UNIT 5

SYSTEM DEVELOPMENT LIFE CYCLE

Objectives

After going through this unit, you should be able to:

- understand the mechanism involved in the system development life cycle,
- differentiate between various stages of system analysis and design,
- appreciate the efforts involved in and criticality of each stage.

Structure

5.1 INTRODUCTION

Regardless of where the data or information processing system has been implemented, what functional area it addresses, what level of management it caters to and who has designed, developed and implemented it, the growth of an information system passes through various identifiable stages and all these stages put together are referred to as the System Development Life Cycle.

The system size, complexity and coverage do not affect these stages. Any system designed for processing of information revolves around a life cycle that begins with the recognition of the problem and ends up with development and implementatin of the system.

To appreciate the stages involved in design and development of an information system and the efforts required to build up these systems, it is a must that managers should be familiar with the distinct stages of this cycle. The present study unit discusses these steps and related issues.

5.2 MODELS OF INFORMATION SYSTEMS

The information systems are considered to be evolved through three different levels of systems. These are:

a) **Conceptual System:** Every information processing system is evolved by way of a concept when somebody imagines that the organisation should have such and such a system to accomplish such and such an objective. A system so conceived may or may not be attained in reality. A conceptual model is no more than an idea.

b) **Logical System:** When the conceived system model is further worked out to design new ways to accomplish the objective set out in the conceptual system, it becomes the logical system design. A logical system design necessarily includes understanding of the flow of information, logic of processing and input-output relationships. The Data Flow Diagrams Flow Charts etc. are the basic components of the logical models.

c) **Physical Systems :** When the logical models are developed to actually deliver the desired results, it is referred to as a physical system model. The physical system model can be tested and implemented. It consists of the programs, data files and documentation.

5.3 SYSTEM DEVELOPMENT LIFE CYCLE

System development is an iterative process and it cosists of the following identifiable stages:

a) Problem Definition

b) Feasibility Study

c) System Analysis

d) System Design

e) System Development

f) Implementation

g) Post- implementation Maintenance & Review

In practice, these steps may or may not be clearly defined in a given system, and there is a possibility of an overlap of these stages. It is quite likely that while the system analyst is working on a particular stage, he is also considering possible solutions related to the next phase. There is always a possibility of coming back from an advanced stage to revise or review the decisions taken in the earlier phases.

Errors are costly in system analysis and design. But these become more and more costly as you keep going from an earlier stage to an advanced stage. It could be seen from Figure 5.1. The cost of fixing an error detected n the earlier stages is lesser as compared to the same detected at a later date. The simple reason for this is that an erarly detection of error will necessitate revision of fewer decisions whereas a late detection of an error will require revision of all the steps taken so far. So utmost care is nesesary on part of the system designers, while going through various stages.

