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CSE3209 - Lecture 01

Introduction to Systems Analysis and Design

What are system analysis and design?

System analysis and design deal with planning the development of information systems through understanding and specifying in detail what a system should do and how the components of the system should be implemented and work together.

Systems Analysis: understanding and specifying in detail what an information system should do.

System Design: specifying in detail how the parts of an information system should be implemented.

The three main things system analysis and design focus on.

Systems: complete knowledge required for the makeup of the system which in turn requires knowledge about the functioning of an organization for which the system is being designed

Processes:

Technology: Thus, a system is a way of thinking about an organization and their problems which involves techniques that helps in solving those problems.

Characteristics of a system

1. Organization: structure and order
   Example: Hierarchical organization in a company.
   Computer system: organization of various components like input devices, output devices, CPU and storage devices
2. Interaction: Between sub systems or the components
   Example: the main memory holds the data that has to be operated by the ALU.
3. Interdependence: Component linkage, Component dependence.
4. Integration: How subsystems are tied together to achieve the system objective.
5. Central Objective: Should be known in early phases of analysis.

Elements of a system.

A system is a set of components working together to achieve some goal. The basic elements of the system may be listed as:

1. Resources: h/w, s/w and liveware (human), Example: Banking system- computers, trained staff.

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2. Procedures: Set of rules to accomplish the goal of the system. Example: Banking systems have their predefined rules for providing interest at different rates for different types of accounts.

3. Data/Information: inputs/outputs.

4. Intermediate Data: Intermediate transformation of data before final output, Output depends on it

5. Processes: Operational elements to convert i/p into o/p. Example: the processing of a cheque as a process.

6. Environment: System should adapt to the environment.

7. Feed Back: Compares the output against a performance standard.

8. Boundaries and Interfaces: Every system has defined boundaries within which it operates. Beyond these limits the system has to interact with the other systems.

Types of systems

1. Physical or Abstract Systems: Physical systems are tangible entities that may be static or dynamic in operation. Abstract systems are not physical entities. They may be formulas, representation or model of a real system.

2. Open or Closed Systems: An open system continually interacts with its environments. It receives inputs from and delivers output to the outside. A closed system is isolated from environmental influences.

3. Deterministic or Probabilistic Systems: A deterministic system is one in which the occurrence of all events is perfectly predictable.

4. Man-made Information Systems: It is generally believed that information reduces uncertainty about a state or event. Main purpose of Man-made Information Systems is managing data for a particular organization.

Further Categorized as:

- **i.** Formal Information Systems: Responsible for flow of information from top management to lower management.
- **ii.** Informal Information Systems: Informal systems are employee based. These are made to solve the day to day work related problems.
- **iii.** Computer-Based Information Systems: This class of systems depends on the use of computer for managing business applications.

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Management information system

→ 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.

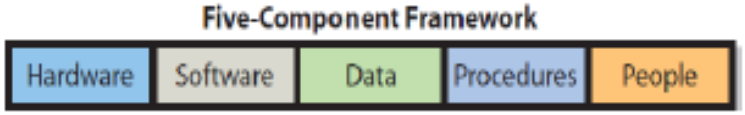
The three sub-components:

i. System emphasizing a fair degree of integration and a holistic view.

ii. Information stressing on processed data in the context in which it is used by end users.

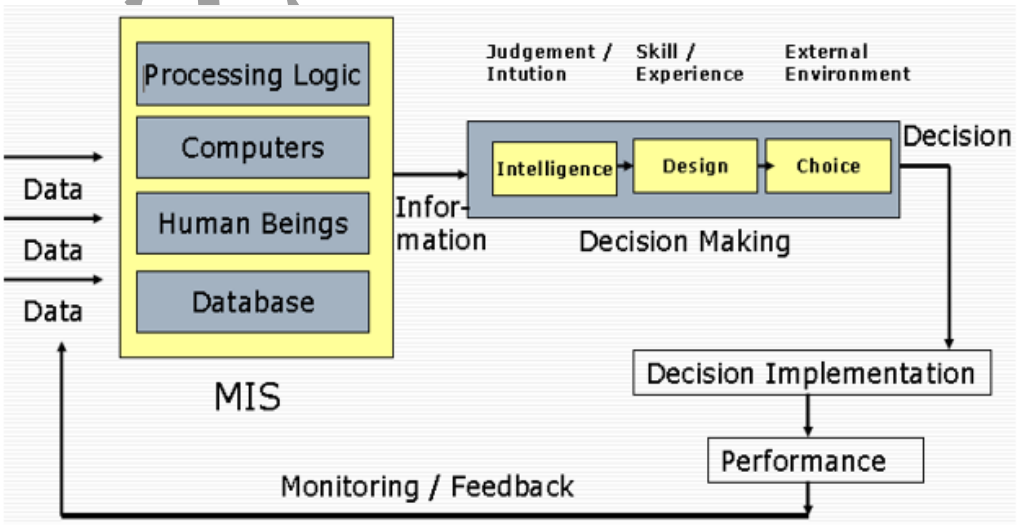
iii. Management focusing on the ultimate use of such information systems for managerial decision making.

