Unit - 1

System Concepts and Information System Environment

Overview

Systems development can generally be thought of as having two major components: Systems analysis and Systems design. System design is the process of planning a new business system or one to replace or complement an existing system. But before this planning can be done, we must thoroughly understand the old system and determine how computers can best be used to make its operation more effective. System analysis, then, is the process of gathering and interpreting facts, diagnosing problems, and using the information to recommend improvements to the system. This is the job of the systems analyst.

Consider, for example, the stockroom operation of a clothing store. To better control its inventory and gain access to more up – to – date information about stock levels and reordering, the store asks a system analyst, to "computerize" its stockroom operations. Before one can design a system to capture data, update files, and produce reports, one needs to know more about the store operations: what forms are being used to store information manually, such as requisitions, purchase orders, and invoices and what reports are being produced and how they are being used.

What is a SYSTEM?

A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process.

- Components and their attribution
- Systems structure: the relationship between components
  - Subsystems
  - Environment and Boundary
- Input and Output

Definition of a System

The term system may be defined as an orderly arrangement of a set of interrelated and interdependent elements that operate collectively to accomplish some common purpose or goal. For example – the human body is a system, consisting of various parts such as head, heart, hands, legs and so on. The various body parts are related by mean of connecting networks of blood vessels and nerves and the system has a main goal of "living".

Thus, a system can be described by specifying its parts, the way in which they are related, and goals which they are expected to achieve. A business is also a system is also a system where economic resources such as people, money, material, machines, etc. are transformed by various organizational processes (such as production, marketing, finance etc.) into goods and services. A computer-based information system is also a system, which is a collection of people, hardware, software, data and procedures that interact to provide timely information to authorized people who need it.

Elements of a System

1. **Input – Whatever a system takes from its environment in order to fulfil its purpose**
2. **A component – an irreducible part or aggregation of parts that make up a system, also called a subsystem**
3. **Interrelated components – Dependence of one subsystem on one or more subsystems**
4. **Boundary – The line that marks the inside and outside of a system and that sets off the system from its environment**
5. **Purpose – The overall goal or function of a system**
6. **Environment – Everything external to a system that interacts with the system**
7. **Interface – Point of contact where a system meets its environment or where subsystems meet each other.**
8. **Constraint – A limit to what a system can accomplish**
9. **Output – Whatever a system returns to its environment after fulfilling its purpose**

Types of System

1. Open and Closed System

- **Open System – A system that interacts freely with its environment, taking input and returning output. For example - The education system or any business process system will quickly change when the environment changes. To do this, an open system will interact with an element that exists and influence from outside the boundary of the system.**
- **Closed System – A system that is cut off from its environment and does not interact with it. For example - Consider a 'throw-away' type sealed digital watch, which is a system, composed of a number of components that work in a cooperative fashion designed to perform some specific task. This watch is a closed system as it is completely isolated from its environment for its operation. Such a closed system will finally run down or become disorganized. This movement to disorder is termed an increase in entropy.**

2. Formal & Informal Information Systems

- **Formal Information System – A formal information system is based on the organization represented by the organization chart. The chart is a map of position and their authority relationship, indicated by boxes and connected by straight lines. it is concerned with the pattern of authority, communication and workflow.**
- **Informal Information System – The informal information system is employee based system design to meet personnel and vocational needs and to help in the solution of work-related problems. it also funnels information upward through indirect channels. In this way, it is considered a useful system because it works within the framework of the business and its stated policies.**

3. Computer Based Information System (CBIS)

A CBIS is an organized integration of hardware and software technologies and human elements designed to produce timely, integrated, accurate and useful information for decision-making purposes. For any given application, the following features must be present:

- **Easy to use interactive (two way) interfaces**
  - **Touchscreen**
  - **GUI**
  - **Menu Driven Interface**
  - **Colour Screen**
  - **Buttons**
  - **Labels**
  - **Voice Activated**
  - **Tones, on phones**
- **Use of advanced technologies**
  - **Phone (including WAP)**
  - **digital television**
  - **Teleconferencing (audio, video and computer)**
  - **Integration of voice, data and images through Integrated Service Digital Networks**
  - **Image transfer systems through facsimile**
- **Fast processing**
  - **Searching (Google gives you search times)**
  - **Looking up names in a database**
  - **Rapid responses**
  - **To input**
  - **To requests**

4. Management Information System

Many experts have defined MIS in a different language. A management information system has been defined by Davis and Olson as "an integrated user-machine system designed for providing information to support operational control, management control and decision making function is an organization".

5. Decision Support Systems (DSS)

The best decision support systems provide high-level summaries and drilldowns to details. Decision Support Systems (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. Typical information that a decision support application might gather and present would be:

- **Accessing all of your current information assets, including legacy and relational data sources, cubes, data warehouses, and data marts**
- **Comparative sales figures between one week and the next**
- **Projected revenue figures based on new product sales assumptions**

- **The consequences of different decision alternatives, given past experience in a context that is described.**

6. General Business Knowledge

For an individual that's new to the business and wants to negotiate procurement contracts at some point their career, one of the first things they need to do is start to build their knowledge and skills. To be a good negotiator you need knowledge and skills in a number of areas.

- **General business knowledge and skills.**
- **Procurement knowledge and skills**
- **Contracting knowledge and skills**
- **Negotiation knowledge and skills**

7. Interpersonal Communicational System

Interpersonal communication is usually defined by communication scholars in numerous ways, usually describing participants who are dependent upon one another. It can involve one on one conversations or individuals interacting with many people within a society. It helps us understand how and why people behave and communicate in different ways to construct and negotiate a social reality. While interpersonal communication can be defined as its own area of study, it also occurs within other contexts like groups and organizations. Interpersonal communication is the process that we use to communicate our ideas, thoughts, and feelings to another person. Our interpersonal communication skills are learned behaviours that can be improved through knowledge, practice, feedback, and reflection.

