System Analysis and Design

Slide 01

Systems Concepts and the Information Systems Environment

What is System?

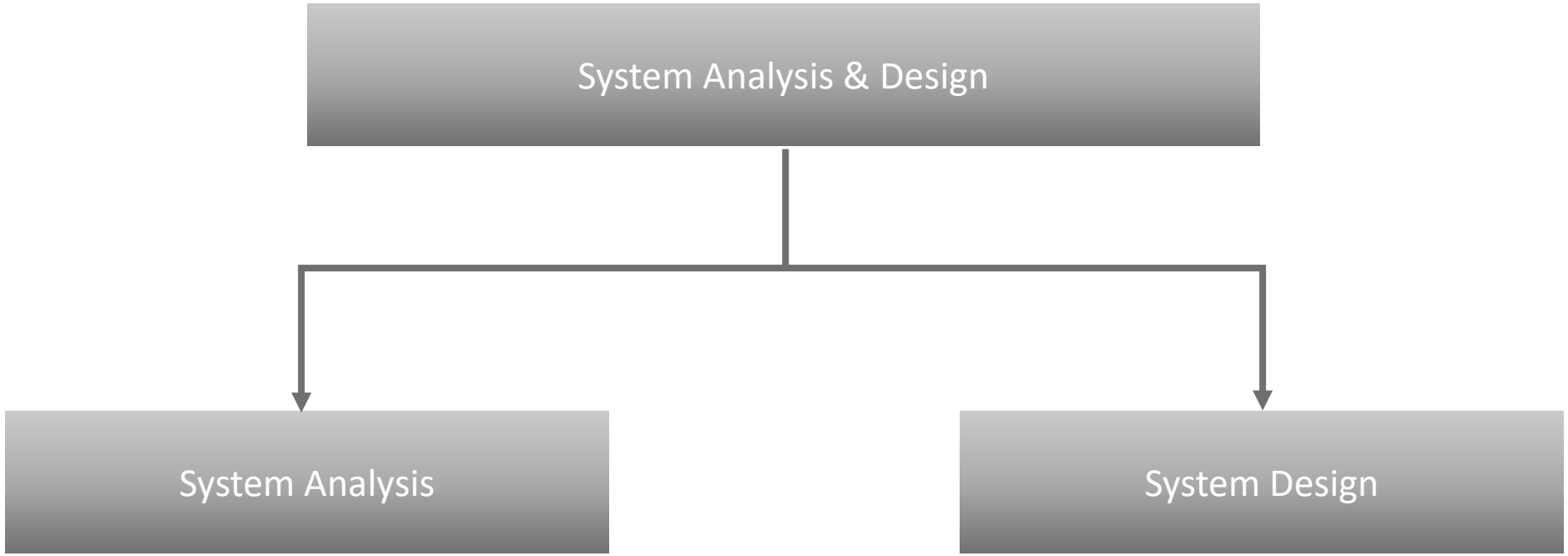
- System is a group of elements or components which work together to accomplish a common task.

What is System Analysis & Design?

- In very simple words, system analysis and design is a study in which we learn how to analyze an existing system and create a better one.

Why we need it?

- For System Development
  - Creating a new one
  - Updating the existing one.


System Analysis & Design
System Analysis
System Design

System Analysis

- System analysis is a process of studying and observing a system to know how it works and to identify its goal and purposes.
- System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives.
- It specifies “What the system should do”.

System Design

- It is a process of planning a new system or replacing an existing system.
- It's done by defining its components or modules to satisfy the specific requirements.
- It focuses on "how to accomplish the objective of the system".

Properties/Characteristics of a System

- A system must have following properties/characteristics:
  - Organization
  - Integration
  - Interaction
  - Interdependence
  - Central Objective

Properties/Characteristics of a System

- Organization
  - It implies Structure and Order.
  - Elements should be well arranged in order to achieve predetermined objective.

Properties/Characteristics of a System

- Integration
  - It implies how components of a system are tied together.
  - The parts of the system must work together within the system even though each part performs a unique function.

Properties/Characteristics of a System

- Interaction
  - It implies in which manner the components operate with each other.

