# Chapter 1
## Overview of Information System Design

# Chapter outlines

- Information and its types
- Why information system?
- Role of information system
- Organizations and information systems
- Major types of systems in organizations
- Managers decision making and information systems
- System Analysis and Design
- System Development Life Cycle

# Data

- Representation of facts ,concepts or instructions in a formalized manner(not organized).

- Suitable for communication ,interpretation or processing by human or electronic machine.

- Represented with the help of characters such as alphabets (A-Z , a-z),digits(0-9) or special characters(+,-,/,*,<,>,=,etc.)

- For example: 1, Ram, 2017

# Information

- When data are processed, it becomes information.

- An information is an organized or classified data having some meaningful values for the receiver , on which decision and actions are based.

- For example:

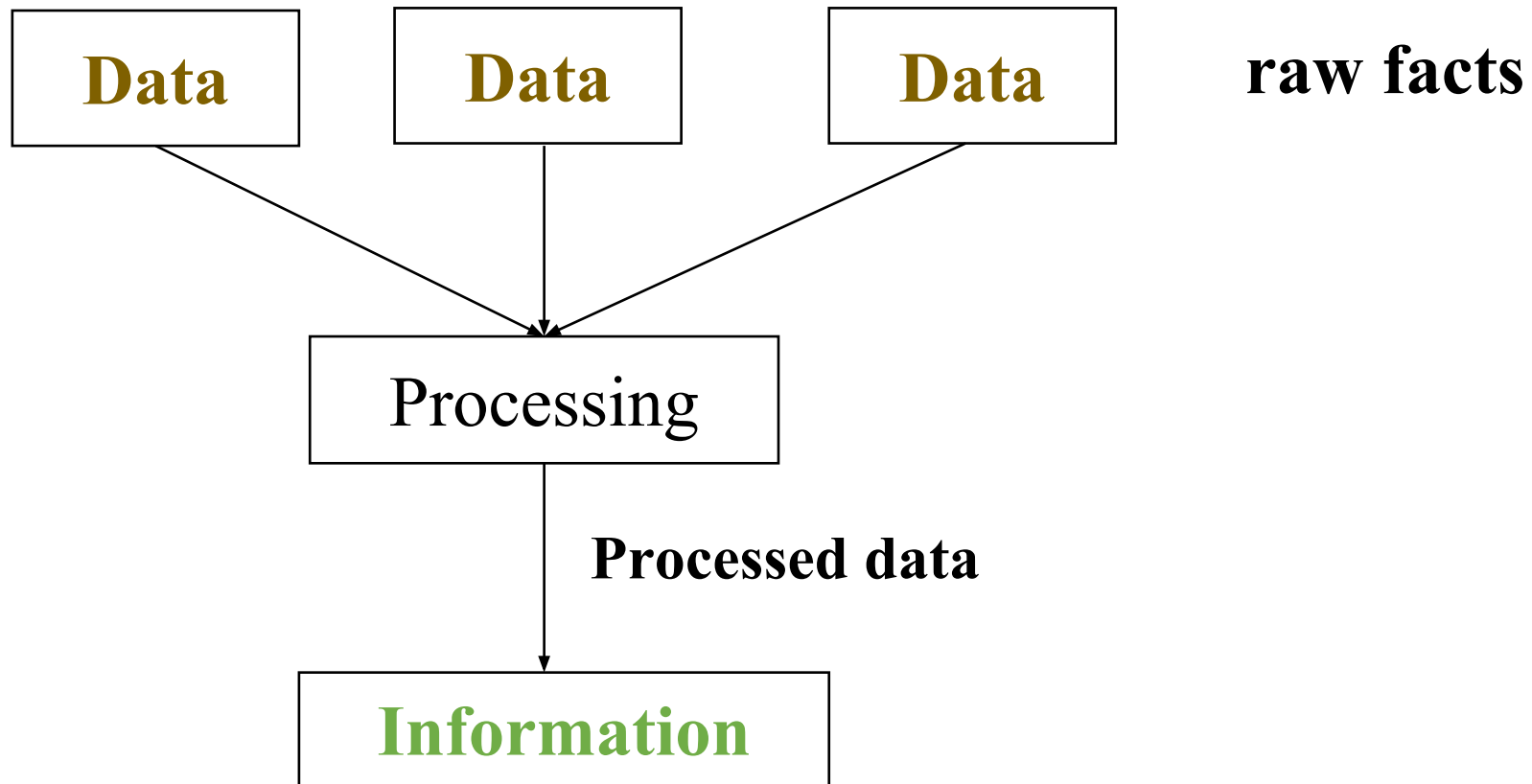| Roll No. | Name | Batch |
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Fig : Data and Information

# a)Types of Information

1. Operational
2. Tactical
3. Strategic

# Operational, tactical, and strategic Information

- Within an organization planning, control and decision-making is carried out at various levels within the structure of the organization.

- There is a direct correlation between the levels of importance of individuals or groups within an organization and the level of information that is being communicated

- The level of information can be classified under 3 levels:
  a) Operational
  b) Tactical
  c) Strategic

# 1.Operational information (Short range)

- Lowest level of information, used to carry out daily scheduled operations.

- Derived almost entirely from internal sources .

- Are implemented for very short period of time anything from immediately, daily or at most a week or month.

- Highly detailed  ,Task-specific  and Largely quantitative .

- Information on direct competitors, a company's labor statistics, information on suppliers, sales record, attendance report ,accounting data and projection of needed resources may all be included in operational data.

- Data collected on direct competitors helps marketers make the products seem superior to competing products.

- Data on customers helps marketers create consumer profiles that help with everything from product creation, to distribution and advertising. Labor and accounting data help with internal control of finances and productivity.

- Day to day decision making.

- The lowest level is operational and operational planning takes place based on the tactical plans.