Unit - 2

System Development Life Cycle (SDLC)

Methodologies

SDLC (System Development Life Cycle), just as the name implies, is defined as the process (as a whole) of developing a system or software to meet certain requirements. It covers many activities; starts from understanding why the system should be built, studying the project feasibility, analyzing problems, choosing the system design and architecture, implementing and testing it, up to delivering the system as a product to the user. SDLC is a process of gradual refinement, meaning that it is done through several development phases. Each phase continues and refines what's done in the previous phase. Commonly known development phases in SDLC are:

1. Planning – It is the process of understanding why the system should be built and defining its requirements. It also includes a feasibility study from several different perspectives, technical, economic, and organization feasibility aspects.
2. Analysis – This phase includes activities such as problems identifying and analysis, and even predicting potential problems that may arise in the future regarding the system. The deliverables/products of this phase will drive how the system will be built and guide the developers' works.
3. Design – System analysis leads to a design decision, which exactly determines how the system operates in terms of process, data, hardware, network infrastructures, user interface, and other important factors in the system environment.
4. Implementation – This is probably the most resource-, cost-, and time-consuming phase of all. This is when the system is actually built, tested, and finally installed. It also includes activities such as user training and system maintenance. Some experts like to separate them into different phases Deployment and Maintenance. However, the four phases are the most commonly known and accepted steps.

Recognition of Needs

One must know what the problem is before it can be solved. The basis of the candidate system is recognition of the need for improving the system. The key question is:

What is the problem?

This recognition of need leads to a preliminary survey or an initial investigation of the current system to determine whether an alternative system can solve the problem. If the problem is serious enough, management may have an analyst look at it.

The idea for change may originate in the environment or within the firm. Environment-based ideas originate from customers, vendors, government sources etc. When investigated each of these ideas may lead to a problem definition. The idea for change may also come from within the organization's top management, the user, the analyst. User-originated ideas also prompt initial investigation.

Impetus for System Change

The ideas for change originate in the environment or from within the firm Environment-based ideas originate from customers, vendors, government sources, and the like. For example, new unemployment compensation regulations may make it necessary to change the restructures. Customer complaints about the delivery of orders may prompt an investigation of the delivery schedule, the experience of truck drivers, or the volume of orders to be delivered. When investigated, each of these ideas may lead to a problem definition as a first step in the system lifecycle process.

Feasibility Study

Depending on the results of the initial investigation, the survey is expanded to a more detailed feasibility study. As we shall learn, a feasibility study is a test of a system proposal according to its workability impact on the organization, ability to meet user needs and effective use of resources. It focuses on three major questions:

- **What are the user's demonstrable needs and how does a candidate system meet them?**
- **What resources are available for given candidate systems? Is the problem worth solving?**
- **What is the likely impact of the candidate system on the organization? How will it fit within the organization's master MIS plan?**

Analysis

The analysis is a detailed study of the various operations performed by a system and their relationships within and outside of the system.

System Design

Based on the user requirements and the detailed analysis of a new system, the new system must be designed. This is the phase of system designing. It is the most crucial phase in the development of a system. The logical system design arrived at as a result of system analysis and is converted into physical system design. In the design phase, the SDLC process continues to move from the what questions of the analysis phase to the how.

The logical design produced during the analysis is turned into a physical design - a detailed description of what is needed to solve the original problem. Input, output, databases, forms, codification schemes and processing specifications are drawn up in detail. In the design stage, the programming language and the hardware and software platform in which the new system will run are also decided. A data structure, control process, equipment source, workload and limitation of the system, Interface, documentation, training, procedures of using the system, taking backups and staffing requirement are decided at this stage. There are several tools and techniques used for describing the system design of the system. These tools and techniques are Flowchart, Data flow diagram (DFD), Data dictionary, Structured English.

Coding

The system design needs to be implemented to make it a workable system. his demands the coding of design into computer language, i.e., programming language. This is also called the programming phase in which the programmer converts the program specifications into computer instructions, which we refer to as programs. It is an important stage where the defined procedures are transformed into control specifications with the help of a computer language. The programs coordinate the data movements and control the entire process in a system.

A well-written code reduces the testing and maintenance effort. It is generally felt that the programs must be modular in nature. This helps in fast development, maintenance and future changes if required. Programming tools like compilers, interpreters and language like C, C++, and Java etc., are used for coding with respect to the type of application. The right programming language should be chosen.

Testing

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

- Program Test – When the programs have been coded and compiled and brought to working conditions, they must be individually tested with the prepared test data. All verification and validation be checked and any undesirable happening must be noted and debugged (error corrected).
- System Test – After carrying out the program test for each of the programs of the system and errors removed, a system test is done. At this stage, the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the results or output of the system is analyzed. During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are fixed and further tested for the expected output.
  All independent modules are brought together and all the interfaces to be tested between multiple modules, the whole set of software is tested to establish that all modules work together correctly as an application or system or package. When it is ensured that the system is running error-free, the users are called with their own actual data so that the system could be shown running as per their requirements.

Implementation

The implementation phase is directly concerned with user training, site preparation and file conversion. During the final testing, user acceptance testing is followed by user training. Conversion usually takes place at about the same time when the user is being trained. Once the program becomes available and data are ready for testing and the results are OK then the program is run with data. Otherwise, a diagnostic procedure is used to locate and correct errors in the program.

Post-Implementation and Maintenance

After the installation phase is completed and the user or staff is adjusted to the changes created by the candidate system, its evaluation and maintenance begins. If the new information is inconsistent with the design specifications, then changes have to be made. Hardware also requires periodic maintenance to keep in tune with design specifications. Changes in organizations requirements or environmental factors also call for system enhancements. This change requires evaluation, program modifications and further testing.

Systems Analyst

These are knowledge workers who facilitate the development of information systems and computer applications by bridging the communications gap that exists between non-technical system users, and System designers and developers.

Need of Systems Analysts

Systems analysts work as a link between Business people, & Computer Programmers. Business People may define the business to be computerized, i.e. establish the scope of computerization. However, they may not fully understand the capabilities and limitations of modern information technology. Computer programmers apply information technology to build information systems which solves these problems but need not fully understand the business usages they are computerizing or supporting.

Systems Analysts due to their expertise in development, knowledge of business processes, awareness of industry best practices, bridge the gap by translating the scope of computerization into how the systems will handle the transactional flows and the relationship between the various aspects of the business for the programmers whilst keeping the overall objectives and requirements, both corporate and IT related in perspective.

