services sector including banking, financial organization, health care, entertainment, tourism and travel, education and numerous others on information.
- ▶ Changing employment scene world over, shifting base from manual agricultural to machine-based manufacturing and other industry related jobs.
- ▶ Information revolution and the overall development scenario.
- ▶ Growth of IT industry and its strategic importance.
- ▶ Strong growth of information services fuelled by increasing competition and reduced product life cycle.
- ▶ Need for sustainable development and quality life.

- ▶ Improvement in communication and transportation brought in by use of information processing.
- ▶ Use of information processing in reduction of energy consumption, reduction in pollution and a better ecological balance in future.
- ▶ Use of information processing in land record managements, legal delivery system, educational institutions, natural resource planning, customer relation management and so on.

In a nutshell –

- ▶ Information is needed to survive in the modern competitive world.
- ▶ Information is needed to create strong information systems and keep these systems up to date.

MIS Need for Information Systems

- ▶ Managers make decisions. Decision-making generally takes a four-fold path –
- ▶ Understanding the need for decision or the opportunity,
- ▶ Preparing alternative course of actions,
- ▶ Evaluating all alternative course of actions,
- ▶ Deciding the right path for implementation.
- ▶ **MIS** is an information system that provides information in the form of standardized reports and displays for the managers. MIS is a broad class of information systems designed to provide information needed for effective decision making.
- ▶ Data and information created from an accounting information system and the reports generated thereon are used to provide accurate, timely and relevant information needed for effective decision making by managers.
- ▶ Management information systems provide information to support management decision making, with the following goals –
- ▶ Pre-specified and preplanned reporting to managers.
- ▶ Interactive and ad-hoc support for decision making.
- ▶ Critical information for top management.
- ▶ MIS is of vital importance to any organization, because –
- ▶ It emphasizes on the management decision making, not only processing of data generated by business operations.
- ▶ It emphasizes on the systems framework that should be used for organizing information systems applications.

Overview of System Analysis and Design

Systems Analysis

- ▶ It is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components.
- ▶ System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose.
- ▶ Analysis specifies **what the system should do.**

Systems Design

- ▶ It is a process of planning a new business system or replacing an existing system by defining its components or modules to satisfy the specific requirements. Before planning, you need to understand the old system thoroughly and determine how computers can best be used in order to operate efficiently.
- ▶ System Design focuses on **how to accomplish the objective of the system.**
- ▶ System Analysis and Design (SAD) mainly focuses on –
 - Systems
 - Processes
 - Technology

What is a System?

- ▶ The word System is derived from Greek word Systema, which means an organized relationship between any set of components to achieve some common cause or objective.
- ▶ *A system is “an orderly grouping of interdependent components linked together according to a plan to achieve a specific goal.”*

Constraints of a System

- ▶ A system must have three basic constraints –
- ▶ A system must have some **structure and behavior** which is designed to achieve a predefined objective.
- ▶ **Interconnectivity and interdependence** must exist among the system components.
- ▶ The **objectives of the organization** have a **higher priority** than the objectives of its subsystems.
- ▶ For example, traffic management system, payroll system, automatic library system, human resources information system.

Properties of a System

A system has the following properties –

- ▶ **Organization**
- ▶ Organization implies structure and order. It is the arrangement of components that helps to achieve predetermined objectives.
- ▶ **Interaction**
- ▶ It is defined by the manner in which the components operate with each other.
- ▶ For example, in an organization, purchasing department must interact with production department and payroll with personnel department.
- ▶ **Interdependence**
- ▶ Interdependence means how the components of a system depend on one another. For proper functioning, the components are coordinated and linked together according to a specified plan. The output of one subsystem is the required by other subsystem as input.
- ▶ **Integration**
- ▶ Integration is concerned with how a system components are connected together. It means that the parts of the system work together within the system even if each part performs a unique function.
- ▶ **Central Objective**
- ▶ The objective of system must be central. It may be real or stated. It is not uncommon for an organization to state an objective and operate to achieve another.
- ▶ The users must know the main objective of a computer application early in the analysis for a successful design and conversion.