- The lowest level of management or workers in an organization implements operational plans. These may be section leaders or foremen in a large organization or workers such as shop assistants, waiting staff, and kitchen staff, etc., in smaller businesses where there is no supervisory layer.

- The timescale is usually very short, anything from immediately, daily or at most a week or month.

- Results of operational work will usually be passed upwards to let the tactical planners evaluate their plans.

# 2.Tactical information (Intermediate range)

- Used by the middle level management to carry out short range of operations.

- Time scale is usually 6 months to 5 years depending upon the projects i.e. short to medium term horizon.

- Describes or analyses the activities or departments .

- It  is prepared routinely and regularly .

- It  is based on quantitative measures (cash flow forecasts, budgetary control or variance analysis reports, short-term purchasing requirement ).

- An organization needs to do a necessary and sufficiency check for this type of information thereby helping the organization to establish the strategy for the welfare of an organization.

- Sub-system decisions are made.

- Tactical planning and decision-making takes place within the guidelines set by the strategic plan.
- Tactical information is based on evaluation of some working parameter, such as, how much 'down time' a production line must allocate for planned maintenance, how much day was a particular employee present, etc.
- Tactical information is used by middle management (employees) when managing or planning projects.
- Tactical plans have a medium level of detail and will be very specific; they deal with such matters as who is doing what and within what specific budgets and timescales.
- These plans have medium scope and will address details at the operational level. They will generally have specific objectives and be geared towards implementation by operational level employees.

# 3.Strategic information  (Long range)

- Strategy refers to WHAT and WHY a company plans to do in the future and tactical refers to HOW it plans to implement it.

- Derived from both internal and external sources and Summarized information.

-  Relevant to the long term ,one to five year (plus) time span.

- Overall structural decision.

- Strategic information is used at the very top level of management within an organization. These are chief executives or directors who have to make decisions for the long term.

- Strategic information is broad based and will use a mixture of information gathered from both internal and external sources.

- In general a timescale may be from one to five years or even longer depending on the project.
    - E.g., oil related projects last for 25 or more years.  Likewise, a new superstore will look at a timescale of 20 years or so.

- A good strategic plan can be devised out of strategic information.
  - Well constructed and more detailed plans will be easier to implement than poorly constructed plans.

- Trade-offs between company functions and with other organizations.

- Both quantitative and qualitative (eg overall profitability, future market prospects, total cash needs capital equipment needs).

- Strategic information aids in a type of strategic analysis know as SWOT, which stands for **strengths, weaknesses, opportunities and threats**.

- SWOT analysis helps companies determine the business's strategic direction and set strategic goals.

- Strategic information also helps keep marketers in tune with trends, which helps create in-demand products and appealing advertisements.

| Types of Information | Time Scale | Level of information | Execute/implement plan by: | Helps in | Example |
|---|---|---|---|---|---|
| Operational | Day, week, month | Lowest | Low level manager and immediate employee, such as teachers in college | Day -to- day decision making | Daily attendance, monthly report, etc. |
| Tactical | 6 months to 5 years | Middle | Middle level manager such as HODs in college. | Sub-system decision making | Yearly report of the college |
| Strategic | 1 to 5 years and above | Highest | High level manager, such as Principal of the college | Long-term decision making and future forecasting | Progress report of college and organization. |

# b. Information Systems(IS)

- A system is a set of inter-related components that function together to achieve a common goal.

- The components of a system are called subsystem that are inter-dependent to each other.

- An information system is an organized system for collection, organization and communication of information.

- More specifically ,an IS is a collection of hardware ,software ,data ,procedure and people that are designed to generate information to generate information that supports the day to day short range and long range activities.

- The main task of IS is to capture and manage data to produce useful information that supports an organization and its employees , customers , suppliers and partners.

# Example

- Online Banking Systems in Banks
- Employee Management Systems in companies
- Library Management System in schools and colleges
- Online Ticket Reservation System in Airways and Bus.