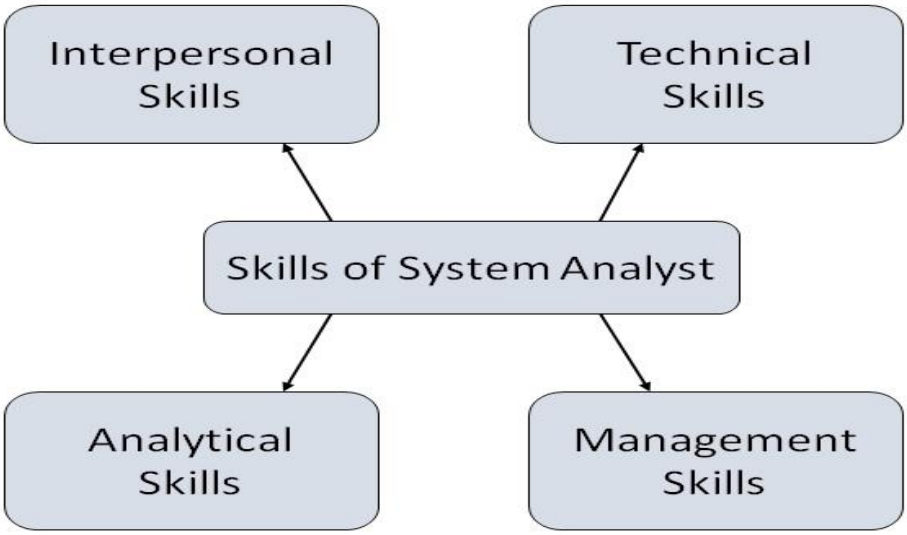
Role of a Systems Analyst

A system analyst is a person who is thoroughly aware of the system and guides the system development project by giving proper directions. He is an expert having technical and interpersonal skills to carry out development tasks required at each phase. He pursues to match the objectives of an information system with the organization goal.

- **Defining and understanding the requirement of the user through various fact-finding techniques.**
- **Prioritizing the requirements by obtaining user consensus.**
- **Gathering the facts or information and acquires the opinions of users.**
- **Maintains analysis and evaluation to arrive at an appropriate system which is more user-friendly.**
- **Suggests many flexible alternative solutions, pick the best solution, and quantify cost and benefits.**
- **Draw certain specifications which are easily understood by users and programmer in precise and detailed form.**
- **Implemented the logical design of the system which must be modular.**
- **Plan the periodicity for evaluation after it has been used for some time, and modify the system as needed.**

Attributes of a Systems Analyst

The following figure shows the attributes a systems analyst should possess –



- **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.**
- **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 the new organization**
- **Management Skills**
  - **Understand users jargon and practices.**
  - **Resource & project management.**
  - **Change & risk management.**
  - **Understand the management functions thoroughly.**
- **Technical Skills**
  - **Knowledge of computers and software.**
  - **Keep abreast of modern development.**
  - **Know of system design tools.**
  - **Breadth knowledge about new technologies.**

Unit - 3

Requirements Determination

A requirement is a vital feature of a new system, which may include processing, or capturing of data, controlling the activities of business, producing information and supporting the management. Requirements determination involves studying the existing system and gathering details to find out what are the requirements, how it works, and where improvements should be made.

Major Activities in requirement determination

Requirements Anticipation

- It predicts the characteristics of the system based on previous experience, which include certain problems or features and requirements for a new system.
- It can lead to an analysis of areas that would otherwise go unnoticed by the inexperienced analyst. However, if shortcuts are taken and bias is introduced in conducting the investigation, then requirement Anticipation can be half-baked.

Requirements Investigation

- It is studying the current system and documenting its features for further analysis.
- It is at the heart of system analysis where the analyst is documenting and describing system features using fact-finding techniques, prototyping, and computer-assisted tools.

Requirements Specifications

- It includes the analysis of data, which determine the requirement specification, description of features for the new system, and specifying what information requirements will be provided.
- It includes an analysis of factual data, identification of essential requirements, and selection of Requirement-fulfillment strategies.

System Planning and Initial Investigation

Introduction:

System Planning and the Initial investigation both are the most critical and important part of any project lifecycle. A wrong initial investigation and planning can lead the system to the failure.

What is planning? Why it is done in System Analysis?

Planning is the process of setting goals, developing strategies and outlining task and program to accomplish the goal. Planning the information system in the business is very important in today's competitive environment as –

- To make the system growing and retain in the competitive environment.
- Information is a very important resource for any company to be managed and it is equally important as the cash, personnel etc.
- Financial resources are committed to the information system.

What is initial investigation?

The first step in SDLC is the identification of the user's need. The initial investigation is one way to do this. Another objective at this stage is to determine whether the user's need is feasible or not.

Steps in the initial investigation

1) Problem Definition – Problem definition is the process of identifying the need of the user which led him to request for the system change.
2) Background Analysis – Background analysis is the process of getting basic information about the customer's company or organization i.e. How it really works? What people are involved in it? etc. Background analysis helps the system analyst to prepare the organization chart with the list of people and functions.
3) Fact-finding – After obtaining the background information, analyst start gathering the data like input, output and cost of the existing system. Information can be gathered by following tools –
    a. Review of written documents.
    b. On-site observations
    c. Interview and questionnaires
4) Fact Analysis – After the collection of data it must be organized and evaluated so that report can be prepared for the final approval from the user.
5) Determination of Feasibility – After organizing data and fact analysis feasibility is evaluated and determine that any alternative proposal is possible or not for the customer's Project.