The five components:



- Hardware—desktops, laptops, PDAs
- Software—operating systems, application programs
- Data—facts and figures entered into computers
- Procedures—how the other four components are used
- People—users, technologists, IS support

The concept of MIS:



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Types of decision support system

Using the relationship with the user as the criterion

1. A passive DSS is a system that aids the process of decision making, but that cannot bring out explicit decision suggestions or solutions.
2. An active DSS can bring out such decision suggestions or solutions.
3. A cooperative DSS allows the decision maker (or its advisor) to modify, complete, or refine the decision suggestions provided by the system, before sending them back to the system for validation.

Common components of an automated system.

1. Computer hardware: CPUs, disks, terminals, and so on.
2. Computer software: system programs such as operating systems, database systems, and so on.
3. People: those who operate the system, those who provide its inputs and consume its outputs, and those who provide manual processing activities in a system.
4. Data: the information that the system remembers over a period of time.
5. Procedures: formal policies and instructions for operating the system.

Advantages of Distributed Systems

1. Economics: cost effective way to increase computing power.
2. Speed: a distributed system may have more total computing power than a mainframe.
3. Reliability: If one machine crashes, the system as a whole can still survive. Higher availability and improved reliability.
4. Incremental growth: Computing power can be added in small increments. Modular expandability.
5. Data sharing: allow many users to access to a common data base
6. Resource Sharing: expensive peripherals like color printers
7. Communication: enhance human-to-human communication, e.g., email, chat
8. Flexibility: spread the workload over the available machines.

Disadvantages of Distributed Systems

1. Software: difficult to develop software for distributed systems.
2. Network: saturation, lossy transmissions.
3. Security: easy access also applies to secrete data.

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Lecture 02

The System Development Life Cycle

→ It is the study of System.

→ A candidate system is approached after the analyst has a thorough understanding of user needs and problems.

→ A candidate system has a life cycle, just like a living system or new product.

→ Consists of several stages.

→ The analyst must progress from one stage to another methodically, answering key questions and achieving results in each stage.

→ In real life, these stages overlap and are highly interrelated.

Recognition of Need - What is the Problem

Basis for a candidate system is recognition of a need for improving an information system or a procedure.

Impetus for System Change

→ The idea for change originates in the environment or from within the firm.

→ Environment-based ideas originate from customers, vendors, government sources and the like.

→ May also come from within the organization-top management, the user, the analyst.

→ User-originated ideas also prompt initial investigations.

→ To what extent and how quickly a user-oriented idea is converted to a feasibility study depend on several factors

Feasibility Study

→ Depending on the results of the initial investigations, survey is expanded to a more detailed feasibility study

→ It 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 questions:

1. What are the user's demonstrable needs and how does a candidate system meet them ?
2. What resources are available for given candidate systems? Is the problem worth solving ?
3. What are the likely impact of the candidate system on the organization? How well does it fit within the organization's master MIS plan ?
4. Result of the feasibility study is a formal proposal- a formal document detailing the nature and scope of the proposed solution.