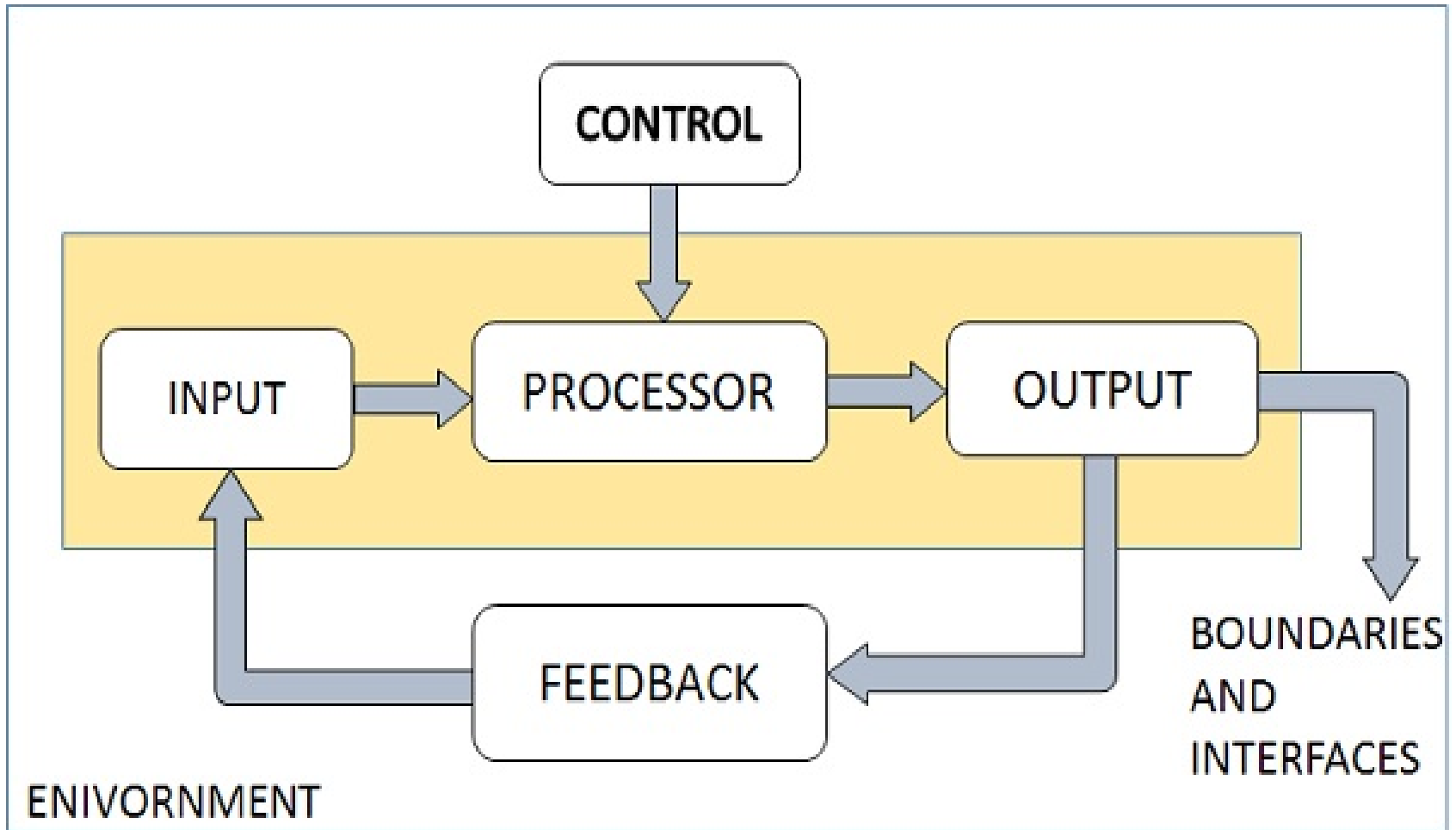
Outputs and Inputs

- ▶ The main aim of a system is to produce an output which is useful for its user.
- ▶ Inputs are the information that enters into the system for processing.
- ▶ Output is the outcome of processing.