Strategies for determining information requirements

There are three general approaches for getting information regarding the user's requirements. They are as follows:

Asking

This strategy obtains information from users by simply asking them about the requirements. It assumes a stable system where users are well informed and can overcome biases in defining their problem. There are three key asking methods:

1. **Questions: Questions may be open-ended or closed. An open-ended question allows the respondent to formulate a response. It is used when feelings or opinions are important. A closed question requests one answer from a specific set of responses. It is used when factual responses are known.**
2. **Brainstorming: Brainstorming is a technique used for generating new ideas and obtaining general information requirements. This method is appropriate for getting non-conventional solutions to problems. A guided approach to brainstorming asks each participant to define ideal solutions and then select the best one. It works well for users who have sound system knowledge but have the difficulty of accepting new ideas.**
3. **Group consensus: This method asks participants for their expectations regarding specific variables. Each participant fills out a questionnaire. The results are summarized and given to participants along with a follow-up questionnaire. Participants are invited to change their responses. The results are again summarized and given back to the participants. This debate by questionnaire continues until participants responses have converged enough. This method is advantageous than brainstorming because the participants are not subjected to psychological pressure.**

Getting information from an existing information system

There are two methods of extracting information from an already existing system

1. **Data Analysis approach – Determining information from an existing application is called the data analysis approach.**
    - **It simply asks the user what information is currently received and what other information is required.**
    - **It depends on the user for getting accurate information.**
    - **The analyst examines all reports, discusses each piece of information with the user, and determines unfulfilled information needs by interviewing the user.**
    - **The analyst is primarily involved in improving the existing flow of data to the user.**
    - **The data analysis method is ideal for making structured decisions, although it requires that users articulate their information requirements.**
    - **A major drawback is a lack of established rules for obtaining and validating information needs that are not linked to organizational objectives.**

2. **Decision Analysis – This method breaks down a problem into parts, which allows the user to focus separately on critical issues.**
    - **It also determines policy and organizational objectives relevant to complete each major decision.**
    - **The analyst and the user then refine the decision process and the information requirements for a final statement of information requirements.**
    - **In this method, information needs are clearly linked to a decision and organizational objectives.**
    - **It is useful for unstructured decisions and information tailored to the user's decision-making style.**
    - **The major drawback is that the information required may change when the user is promoted or replaced.**

Prototyping

The third strategy for determining user information requirements is used when the user cannot establish information needs accurately before the information system is built. The reason could be the lack of an existing model on which to decide requirements or a difficulty in visualizing candidate system. In this case, the user needs to consider real-life systems from which adjustments can be made. This iterative approach first set up the initial requirements and builds a system to meet these requirements. As users gain experience, they request additional requirements or modifications and the process continues. Prototyping is suitable for environments where it is difficult to formulate a concrete model for defining information requirements. Prototyping strategy is appropriate for determining high uncertainty information requirement.

Fact Finding Method of System Analysis

Fact-finding means learning as much as possible about the present system. The tools used in information gathering or fact-finding are as follows –

Review of Written Documents

In all organizations documents such as forms, records, reports, manuals, etc. are available. These help in determining how the present system runs. The process of fact-finding includes a collection of all possible documents and evaluating them. Unfortunately, most manuals are not up to date and may not be readable. The analyst needs to find out how the forms are filled out, what changes need to be made and how easy they are to read.

On-Site Observation

The purpose of on-site observation is to get as close as possible to the real system being studied. It is the process of recognizing and noting people, objects and occurrences to obtain information. As an observer, the analyst must follow a set of rules. He/she must listen than talk and not give advice or pass a moral judgment, must not argue or show friendliness towards others. 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?**

Interviews

An interview is a face to face interpersonal situation in which a person called the interviewer asks a person being interviewed, questions designed to gather information about a problem. The analyst or interviewer can schedule interviews with key personnel of the organization. The analyst also needs to conduct detailed interviews with all the people who will actually use the system. Interviews help gather vital facts about the existing problems, such as lack of quality control or security, etc. Interviewing needs a friendly atmosphere so that the interviewer can ask questions properly, obtain reliable and correct answers and record the answers accurately and completely.

Questionnaires

A questionnaire is a tool that has questions to which individuals respond. A questionnaire has the following advantages:

- **It is economical and requires less skill than an interview.**
- **It is useful in a situation to know what proportion of a given group approves or disapproves of a particular feature of the proposed system.**
- **It is useful to determine the overall opinion before giving any specific direction to the system project.**
- **It is more reliable and provides high confidentiality of honest responses.**
- **It is appropriate for selecting information and for statistical data collection, which can be emailed and sent by post.**

Unit - 4

Information Gathering

Introduction

Information Gathering is a very key part of the feasibility analysis process. Information gathering is both an art and a science. It is a science because it requires a proper methodology and tools in order to be effective. It is an art too because it requires a sort of mental dexterity to achieve the best results.

Advantages and Disadvantages of Information Gathering

Information gathering, per se, delivers a lot of advantages to the organization undertaking it. Due to its enlightening nature, for example, the researcher and his organization catch a better glimpse of other people's situations. They are able to empathize with other people if they knew better. Better alternatives in problem-solving are also in the offing upon learning of mistakes already committed by other parties.

On the downside, with the proliferation of massive amounts of data on the Internet, any researcher who took up a gathering of information on the Internet can suffer from information overload. There's just no absolute lead with information gathering on the Internet and pursued leads might lead to the doldrums in information gathering.

Information Gathering Tools

There are no standard procedures defined when it comes to the gathering of information. However, an important rule that must be followed is the following: information must be acquired accurately and methodically, under the right conditions and with minimum interruption to the individual from whom the information is sought.

The top tools of information gathering for system analysis are as follows:

Interviews and Questionnaires

Generally, the onsite observation is directed primarily towards describing and understanding events as they occur. By this, we cannot get the profit. On the other hand, we need to learn about people's knowledge, feelings or motivations. Therefore, other information gathering tools are used for analysis. If we wish to know about something, we simply ask someone about it directly, but we cannot get the right answer. When asked by direct questions, the respondent may yield information that is invalid. The information can be successfully obtained with interviews or questionnaires.

8. Types of Interview

1. **Structured Interview – The skill of the interviewer helps in getting the interviewee to respond and move to the next question without diversion. The questions are presented to the interviewee with exactly the same wording and in the same order.**
2. **Unstructured Interview – In the unstructured interview, the respondents are allowed to answer freely in their own words. The responses are not forced. They are self-revealing and personal rather than general and superficial. The interviewer has encouraged the respondents to talk freely. Unstructured interviews provide an opportunity to delve more deeply into complex topics than is possible with surveys.**

Questionnaire

It is a self-administered tool that is more economical and requires less skill to administer than the interview. At any point in time, unlike the interview, feedback from many respondents can be collected at the same time. Since questionnaires are usually self-administered it is critical that questions be clear and unambiguous.