# Fig: Block Diagram Of Information System



Environment

Boundaries and interfaces
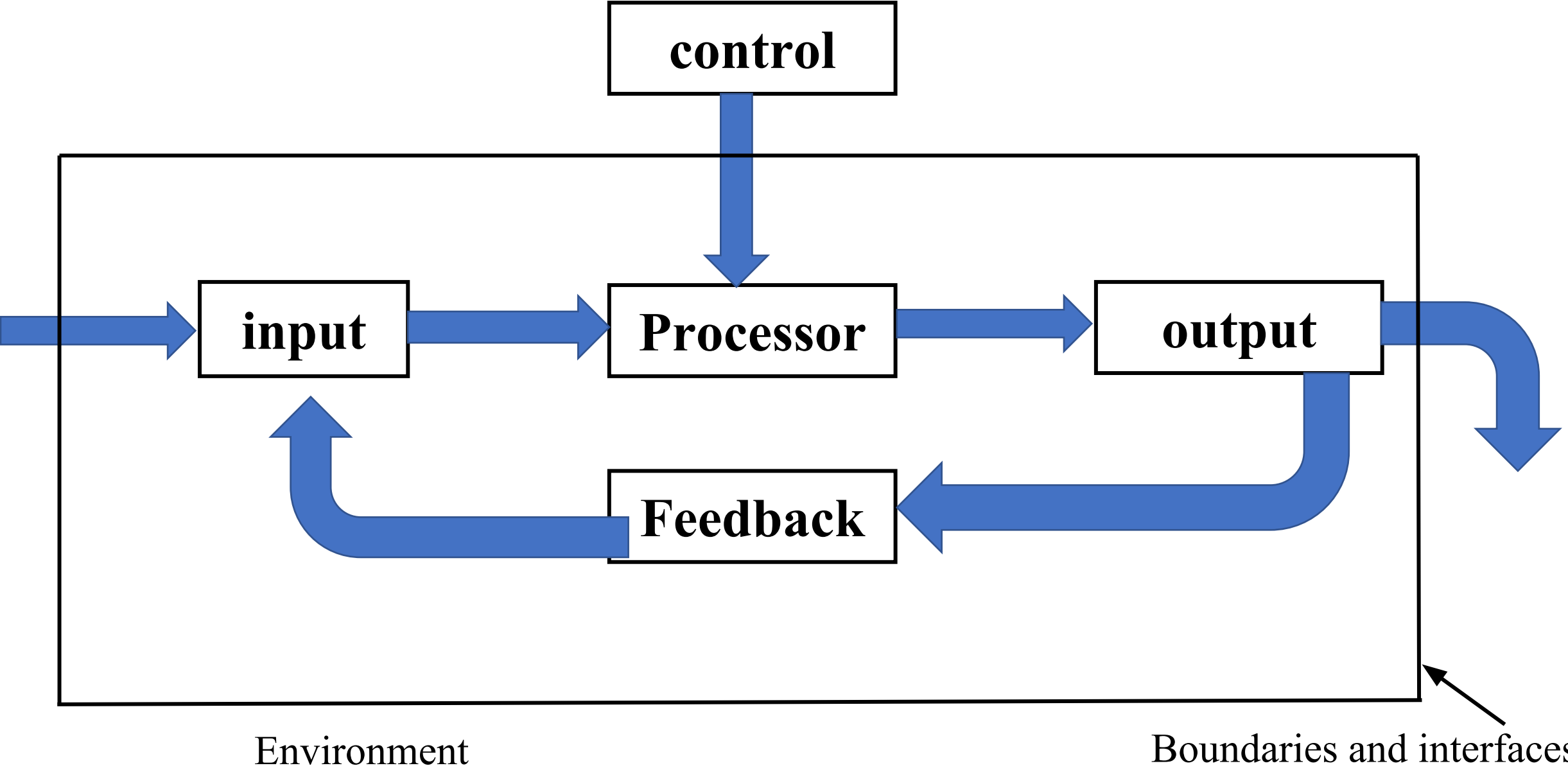
- **Inputs and Outputs:**
  -  Inputs are the data that enter into the system for processing .
  - Output is the outcome of processing which is useful for its user.

- **Processor:**
  - Involves the actual transformation of input into output.
  - May modify the input either totally or partially depending upon the output specification.

- **Control:**
  - Guides the Information System.
  - Decision making subsystem that controls the pattern of activities governing the input ,processing and output.

- **Feedback:**
  - Provides control in a dynamic system.
  - Positive feedback encourages the performance of the system.
  - Negative feedback provides the controller with information for action.

- **Environment:**
  -  Determines how a system must function.
  -  Example vendors and competitors of the organization provides constraints that effect the actual performance of the business.

# Types Of Information System

- On the basis of their function , Information System can be classified into FOUR categories:
    1. Transaction Processing System(TPS)
    2. Management Information System(MIS)
    3. Decision Support System(DSS)
    4. Executive Information System(EIS)

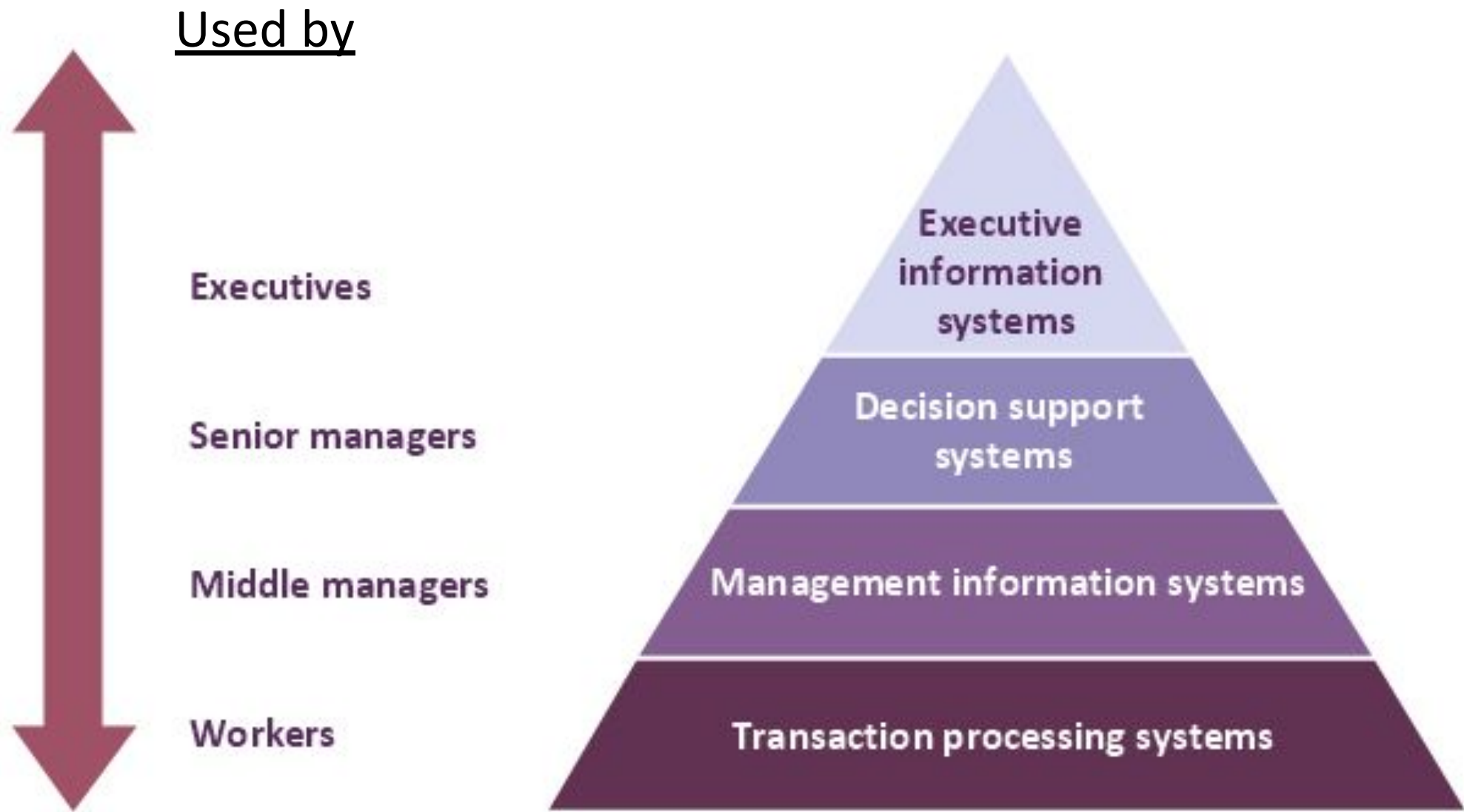    (These are the major types of system in organization.)