Properties/Characteristics of a System

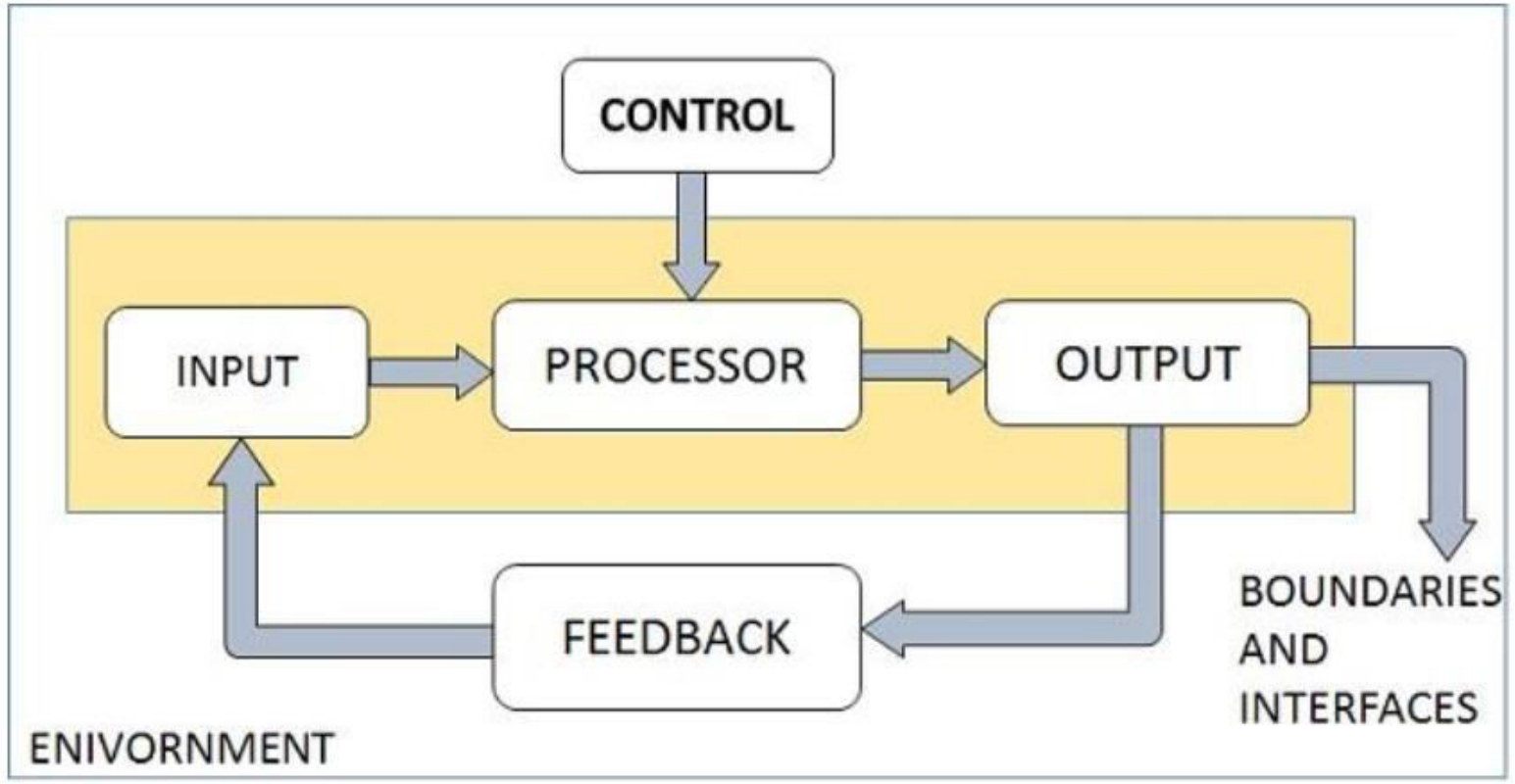
- Interdependence
  - It implies how components of a system depend on each other.
  - The components must be well linked and they must coordinate with each other for proper functioning.
  - Interdependence is important because the output of one subsystem may be required by other subsystem as input.

Properties/Characteristics of a System

- Central Objective
  - The objective of the system must be central.
  - It means, the user must know the main objective of the system in the early phase for successful design and conversion.

Elements of a System

- There are 6 elements in a system:
  - Inputs and Outputs
  - Processor
  - Control
  - Feedback
  - Boundaries & Interface
  - Environment



Elements of a System

- Inputs and Outputs
  - The information that enters in a system is treated as input.
  - Output is the outcome of input after processing.
  - The main aim of a system is to produce an output which is useful for the users.

Elements of a System

- Processor
  - It transforms the input into useful output.
  - It is an operational element.
  - It may modify the input either totally or partially, depending on the output's specification.

Elements of a System

- Control
  - The element guides the system.
  - It is a decision making element that controls the pattern of activities governing input, processing and output.

Elements of a System

- Feedback
  - The output is checked with the desired output set and then necessary steps are taken for achieving the output as per the standards.
  - Positive feedback encourages the performance of the system.
  - Negative feedback is informational in nature.

Elements of a System

- Boundaries and Interface
  - The boundaries are the limits under which the components of a system interact with each other.
  - Each system has boundaries that determine its sphere of influence and control.
  - The interconnection and the interaction between the sub-system is known as the interface.

Elements of a System

- Environment
  - The things outside the boundary of the system are known as environment.
  - It is the source of external elements that strike on the system.
  - Change in the environment affects the working of the system.

Types of System

- A system can be divided into following types:
  - Physical or Abstract System
  - Open or Closed System
  - Adaptive or Non-Adaptive System
  - Permanent or Temporary System
  - Natural or Manufactured System.

Types of System

Physical	Abstract
▪ Physical systems are tangible entities ▪ It may be static or dynamic in nature ▪ The physical parts of the computer center are desks, and chair that facilitate operation of the computer are static. A computer is a dynamic system in which programs, data and applications can change according to the user's needs.	▪ Abstract systems are non-physical entities or conceptual that maybe formulas, representations or model of a real system.

Types of System

Open	Closed
• An open system must interact with its environment. • It receives inputs and delivers outputs to the outside of the system. • It must adopt to the changing demands of the users.	• A closed system is isolated from environment influences. • A completely closed system is rare.

Types of System

Adaptive	Non-Adaptive
▪ Adaptive System responds to the change in the environment in a way to improve their performance and to survive. ▪ For example: human beings, animals.	• Non Adaptive System is the system which does not respond to the environment. • For example: machines.

Types of System

Temporary	Permanent
▪ Temporary System is made for specified time and after that they are demolished. ▪ For example: A DJ system is set up for a program and it is dissembled after the program.	▪ Permanent System persists for long time. ▪ For example: Business policies.

Types of System

Natural	Manufactured
▪ Natural systems are created by the nature. ▪ For example: Solar system, seasonal system.	▪ Manufactured system is the man-made system. ▪ For example: Rockets, dams, trains.

Information Systems

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

- The major information systems are:
  - Formal
  - Informal
  - Computer based.