9. Types of Questionnaire

1. **Fill-in-the-blanks Questions: They seek specific responses.**
2. **Yes / No Questions: They just seek one value either true or false or Yes or NO. There is no mixed response.**
3. **Ranking Scale Questions: The respondent needs to rank the responses to a certain scale. For e.g., to a question, you might be asked to rate a service from a level 1 to 10.**
4. **Multiple-Choice Questions: They ask for a specific answer choice.**

With the help of a table below, we can understand the differences between the questionnaires and an interview. This is designed to give a completely unbiased view of both methods. We will be able to view them in such a way that the benefits and shortcomings of each will be easily visible right away.

Questionnaire	Interview
Economical	Less Economical
Can be completed by many people at the same time	Can be administered to ONLY ONE person at a time
Chances of error or omissions are fewer.	It could be error prone since it depends upon the skill of the interviewer to gauge the questions and interpret the responses.
Anonymity can be maintained. Hence user is not prevented from giving his candid opinion about an issue	Anonymity is not maintained. Hence the user might feel forced to conceal his candid opinion on an issue.
Gives time to the respondents. Hence they can think and give their regarded opinions on an issue	It may not give time to the respondents. Hence they may not get enough time to think and give their opinion on an issue.

Review of Literature, Procedures and Forms

few system problems are difficult, therefore, as in the first step, a search of the literature through professionals; references and procedure manuals, company studies, government publications, or consultant studies is very useful. The primary drawback of this search is time. It is very difficult to such reports. Publications may be expensive and the information may be outdated due to a time lag in publication.

Procedures manuals and forms are very useful sources for the analyst. They describe the formation and functions of the present system. Up-to-date and good manuals save hours of information gathering time. Printed forms are widely used for capturing and providing information.

The following questions help decide the form's usefulness:

1. Do the forms include all the necessary information? What items should be added or detected?
2. How does the information in the form helps other users make for better decisions?
3. Who uses the form? How important are they to the user?
4. How readable and easy to follow is the form?
5. How many departments receive the existing form? Why?

On-Site Observation:

Another information gathering tool used in system studies is called the 'on-site observation'. On-site observation is the process of recognizing and noting people, objects and gets the information. The analyst's role is that of an information seeker who is expected to be detached from the system being observed. The role permits participation with the user staff openly and freely. The major objective of onsite observation is to get as close as possible to the real system being studied. For this reason, it is important that the analyst has the knowledge about the general makeup and activities of the system.

Advantages & Disadvantages of Information Gathering Tools

Information Gathering Tools	Advantages	Disadvantages
Document Review	Relatively inexpensive	Information may be inapplicable, disorganized, unavailable or out of date
	Good source of background information	Could be biased because of selective survival of information
	Unobtrusive	Information may be incomplete or inaccurate
	Provides a "behind the scenes" look at a program that may not be directly observable	Can be time-consuming to collect, review, and analyze many documents
	May bring up issues not noted by other means	
On-site Observation	Collect data where and when an event or activity is occurring	Susceptible to observer bias
	Does not rely on people's willingness to provide information	Hawthorne effect – people usually perform better when they know they are being observed
	Directly see what people do rather than relying on what they say they do	Does not increase understanding of why people behave the way they do
Questionnaires	The administration is comparatively inexpensive and easy even when gathering data from large numbers of people spread over a wide geographic area	Survey respondents may not complete the survey resulting in low response rates
	Reduces the chance of evaluator bias because the same questions are asked of all respondents	Items may not have the same meaning to all respondents
		Size and diversity of sample will be limited by people's ability to read
Interviews	Useful for gaining insight and context into a topic	Susceptible to interview bias
	Allows respondents to describe what is important to them	Time-consuming and expensive compared to other data collection methods
	Useful for gathering quotes and stories	May seem intrusive to the respondent

Technical Methods of Information Gathering:

There are varieties of technical methods for information gathering. Some methods require high-tech equipment and in other situations, low-tech options will work. No one source of information is the leading method to use, nor is one method alone likely to give you enough data for the compromise. When preparing for a pen test utilize multiple methods of gathering information and then synthesize the proper attack vector from that data. Attackers also use these very same methods of information gathering to execute malicious social engineering attacks. This underscores the advisability of ongoing training and education of both top-level executives and employees.

Telephone

A simple phone call can reveal the company's name, the name and department of the person who answered the phone, basic lingo or protocols used by the organization, and so much more. After one phone call is completed, the pen tester can call back and use the information obtained previously to compromise the organization. There are plenty of different ways to make the call, including burner cell phones, Google Voice, Skype, and other VoIP options. The Caller ID Spoofing section of the Framework has more details about these pen testing tools.

Online searches or Search engines

Pen testers use search engines to locate and comb through corporate documents, resumes, floor plans, vendor relationships, phone numbers, job titles, email address protocol, business locations (even amazingly detailed photos of the buildings), and much more. A digital trip to the county auditor's website provides a wealth of information on the target building and property, as well as a listing of tenants within the building.

Searching Social Networking Sites

Searching social media accounts can reveal clues or possible answers to security questions, photos of employees wearing their ID badge, or linking a job title to a key individual's hobbies/interests for phishing ideas. Try typing in a name of a co-worker or friend and see how many hits or matches appear with their information.

Unit 5

Structured Analysis

Structured Analysis is a development method that allows the analyst to understand the system and its activities in a logical way. It is a systematic approach, which uses graphical tools that analyse & refine the objectives of an existing system, and develop a new system specification, which can be easily understandable by user.