Fig : Pyramidal Structure of Types of Information System

# 1.Transaction Processing System(TPS)

- A basic system that serves the operational level i.e. it performs and records the daily routine transactions necessary to conduct the business.

- TPS provides a way to collect , process , store , display , modify or cancel the transactions of an organization.

- The data are stored in databases which can be used to produce reports such as billing , wages , inventory summaries , manufacturing schedules or check registers.

- TPS is used for periodic report generation in a scheduled manner like day-to-day log, etc.

- It automates handling of data for business transaction.

- Data about each transactions are captured, transactions are verified and put into action (accepted / rejected), and validated transactions are stored.

- To make such system, one needs to know how organization is working, and how it is keeping the track of its work.

- Users are at operation level.

- E.g. Banking software used at reception or cashier, System at departmental store, sales order entry, payroll, and shipping records etc.

# 2.Management Information System(MIS)

- This system monitors an organization's current performance status based on result of TPS.

- The essential services are recorded by the TPS of the organization and MIS consolidates the data on sales, production etc.

- MIS provides routine information to managers and decision makers.

- The primary objective behind installing an MIS in the organization is to increase operational efficiency.

- MIS may support marketing, production, finance, etc.

- One MIS may require data from various TPS.
    - E.g. Sales, Customer Order, Worker records etc.

- Analysis of such MIS can therefore help in data orientation.

- Example: Annual Budgeting report.

- E.g. A MIS that tracks sales records of a fashion store can summarize how the sales is trending, how the workers are performing, what & when to order for stock, etc.

# 3.Decision Support System(DSS)

- Serves the management of an organization.

- Has sophisticated data analysis tools, which support and assist all aspects of problem-specific decision-making.

- It provides solutions to business level problems using mathematical model & statistical techniques.

- A DSS provides an interactive environment in which decision makers can quickly manipulate data and models of business operations.

- A DSS consists of (a) A database that contains information from TPS and/or MIS (b) A mathematical or business model that fits under certain statistical data, and (c) A User Interface (UI) that helps user to interact with the system.

- Developing DSS requires knowledge of business, possible problems that might occur and their potential outcomes.

- Analysis of DSS benefits in data and decision logic orientations.

- E.g. e-Medicine systems, modern AI related systems (image processing & pattern recognition)

# 4.Executive Information System(EIS)

- Also called the Executive Support System.

- Senior managers and executives (upper-level staff) of an organization use the EIS in order to analyze the environment in which the organization operates , to identify long term trends and to plan appropriate course of actions.

- Therefore, it must be easy to use so that executives can use it without any assistance.

- The results are usually presented in a graphical form that organizes and present the data and information from both internal MIS or  TPS.

-  EIS has on-line analysis tools and they filter data , link data , track and  summarizes the information which helps in taking  effective decisions.

- An Executive Information System (EIS) is a kind of decision support system (DSS) used in organizations to help executives in decision making.

- An EIS usually has graphical displays on a user-friendly interface.

- It facilitates and supports senior executive information and decision-making needs.

- It provides easy access to internal and external information relevant to organizational goals.

# Types of Information Systems

Hierarchical representation of Information Systems.

Executive Information System Is used by EXECUTIVES for Strategic Decisions
E.I.S

Decision Support System is used by SENIOR MANAGERS for decision making
Decision Support System