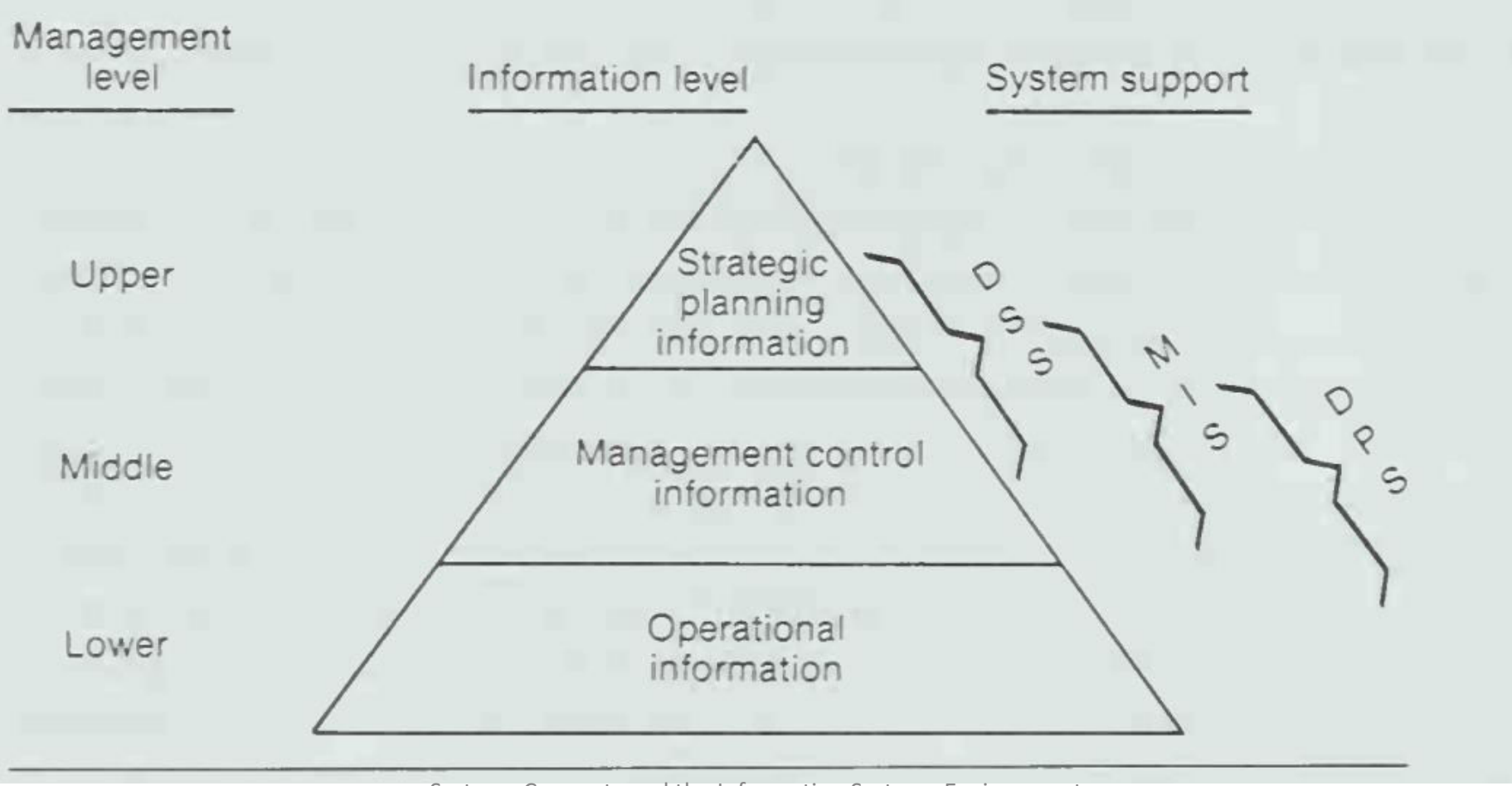
Formal Information Systems

- A Formal Information System is based on the organization represented by the organization chart. The chart is map of their positions and relationships, the pattern of authority, communications and workflow.

Formal Information Systems

- Categories of Information:
  - **Strategic information:** relates to long-range planning policies that are of direct interest to upper management. Example: decision support systems (DSS)
  - **Managerial information:** It is of direct use to middle management and department heads for implementation and control. Example: management information systems (MIS)
  - **Operational information:** daily information used to operate departments and enforce the day-to-day rules and regulations of the business. Example: data processing systems (DPS)

Management and Information Levels in a Typical Organization



EXAMPLE OF INFORMATION NEEDED BY A SHOPKEEPER

- Daily sales account
- List of low stock items to be re-ordered
- List of overstock items
- Long overdue payments
- Profit and loss account

- **Used to streamline day to day operations called Operational information**

EXAMPLE OF INFORMATION NEEDED BY A SHOPKEEPER

- Slow or fast moving items
- Reliable supplier of items
- Sales trends

- **Used to improve profitability of shop called Tactical information or managerial information**

EXAMPLE OF INFORMATION NEEDED BY A SHOPKEEPER

- Whether to stock different varieties of items
- Whether to diversify
- Whether to start a new branch in a different locality
- Whether to start an e-shop

- **Information to expand business and explore new opportunities known as Strategic Information**

Informal Information Systems

- The formal information system is a power structure designed to achieve company goals. An organization's emphasis on control to ensure performance tends to restrict the communication flow among employees, however.

- As a result, an informal information system develops. It is an employee based system designed to meet personnel and vocational needs and to help solve work-related problems

Computer based Information Systems

- **Transaction Processing Systems or Data Processing Systems(Operational information):**
  - TPS processes business transaction of the organization.
  - For example, take a railway reservation system. booking, canceling etc. are all transactions.
  - Transaction processing systems provide speed and accuracy, and can be programmed to follow routines functions of the organization.

Computer based Information Systems

- **Management Information Systems(MIS)**
  - These systems assist lower management in problem solving and making decisions.
  - They use the results of transaction processing and some other information also.
  - An important element of MIS system is database.
  - And the information is accessed through DBMS.

- But there are two drawbacks of database i.e. requirement of a specialized personnel and need to secure data from unauthorized access.

