Unit 4. Systems Analysis **8 Hrs.**

Systems Planning and Initial Investigation

The primary purpose of systems planning is to identify problem's nature and its scope. It also includes preliminary (or initial) investigation and feasibility study. Initial investigation is used to understand the problem, define the project scope and constraints, identify the benefits, estimate the time and costs, and interact with managers and users. Feasibility study is used to determine some feasibility (economic, operational, technical feasibility etc) of the system.

The purpose of this phase is twofold. First, it answers the question, "Is this project worth looking at?" Second, assuming that the problem is worth looking at, it establishes the size and boundaries of the project, the project vision, any constraints or limitations, the required project participants, and the budget and schedule.

Information Gathering Techniques

To develop an information system, we first must be able to correctly identify, analyze, and understand what the users' requirements are or what the user wants the system to do. To know users' requirements, we use information gathering techniques. Information gathering techniques are also called **requirements discovery techniques** or **fact finding techniques** or **data collection techniques**. Information gathering includes those techniques to be used by system analysts to identify or extract system problems and solution requirements from the user community. Systems analysts need an organized method for information gathering. Some information gathering techniques are discussed below:

Sampling of Existing Documentation, Forms, and Files

When we are studying an existing system, we can develop a good feel for the system by studying existing documentation, forms, and files. A good analyst always gets facts from the existing documentation rather than from people.

Because it would be impractical to study every occurrence of every form or record in a file or database, system analysts normally use sampling techniques to determine what can happen in the system.

Sampling is the process of collecting a representative sample of documents, forms, and records. The most commonly used sampling techniques are **randomization** and **stratification**.

Randomization is a sampling technique in which there is no predetermined pattern or plan for selecting sample data.

Stratification is a systematic sampling technique that attempts to reduce the variance of the estimates by spreading out the sampling.

Research and Site Visits

In this technique, we perform site visits at systems they know have experienced similar problems. If these systems are willing to share, valuable information can be obtained that may save tremendous time and cost in the development process.

Computer trade journals and reference books are also a good source of information. They can provide us with information how others have solved similar problems. Also, through the Internet we can collect immeasurable amounts of information.

Observation of the Work Environment

Observation is an effective data-collection technique for obtaining an understanding of a

system. In this technique, the systems analyst either participates in or watches a person performing activities to learn about the system.

Advantages:

- → Data gathered can be highly reliable. Sometimes observations can be conducted to check the validity of data obtained directly from individuals.
- → The systems analyst is able to see exactly what is being done.
- → It is relatively inexpensive compared to other fact-finding techniques, because other techniques usually require more employees.
- → It allows the system analyst to do work measurement.

Disadvantages:

- → People usually feel uncomfortable when being watched to their work.
- → Some system activities may take place at odd times, causing a scheduling inconvenience for the system analyst.
- → It may cause interruption.
- → Some tasks may not always be performed by observation.

Questionnaires

This technique is used to conduct surveys through questionnaires. **Questionnaires** are special purpose documents that allow the analyst to collect information and opinions from the respondents. The document can be mass-produced and distributed to respondents, who can then complete the questionnaire on their own time. Questionnaires allow the analyst to collect facts from a large number of people.

Types of Questionnaires

There are two formats of questionnaire, **free-format** and **fixed-format**. Free-format questionnaire offer the respondent to record the answer in the space provided after the questionnaire.

Fixed-format questionnaire contain questions that require selection of predefined responses. In this format, the respondent must choose from the available answer. There are three types of fixed-format questions:

- → **Multiple Choice Questions: -** The respondent is given several answers of a question. The respondent should be told if more than one answer can be selected.
- → **Rating Questions: -** The respondent is given a statement and asked to use supplied responses to state an opinion.
- → **Ranking questions: -** The respondent is given several possible answers, which are to be ranked in the order of preference or experience.

Advantages

- → Most questionnaires can be answered quickly.
- → Inexpensive for gathering data from a large number of individuals.
- → Responses can be tabulated and analyzed quickly.

Disadvantages

- → There is no guarantee that an individual will answer or expand on all the questions.
- → Questionnaires tend to be inflexible.
- → It not possible for the systems analyst to observe and analyze the respondent's body language.
- → There is no immediate opportunity to clarify a vague or incomplete answer to questions.
- → Good questionnaires are difficult to prepare.
- → The number of respondents is often low.

Interviews

The personal **interview** is generally recognized as the most often used fact-finding technique. Interviews are the fact-finding techniques whereby the systems analysts collect information from individuals through face-to-face interaction.

There are two roles assumed in an interview. The systems analyst is the **interviewer**, responsible for organizing and conducting the interview. The system user or system owner is the **interviewee**, who is asked to respond to a series of questions.