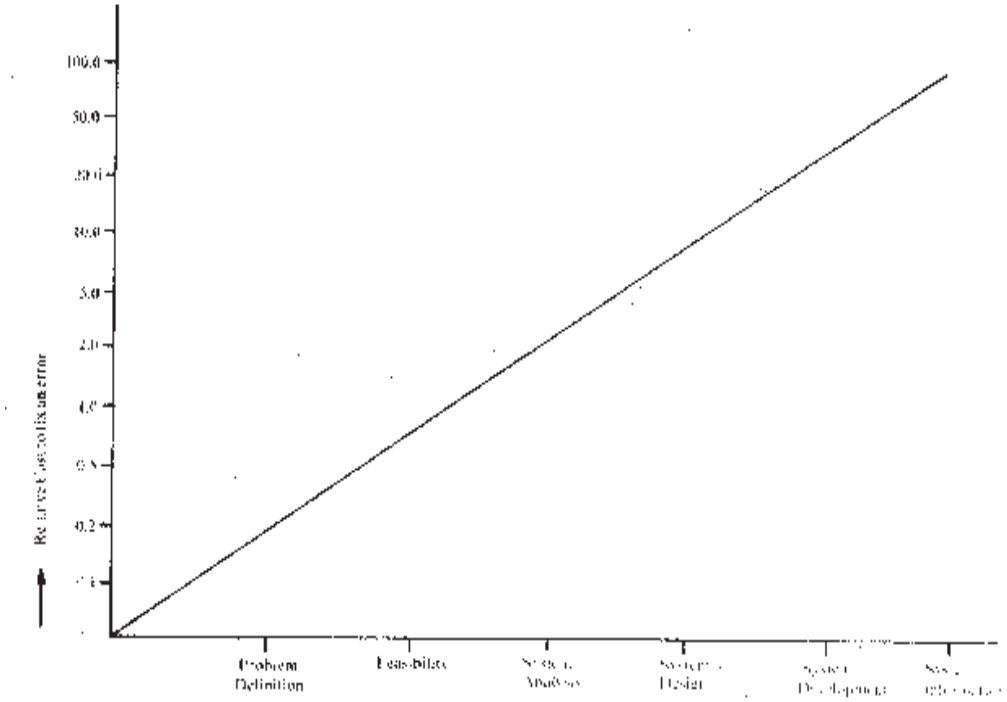

Fig. 5.1 Stages and cost of fixing an error

Every stage of the system development life cycle is marked by an identifiable end- result as well as sub-activities. These stages and the various activities involved are given in Table 1.

Tabel 1

Stage	End Result
Problem definition	Statement of Scope and Objectives. Performance Criteria.
Feasibility Study	Economic/Technical/Political/Feasibility Report. Financial Viability and Modification of System Scope & Objectives, if any,
System Analysis	Logical Model of the system consisting of details such as data flow diagrams,data dictionary, etc.
System Design	Alternative solutions along with revised cost-benefit analysis, hardware specifications, manpower requirements, plan for implementation, user sign- off, test plans, formal system test procedures, security, audit and operating procedures.
System Development	Actual programming as per the user sign- off, compilation and testing of the programmes.
System Implementation	Training of the user, staff, system documentation, implementation.
Post- implementation maintenance & Review	Refined and Tuned system along with revised documentation, satisfied users.

5.4 PROBLEM DEFINITION

Orgnisations face problems during their operations and come across opportunities which could be converted into profitable solutions. Whenever there is an opportunity and/or problem in the existing system or when a system is being developed for the first time the organisation considers designing a new system for information processing.

The organisation may face a problem or get an opportunity due to:

- a new product/plant/branch/market/process
- a failure of an existing system
- inefficiency of an existing system
- programming errors in the existing system

and therefore, a thorough analysis of the situation is required.

For identifying problems and/or opportunities, we scan:

- the performance of the system
- the information being supplied and its form
- the economy of processing
- the control on the information processing
- the efficiency of the existing system
- the security of the data, software, equipment, personnel etc.

After identifying the problem, it is defined and a general direction for solving this problem is also determined. The project boundaries are also defined. The management also establishes the terms of reference as well as the resources to be provided for the project.

Final output of this stage is **Terms of Reference.**

5. 5 FEASIBILITY STUDY

After the user has identified the need for a new system, his requirments are determined and the terms of reference are established. The proposed system has to be viewed from the practical utility and acceptability dimension. A few questions which are usually asked during this stage are:

a) Is the proposed system worth developing?

b) Will the proposed system contribute by way of improved efficiency, productivity or organisational effectiveness?

c) Will the system improve information availability and be cost-effective?

d) What will be the system development costs and will these be justifiable?

e) How will the user departments take this system and what will be the overall impact of this system on the organisation?

The key considerations involved in the feasibility analysis are:

- Economic
- Technical
- Behavioural

The economic feasibility will only consider the cost/benefit analysis of the proposed project. The benefits are always expected to be overweighing the costs.

The technical feasibility always focuses on the existing computer hardware and software. This also includes the need for more hardware or software and the possibility of procuring/installing such facility.

The behavioural feasibility includes a study of the organisational behaviour. An estimate of how strong the user reaction will be to the new system, will have to be made at this stage.

The final output of this step is a **Feasibility Report** having discussions on Financial Feasibility, Economic Viability, Technical Feasibility and Social Acceptability of the proposed system.

5.6 SYSTEM ANALYSIS

The system analysis includes review of the existing procedures and information flow. Decision making and individual information needs at various levels in different functional areas are also reviewed. The system analysis phase primarily focuses on isolation of deficiencies from the existing system.

The fundamental activities involved in the system analysis are:

- definition of the overall system
- separation of the system into smaller and manageable parts
- understanding the nature, function and interrelationship of various subsystems.

The analysis of the information systems could be done with the help of various tools of system analysis. Some of the tools which are available with the system analysts are:

Review of Documentation: Documentation on the existing system could be reviewed and analysed to study the objectives, reports, procedures being followed and equipment being used. The only limitation with this technique is that the documentation on any existing system is never complete and up-to-date.