Management Information System is used by MANAGERS for operational efficiency.
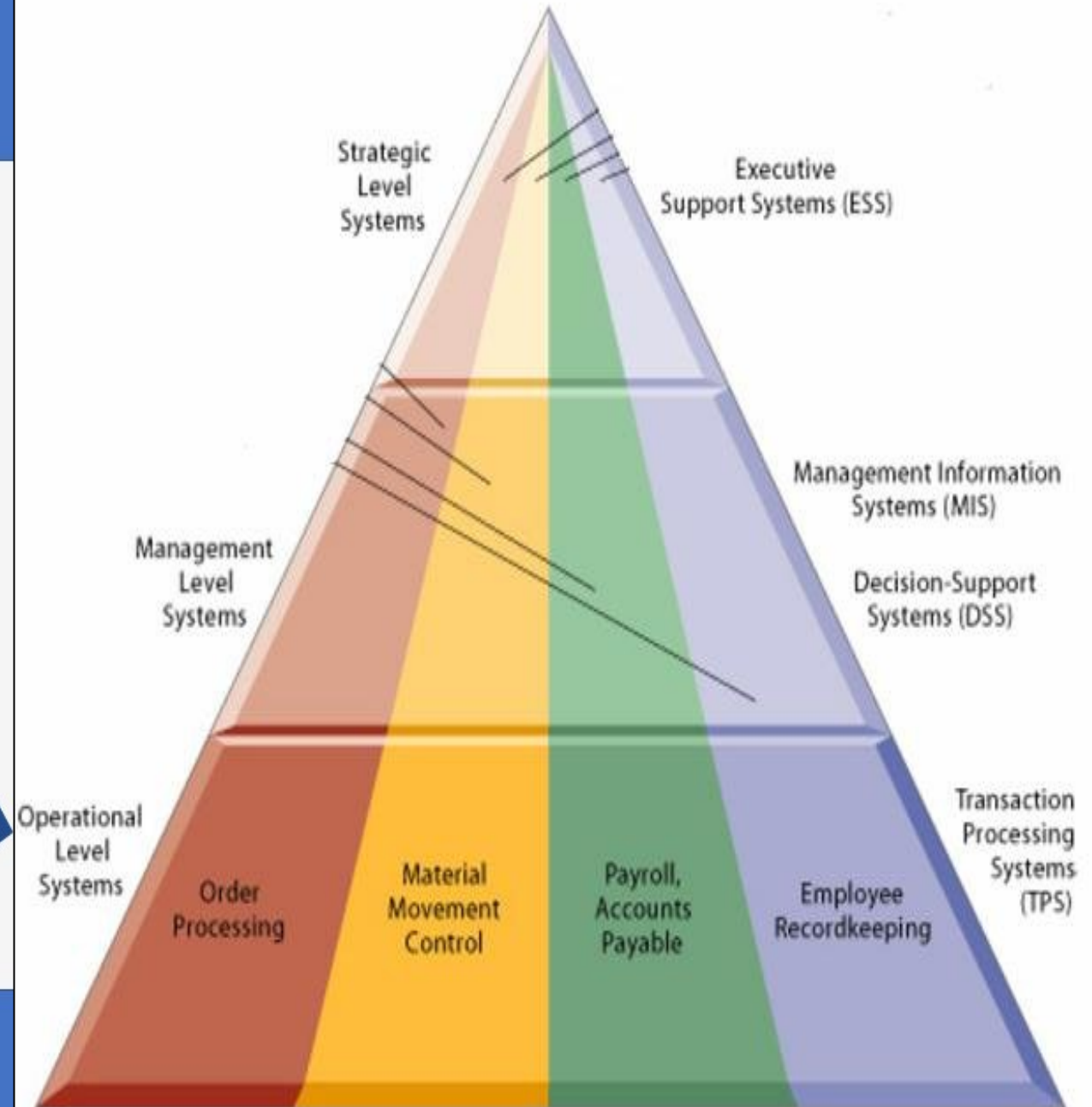Management Information System

Transaction Processing System is used by WORKERS for Basic Reporting
Transaction Processing System

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Strategic Level Systems
Executive Support Systems (ESS)

Management Level Systems
Management Information Systems (MIS)

Decision-Support Systems (DSS)

Operational Level Systems

Order Processing

Material Movement Control

Payroll, Accounts Payable

Employee Recordkeeping

Transaction Processing Systems (TPS)

# Why information system?

- Why do people need information??
   - Individuals need it for enlightenment, and entertainment
   - Business demands it for decision making, problem solving and control

- What kind of information is desirable:
   - ❖ Relevant
   - ❖ Complete
   - ❖ Accurate
   - ❖ Current
   - ❖ economical

# What does IS provide?

- Improved service
- Better performance
- More information
- Stronger controls
- Reduced cost
- Solution to a particular business problem.
- Seek opportunity in this growing world

# Importance of Information Systems

- Provides career on the field of information system experts (system analysis, database admin, telecommunication specialist, and so on.

- Makes performing tasks easier in various levels of an organization (e.g. CEOs, managers, accountants, other staffs, etc.)

- Promotes online marketing and system development so as to replace the traditional filing mechanisms

- Encourages Computer literacy (Digital Literacy) over Traditional literacy

- Supports an organization's business processes' and operations to decide the right thing on right time

- Generate innovative ideas for solving critical problems.

**Q. Why Information Systems? Or Importance of Information Systems .Or Information System in an organizations.**

    I.     Operational Excellence
    II.    Costumer and Supplier Intimacy/Communication
    III.   New Product service and business model          **(Assignment-1)**
    IV.   Competitive  and improved decision making
    V.    Records
    VI.   A day to day survival

# Role of information system

- Support an organization's business processes and operations

- Support business decision making

- Support strategic competitive advantage

- Store and maintain records of day-to-day business activities and help the presentation of precise facts to the concerned activities for better evaluation of current situation