Types of Interviews

There are two types of interviews: **unstructured** and **structured**. Unstructured interviews are conducted with only a general goal or subject in mind and with few, if any, specific questions. Structured interviews on the other hand are conducted with a set of specific questions to ask the interviewee.

Types of Questions

There are two types of questions in interview: **open-ended** and **closed-ended**. Open-ended questions allow the interviewee to respond in any way that seems appropriate. But, closed-ended questions restrict answers to either specific choices or short, direct responses.

Advantages

- → Interviews give the analyst an opportunity to motivate the interviewee to respond freely and openly to questions.
- → Interviews allow more feedback from the interviewee.
- → Interviews give the analyst an opportunity to observe the interviewee's nonverbal communication.

Disadvantages

- → Interviewing is a very time-consuming and therefore costly fact-finding approach.
- → Success of interviews is highly dependent on the systems analyst's human relational skills.
- → Interviewing may be impractical due to the location of interviewees.

Discovery Prototyping

Discovery prototyping is the act of building a small-scale, representative or working model of the users' requirements to discover or verify the requirements.

Usually only the areas where the requirements are not clearly understood are prototyped. Creating discovery prototypes enables the developers as well as the users to better understand and refine the requirements involved with developing the system.

Advantages

- → Allows users and developers to experiment with the software and develop an understanding of how the system might work.
- → Aids in determining the feasibility and usefulness of the system before high development costs are incurred.
- → Serves as a training mechanism for users.
- → Aids in building system test plans and scenarios to be used last in the system testing process.
- → May minimize the time spent for fact-finding and help to define more stable and reliable requirements.

Disadvantages

- → Users and developers may need to be trained in the prototyping approach.
- → Doing prototyping may extend the development schedule and increase the development costs
- → Users may develop unrealistic expectations.

Joint Requirements Planning (JRP)

It is a process whereby highly structured group meeting is conducted to analyze problems and define requirements. JRP is a subset of a more comprehensive ***joint application development (JAD)***. The JRP participants are:

- → **Sponsor: -** This person is normally an individual who is in top management and has authority that spans the different departments and users who are to be involved in the systems project.
- → **Facilitator: -** The JRP facilitator or leader is usually responsible for leading all sessions that are held for a systems project.
- → **Users and Managers: -** Users devote themselves to the JRP sessions to effectively communicate business rules and requirements, review design prototypes and make acceptance decisions. Managers approve project objectives, establish project priorities, approve schedules and costs, and approve identified training needs and implementation plans.
- → **Scribe(s): -** Scribes are responsible for keeping records pertaining to everything discussed in the meeting.
- → **IT Staff: -** IT personnel listen and take notes regarding issues and requirements voiced by the users and managers. Normally, IT personnel do not speak unless invited to do so.

Benefits

- → It actively involves users and managers in the development project.
- → It reduces the amount of time required to develop systems.
- → When JRP incorporates prototyping as a means for conforming requirements and obtaining design approvals, the benefits of prototyping are realized.

Structured Analysis Tools

Structured analysis includes different tools like DFD (data flow diagram), ERD (entity relationship diagram), data dictionary, structured English, decision table, and decision tree.

Feasibility Study

Feasibility is the measure of how beneficial or practical the development of information system will be to an organization. **Feasibility study** is the process by which feasibility is measured. Feasibility analysis is appropriate to the systems analysis phase.

Four Tests for Feasibility

During systems analysis phase, the system analyst identifies different alternate solutions and analyzes those solutions for feasibility. To analyze different alternative solutions, most analysts use four categories of feasibility tests:

- Operational feasibility
- Technical feasibility
- Schedule feasibility and
- Economic feasibility

1. **Operational Feasibility:** It is a measure of how well the solution will work in an organization. It is also a measure of how people feel about the system/project. So, this feasibility is people oriented. Operational feasibility addresses two major issues:
    a. *Is the problem worth solving, or will the solution to the problem work?*

b. *How do end users and management feel about the problem (solution)?*

When determining operational feasibility, *usability analysis* is often performed with a working prototype of the proposed system. **Usability analysis** is a test of system's user interfaces and is measured in how easy they are to learn and to use and how they support the desired productivity levels of the users. Usability is measured in terms of *ease of learning*, *ease of use*, and *satisfaction*.

2. **Technical Feasibility:** It is a measure of practically of a specific technical solution and availability of technical resources and expertise. Technical feasibility is computer oriented. This feasibility addresses three major issues:
   a. *Is the proposed technology or solution practical?*
   b. *Do we currently possess the necessary technology?*
   c. *Do we possess the necessary technical expertise, and is the schedule reasonable?*
3. **Schedule Feasibility:** It is a measure of how reasonable the project timetable is. Schedule feasibility is the determination of whether the time allocated for a project seems accurate. Projects are initiated with specific deadlines. It is necessary to determine whether the deadlines are mandatory or desirable. If the deadlines are desirable rather than mandatory, the analyst can propose alternative schedules.
4. **Economic Feasibility:** It is the measure of the cost-effectiveness of a project or solution. This feasibility deals with costs and benefits of the information system. The bottom-line in many projects is economic feasibility. During the early phases of the project, economic feasibility analysis amounts to little more than judging whether the possible benefits of solving the problem are worthwhile. However, as soon as specific requirements and alternative solutions have been identified, the analyst can determine the costs and benefits of each alternative.

