Chapter IV

System Analysis

4.1 System Planning and Initial Investigation

- This is the first phase of SDLC and is known as identification of need.

- This is a user's request to change, improve or enhance an existing system.

- The objective is to determine whether the request is valid or feasible

- The user request identifies the need for change and authorizes the initial investigation.

User's Request Form

- User assigned title of work requested.

- Nature of work requested (problem definition)

- Date request was submitted

- Date job should be completed

- Purpose of job requested

- Expected benefits

- Input / Output description

- Requester's signature title, department, and phone number.

- Signature, title and department of person approving the request.

Needs Identification

- The success of a system depends largely on how accurately a problem is defined, thoroughly investigated and properly carried out through the choice of solution.

- It is concerned with what the user needs rather than what he/she wants.

Determining the User's Information Requirements

It is difficult to determine user requirements because of the following reasons:

- System requirements change and user requirements must be modified.

- Articulation of requirements is difficult.

- The pattern of interaction between users and analysts in designing information requirements is complex.

Strategies used by the Users

- **Kitchen Sink Strategy**

    - user throws everything into the requirement definition, over statement of needs such as a very large quantity of reports

- **Smoking Strategy**

    - It sets up a smoke screen by requesting several system features when only one or two are needed.

    - Requests have to be reduced to one that is realistic, manageable and achievable

  Same Thing Strategy

    - "Give me the same thing but in a better format through the computer" is a typical statement.

    - The analyst has chance of succeeding because only the user can fully discover the real needs and problems.

Strategies for Determining Information Requirements

- Asking

- Getting Information from the existing information system

- Prototyping

Asking

- This strategy obtains information from users by simply asking them about their requirements.

- The three methods of asking are:

    - Questions

    - Brainstorming

    - Group Consensus

Getting Information from the existing information system

- Data Analysis

    - Determining Information from existing system. It simply asks the user what information is currently received and what other information is required.

- Decision Analysis

    - In this problem is broken down into parts, so that user can focus separately on the critical issues.

Problem Definition and Project Initiation

- The problem must be stated clearly, understood, and agreed upon by the user and the analyst.

Background Analysis

- Once the project is initiated, the analyst begins to learn about the setting, the existing system, and the processes related to the revised system.

Fact Finding

- After obtaining the background knowledge, the analyst begins to collect data on the existing system's outputs, inputs and costs,

- The tools used in data collection are:

    - Review of written documents

    - On site observations

    - Interviews

    - Questionnaires

4.2 Information Gathering Techniques

- Information gathering techniques are also called requirements discovery techniques or fact finding techniques or data collection techniques.

- The Information system designed for an organization must meet the requirements of the end users of the organization.

- To obtain what an end user expects from the Information System the designer must gain complete knowledge of the organization's working.

4.2.1 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.

- 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.

- It may cause interruption.

- Some tasks may not always be performed by observation.

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4.2.2 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 Questionnaire

- *An **open ended question** is likely to receive a long answer.* These questions begin with "who," "what," "why," "where," and "when"

- Advantages: give interviewees more sense of involvement; put interviewee at ease as they respond in their own words

- Disadvantages: takes long time to answer; difficult to summarize

- A **closed-ended question** is a question format that limits respondents with a list of answer choices from which they must choose to answer the question.

- Examples: True or False, Multiple choice, rating a response

- Advantages: takes less time to answer and more topics covered

- Disadvantages: useful information may be overlooked

Format of Questionnaire

- **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.

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.

- It is necessary to interview top level managers as the first step in information gathering

    a. otherwise you will not get cooperation
    b. they can give you an overview of the organization and specify objectives of the system

    c. they are usually not available

    d. the number of persons to be interviewed at top level is small

- Rating Questions: - The respondent is given a statement and asked to use supplied responses to state an opinion.

Using a scale of 0= Not at all important to 5=Very Important, please rate the following aspects of our service in the restaurant?

	Not at all important 0	1	2	3	4	Very Important 5	No Opinion
Speed of Service	☐	☐	☐	☐	☐	☐	☐
Friendliness of Staff	☐	☐	☐	☐	☐	☐	☐
Helpfulness of Staff	☐	☐	☐	☐	☐	☐	☐
Value for Money	☐	☐	☐	☐	☐	☐	☐

- Ranking questions: - The respondent is given several possible answers, which are to be ranked in the order of preference or experience.

Please rank the following in order of importance from 1 to 4 where 1 is most important to you and 4 is least important to you

Speed of Service	☐
Ease of Parking	☐
Cleanliness	☐
Friendliness of Staff	☐

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.