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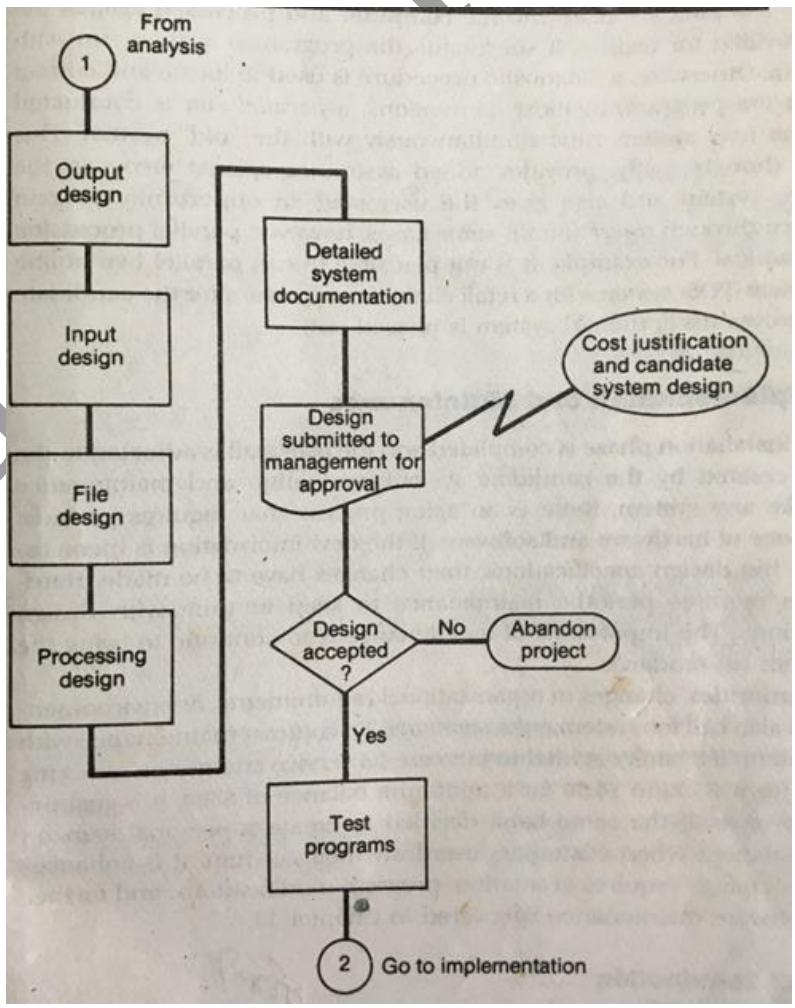
Proposal consists of the following

→ Statement of the problem
→ Summary of findings and recommendations
→ Details of findings
→ Recommendations and conclusions

Analysis

→ Detailed study of the various operations performed by a system and their relationships within and outside of the system
→ Key question- What must be done to solve the problem?
→ One aspect-defining the boundaries of the system and determining whether or not a a candidate system should consider other related systems.
→ Some logical system models and tools are used in analysis
→ Data flow diagrams, interviews, on-site observations and questionnaires are used
→ Bias in data collection and interpretation can be a problem

Steps in System Design



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Design

→ Design describes a final system the process by which it is developed

→ Refers to the technical specifications that will be applied in implementing the candidate system

→ Includes the construction of programs and program testing

→ Key question: How should the problem be solved?

→ First step: How the output is to be produced and in what format?

→ Second: Input data and master files (data base) have to be designed to meet the requirements of the proposed output

→ The operational (processing) phases are handled through program construction and testing

→ Finally, details relating to justification of the system and an estimate of the impact of the candidate system on the user and the organization are documented and evaluated by management.

Implementation

→ Primarily concerned with user training, site preparation and file conversion.

→ During the final testing, user acceptance is tested, followed by user training.

→ System testing checks the readiness and accuracy of the system to access, update and retrieve data from new files.

Post-Implementation and maintenance

→ After installation phase completed and user staff adjusted to change, evaluation and maintenance begin.

→ Due to aging process, periodic maintenance of hardware and software is required.

→ User priorities, changes in the organizational requirements or environmental factors also call for system enhancement.

Project Termination

→ May be dropped at any time prior to implementation.

→ Changing objectives or requirements of the user cannot be met by the existing design.

→ Benefits realized from the candidate system do not justify commitment to implementation.

→ There is a sudden change in the user's budget or an increase in design costs beyond the estimate made during the feasibility study.

→ The project greatly exceeds the time and cost schedule.

→ The user was not involved in the crucial phases or system development.

→ The analyst, programmer, or both inexperienced.

→ The systems analyst (or the project team) had to do the work -under stringent time constraints. Consequently, not enough thought went into the feasibility' study and system design.

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→ User training was poor.