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 either totally or partially, depending on the output specification.
- ▶ As the output specifications change, so does the processing. In some cases, input is also modified to enable the processor for handling the transformation.

Elements of a System



Control

- ▶ The control element guides the system.
- ▶ It is the decision-making subsystem that controls the pattern of activities governing input, processing, and output.
- ▶ The behavior of a computer System is controlled by the Operating System and software. In order to keep system in balance, what and how much input is needed is determined by Output Specifications.

Feedback

- ▶ Feedback provides the control in a dynamic system.
- ▶ Positive feedback is routine in nature that encourages the performance of the system.
- ▶ Negative feedback is informational in nature that provides the controller with information for action.

Environment

- ▶ The environment is the “supersystem” within which an organization operates.
- ▶ It is the source of external elements that strike on the system.
- ▶ It determines how a system must function. For example, vendors and competitors of organization’s environment, may provide constraints that affect the actual performance of the business.

Boundaries and Interface

- ▶ A system should be defined by its boundaries. Boundaries are the limits that identify its components, processes, and interrelationship when it interfaces with another system.
- ▶ Each system has boundaries that determine its sphere of influence and control.
- ▶ The knowledge of the boundaries of a given system is crucial in determining the nature of its interface with other systems for successful design.

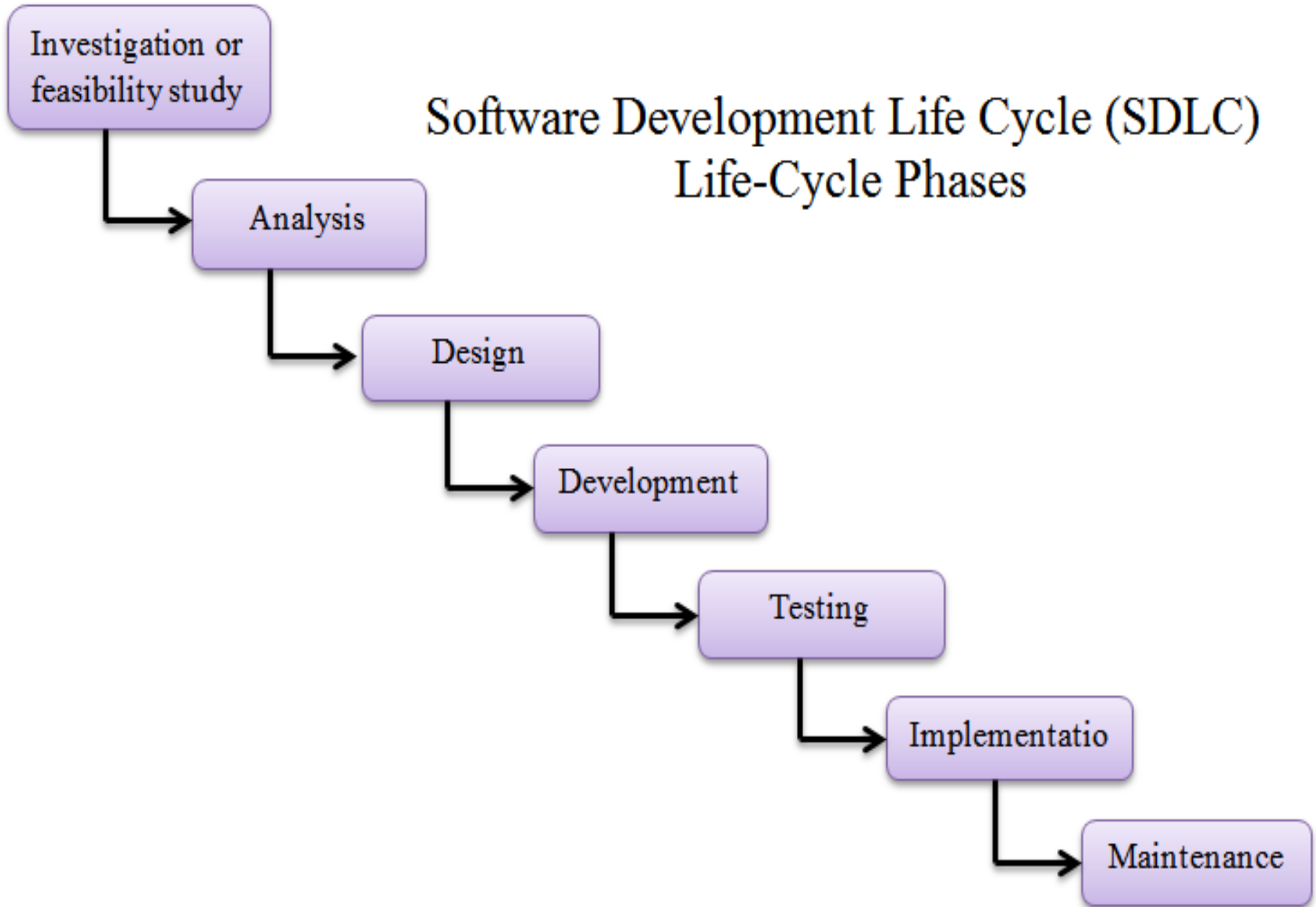


Introduction to SDLC

- Basic Pattern of General Life Cycle Models:
 - **Planning**
 - **Requirements Definition and Analysis**
 - **Design**
 - **Development**
 - **Integration and Testing**
 - **Implementation**
- Each phase produces output (**deliverables**) that will be the input to the next phase.



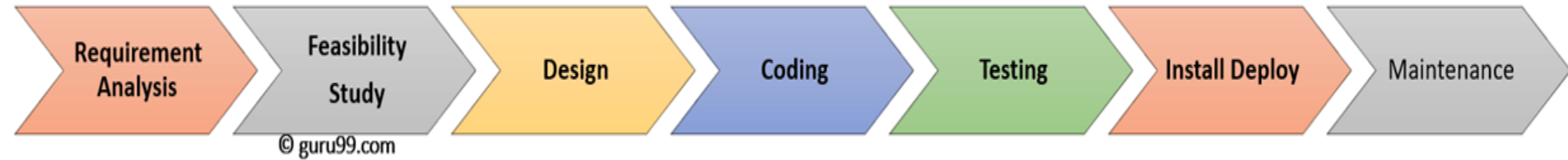
Software Development Life Cycle (SDLC) Life-Cycle Phases



SOFTWARE DEVELOPMENT LIFECYCLE (SDLC)

Is a systematic process for building software that ensures the quality and correctness of the software built. SDLC process aims to produce high-quality software that meets customer expectations. The system development should be complete in the pre-defined time frame and cost. SDLC consists of a detailed plan which explains how to plan, build, and maintain specific software. Every phase of the SDLC life cycle has its own process and deliverables that feed into the next phase. SDLC stands for Software Development Lifecycle.

SDLC Phases



- ▶ Phase 1: Requirement collection and analysis
- ▶ Phase 2: Feasibility study:
- ▶ Phase 3: Design:
- ▶ Phase 4: Coding:
- ▶ Phase 5: Testing:
- ▶ Phase 6: Installation/Deployment:
- ▶ Phase 7: Maintenance:

Phase 1: Requirement collection and analysis:

- ▶ The requirement is the first stage in the SDLC process. It is conducted by the senior team members with inputs from all the stakeholders and domain experts in the industry. Planning for the quality assurance requirements and recognition of the risks involved is also done at this stage.
- ▶ This stage gives a clearer picture of the scope of the entire project and the anticipated issues, opportunities, and directives which triggered the project.
- ▶ Requirements Gathering stage need teams to get detailed and precise requirements. This helps companies to finalize the necessary timeline to finish the work of that system.