Computer based Information Systems

- **Decision Support Systems (strategic information):**
  - These systems assist higher management to make long term decisions.
  - These type of systems handle unstructured or semi structured decisions.
  - A decision is considered unstructured if there are no clear procedures for making the decision

System Analysis and Design

Slide 02

System Development Life Cycle

System Development Life Cycle

- Systems analysis and design are keyed to the system life cycle.
- The analyst must progress from one stage to another methodically, answering key questions and achieving results in each stage
- An effective System Development Life Cycle (SDLC) should result in a high quality system. System Development Life Cycle (SDLC) is a conceptual model.

A Word of caution regarding life cycle activities: We isolate and sequence these activities for learning purposes, but in real life they overlap and are highly interrelated.

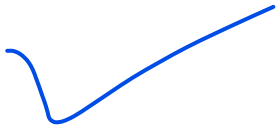
System Development Life Cycle

- SDLC is used by analysts to develop an information system. SDLC includes the following activities −
  1. Preliminary Investigation
  2. Feasibility Study
  3. System Analysis
  4. System Design
  5. System Coding and Testing
  6. System Implementation
  7. System Maintenance

Preliminary Investigation

- Tasks:
  - Recognition of need
  - What is the problem
  - Determine if a new system is needed

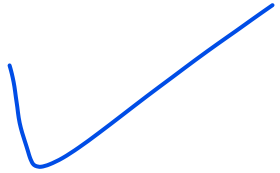
- Results:
  - Need for improving existing new system identified
  - Statement of scope



Feasibility Study

- Tasks: evaluate alternatives system based on:
  - Economic Feasibility: do benefits justify the costs?
  - Technical Feasibility: is the reliable technology and training available?
  - Operational Feasibility: can user operate easily?

- Results:
  - feasibility report for the complete project is created
  - threats, constraints, integration and security of system are identified.
  - Flexibility for the future
  - cost v/s benefits



System Analysis

- Tasks:
  - detailed evaluation of the present system
  - Define boundaries of the candidate system
  - Data collection
- Tools:
  - Data flow diagram
  - Interview
  - Onsite observation
  - Questionnaires
  - Data dictionaries

- Result:
  - SRS (Software Requirement Specification) is finalized
    - which specifies the software, hardware and network necessities of the system is ready on the stop of this phase.
  - Logical model of the system (DFD, Data dictionary)

System Design

- Tasks:
  - most creative and challenging task
  - Translate the requirements into design specifications
  - how must the problem solved
  - input data and master files are designed
  - Output format are designed
- Result:
  - Detailed system document
  - Procedural flowcharts
  - Work plan/time schedule for implementing each component

System Coding and Testing

- Tasks:
  - Build the system to design specification
  - System testing
  - User acceptance testing

System Implementation

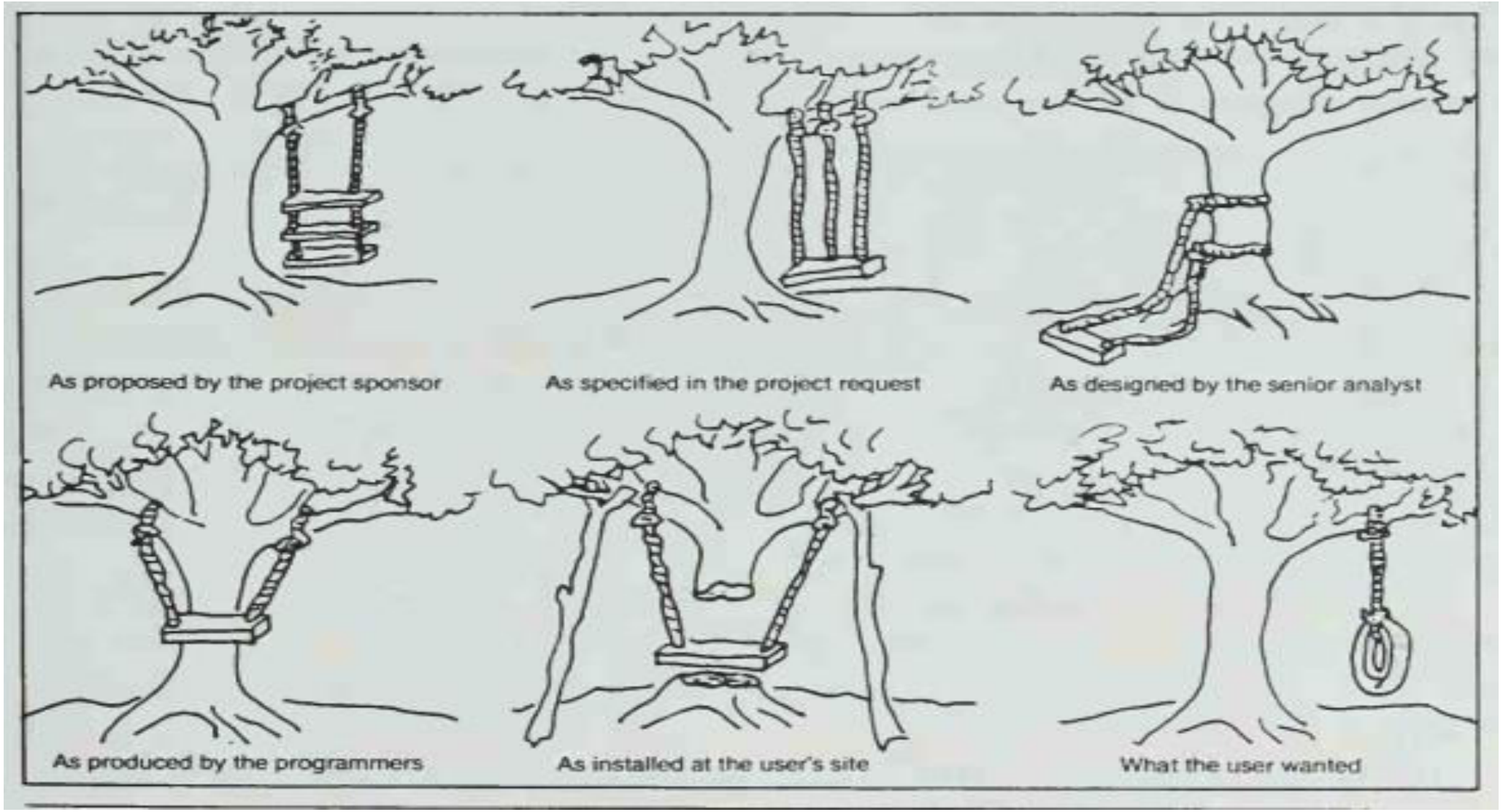
- Tasks:
  - New system completely replaces the old system
  - Parallel approach or pilot approach
  - User training
  - User friendly documentation/ ready the manual