Observation of the Situation: The system under study can always be observed by getting involved in the system. The system analyst can work in the system or can be a mere observer. The exercise is time consuming and costly. Also it has an inherent limitation of the fact that the analyst may never be able it observe the intricacies of the system.

Conducting Interviews: The system analyst can conduct interviews with the user managers and ask questions related to their job responsibilities. The interviews could be formal or informal ones and may span over a period of time. Teh limitation of this tool is that the user manager may not be able to explain the problem in detail.

Questionnaire Administration : A printed structured or unstructured questionnaire may be administered to find out the information needs of individual managers. The questionnaire survey does help in saving time as compared to interviews as well as gets more committed data. But it is impossible to design an exhaustive questionnaire to cover various aspects of the system under study.

The analysts use a combination of all the tools to analyse an existing system. The analysis phase is a time consuming phase and yet a very crucial phase. The final output of this phase is a functional specification report of the existing system.

5.7. SYSTEM DESIGN

If the system analysts phase defines the way things are, the system development phase defines the way things should be for the same problem.

The system development phase includes mapping of the business requirements of the managers on to the

proposed system. The conceptual design of the model which has been developed in the problem definition stage is enlarged to understand the actual flow of data and the logical model is developed. The logical model is worked out to finally develop and test the physical system in the system development phase.

The system design should be as hardware and software environment independent as possible. The system development team should always keep in mind the cost-effectiveness. This phase includes development of the following:

- Output Definitions
- Input Definitions
- Data Element Dictionary
- Programme Specifications
- System Specifications

During the system development, the analysts also undertake the codification and compressing of the data to:

- use lesser magnetic storage space
- commit lesser mistakes while entering data
- maintain uniformity of data
- incur lesser cost in entering, updating, processing and storage of data.

Output Definitions : Are there detailed reports, screen and file layouts which will be outputted by the programs throughout the system? The system analyst is required to consult the user in finalising the system outputs.

Input Definitions : The data coming into the system has to come through some input formats and these formats are defined by the design of input documents.

Data Element Dictionary : A Document which contains bonafide details of each and every data item used in the system is called a data dictionary. The data dictionary contains the following details regarding the data items:

Name
Description
Source
Usage
Maintenance
Storage
Organisation

Programme Specifications : The actual logic up for individual programmes is defined in the Programme specifications by way of decision tables,decision trees and program flow charts. The program flow charts could be drawn for individual programmes or parts of the programmes . These tools are necessarily used for storing the logic of processing in individual programmes for future reference. The logic could also be stored by using English language which is also referred to as pseudo code.

System Specifications: The system specifications include description of the relationships of various modules of the system among each other and relationships between different programmes within a subsystem. Though the system specifications do not give the details of logic being followed, it gives the flow of processing among the programmes, files and reports. Apart from using descriptive English, the system developers also use System Flow Charts for depicting system specifications.

The end result of this phase is a design specification report which includes the existing system, the proposed system, system flow charts, modular design of the system, print layout charts, data file designs etc.

5.8 SYSTEM DEVELOPMENT

Following the modular design of the proposed system, the system analysts assign specific responsibilities to the programmers who develop and test the programmes. The development and testing of the systems take place in a phased manner:

* Development and testing of the individual programmes
* Development and testing of the individual programmes as a part of the system modules
* Development and testing of the system modules as a part of the major subsystems
* Development and testing of the major subsystems as a part of the proposed system.

The development of the system includes writing of the actual programmes to handle data. Excellent programming skills and experience are required for this phase of the system development life cycle. The basic activities involved in this phase are:

- Checking of the programme specifications received from the system development stage and expanding these specifications
- Breaking the system modules into smaller programmes and allocating these programmes to the members of the system development team
- Producing the programme code in the chosen computer programming language
- Defining the interfaces between various programmes and designing tests for checking their interfaces
- Ensuring the data availability for individual and integrated testing
- Checking the quality of the code and its adherence to the established standards
- Prepare the documentation for each one of the programmes
- Receiving the user data for acceptance testing
- Getting the user sign - off after the acceptance testing

For development of the proposed system, it its important that all possible support should be provided to the development team. This support includes availability of:

- Office Space
- Relevant Data
- Secretarial Assistance
- Access to key functionaries throughout the system development effort.

The final output of this phase is a fully developed and tested software system along with complete documentation and testing results.

5.9 SYSTEM IMPLEMENTATION

Once the system has been declared fully developed and tested by the development team, it is ready for implementation with the user department. The involvement of the user is necessary throughout the project duration, but the user involvement is critical during this phase.