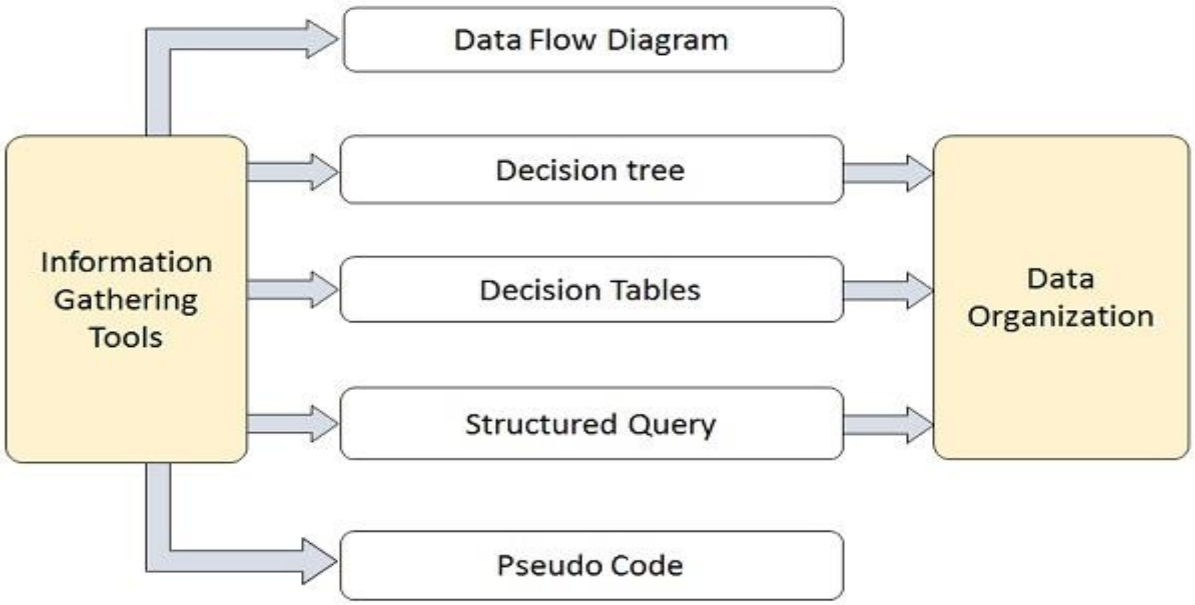
It has following attributes –

- **It is graphic which specifies the presentation of application.**
- **It divides the processes so that it gives a clear picture of system flow.**
- **It is logical rather than physical i.e., the elements of system do not depend on vendor or hardware.**
- **It is an approach that works from high-level overviews to lower-level details.**

Structured Analysis Tools

During Structured Analysis, various tools and techniques are used for system development. They are –

- **Data Flow Diagrams**
- **Data Dictionary**
- **Decision Trees**
- **Decision Tables**
- **Structured English**



Data Flow Diagrams (DFD) or Bubble Chart

It is a technique developed by Larry Constantine to express the requirements of system in a graphical form.

- **It shows the flow of data between various functions of system and specifies how the current system is implemented.**
- **It is an initial stage of design phase that functionally divides the requirement specifications down to the lowest level of detail.**
- **Its graphical nature makes it a good communication tool between user and analyst or analyst and system designer.**
- **It gives an overview of what data a system processes, what transformations are performed, what data are stored, what results are produced and where they flow.**

Basic Elements of DFD

DFD is easy to understand and quite effective when the required design is not clear and the user wants a notational language for communication. However, it requires a large number of iterations for obtaining the most accurate and complete solution.

The following table shows the symbols used in designing a DFD and their significance –

Symbol Name	Symbol	Meaning
Square		Source or Destination of Data
Arrow		Data flow
Circle		Process transforming data flow
Open Rectangle		Data Store

Types of DFD

DFDs are of two types: Physical DFD and Logical DFD. The following table lists the points that differentiate a physical DFD from a logical DFD.

Physical DFD	Logical DFD
It is implementation dependent. It shows which functions are performed.	It is implementation independent. It focuses only on the flow of data between processes.
It provides low-level details of hardware, software, files, and people.	It explains events of systems and data required by each event.
It depicts how the current system operates and how a system will be implemented.	It shows how business operates not how the system can be implemented.

Data Dictionary

A data dictionary is a structured repository of data elements in the system. It stores the descriptions of all DFD data elements i.e., details and definitions of data flows, data stores & the data stored in data stores and the processes.

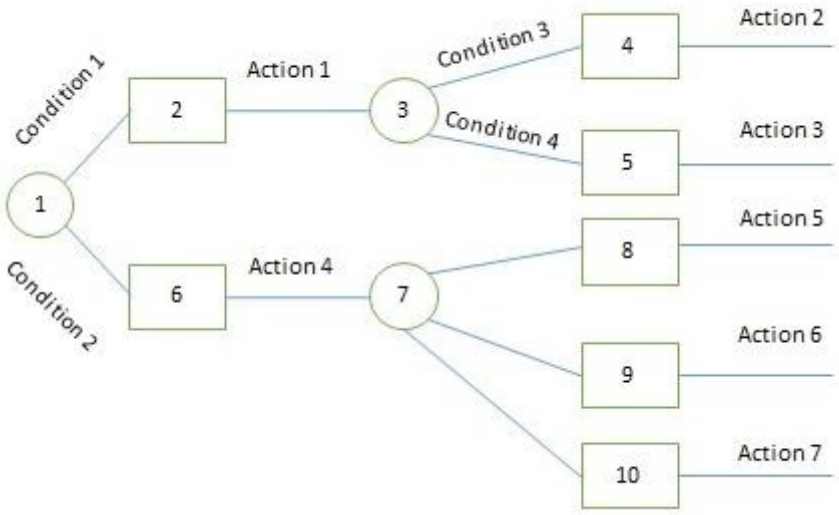
A data dictionary improves the communication between the analyst and the user. It plays an important role in building a database. Most DBMS' have a data dictionary as a standard feature. For example, refer the following table –

Sr. No.	Data Name	Description	No. of Characters
1	ISBN	ISBN Number	10
2	TITLE	Title	60
3	SUB	Book Subjects	80
4	ANAME	Author Name	15

Decision Trees

Decision trees are a method for defining complex relationships by describing decisions and avoiding the problems in communication. A decision tree is a diagram that shows alternative actions and conditions within horizontal tree framework. Thus, it depicts which conditions to consider first, second, and so on.

Decision trees depict the relationship of each condition and their permissible actions. A square node indicates an action and a circle indicates a condition. It forces analysts to consider the sequence of decisions and identifies the actual decision that must be made.



The major limitation of a decision tree is that it lacks information in its format to describe what other combinations of conditions you can take for testing. It is a single representation of the relationships between conditions and actions.