System Maintenance

- Tasks:
  - Corrections of new bugs
  - System adjustments to environmental changes/user changing needs
  - Enhancing the performances

- **There are many reasons a new system does not meet user requirements:**
  - User requirements were not clearly defined or understood. (Ref: figure of the next slide)
  - The user was not directly involved in the crucial phases of system development.
  - The analyst, programmer, or both were inexperienced.
  - The systems analyst (or the project team) had to do the work under strict time constraints. Consequently, not enough thought went into the feasibility study and system design.
  - User training was poor.
  - Existing hardware proved deficient to handle the new application.
  - The new system was not user-friendly.
  - Users changed their requirements.

The Systems Design Procedure



Considerations For Candidate Systems

- The basic problem is to match the demands for services with the available resources. How much one project is favored over another depends on technical, behavioral, and economic factors.
- **The technical factor** involves the system department's ability to handle a project. Much depends on the availability of qualified analysts, designers, and software specialists to do the work.
- **The behavioral factor** involves (1) the user's past experience with an existing system, (2) the success record of the analyst, and (3) the influence the user can exert on upper management to finance a candidate system.
- Perhaps the most important criterion in selecting a project is the economic factor. It focuses on the system's potential return on investment.

Planning and Control for System Success

- First, a plan must be devised, detailing the procedure, some methodology, activities, resources, costs, and timetable for completing the system.
- Second, in larger projects, a project team must be formed of analysts, programmers, a system consultant, and user representatives.
- Finally, the project should be divided into manageable modules to reflect the phases of system development—analysis, design, and implementation.

Planning and Control for System Success

- In planning a project, the following steps should be taken:
  1. Identify the activities in each phase and the tasks within each activity.
  2. Calculate the budget for each phase and obtain agreement to proceed.
  3. Review, record, and summarize progress on activities periodically.
  4. Prepare a project progress report at the end of a reporting month.

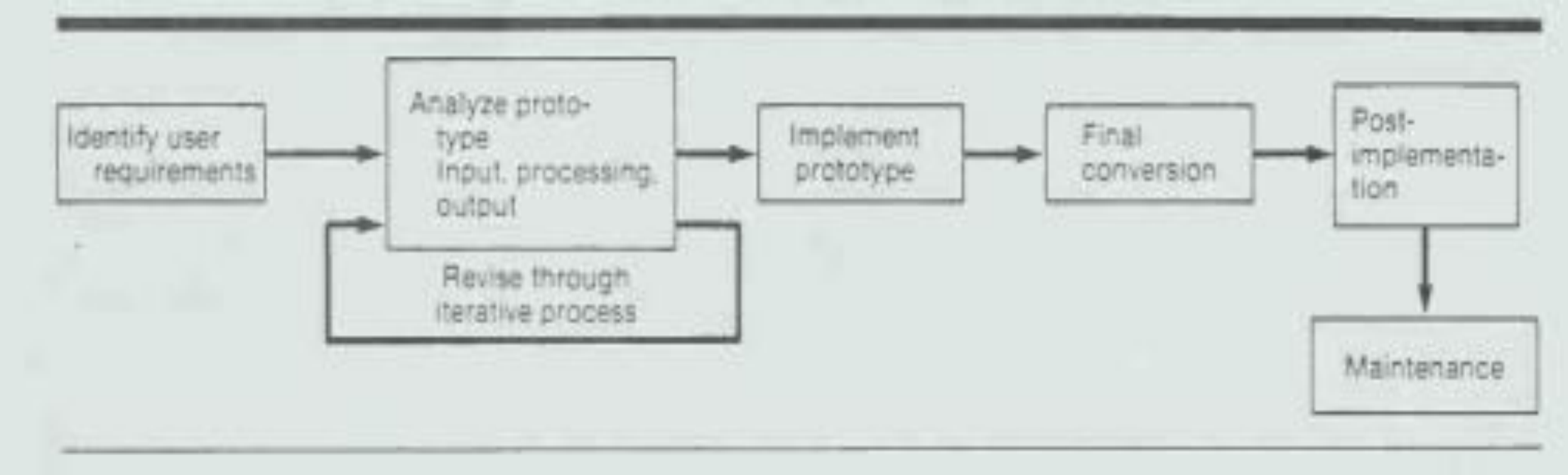
Prototyping

- As can be deduced from the discussion on system development, there are two major problems with building information systems:
  (1) the system development life cycle takes too long
  (2) the light system is rarely developed the first time.
- Lengthy development frustrates the user expect users to define their information requirements. It usually turns out that what users ask for is not what they want, and what they want is not what they need.
- An alternative to this "paralysis by analysis" is an advanced technique called prototyping. Prototyping recognizes problems of cognitive style and uses advanced computer technology. It advocates building a simple system through trial and error and refining it through an iterative process.