## Q. Roles of Information System(along with diagram)

    I.    Support strategic advantage

    II.    Support Business/Managerial Decision making    **(Assignment-1)**

    III.    Support Business Process and Operations

# Organizations and information systems

- Organizations can use IS on various fields or departments
    1. Finance and accounting
    2. Marketing and sales
    3. Human Resource
    4. Inventory management
    5. Production and manufacturing
    6. Customer Relationship management
- In general, any department that requires management can implement Information system for ease.
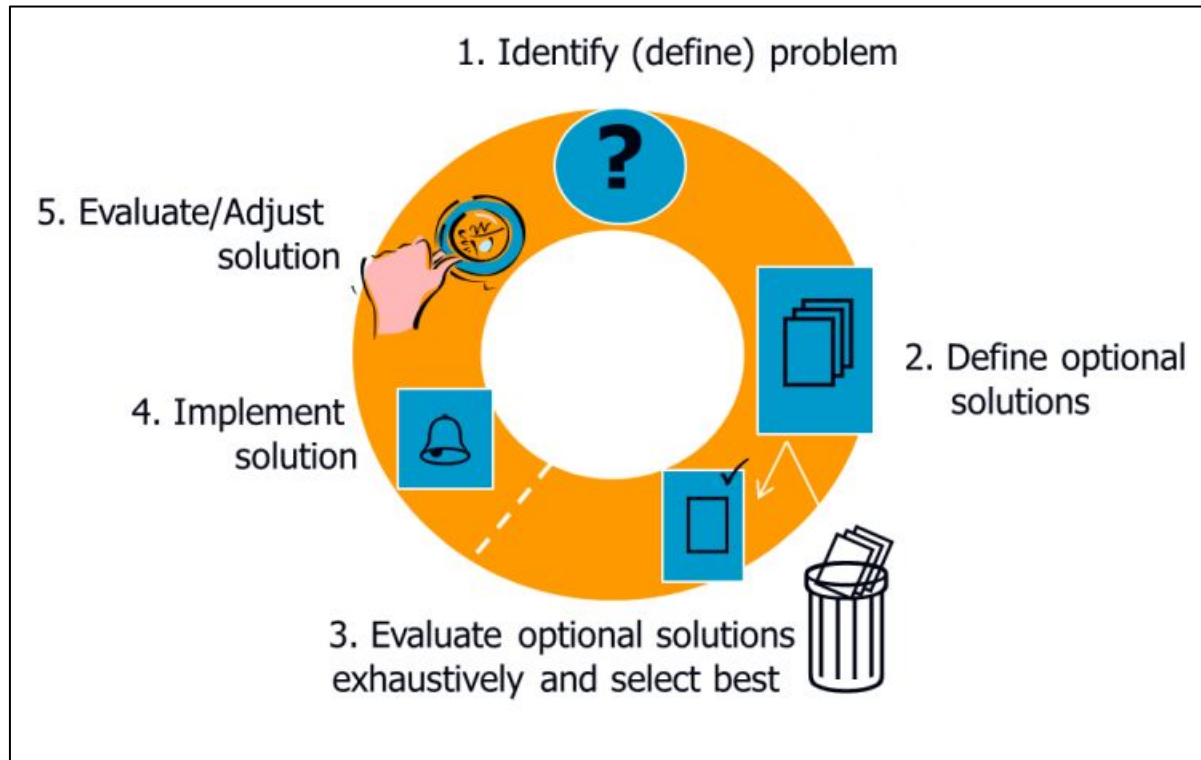
# The important implications of IS in business

1. Information system helps managers in efficient decision-making to achieve the organizational goals.
2. An organization will be able to survive and thrive in a highly competitive environment on the strength of a well-designed Information system.
3. Information systems helps in making right decision at the right time i.e. just on time.
4. A good information system may help in generating innovative ideas for solving critical problems.
5. Knowledge gathered though Information system may be utilized by managers in unusual situations.
6. Information system is viewed as a process; it can be integrated to formulate a strategy of action or operation.

- VR Talsaniya

# Managers decision making and information systems

- A classical list of managerial tasks includes planning, organizing, staffing, delegating or directing, coordinating or controlling, reporting, and budgeting
  - A big part of management is decision making.

- Decision making process is data-intensive.
  - A manager may need various reports, business documents, analyses, and direct communication in order to get prepared for making effective decisions.
  - The scope of data coverage depends on the level of management and the problem dealt with.

- Decision making requires knowledge.
  - In particular, knowledge of business is a part of management competence.
  - All IS types supporting management, which were mentioned before, assist in decision making.
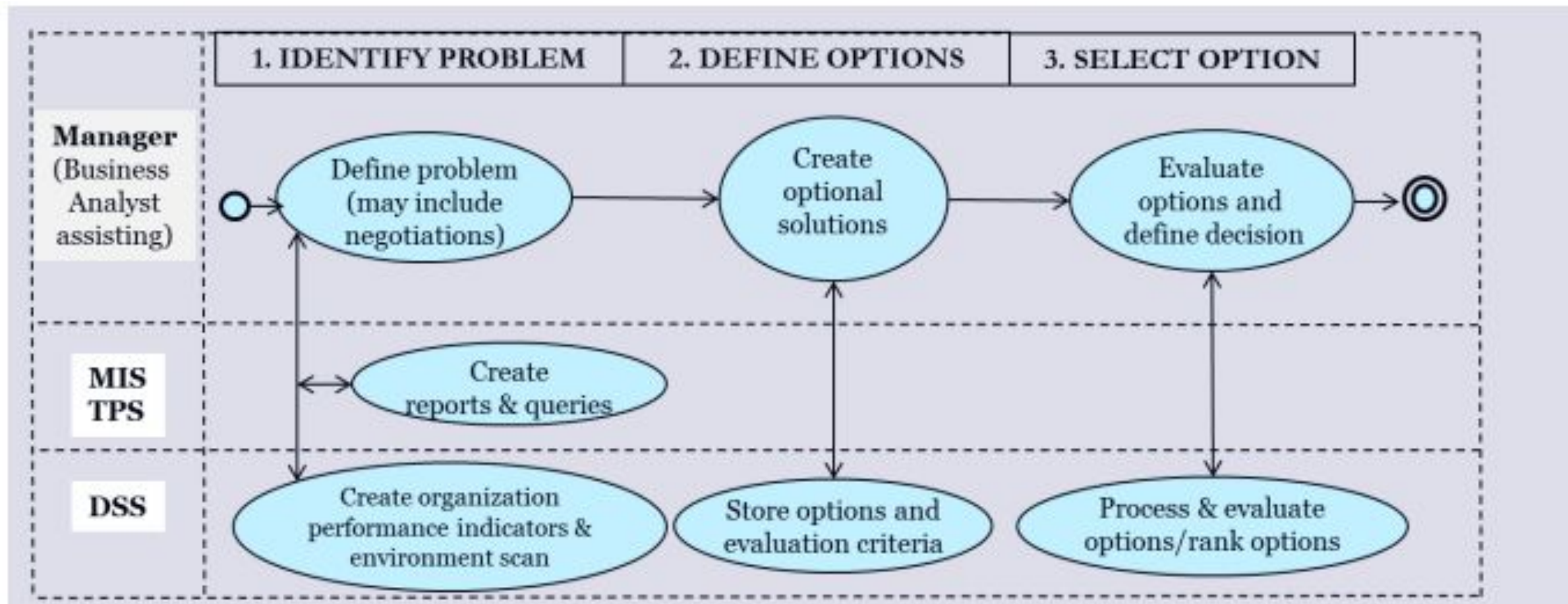
- Herbert Simon's rational model of decision making raises the management task to the level of science.