Decision Tables

Decision tables are a method of describing the complex logical relationship in a precise manner, which is easily understandable.

- **It is useful in situations where the resulting actions depend on the occurrence of one or several combinations of independent conditions.**
- **It is a matrix containing row or columns for defining a problem and the actions.**

Components of a Decision Table

- **Condition Stub − It is in the upper left quadrant which lists all the condition to be checked.**
- **Action Stub − It is in the lower left quadrant which outlines all the action to be carried out to meet such condition.**
- **Condition Entry − It is in upper right quadrant which provides answers to questions asked in condition stub quadrant.**
- **Action Entry − It is in lower right quadrant which indicates the appropriate action resulting from the answers to the conditions in the condition entry quadrant.**

The entries in decision table are given by Decision Rules, which define the relationships between combinations of conditions and courses of action. In rules section,

- **Y shows the existence of a condition.**
- **N represents the condition, which is not satisfied.**
- **A blank - against action states it is to be ignored.**
- **X (or a check mark will do) against action states it is to be carried out.**

For example, refer the following table −

CONDITIONS	Rule 1	Rule 2	Rule 3	Rule 4
Advance payment made	Y	N	N	N
Purchase amount = Rs 10,000/-	-	Y	Y	N
Regular Customer	-	Y	N	-
ACTIONS				
Give 5% discount	X	X	-	-
Give no discount	-	-	X	X

Structured English

Structure English is derived from structured programming language, which gives more understandable and precise description of process. It is based on procedural logic that uses construction and imperative sentences designed to perform operation for action.

- **It is best used when sequences and loops in a program must be considered and the problem needs sequences of actions with decisions.**
- **It does not have strict syntax rule. It expresses all logic in terms of sequential decision structures and iterations.**

For example, see the following sequence of actions −

```
if customer pays advance
  then
    Give 5% Discount
  else
    if purchase amount >=10,000
      then
        if  the customer is a regular customer
          then Give 5% Discount
        else  No Discount
      end if
    else No Discount
  end if
end if
```

Guidelines for Selecting Appropriate Tools

Use the following guidelines for selecting the most appropriate tool that would suit your requirements −

- **Use DFD at high or low level analysis for providing good system documentations.**
- **Use data dictionary to simplify the structure for meeting the data requirement of the system.**
- **Use structured English if there are many loops and actions are complex.**
- **Use decision tables when there are a large number of conditions to check and logic is complex.**
- **Use decision trees when sequencing of conditions is important and if there are few conditions to be tested.**

Feasibility study:

To determine what the candidate system is to do by defining its expected performance. Thus, a feasibility study is carried out to select the best system that meets performance requirements.

Types of Feasibility Study

1. Economic Feasibility

- **It is also known as cost benefit analysis.**
- **To determine the benefits and savings that are expected from a candidate system and compare them with costs.**
- **If Benefits outweigh Costs, then the decision is made to Design and Implement the system.**

2. Technical Feasibility

- **It checks whether the existing computer system supports the candidate system or not or up to what extent it supports.**
- **It centres around Hardware, Software etc.**
- **For e.g. Current Computer is operating at 77 % capacity and running another application can Overload the system so need new system.**

3. Behavioural Feasibility

- **An estimate should be made of how strong a reaction the user staff is likely to have towards the development of a computerized system.**
- **It is common knowledge that computer installation have something to do with Turnover, Transfers and changes in employee Job Status.**
- **For e.g. SBI Bank.**

Steps in Feasibility Analysis

1. **Form a project team and appoint a project leader**
2. **Prepare system flowcharts**
3. **Enumerate potential candidate systems**
4. **Describe and identify characteristics of candidate systems**
5. **Determine and evaluate performance and cost effectiveness of each candidate system**
6. **Weight system performance and cost data**
7. **Select the best candidate system**
8. **Prepare and report final project directive to management**

Input Design

In an information system, input is the raw data that is processed to produce output. During the input design, the developers must consider the input devices such as PC, MICR, OMR, etc.

Therefore, the quality of system input determines the quality of system output. Well-designed input forms and screens have following properties –

- **It should serve specific purpose effectively such as storing, recording, and retrieving the information.**
- **It ensures proper completion with accuracy.**
- **It should be easy to fill and straightforward.**
- **It should focus on user's attention, consistency, and simplicity.**
- **All these objectives are obtained using the knowledge of basic design principles regarding –**
    - **What are the inputs needed for the system?**
    - **How end users respond to different elements of forms and screens.**

Objectives for Input Design

The objectives of input design are –

- **To design data entry and input procedures**
- **To reduce input volume**
- **To design source documents for data capture or devise other data capture methods**
- **To design input data records, data entry screens, user interface screens, etc.**
- **To use validation checks and develop effective input controls.**

Data Input Methods

It is important to design appropriate data input methods to prevent errors while entering data. These methods depend on whether the data is entered by customers in forms manually and later entered by data entry operators, or users directly enter data on the PCs.

A system should prevent user from making mistakes by –

- **Clear form design by leaving enough space for writing legibly.**
- **Clear instructions to fill form.**
- **Clear form design.**
- **Reducing key strokes.**
- **Immediate error feedback.**

Some of the popular data input methods are –

- **Batch input method (Offline data input method)**
- **Online data input method**
- **Computer readable forms**
- **Interactive data input**

Input Integrity Controls

Input integrity controls include a number of methods to eliminate common input errors by end-users. They also include checks on the value of individual fields, for both format and the completeness of all inputs.

Audit trails for data entry and other system operations are created using transaction logs which gives a record of all changes introduced in the database to provide security and means of recovery in case of any failure.

Output Design

The design of output is the most important task of any system. During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts.

Objectives of Output Design

- To develop output design that serves the intended purpose and eliminates the production of unwanted output.
- To develop the output design that meets the end users requirements.
- To deliver the appropriate quantity of output.
- To form the output in appropriate format and direct it to the right person.
- To make the output available on time for making good decisions.

Types of Outputs

1. External Outputs

Manufacturers create and design external outputs for printers. External outputs enable the system to leave the trigger actions on the part of their recipients or confirm actions to their recipients. Some of the external outputs are designed as turnaround outputs, which are implemented as a form and re-enter the system as an input.