Prototyping

- The basic steps are:
  1. Identify' the users information and operating requirements.
  2. Develop a working prototype that focuses on only the most important functions, using a basic data base.
  3. Allow the user to use the prototype, discuss requested changes, and implement the most important changes.
  4. Repeat the next version of the prototype with further changes incorporated until the system fully meets user requirement

System Development Life Cycle with Prototyping



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System Analysis and Design

Slide 03

The Role of the Systems Analyst

System Analyst

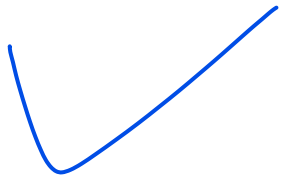
- Designing and implementing systems to suit organizational needs are the functions of the systems analyst.
- The analyst is a person with unique skills. The job is not confined to data processing as such, because it deals heavily with people, procedures, and technology.
- The role of the analyst has been emerging with changing technology.

Attributes of a Systems Analyst

- **Interpersonal Skills:**
  - Interface with users and programmer.
  - Facilitate groups and lead smaller teams.
  - Managing expectations.
  - Good understanding, communication, selling and teaching abilities.
  - Motivator having the confidence to solve queries.

Attributes of a Systems Analyst

- **Analytical Skills:**
  - System study and organizational knowledge
  - Problem identification, problem analysis, and problem solving
  - Sound commonsense
  - Ability to access trade-off
  - Curiosity to learn about new organization



Attributes of a Systems Analyst

- **Management Skills:**
  - Understand users jargon and practices.
  - Resource & project management.
  - Change & risk management.
  - Understand the management functions thoroughly.

Attributes of a Systems Analyst

- **Technical Skills:**
  - Knowledge of computers and software.
  - Keep abreast of modern development.
  - Know of system design tools.
  - Breadth knowledge about new technologies.

The Role of System Analyst

- **Change Agent**

  The analyst may be viewed as an agent of change. A candidate system is designed to introduce change and reorientation in how the user organization handles information or makes decisions. It is important, then, that change be accepted by the user. The way to secure user acceptance is through user participation during design and implementation.

- **Investigator and Monitor**

  A systems analyst may investigate the existing system to find the reasons for it's failure. The role of an investigator is to extract the problems from existing systems and create information structures that uncover previously unknown trends that may have a direct impact on organization. The role of a Monitor is to undertake and successfully complete a project. In this role, analysts must monitor programs in relation to time, cost and quality.

The Role of System Analyst

- **Architect:**

  The analyst's role as an architect is liaison between the user's logical design requirements and the detailed physical system design. As architect the analyst also creates a detailed physical design of candidate systems. A systems analyst makes the design of information system architecture on the basis of end user requirements. This design becomes the blue print for the programmers.

- **Psychologist**:

  In system development, systems are built around people. The analyst plays the role of psychologist in the way s/he reaches people, interprets their thoughts, assesses their behavior and draws conclusions from these interactions. Psychologist plays a major role during the phase of fact finding.

The Role of System Analyst

- **Motivator:**

  System acceptance is achieved through user participation in its development, effective user training and proper motivation to use the system. The analyst's role as a motivator becomes obvious during the first few weeks after implementation and during times when turnover results in new people being trained to work with the candidate system.

- **Intermediary/politician:**

  In implementing a candidate system, the analyst tries to appease all parties involved. Diplomacy in dealing with people can improve acceptance of the system. The analyst's goal is to have the support of all the users. S/he represents their thinking and tries to achieve their goals through computerization.

System Analysis and Design

Slide 04

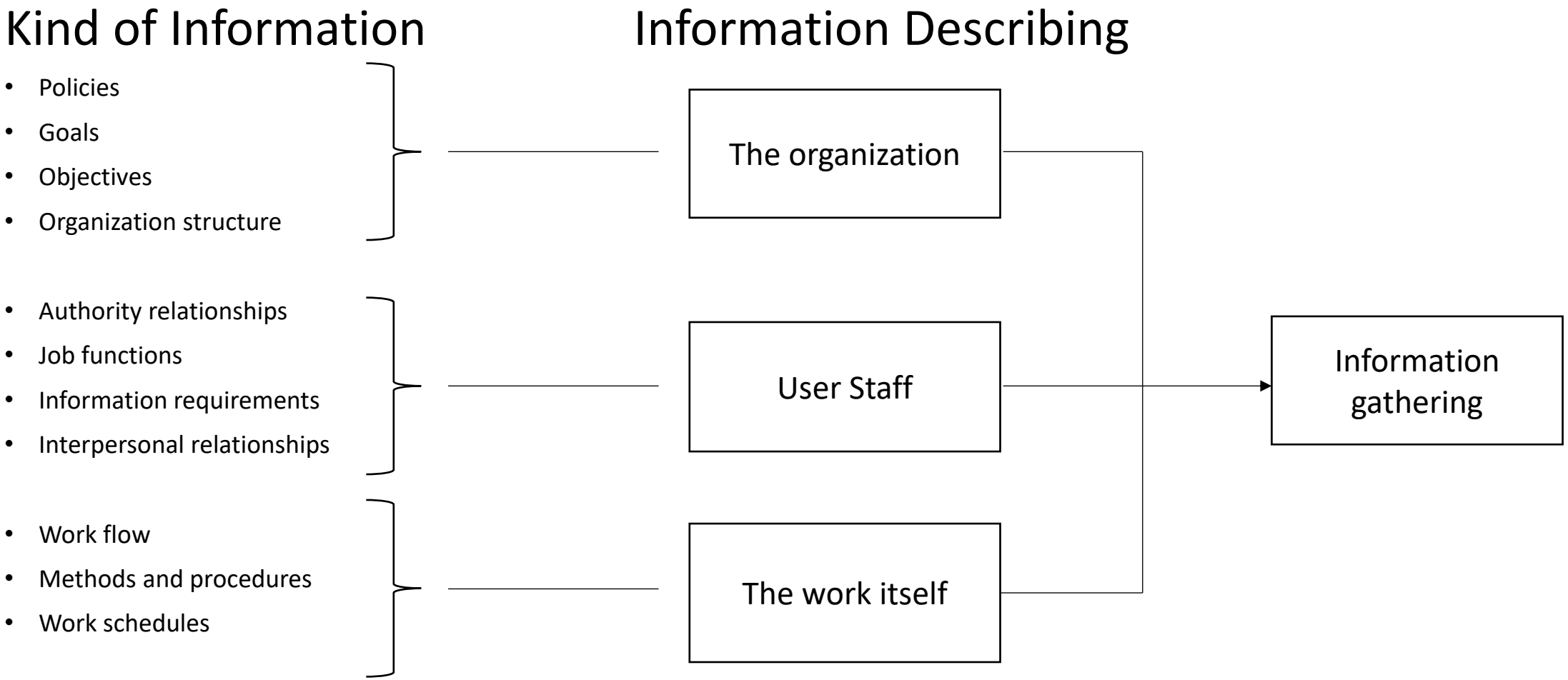
Information Gathering

Information Gathering

- The key part of feasibility study/analysis is the gathering information about the present system.