Phase 2: Feasibility study:

- ▶ Once the requirement analysis phase is completed the next step is to define and document software needs. This process conducted with the help of 'Software Requirement Specification' document also known as 'SRS' document. It includes everything which should be designed and developed during the project life cycle.

There are mainly five types of feasibility checks:

- ▶ **Economic:** Can we complete the project within the budget or not?
- ▶ **Legal:** Can we handle this project as cyber law and other regulatory framework/compliances.
- ▶ **Operation feasibility:** Can we create operations which is expected by the client?
- ▶ **Technical:** Need to check whether the current computer system can support the software
- ▶ **Schedule:** Decide that the project can be completed within the given schedule or not.

Phase 3: Design:

- ▶ In this third phase, the system and software design documents are prepared as per the requirement specification document. This helps define overall system architecture.
- ▶ This design phase serves as input for the next phase of the model.
- ▶ There are two kinds of design documents developed in this phase:

High-Level Design (HLD)

- ▶ Brief description and name of each module
- ▶ An outline about the functionality of every module
- ▶ Interface relationship and dependencies between modules
- ▶ Database tables identified along with their key elements
- ▶ Complete architecture diagrams along with technology details

Low-Level Design(LLD)

- ▶ Functional logic of the modules
- ▶ Database tables, which include type and size
- ▶ Complete detail of the interface
- ▶ Addresses all types of dependency issues
- ▶ Listing of error messages
- ▶ Complete input and outputs for every module

Phase 4: Coding:

- ▶ Once the system design phase is over, the next phase is coding. In this phase, developers start build the entire system by writing code using the chosen programming language. In the coding phase, tasks are divided into units or modules and assigned to the various developers. It is the longest phase of the Software Development Life Cycle process.
- ▶ In this phase, Developer needs to follow certain predefined coding guidelines. They also need to use programming tools like compiler, interpreters, debugger to generate and implement the code.

Phase 5: Testing:

- ▶ Once the software is complete, and it is deployed in the testing environment. The testing team starts testing the functionality of the entire system. This is done to verify that the entire application works according to the customer requirement.
- ▶ During this phase, QA and testing team may find some bugs/defects which they communicate to developers. The development team fixes the bug and send back to QA for a re-test. This process continues until the software is bug-free, stable, and working according to the business needs of that system.

Phase 6: Installation/Deployment:

- ▶ Once the software testing phase is over and no bugs or errors left in the system then the final deployment process starts. Based on the feedback given by the project manager, the final software is released and checked for deployment issues if any.

Phase 7: Maintenance:

- ▶ Once the system is deployed, and customers start using the developed system, following 3 activities occur
- ▶ Bug fixing – bugs are reported because of some scenarios which are not tested at all
- ▶ Upgrade – Upgrading the application to the newer versions of the Software
- ▶ Enhancement – Adding some new features into the existing software
- ▶ The main focus of this SDLC phase is to ensure that needs continue to be met and that the system continues to perform as per the specification mentioned in the first phase.

Unit – III Detailed System Design and Implementation

- ▶ **Conceptual design** in itself is not the end of the design process, rather it serves as a basis for the detailed MIS design. The performance requirements specified by the conceptual design become inputs to the detailed design phase, in which these are further refined, detailed and finalized to be called the system specifications.
- ▶ Thus, the main objective of the detailed system design is to prepare a blue print of a system that meets the goals of the conceptual system design requirements. Detailed system design involves the following phases.
 - 1) Project planning and control.
 - 2) Involve the user
 - 3) Define the detailed sub-system.
 - 4) Input/Output design.
 - 5) Feedback form the user
 - 6) Database design.
 - 7) Procedure design.
 - 8) Design Documentation

1) Project planning and control

- ▶ In order to ensure an effective and efficient design of an MIS, it is very important that a detailed design process should in itself be considered a complete project. Therefore, the first step in the detailed design is planning and controlling, so that standards may be established and a proper follow-up is made. Some of the main points, which are important in planning and control of a detailed design, are given below.