→ Existing hardware proved deficient to handle the new application.

→ The new system left users in other departments out of touch with information that the old system had provided.

→ The new system was not user-friendly.

→ Users changed their requirements.

→ The user staff was hostile.

In each case, a system project may be terminated at the user's request.

CONSIDERATIONS FOR CANDIDATE SYSTEMS

In today's business, there is more demand for computer services than there are resources available to meet the demand. The demand is made up of the following:

1. Operations of existing systems.

2. Maintenance that focuses on "patching" programs-often representing over 50 percent of maintenance.

3. Enhancements that involve major modifications in program structure or equipment.

4. Requests for candidate systems.

All these demands require resources-human, financial, and technological. On the human side, the computer department has to provide the following:

- Computer operators to run equipment.
- Data entry personnel.
- Systems analysts to define and design specifications.
- Application programmers to convert system specifications to computer programs.
- Maintenance programmers to repair errors.
- Supervisors, project leaders, and managers to coordinate the jobs with the users.

Considerations for Candidate systems

- Basic problem is to match the demands for services with the available resources.
- One project is favored over another depending on technical, behavioral and economic factors.
- Technical factor involves system department’s ability to handle a project.
- Alternative to abandoning is to free-lancing to an outside consulting firm.
- Behavioral factor involves users past experience with an existing system, success record of the analyst and the influence the user can exert on upper management to finance a candidate system.
- Most important criterion in selecting a project is the economic factor which focuses on the system’s potential return on investment.

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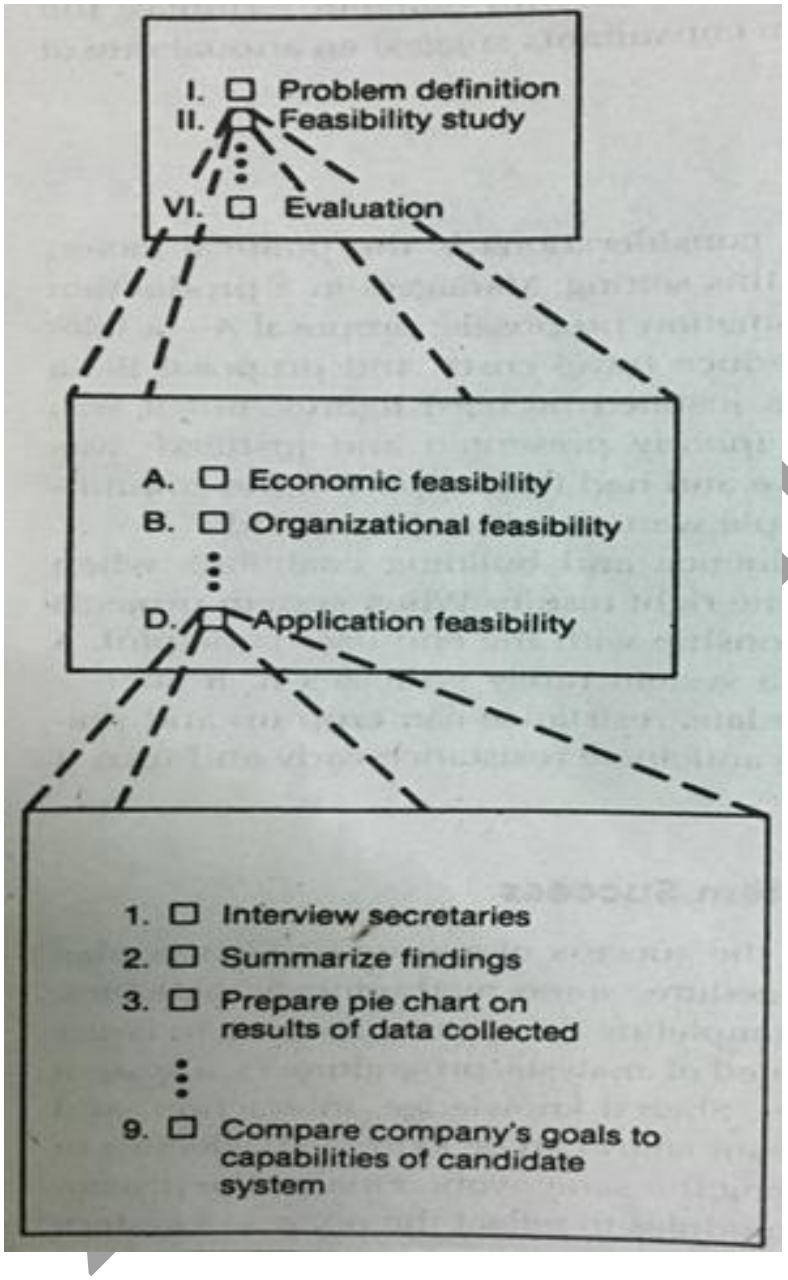
Phases, Activities and Tasks of a System Project