- **The analyst must know-**
  - What information to gather
  - Where to find it
  - How to collect it and
  - What to make it

Categories of Information



Sources of Information Gathering

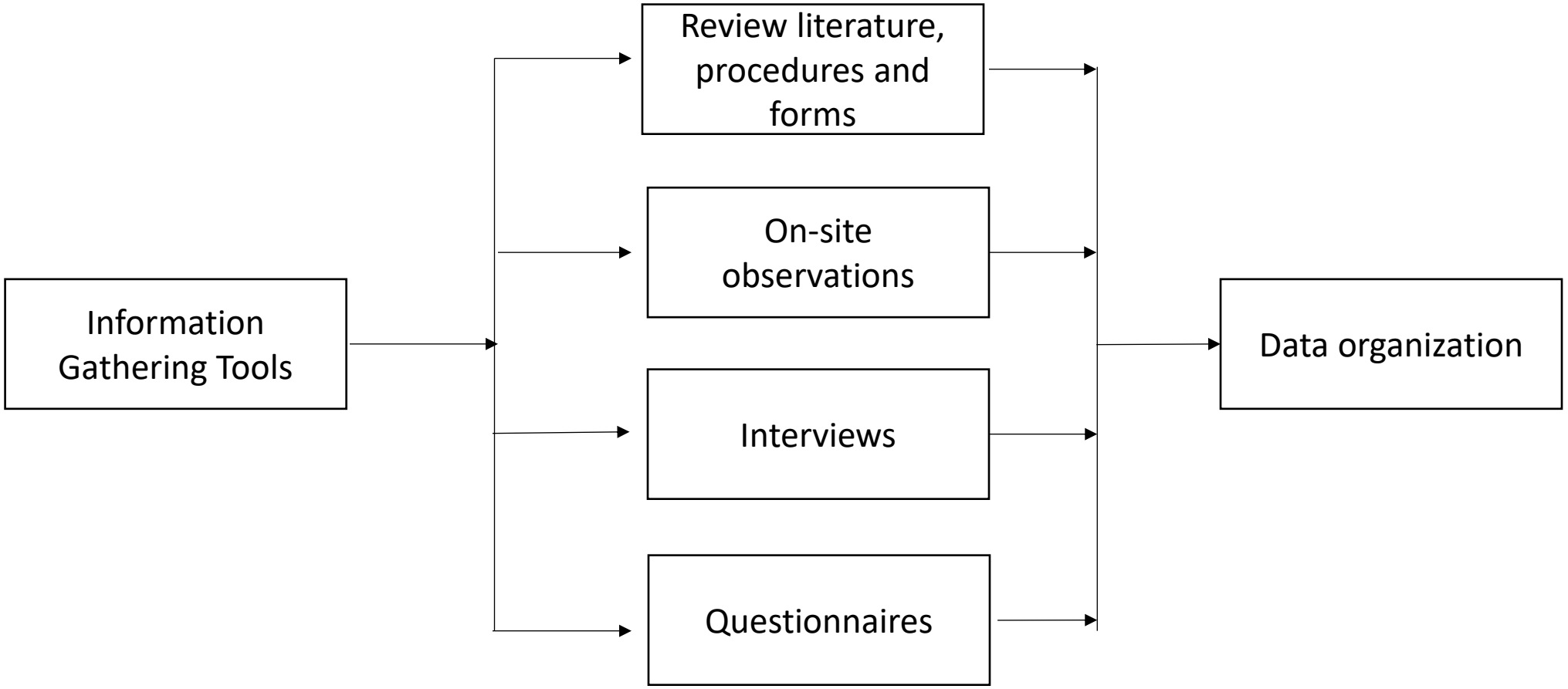
- **Information about the organization**
  - Policies, goals, structures
  - Employee manual, orientation pamphlet, annual report cards
- **Information about user staff**
  - What kind of people run the present system
  - Job function, status and responsibilities,
  - Determine the importance of existing system
- **Information about work flow**
  - What happens to data
  - Shown by a data flow diagram or system flowchart

Information Gathering Methods/Tools

- The proper use of tools for gathering information is the key to successful analysis.

- **The tools are-**
  - Review of Literatures, Procedures, and Forms
  - On Site Observation
  - Interview
  - Questionnaires

Information Gathering Methods/Tools



Review of Literature, Procedures, and Forms

A search of the **literature** through professional references and procedures manuals, textbooks, company studies, government publications or consultant studies may prove invaluable. The primary drawback of this search is time.

Procedures manuals and forms are useful sources for the analyst. They describe the format and functions of the present system.

Printed **forms** are widely used for capturing and providing information. To understand forms, these following questions may be used:

- Who uses the form(s)? How important are they to the users?
- Do the forms include all the necessary information? What items should be added or deleted?
- How many departments receive the existing form(s)? Why?
- How readable and easy to follow is the form?
- How does the information in the form help other users make better decisions? What other uses does the form offer the user area?

On-site observation

It is the process of recognizing and noting people, objects, and occurrences to obtain information. The major objective of on-site observation is to get as close as possible to the "real" system being studied.