The implementation includes the following activities:

- Planning for implementation
- Preparing the schedule for implementation
- Procurement of hardware
- Installation of software
- Operation and testing of software on hardware
- Recruitment of operating personnel
- Motivation and training of the selected personnel and users
- Conversion of data files from old system
- Final changeover
- Operation and production

Once the system has been implemented, the systems group provides outside support to the user group and trains the user group to handle production and operations of the system.

5.10 POST - IMPLEMENTATION MAINTENANCE & REVIEW

Though the system is thoroughly tested before the implementation, yet the system is never foolproof and errors always continue to exist. Therefore, there is a need to have a systems person to look after the system and maintain it even during the operation and production. The system maintenance could be because of any of the following reasons:

- Minor changes in the processing logic
- Errors detected during the processing
- Revision of the formats of the reports
- Revision of the formats for data inputs

Also the management is keen to know the quality of the system developed and the standards which have been followed. There is usually review team which evaluates the implemented systems and suggests changes, if required. It also leads to integrated and standardised system development.

5.11 PROJECT TEAM CONSTITUTION

For undertaking a study and design of a commercial information processing system, a project team is constituted. The members of this team are drawn from various functional areas and professional backgrounds. This team is usually of 7-11 member size. Each member is assigned specific responsibility with scheduled deadlines for each job. The involvement and representation of the user departments and affected parties is ensured while constituting such project teams. Normally organisations face a dilemma about choosing a project leader. The choice is between the user group or the systems group. Depending upon the availability, experience and type of project. The leader is chosen. It is in the interest of the proposed system that all the members of the project team should have sufficient time at their disposal and take keen interest in the progress of the project.

5.12 EFFORT DISTRIBUTION IN SYSTEM DEVELOPMENT LIFE CYCLE

The distribution of the organisational efforts over various phases of the system development life cycle can be seen from Figure 5.2. It can be seen that over the life cycle. almost half the efforts are devoted to maintenance after implementation and half the efforts in the system development itself are devoted to the testing and debugging activities. This once again underlines the need for a thorough testing and debugging of the information system before it is implemented.

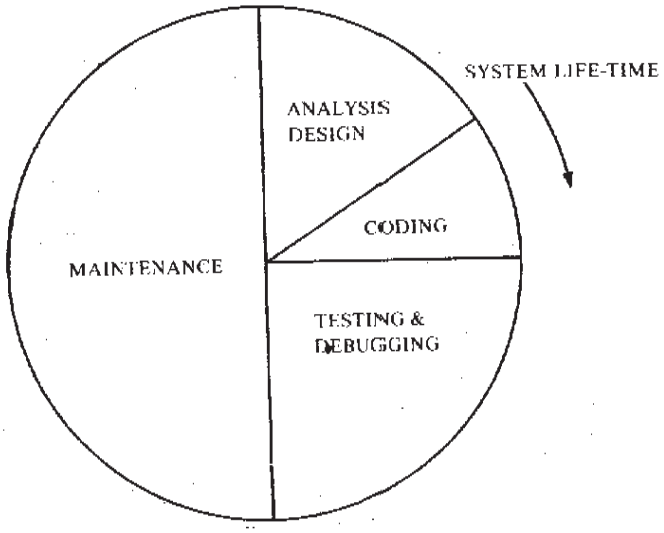

Figure 5.2 : Distribution of Effort

5.13 SUMMARY

Every system either developed as an improvement over the existing system or developed for the first time has to undergo various indentifiable stages. The unit has discussed these stages as problem definition, feasibility study, system analysis, system design, system development, implementation and maintenance. The birth of a system takes place when the conceptual model is developed by way of expressing a need. This need is converted into a logic for fulfilling of this need. It ultimately gets converted into data files, programmes and documentation at the stage of physical model. The total development cycle needs more than one full - time individual. Generally a project team consists of member from user group as well as systems group.

5.14 SELF - ASSESSMENT EXERCISES

1) What are the various outputs of each stage of the system development life cycle?

2) "Analysis is the what of the system whereas design is the how of the system." Comment.

3) What are the various stages of a system development life cycle and how are the efforts distributed over these phases?

4) What are the various stages system analysis tools and why do we need more than one tool at a time?

5) What do you understand by conceptual, logical and physical models of a system?

6) Discuss the various steps involved in programming

5.15 FURTHER READINGS

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