▶ **Project planning**

1. Formulate the project objectives.
2. Define the project tasks.
3. Prepare a network diagram of all events and activities so as to specify sequential and parallel events.
4. Schedule the work as per the requirements of the user.
5. Prepare a budget for the project.

▶ **Project control**

Get a feedback of the actual performance of the project with respect to time, cost and work of the project and compare it with schedules, budgets and technical plans.

Take corrective action where required so as to maintain control.

2) Involve the user

- ▶ System designers must inform the user regarding the new information system being developed and gain their support and acceptance. In this phase, users are assured that changes will benefit them or that they will not be at disadvantage because of the new system.

3) Detailed sub system definition

- ▶ In detailed system design, every system needs to be broken down to ascertain all activities required and their respective inputs and outputs. In some of the cases, sub systems are broadly defined in the conceptual design phase, but at this stage they are specifically defined to work out every detail concerning the sub-system. Decomposition of the system to operational activities in general is carried out as follows.

System

Sub System

Functional component

Task

Sub Task

Operation element

4) Output/Input Design

- ▶ Having defined the subsystem well, by way of flow diagrams and a thorough discussion with the users of MIS, the system designers now define the specifications of outputs and inputs for each sub-system, in more detail. These specifications will later be used by programmers to develop programs to actually produce the output/input.

5) Feedback from the user

- ▶ Having specifically defined sub-system, output and inputs, the designers once again involve the user to get feedback. This step will increase the acceptance of the MIS being designed. The system analyst should demonstrate the proposed MIS to the users of the system/sub-system. This step will also reassure the top management of the user organization that the detailed design project is processing as per plans.

6) Database design

- ▶ A database is an orderly arrangement of all the records related to each other. It servers as a data resource for the MIS of an organization. To have optimum performance, storage and fast retrieval of data, database design is an important phase in the detailed design of a system. For designing a database, the designer should keep the following points in mind.
- ▶ Identify all data tables and record types.
Identify fields for each table, the key fields for each table and relations between various tables.
Determine the data type and width for each field of the tables.
Normalize the data tables.
Properly document data dictionary.

7) Procedure design

- ▶ Procedures are the rules, standards or methods designed to increase the effectiveness of the information system. The procedures detail about the tasks to be performed in using the system. They serve as the ready reference for the designers as well as for the users. Sometimes they perform the task of a supervisor over operators. There are a wide variety of procedures, which include:
 - ▶ Data entry procedures.
 - ▶ Run time procedures.
 - ▶ Error handling procedures.
 - ▶ Security and back up procedures.
 - ▶ Software documenting procedures.
- ▶ **In designing procedures, designers should:**
- ▶ Understand the purpose and quality standards of each procedures
 - ▶ Develop a step-by-step direction for each procedure, and
 - ▶ Document all the procedures.

8) Design Documentation

- ▶ Detailed design starts with the performance specifications given by the conceptual design and ends with a set of design specifications for the construction of MIS. The outputs from the detailed design, i.e. design specifications, are handed over to the programmers for writing codes to translate system specifications into a physical MIS. Therefore, the system analyst should very carefully document the detailed design. In fact, design documents should consist of comprehensive details of all the design phases. Design documentation of detailed design report, generally, consists of
 - ▶ System objectives,
 - ▶ Design constraints,
 - ▶ Inputs/outputs,
 - ▶ Data files,
 - ▶ Procedures (manuals)
 - ▶ Proposed system (a summary and detailed flow charts),
 - ▶ Input/Output specifications,
 - ▶ Program specifications,
 - ▶ Database specifications,
 - ▶ Cost of installation and implementation, and
 - ▶ System test conditions.