The following questions can serve as a guide for on-site observations:

- What kind of system is it? What does it do?
- Who runs the system? Who are the important people in it?
- What is the history of the system? How did it get to its present stage of development?
- Apart from its formal function, what kind of system is it in comparison with other systems in the organization? Is it a primary or a secondary contribution to the organization? Is it fast paced or is it a leisurely system that responds slowly to external emergencies?

On-site observation (cont.)

When human observers are used, four alternative observation methods are considered:

- **Natural or Contrived**: A natural observation occurs in a setting such as the employee's place of work; a contrived observation is set up by the observer in a place like a laboratory.
- **Obtrusive or Unobtrusive**: An obtrusive observation takes place when the respondent knows he/she is being observed; an unobtrusive observation takes place in a contrived way such as behind a one-way mirror.
- **Direct or Indirect**: A direct observation takes place when the analyst actually observes the subject or the system at work. In an indirect observation, the analyst uses mechanical devices such as cameras and videotapes to capture information.
- **Structured or Unstructured:** . In a structured observation, the observer looks for and records a specific action such as the number of soup cans a shopper picks up before choosing one. Unstructured methods place the observer in a situation to observe whatever might be pertinent at the time.

Problems of on-site observation

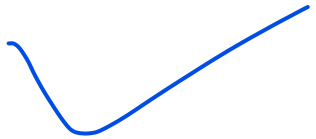
- Introducing into the user's area often results in adverse reactions by the staff. Therefore, adequate preparation and training are important.
- Attitudes and motivations of subjects cannot be readily observed-only the actions that result form them.
- Observations are subject to error due to the observer's misinterpretation and subjective selection of what to observe, as well as the subject's altered work pattern during observation.
- Unproductive, long hours are often spent in an attempt to observe specific, one-time activities or events.

In deciding to use an on-site observation, several questions are considered

- What behavior can be observed that cannot be described in other way?
- What data can be obtained more easily or more reliably by observation than by other means?
- What assurances can be given that the observation process is not seriously affecting the system or the behavior being observed?
- What interpretation needs to be made about observational data to avoid being misled by the obvious?
- How much skill is required and available for the actual observation?

Interviews

- The interview is a face-to-face interpersonal meeting designed to identify relations and verify information to capture raw information as told by the interviewee.
- Interview is a flexible tool and a better tool than a questionnaire for the evaluation of the validity of the information.
- It is easy to discover key problem by seeking opinions.
- It bridges the gaps in the areas of misunderstandings and minimizes future problems



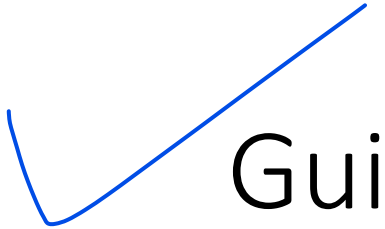
Advantages of Interview

There are four primary advantages of the interview:

- Its flexibility makes the interview a superior technique for exploring areas where not much is known about what questions to ask or how to formulate questions.
- It offers a better opportunity than the questionnaire to evaluate the validity of the information gathered. The interview can observe not only what subjects say but also how they say it.
- It is an effective technique for producing information about complex subjects and for examining the sentiments underlying expressed opinions.
- Many people enjoy being interviewed, regardless of the subject.

Interviews (cont.)

- **The art of Interviewing:** Interviewing is an art. Few analysts learn it in school, but most of them develop expertise through experience. Primary requirements for a successful interview are to create a friendly atmosphere and to put the respondent at ease. Then the interview proceeds with asking questions properly, obtaining reliable responses, and recording them accurately and complete
- **Arranging the interview**: The interview should be arranged so that the physical location, time of the interview, and order of interviewing assure privacy and minimal interruption.
- Guides to a successful interview:
  - Set the stage for the interview.
  - Establish rapport, put the interviewee at ease.
  - Phrase questions clearly and concisely.
  - Be a good listener; avoid arguments.
  - Evaluate the outcome of the interview

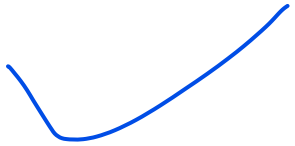


Guides to a successful interview

- **Set the stage for the interview**: This is an "ice breaking', relaxed, informal phase where the analyst opens the interview.
- **Establish rapport; put the interviewee at ease:** Even though the procedure is authorized by management in advance, many staff members are reluctant to participate. There is a strong perception that it may do them harm. This factor makes it important to gain and maintain rapport with the user staff.
- **Phrase questions clearly and concisely:** Except in unstructured interviews. it is important that each question is asked exactly as it is worded.
- **Be a good listener; avoid arguments:** Obtaining and recording the response. Interviewers must be prepared to coax respondents to elicit further information when necessary
- **Evaluate the outcome of the interview:** Care must be taken to record the data, their source, and the time of collection. If there is no record of a conversation, the analyst runs the risk of not remembering enough details, attributing them to the wrong source, or otherwise distorting the data

Questionnaires

- This method is used by analyst to gather information about various issues of system from large number of persons.
- Types of Interviews and questionnaires:
  - The Unstructured Alternative:. It allows respondents to answer questions freely in their own words. The responses are spontaneous rather than forced. They are self-revealing and personal rather than general and superficial.
  - The Structured Alternative: In the structured approach, the questions are presented with exactly the same wording and in the same order to all subjects.
    - Open-Ended questions: An open-ended question requires no response direction or specific response
    - Closed questions: Closed questions are those in which the responses are presented as a set of alternatives of system from large number of persons.



Advantages of Questionnaires

- It is economical and less skill to administer than interview.
- Can be administered a large number of people simultaneously.
- Appropriate for statistical data collection.

- Types of closed questions:
  - Fill in the gaps
  - Yes/no types
  - Ranking scales
  - Multiple choice questions