- Good questionnaires are difficult to prepare.

- The number of respondents is often low.

4.2.3 **Interview**

- An *interview* is "a formal face-to-face meeting, especially, one arranged for the assessment of the qualifications of an applicant, as for employment or admission.... A conversation, as one conducted by a reporter,

- *The interview is the primary technique for information gathering during the systems analysis phases of a development project.*

- The interview is a specific form of meeting or conference, and is usually limited to two persons, the interviewer and the interviewee.

Types of Interviews

- Unstructured: interviews are conducted with only a general goal or subject in mind and with few, if any, specific questions. Questions develop during the course of the interview.

- Structured interviews on the other hand are conducted with a set of specific questions to ask the interviewee

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.

Interviews Vs Questionnaires

Interviews	Questionnaires
Interviews are *very expensive* and *time-consuming*	**Questionnaires** are not expensive and can gather information from many people simultaneously in a relatively short time
Interviews can have limited number of questions and limited number of people contacted	**Questionnaires** give less depth of understanding as they provide no direct means to ask follow-up questions
Interviews provide the opportunity to judge the truthfulness of responses by the words or voice tone or the body language of the respondent	**Questionnaires** do not provide the opportunity to judge the accuracy of responses

4.3 Feasibility Study

- A feasibility study, also known as feasibility analysis, is an analysis of the viability of an idea.
- Feasibility is the measure of how beneficial or practical development of an information system will be to an organization.
- A feasibility study is a formal report that documents decisions concluding in a choice of one from two or more alternatives.

Types of Feasibility

- Economic feasibility

- Technical feasibility

- Operational feasibility

- Organizational / Political feasibility

- Legal feasibility

- Schedule feasibility

Economic feasibility

- How much will the system cost?

- What benefits will the system provide

  – Tangible benefits

  – Intangible benefits

    - Is the proposed system cost effective

- Cost benefit analysis

Technical Feasibility

- Can it be built?

- Is the proposed technology or solution practical?

- Do we currently have the necessary technology?

- Do we have the necessary technical expertise, and is the schedule reasonable?

Operational Feasibility

- Is measure of how well the solution of problems work in the organization

- It is also a measure of how people about the system /project.

- how new system will affect organizational structures and processes,

- how it fits into current day-to-day operations

Organizational/political feasibility

- how key stakeholders in organization view system

- system can affect distribution of information, thus power

Schedule feasibility

- Is measure of how reasonable the project timetable is.

- Given our technical expertise, are the project deadlines reasonable?

Legal feasibility

- Copyrights, anti-trust laws (systems that share data across organizations), software ownership, etc.

4.4 Cost Benefit Analysis

- CBA is a process for evaluating the merits of a particular project in a systematic way in terms of cost and benefits of the project.

- Cost is the value of money that has been used up to produce something and hence is not available for use anymore.

- Benefit are the monetary values of desirable consequence of economic policies and decisions

- Cost Benefit Analysis (CBA) is an economic evaluation technique that measures all the positive (beneficial) and negative (costly) consequences of a program in monetary terms.

- CBA can be used to rank alternative projects

4.4.1 Direct Cost vs. Indirect Cost

Direct Cost

- Direct costs are expenses a company can easily connect to a specific object, or cost object.

- when pricing a software application

  Direct cost: the programmers' salaries

   Indirect cost: the purchase of tools and equipment, the expenses of marketing, the manpower associated with supporting the company

- A particular cost may be direct cost for one cost object but indirect cost for another cost object.

Indirect Costs

- **Indirect costs** are costs that are not directly accountable to a cost object.

- Indirect costs are expenses that affect the company as a whole and not just the product.

- These constitute the overhead of maintaining the entire company and not just costs associated with creating a product.

- Indirect costs include administration, personnel and security costs.

Example:

- Following costs are incurred by a factory on the production of cupboards:

1. Laborers' wages   2.Synthetic wood   3.Power consumption   4.Glass 5 screws   6.Factory insurance   7.Handles, locks 8.Wood   9.Supervisors' salaries 10.Factory depreciation 11.Varnish, glue, paints 12.Factory manager's salary

4.4.2 Tangible Benefit vs. Intangible Benefit

- Tangible Benefit: - It is a benefit to a person or organization which can be felt and touched. It is a real benefit which is straight forward. Ex: Saving money

- Can easily be measured in dollars

    - Example: Hardware

- Intangible Benefit: - It is an indirect benefit which can't be felt or touched. Ex: Saving time

- Cannot be easily measured in dollars

    - Examples:

        - Loss of customer goodwill

        - Loss of employee morale

4.4.3 Payback Period

- Payback period is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows generated by the investment.