2. Internal outputs

Internal outputs are present inside the system, and used by end-users and managers. They support the management in decision making and reporting. There are three types of reports produced by management information −

- Detailed Reports − They contain present information which has almost no filtering or restriction generated to assist management planning and control.
- Summary Reports − They contain trends and potential problems which are categorized and summarized that are generated for managers who do not want details.
- Exception Reports − They contain exceptions, filtered data to some condition or standard before presenting it to the manager, as information.

Output Integrity Controls

Output integrity controls include routing codes to identify the receiving system, and verification messages to confirm successful receipt of messages that are handled by network protocol. Printed or screen-format reports should include a date/time for report printing and the data. Multipage reports contain report title or description, and pagination. Pre-printed forms usually include a version number and effective date.

Forms Design

Both forms and reports are the product of input and output design and are business documents consisting of specified data. The main difference is that the forms provide fields for data input but reports are used only for reading. For example, order forms, employment and credit application, etc.

During form design, automated design tools enhance the developer's ability to prototype forms and reports and present them to end users for evaluation. During form designing, the designers should know –

- **who will use them**
- **where would they be delivered**
- **the purpose of the form or report**

Objectives of Good Form Design

A good form design is necessary to ensure the following –

- **To keep the screen simple by giving proper sequence, information, and clear captions.**
- **To meet the intended purpose by using appropriate forms.**
- **To ensure the completion of form with accuracy.**
- **To keep the forms attractive by using icons, inverse video, or blinking cursors etc.**
- **To facilitate navigation.**

Types of Forms

1. **Flat Forms**
   - **It is a single copy form prepared manually or by a machine and printed on a paper. For additional copies of the original, carbon papers are inserted between copies.**
   - **It is a simple and inexpensive form to design, print, and reproduce, which uses less volume.**
2. **Unit Set/Snap out Forms**
   - **These are papers with one-time carbons interleaved into unit sets for either handwritten or machine use.**
   - **Carbons may be either blue or black, standard grade medium intensity. Generally, blue carbons are best for handwritten forms while black carbons are best for machine use.**
3. **Continuous strip/Fanfold Forms**
   - **These are multiple unit forms joined in a continuous strip with perforations between each pair of forms.**
   - **It is a less expensive method for large volume use.**

4. No Carbon Required (NCR) Paper
    - They use carbonless papers, which have two chemical coatings (capsules), one on the face and the other on the back of a sheet of paper.
    - When pressure is applied, the two capsules interact and create an image.

Documentation

Project Documentation

The purpose of project documentation describes the project as a whole. The project documentation gives executives, managers and employees a broad view of the project's proposed methods, resources and objectives. The project proposal documents show executives the goals and budget of the project. The technical specifications outline the hardware and software requirements for the projects. The project plan details the steps the programmers, technicians and designers will take to achieve the project's objectives.

Test Documentation

Test documents illustrate the plans for testing the product before its release. The quality assurance department develops testing plans for both internal "alpha" users and external "beta" testers. The test documentation includes testing instructions -- such as a specific set of steps testers must follow -- to determine if the product is functioning as planned. QA staffers also collect issue logs, bug lists and reports from testers.

Team Documentation

The exchange of ideas among team members is vital to the success of a project. Team documentation records these exchanges for use on the current project and on future projects. Team plans, schedules and status updates are major components of team documentation. Checklists help project managers' view, which tasks the team, has completed. The minutes of team meetings allow managers to track various issues, suggestions and assignments among team members.

User Documentation

The most critical element of system documentation is the content that reaches the customer. The user documentation must be free from overly technical jargon and contain clear, concise language. The user manual is typically the main component of the user documentation, but users also rely on other sources. Training resources -- including manuals and videos -- can help users quickly and easily understand how the system works. When the system does not perform as expected, a troubleshooting guide can help the user find and solve the problem.

Disaster Management Planning

No one is exempt from a disaster, and most organizations are unprepared if a disaster erupts, unless your company has prepared a Disaster Plan that accounts for any disaster that will exceed your ability to respond effectively: a worst-case scenario.

Disasters result from three types of incidents, caused by:

- **Natural or cataclysmic events (i.e., hurricane, earthquake, fire, flood, storm)**
- **Human behaviour (i.e., robbery, bomb threat, arson, hostage event, transportation strike)**
- **Technological breakdowns (i.e., power outage, computer crash, computer virus).**

Planning Your Disaster Plan

The key to disaster management is to have a disaster plan in place before disaster strikes. Your disaster plan should include set of simple, effective disaster recovery guidelines and disaster procedures for all people to follow. Just as a ship without a rudder is at the mercy of the tides, a company without a disaster plan is at the mercy of potentially tragic events. After a review of disaster responses following various disasters, U.S. regulators are now urging firms to improve business continuity and disaster recovery plans.

Human beings tend to make inappropriate decisions during a crisis. Therefore, if your company has a plan already prepared for coping with most emergencies and you have shared the plan with your employees, then you stand a better chance of surviving an emergency and recovering rapidly.

Disaster Management Preventive Action

Your disaster management planning process should include preventative actions designed to accomplish a common goal — to prevent you from becoming a victim of a violent act, or at least to reduce the likelihood of serious injury. Your Disaster Recovery Plan is a strategic planning, training and reference tool for helping you to decide what to do before, during and after a violent event. Tactics that work for one person may not work for another. The choices — and your success or failures — are all yours. You can, after all, do everything right and still lose, and everything wrong and still win.

You have more work to do if you are truly committed to developing a safe working environment for your company, including:

- **Conducting a survey of your employees to help you determine if, in fact, you even have a potential problem. Your insurance company's risk management department may provide the survey form — or even conduct the survey for you.**
- **Contacting your local, state and federal emergency and crisis management agencies, insurance providers and other community resources for more information. The agencies, providers and other service groups often offer literature, signage, training programs and counselling referrals that you can adapt to your workplace.**
- **Using a computer online service to locate and contact other resources, such as articles in periodicals, online focus groups and other similar companies that have experienced the same events that you are trying to prevent. You can benefit from other peoples' mistakes.**