Political consideration

→ It is partly behavioral

→ Right people should be convinced

→ Art of using influence and building coalitions when routine procedure do not achieve right results

→ Collaborative relationship with the end user is helpful

→ A user who participated in building a system rarely criticizes it

→ If participative relationship comes too late, resistance can crop up and politics comes into play

→ Trick is to anticipate resistance early and turn it into support.

Planning and Control for System Success

→ To ensure success, the analyst can do

→ First, plan must be devised, detailing the procedure, some methodology, activities, resources, cost and timetable for completing the system

→ Second, 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

→ Main idea behind SDLC is to formalize a means of establishing control over a complex process

→ Work units have to be structured at three major levels for effective control of the project.

→ A task is usually a well-defined structured work unit that can be carried out by one individual

→ The second level of work unit involves activities that have a larger scope and are designed to produce substantial results.

→ Ac activity is a group of logically related tasks that serve one phase of the SDLC

→ A phase, a third level of control, is a set of activities that bring the projects to a critical milestone. Milestones are steppingstones that make up the entire project.

Prototyping

→ Two major problems with building information systems

→ The SDLC takes too long and the right system is rarely developed the first time

→ Lengthy development frustrates the user

→ Analysts seem to get bogged down with tedious methodologies

→ Alternative to this "paralysis by analysis" is *prototyping*

→ Prototyping recognizes problems of cognitive style and uses advanced computer technology

Basic steps of prototyping

→ Identify user's information and operating requirements

→ Develop a working prototype that focuses on only the most important functions, using a basic database

→ Allow the user to use the prototype, discuss requested changes and implement the most important changes

→ Repeat the next version of the prototype with further changes incorporated until the system fully meets user requirements

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Lecture 03

THE ROLE OF THE SYSTEMS ANALYST

Definition

→ "A person who conducts a methodical study and evaluation of an activity such as a business to identify its desired objectives in order to determine procedures by which these objectives can be gained."- Random House Dictionary.

→ "The task of the systems analyst is to elicit needs and resource constraints and to translate these into a viable operation." – Nicholas

Historical Perspective

Taylor's approach: four key steps in scientific management-

→ Develop an ideal method of doing a task and establish a standard for it. In turn, the worker should be paid an incentive for exceeding the standard.

→ Select the best person for the job and train him/her accordingly.

→ Incorporate the scientific method with well-trained people.

→ Establish cooperation between manager and worker based on the division of labor.

Problems of Taylorism

→ It was basically psychological and ignored behavior.

→ Applied to lower-level, repetitive tasks and said nothing about decision making in organizations.

→ Assumed that money is a primary motivator and that humans always act rationally.

→ Suggested that people are lazy. They do not want to work, so close supervision is required

Required skills for a systems analyst

Interpersonal skills:

→ Communication-having the ability to articulate and speak the language of the user.

→ Understanding-identifying problems and assessing their ramifications having a grasp of company goals and objectives and showing sensitivity to the impact of the system on people at work.

Required skills for a systems analyst

→ Teaching-educating people in use of computer systems, selling the system to the user and giving support when needed.

→ Selling-selling ideas and promoting innovations in problem solving using computers technical skills.

→ Creativity-helping users model ideas into concrete plans and developing candidate systems to match user requirements.

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→ Problem solving-reducing problems to their elemental levels for analysis, developing alternative solutions to a given problem.

→ Project management-scheduling, performing well under time constraints, coordinating team efforts and managing costs and expenditures.