1. Identify (define) problem
2. Define optional solutions
3. Evaluate optional solutions exhaustively and select best
4. Implement solution
5. Evaluate/Adjust solution

- The model, as shown, is a circular process.
- Use of TPS & MIS reports and queries can help identify the problems
- Market research, investigation reports from the related stakeholders(vendors, suppliers) can help understand current situation.

# What happens in rational decision making?

1. Identify/ define problem
   - Using TPS and MIS reports and queries

2. Define optimal solutions
   - Study current situation, performance of stakeholders, propose viable alternatives

3. Evaluate optimal solutions
   - Use DSS for Financial analysis and evaluate cost-to-benefit ratio.

|  | 1. IDENTIFY PROBLEM | 2. DEFINE OPTIONS | 3. SELECT OPTION |
|---|---|---|---|
| **Manager** (Business Analyst assisting) | Define problem (may include negotiations) | Create optional solutions | Evaluate options and define decision |
| **MIS TPS** | Create reports & queries | | |
| **DSS** | Create organization performance indicators & environment scan | Store options and evaluation criteria | Process & evaluate options/rank options |

# Assignments

**1.Why Information Systems? Or Importance of Information Systems .Or Information System in an organizations.**

    I.    Operational Excellence

    II.    Costumer and Supplier Intimacy/Communication

    III.    New Product service and business model

    IV.    Competitive  and improved decision making

    V.    Records

    VI.    A day to day survival

**2.Roles of Information System(along with diagram)**

    I.    Support strategic advantage

    II.    Support Business/Managerial Decision making

    III.    Support Business Process and Operations

# System analysis and design

# System Development Life Cycle(SDLC)

- SDLC is the acronym of Software Development Life Cycle.

- A process used by the software industry to design, develop and test high quality software.

- A framework defining tasks performed at each step in the software development process.

- It aims to produce a high-quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates.

- Also called as Software Development Process.

- SDLC provides a well-structured flow of phases that help an organization to quickly produce high-quality software which is well-tested and ready for production use.

# Phases of SDLC:

1. Planning
2. Analysis
3. System Design
4. Development
5. Testing
6. Deployment
7. Maintenance & Evolution

- The phases are customized as per organizational needs.

- While it seems all phases are sequentially ordered, the occurrence of phases can adapt as per situation.
  -  some phases run in parallel, while some phases run in loops until an acceptable system output is obtained.

- SDLC is a cyclic process as long the software is running, and is deemed feasible for updates

# 1. Planning

- This phase has two main primary activities:
    1. Identify current problems, and discuss the need for new or improved system
    2. Investigate the system and determine scope of the proposed system.

  - The needs for new system are realized from the needs to deal with currently existing errors, or from the desire to perform some additional task.
    - Advancement of IT sector and its vast applications into the field of business is another possible factor for the need of improvement.

- Discuss on "what we want?" and "can it be done?"

- Input from all related stakeholders[customers, developers, vendors, industry experts, etc.) are taken into consideration

- Determination of cost, usefulness of system, and risk associated with system development are performed
    - ***These processes are called feasibility study***.
    - The project can be carried forward only if it seems feasible to be worked upon.

# 2. Analysis

- During this phase, a thorough study of the organization's current procedures and the information systems used to perform tasks takes place.

- This phase define and document the product requirements and get them approved from the customer or the market analysts.
  - This is done through an **SRS (Software Requirement Specification)** document which consists of all the product requirements to be designed and developed during the project life cycle.

- The analysis is performed under different sub-phases:
  - Determining system requirements
  - Studying and arranging requirements with their relationship (dependency)
  - Generating various initial designs(modeling diagrams) based on relationships among the requirements.
  - Generating optimal solution from existing alternative design solutions.

- Analysis phase sets a clear path for system analyst and project manager.

# 3. System Design

- In this phase, conversion of descriptive design models into physical and logical system specifications take place.
  - Here, logical design explains how the system works. It is not tied to a specific hardware or configuration.
  - The physical design explains what the system is technically. It specifies where the sub-systems interact, where are databases kept, what language is used, etc.

- All aspects of the system (interface, database, processing engine, reports etc.) are designed for actual work.

- This phase creates a technical view of system along with its physical specification.
  - This can be presented to the programmers to construct the system as specified.

- A design approach clearly defines all the architectural modules of the product along with its communication and data flow representation with the external and third party modules (if any)

# 4. Development / Build

- In this stage of SDLC the actual development starts and the product is built.

- The programming code is generated as the system design.
  - If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle.

- Different high level programming languages such as C, C++, Java, Python, and PHP are used for coding.

- Codes are used to build databases, user interfaces, and the processing engine(Backend)

- To ensure all the codes are uniform and easy to comprehend, having a coding guidelines about styles and practices is a must.

# 5. Testing

- In this stage, test for defects and deficiencies are conducted.
    - Those detected issues are fixed until the product meets the original specifications.

- This phase verifies if the code meets the defined requirements.

- In this phase, product defects are reported, tracked, fixed and retested, until the product reaches the quality standards defined in the SRS.