- **Cash flow** is the movement of money into or out of a business, project, or financial product.

- **Decision Rule**

    Accept the project only if it's payback period is LESS than the target payback period.

- Payback Period =Initial Investment/ Cash Inflow per Period

Example 1: Even Cash Flows
Company C is planning to undertake a project requiring initial investment of $105 million. The project is expected to generate $25 million per year for 7 years. Calculate the payback period of the project.

Solution
Payback Period = Initial Investment ÷ Annual Cash Flow = $105M ÷ $25M = 4.2 years

When cash inflows are uneven, we need to calculate the cumulative net cash flow for each period and then use the following formula for payback period:

- Payback Period = A + B/C

- In the above formula,
  A is the last period with a negative cumulative cash flow;
  B is the absolute value of cumulative cash flow at the end of the period A;
  C is the total cash flow during the period after A

Example 2: Uneven Cash Flows
Company C is planning to undertake another project requiring initial investment of $50 million and is expected to generate $10 million in Year 1, $13 million in Year 2, $16 million in year 3, $19 million in Year 4 and $22 million in Year 5. Calculate the payback value of the project.

Solution

(cash flows in millions) Year	Cash Flow	Cumulative Cash Flow
0	(50)	(50)
1	10	(40)
2	13	(27)
3	16	(11)
4	19	8
5	22	30

Payback Period
= 3 + (|-$11M| ÷ $19M)
= 3 + ($11M ÷ $19M)
≈ 3 + 0.58
≈ 3.58 years

4.4.4 Calculating a break-even point

- Businesses must make a profit to survive

- To make a profit, income must be higher than expenditure (or costs)

There are two types of costs:

- **Variable costs** increase by a step every time an extra product is sold (eg cost of ice cream cornets in ice cream shop)

- **Fixed costs** have to be paid even if no products are sold (eg rent of ice cream shop)

- Variable + fixed costs = **total costs**

- When total costs = **sales revenue**, this is called the **break-even point**, eg

    - total costs = Rs 5,000

    - total sales revenue = Rs 5,000

- At this point the business isn't making a profit or a loss – it is simply breaking even.


Why calculate break-even?

Tom can hire an ice-cream van for an afternoon at a summer fete. The van hire will be £100 and the cost of cornets, ice cream etc will 50p per ice cream.

Tom thinks a sensible selling price will be £1.50.

At this price, how many ice-creams must he sell to cover his costs?

Calculating this will help Tom to decide if the idea is good or bad.

Identifying the break-even point

Tom's ice creams
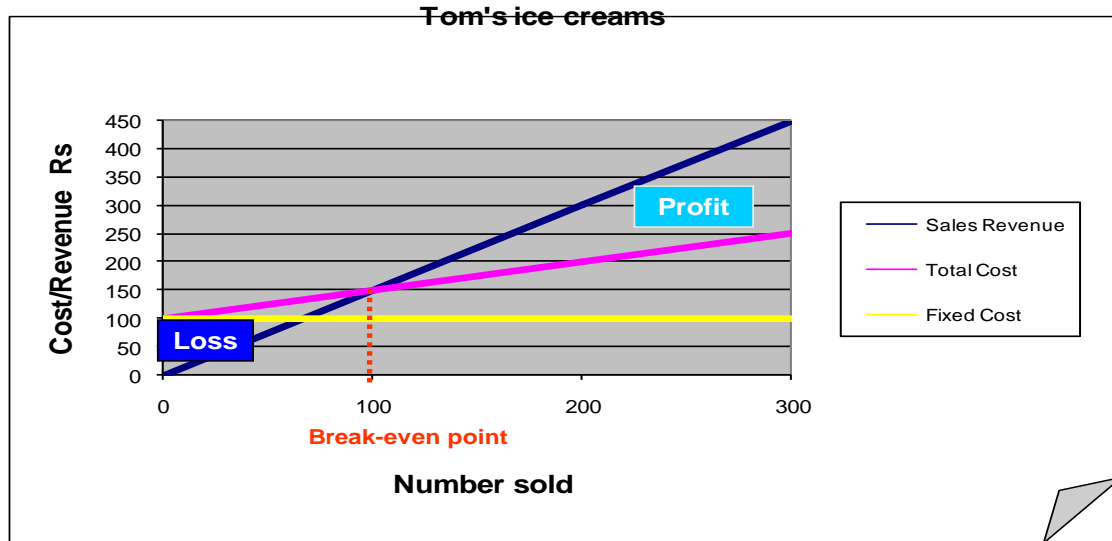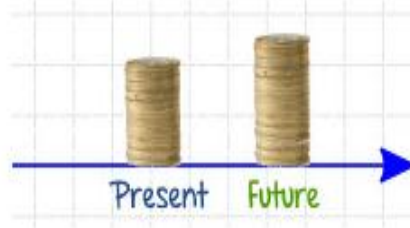

Applying the formula

Fixed costs

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(Selling price per unit minus variable cost per unit)

Tom: £100
       ───────────── =   **100**
       (£1.50 − 50p)

Present Value

Present Value   Future Value

$1,000   10% $1,100

So $1,000 now is the **same** as $1,100 next year (at 10% interest).