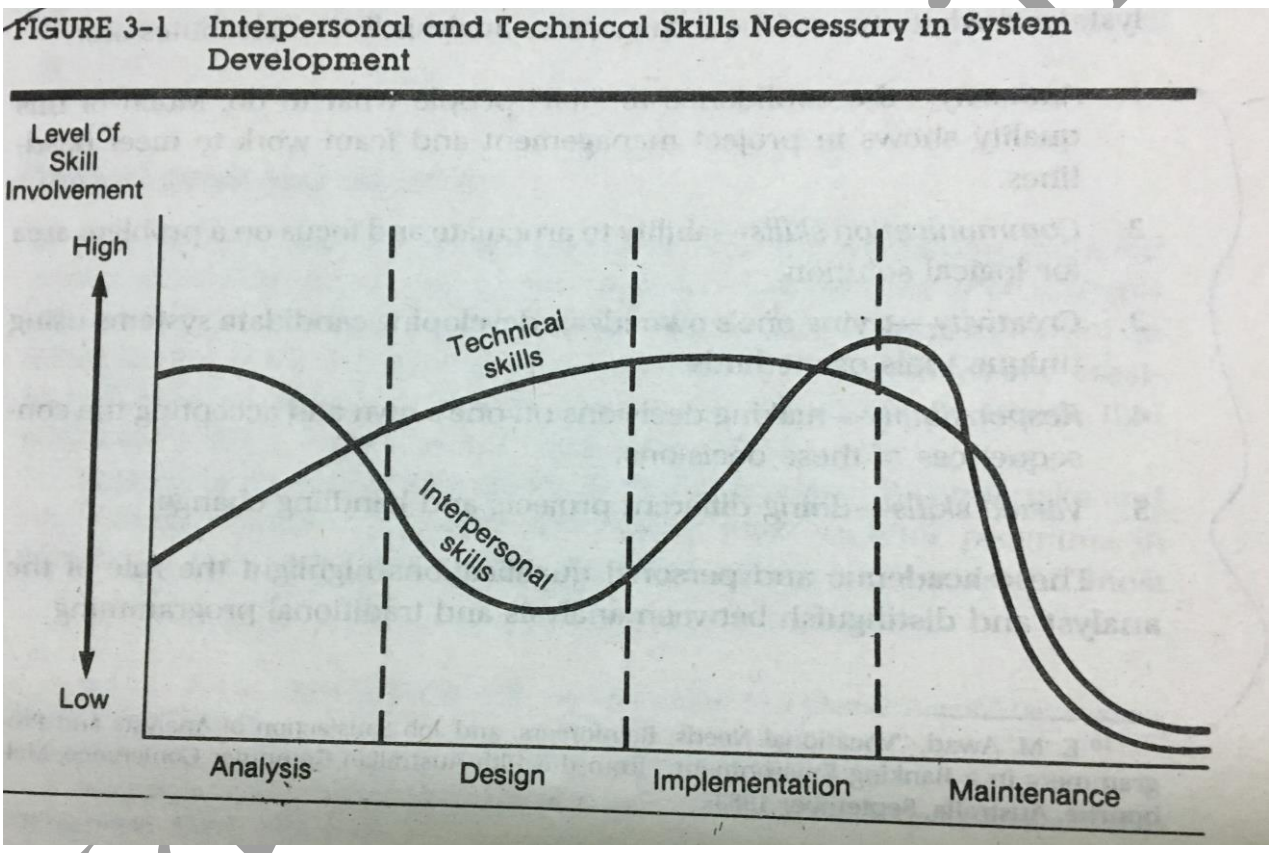
→ Dynamic interface-blending technical and nontechnical considerations in functional specifications and general design.

Required skills for a systems analyst

→ Questioning attitude and inquiring mind-knowing the what, when, why, where, who and how a system works.

→ Knowledge of the basics of the computer and the business function.

FIGURE 3-1 Interpersonal and Technical Skills Necessary in System Development



Academic and Personal Qualifications

The background and experience of analysts include:

1. A background in systems theory and organization behavior.
2. Familiarity with the makeup and inner workings of major application areas such as financial accounting, personnel administration, marketing and sales, operations management, model building, and production control.
3. 3. Competence in system tools and methodologies and a practical knowledge of one or more programming and data base languages.
4. Experience in hardware and software specifications, which is important for selection.

Awad conducted a study to determine the personal attributes of analysts and what attracts them to systems analysis. The attributes are:

1. Authority- the confidence to "tell" people what to do. Much of this quality shows in project management and team work to meet deadlines.
2. Communication skills- ability to auriculate and focus on a problem area for logical solution.
3. Creativity- trying one's own ideas, developing candidate systems using unique tools or methods.
4. Responsibility- making decisions on one's own and accepting the con sequences of these decisions.
5. Varied skills- doing different projects and handling change.