- Testing and debugging is a cyclic process; SDLC moves forward only when the system seems free from visible bugs or errors.

- There are various mechanism to test the system: testing each lines, testing certain modules, verifying proper integration of modules, or testing the overall system

# 6. Deployment / Installment

- Once the product is tested and ready to be deployed it is released formally in the appropriate market/workplace.

- The product may be released as it is or with suggested enhancements in the targeting market segment.

- The installation can be done using various mechanism: isolated installation, parallel installation, or phased installation.

- At this stage, the goal is to deploy the software to the production environment so users can start using the product. However, many organizations choose to move the product through different deployment environments such as a testing or staging environment.

- This allows any stakeholders to safely play with the product before releasing it to the market. Besides, this allows any final mistakes to be caught before releasing the product.

# 7. Maintenance and Evolution

- After the product is released in the market, its maintenance is done for the existing customer base.

- As conditions in the real world change, software needs to update and needs to match the current requirement.

- Sometimes new requirements or scenario result in system crash or anomaly.
  - System hence needs periodic maintenance and/or updates

- System maintenance ensures the programmers make changes if program shows any uneasy or unwanted behavior after installation.
  - If the system gets old, or the maintenance of the system is getting costlier in terms of resource, the SDLC phases are repeated from the beginning.

- Sometimes, new software needs to be developed instead of updating the current software.
  - This is where the system evolves into a new form.
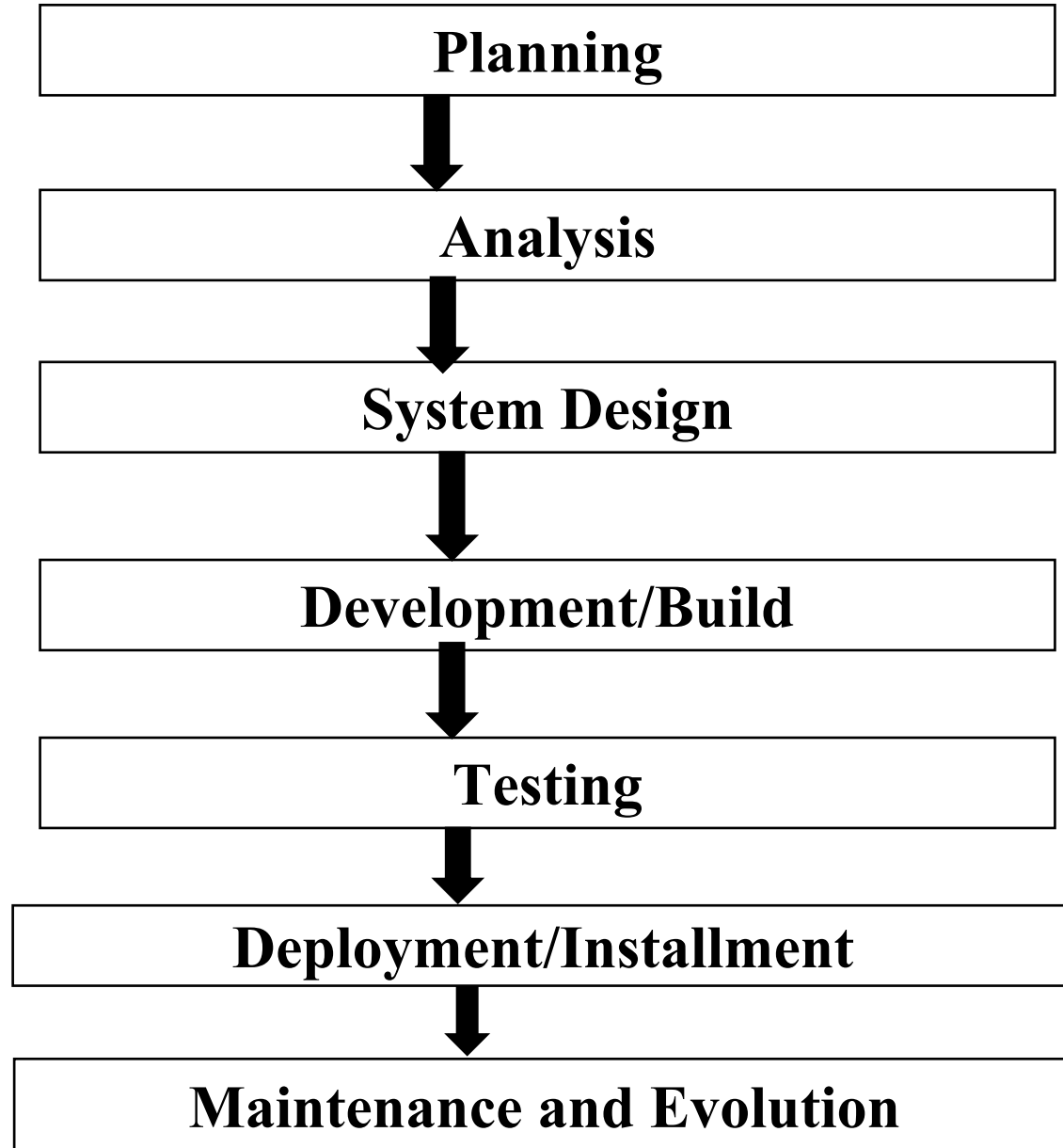
Fig : Phases Of SDLC

# SDLC Models

- There are various software development life cycle models defined and designed which are followed during the software development process.

- These models are also referred as **Software Development Process Models**.

- Each process model follows a Series of steps unique to its type to ensure success in the process of software development.

- Following are the most important and popular SDLC models followed in the industry :
  1. Waterfall Model
  2. Iterative Model
  3. Spiral Model
  4. Prototyping Model
  5. RAD model
  6. Incremental Model