Present   Future

We say the **Present Value** of $1,100 next year is **$1,000**

Because we could turn $1,000 into $1,100 in one year (if we could earn 10% interest).

$1,000 ×1.10→ $1,100 ×1.10→ $1,210 ×1.10→ $1,331

Future Back to Now

And to see what **money in the future** is worth **now**, go backwards (dividing by 1.10 each year instead of multiplying):

$1,000 ←÷1.10 $1,100 ←÷1.10 $1,210 ←÷1.10 $1,331

Example: Sam promises you **$500 next year**, what is the Present Value?

→ To take a future payment backwards one year **divide by 1.10**

So **$500 next year** is $500 ÷ 1.10 = **$454.55 now** (to nearest cent).

The Present Value is **$454.55**

- **Time value of money** (**TVM**): the concept that money available today is worth more than the same amount tomorrow

- **Discount rate**: the rate of return used to compute the present value of future cash flows

- **Discount rate**, an inverse interest rate when performing calculations in reverse

- **Present value**: the current value of a future cash flow

- *Salvage value* is the estimated resale value of an asset at the end of its useful life.

4.4.5 Net Present Value (NPV)

- The first step involved in the calculation of NPV is the determination of the present value of net cash inflows from a project or asset.

- The net cash flows may be even (i.e. equal cash inflows in different periods) or uneven (i.e. different cash flows in different periods).

Decision Rule

Accept the project only if its NPV is positive or zero. Reject the project having negative NPV.

While comparing two or more exclusive projects having positive NPVs, accept the one with highest NPV.

When cash inflows are even

$$NPV = R \times \frac{1-(1+i)^{-n}}{i} - \text{Initial Investment}$$

In the above formula,

   R is the net cash inflow expected to be received each period;

   i is the required rate of return per period;

   n are the number of periods during which the project is expected to operate and generate cash inflows.

Example 1: Even Cash Inflows: Calculate the net present value of a project which requires an initial investment of $243,000 and it is expected to generate a cash inflow of $50,000 each month for 12 months. Assume that the salvage value of the project is zero. The target rate of return is 12% per annum.

<u>Solution</u>

We have,

    Initial Investment = $243,000

    Net Cash Inflow per Period = $50,000

    Number of Periods = 12

    Discount Rate per Period = 12% ÷ 12 = 1%

Net Present Value

    = $50,000 × (1 − (1 + 1%)^-12) ÷ 1% − $243,000

    = $50,000 × (1 − 1.01^-12) ÷ 0.01 − $243,000

    ≈ $50,000 × (1 − 0.887449) ÷ 0.01 − $243,000

    ≈ $50,000 × 0.112551 ÷ 0.01 − $243,000

    ≈ $50,000 × 11.2551 − $243,000

    ≈ $562,754 − $243,000

    ≈ $319,754

When cash inflows are uneven

$$NPV = \left[\frac{R_1}{(1+i)^1} + \frac{R_2}{(1+i)^2} + \frac{R_3}{(1+i)^3} + \ldots \right] - \text{Initial Investment}$$

Where,

    i is the target rate of return per period;

    R_1 is the net cash inflow during the first period;

    R_2 is the net cash inflow during the second period;

    R_3 is the net cash inflow during the third period, and so on …

Assignment IV

1. Explain the cost-benefit analysis with example.
2. Describe the commonly used methods for performing economic cost-benefit analysis
3. Explain the steps of feasibility analysis.
4. Why feasibility analysis is necessary before designing a system?
5. Explain with example of tangible and intangible benefit.
6. Describe the commonly used methodology for performing economic cost benefit analysis.
7. Distinguish between initial investigation and feasibility study. In what way are they related?
8. Why is it necessary to conduct cost/benefit analysis?
9. Why is it difficult to determine user requirements?
10. Compare the different conversion methods with each other.
11. What do you mean by requirement determination? Explain questionnaires and interview techniques for gathering the information with suitable examples.