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Lecture 04

SYSTEMS PLANNING AND THE INITIAL INVESTIGATION

MIS Master Plan

→ Identifying the need for a new information system and launching an investigation and feasibility study must be based on an MIS master plan that has management support

→ Proper planning for information systems ensure that the role played by the system will be congruent with that of the organization.

Strategic MIS Planning

Planning for information system development must be done within the framework of the organization's overall MIS plan. It may be viewed from two dimensions:

i. The time horizon dimension specifies whether it is short range, medium term or long range.

ii. The focus dimension tells whether the primary concern is strategic, managerial or operational.

Managerial and Operational MIS planning

→ System development must support organizational MIS objectives as laid out in the corporate plan and identify and select applications that are the organization's priorities

→ Three-stage model

→ Strategic system planning-establishing relationship between the organization and the plan for a candidate system

→ Information requirements analysis- identifying organization requirements to direct the specific application of system development projects

→ Resource allocation- determining hardware, software, telecommunication, facilities and financial resources to execute the development of the system

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Initial investigation

Determine whether the request for change is valid and feasible before a recommendation is reached to do nothing, improve or modify the existing system or build a new one. User's request form may contain:

→ User-assigned title of work requested
→ Nature of work requested (problem definition)
→ Date request was submitted
→ Date job should be completed
→ Job objective(s)-purpose of job requested
→ Expected benefits to be derived from proposed change
→ Input/output description
→ Requester's signature, title, department and phone number
→ Signature, title, department and phone number of person approving the request

About Initial investigation

- ❖ User request identifies the need for change and authorizes the initial investigation
- ❖ It may undergo several modifications before it becomes a written commitment
- ❖ Once the request is approved: background investigation, fact-finding and analysis and presentation of results-called project proposal
- ❖ Approved proposal initiates a detailed user-oriented specification of system performance and analysis of the feasibility of the candidate system
- ❖ A feasibility study focuses on identifying and evaluating alternative candidate systems with a recommendation of the best system for the job

Need Identification

→ Success of a system depends largely on how accurately a problem is defined, thoroughly investigated and properly carried out through the choices of solution.
→ User need identification and analysis are concerned with what the user needs rather than what he/she wants.
→ Not until the problem has been identified, defined and evaluated should the analyst think about solutions and whether the problem is worth solving.

Determining the User's Information Requirements

→ It is one of the most difficult tasks in system development
→ Several reasons why it is difficult to determine:
→ System requirements change and user requirements must be modified to account for these changes
→ The articulation of requirements is difficult, except for experienced users. Functions and processes are not easily described
→ Heavy user involvement and motivation are difficult
→ Pattern of interaction between users and analysis in designing information requirements is complex.

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User's Strategy

→ In the kitchen sink strategy, user throws everything into the requirement definition-overstatement of the needs. This approach usually reflects the user's lack of experience in the area

→ The smoking strategy sets up a smoke screen by requesting several system features when only one or two are needed. This strategy usually reflects the user's experience in knowing what he/she wants.

→ The same thing strategy indicates the user's laziness, lack of knowledge or both. "Give me the same thing, but in a better format through the computer" is a typical statement

Human's limitation specifying information requirements

→ Humans as information processors

→ Humans are generally biased in their selection and use of data

→ Human problem solving behavior

Strategies for Determining Information Requirements

→ Asking - Information is obtained

→ Questions - may be open ended or closed

→ Brainstorming - technique used for generating new ideas and obtaining general information requirements

→ Group consensus - asks participants for their expectations regarding specific variables. Each participant fills out a questionnaire. Results are summarized and given to participants with a follow up questionnaire by asking about the requirements.

→ Prototyping - used when the user cannot establish information needs accurately before the information system is built

→ Reason - lack of an existing model on which to base requirements or a difficulty in visualizing candidate system

Getting information from the existing information system

→ also called data analysis approach.

→ Simply asks the user what information is currently received and what other information is required

→ Analyst examines all reports, discusses with the user each piece of information examined and determines unfulfilled information needs by interviewing the user

→ Major drawback - lack of established rules for obtaining and validating information needs that are not linked to organizational objectives.

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