Some other feasibility tests are also possible. These are *legal and contractual feasibility* and *political feasibility*. **Legal and contractual feasibility** is the process of assessing potential legal and contractual ramifications due to the construction of a system. **Political feasibility** is the process of evaluating how key stakeholders within the organization view the proposed system.

Cost-Benefit Analysis Techniques

Economic feasibility has been defined as a cost-benefit analysis. Most schools offer coerces like *financial management*, *financial decision analysis*, and *engineering economics and analysis* for cost benefit analysis. The cost benefit analysis techniques include:

- *How much will the system costs?*
- *What benefits will the system provide?*
- *Is the proposed system cost-effective?*

How much will the system costs?

Costs fall into two categories: *costs associated with developing the system* and *costs associated with operating the system*. The former costs can be estimated from the start of the project and should be refined at the end of each phase of the project. The later can be estimated only after specific computer-based solution has been defined.

System development costs are usually onetime costs that will not recur after the project has been completed. Many organizations have standard cost categories that must be evaluated. In the absence of such categories, we use the following list:

- **Personnel cost –** The salaries of systems analysts, programmers, consultants, data entry personnel, computer operators, secretaries, and the like who work on the

project.

- **Computer usage –** The cost in the use of computer resources.
- **Training –** Expenses for the training of computer personnel or end-users.
- **Supply, duplication, and equipment costs**.
- **Cost of any new computer equipment and software**.

The operating costs tend to recur throughout the lifetime of the system. The costs in this case can be classified as *fixed* or *variable*.

- **Fixed costs –** Fixed costs occur at regular intervals but at relatively fixed rates. Some examples include: lease payments and software license payments, salaries of IS operators and support personnel etc.
- **Variable costs –** Variable costs occur in proportion to some usage factor. Some examples include: costs of computer usage (e.g., CPU time used, storage used), supplies (e.g., printer paper, floppy disks), overhead costs (e.g., utilities, maintenance, and telephone service) etc.

What benefits will the system provide?

Benefits normally increase profits or decrease costs. Benefits can be classified into two categories: *tangible* and *intangible*.

- **Tangible benefits –** Tangible benefits are those that can be easily quantified. These benefits are usually measured in terms of monthly or annual savings or of profit to the firm. Alternatively, these benefits might be measured in terms of unit cost savings or profit. Some examples of tangible benefits are: fewer processing errors, increased throughput, decreased response time, elimination of job steps, increased sales, reduced credit losses, and reduce expenses.
- **Intangible benefits –** Intangible benefits are believed to be difficult or impossible to quantify. Unless these benefits are at least identified, it is entirely possible that many projects would not be feasible. Some examples of intangible benefits are: improved customer goodwill, improved employee morale, better service to community, and better decision making.

Unfortunately, if a benefit cannot be quantified, it is difficult to accept the validity of an associated cost-benefit analysis that is based on incomplete data.

Is the proposed system cost-effective?

There are three popular techniques to assess economic feasibility, also called cost-effectiveness: *payback analysis*, *return to investment*, and *net present value*.

One concept that is shared by all three techniques is the **time value of money** – a dollar today is worth more than a dollar one-year from now.

Some of the costs of the system will be accrued in after implementation. Before cost-benefit analysis, these costs should be brought back to the current dollars. **Present value** is the current value of a dollar at any time in the future. It is calculated using the formula:

$$PV_n = 1/(1 + i)^n$$

Where PV_n is the present value of \$1.00 n years from now and i is the discount rate.

- **Payback analysis –** It is a technique for determining if and when an investment will pay for itself. Because system development costs are incurred long before benefits begin to occur, it will take some time for the benefits to overtake the costs. After implementation, there will be additional operating expenses that must be recovered. *Payback analysis* determines how much time will lapse before accrued benefits overtake accrued and continuing costs. This period of time is called **payback period**, that is, the period of time that will lapse before accrued benefits overtake accrued costs.

- **Return-on-investment analysis –** This technique compares the lifetime profitability of the solution. It is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the amount invested. It is calculated as follows:

  Lifetime ROI = (Estimated lifetime benefits – Estimated lifetime costs)/Estimated lifetime costs

- **Net present value –** It is an analysis technique that compares costs and benefits for each year of the system's lifetime. Many managers consider it the preferred cost-benefit analysis technique.