STRUCTURED SYSTEMS ANALYSIS AND DESIGN METHOD (SSADM)

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"A disciplined approach is better than mere intuitions"

CHAPTER - 4

STRUCTURED SYSTEMS ANALYSIS AND DESIGN METHOD (SSADM)

4.1 Need for Structured Analysis and Design

Conventional system development method (SDLC) has some limitations. These limitations are :

1. Interaction with the user is limited. The users interact with the systems analyst at the problem identifications and feasibility study stages. After that they are expected to use the system when it is implemented. Hence for the user, the new system is a black box. Further in SDLC, there is no proper mode for the user to express his requirements clearly to the analyst at different stages.

2. The systems analyst is constantly overwhelmed with the business and technical details of the system.

3. The analytical tools of SDLC like system flowchart, program flowchart etc. are concerned more with physical aspect of the system rather than the logical ones. Also, some of the SDLC tools are narrative and vague instead of being precise and clear in their format. It becomes difficult for the user to understand how the system parts fit together.

4. The system specifications of SDLC are difficult to maintain or modify. Even a small change in the users' requirements necessitates several changes in different system documents. The user has to plough through several documents in order to find the information pertaining to particular part of the system and this frustrates the user.

5. Software development is bottom-up. Hence the package can be viewed only after it is fully complete by which time it becomes difficult to make any correction.

6. All system documentation is prepared at the end of the project.

In short, SDLC lacks a structured approach to system development. The structured methodology has overcome most of the disadvantages of the conventional method. We shall discuss the structured method here in this chapter.

4.2 What is SSADM ?

Structured systems analysis and design is a well defined approach in the form of methodology. It is not new. SSADM is in fact a modified form of SDLC. Hence we can also call SSADM as SDLC using structured techniques.

SSADM consists of :

1) System Survey	2) Structured Analysis
3) Structured Design	4) Hardware Study
5) Implementation and	6) Maintenance

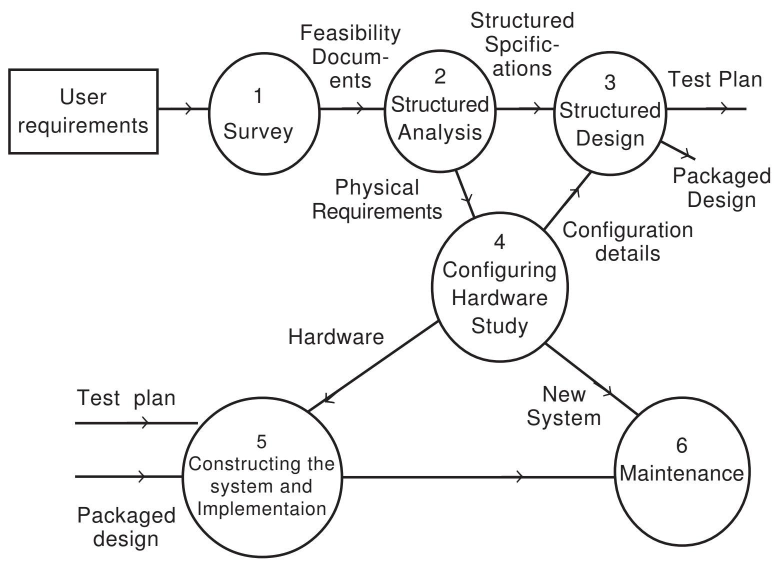

Fig 4.1

The structured analysis uses symbols instead of narrative descriptions and creates a graphic model of the system.

The SSADM involves data flow diagram (DFD) method of showing the movement of data through a system. The DFD's are free of unnecessary details and are therefore very useful in providing an overview of the system.

The structured analysis uses other tools like

1. Data Dictionary	2. Structured English
3. Decision Trees	4. Decision Tables

** [For Tools and Techniques refer chapters 6 to 20]

The term structured is borrowed from Structured Programming. The word structured generally imposes a structure or a disciplined approach on the design of the system.

SSADM Methodology

1. System Survey

The first step in SSADM is system survey. The subactivities in survey are

1. Identify the scope of the current system.
2. Identify and list the deficiencies in the current system by taking into consideration the user requirements.
3. Establish new system goals and identify the constraints.
4. Prepare a document consisting of
   - goals and objectives
   - customized project life cycle
   - constraints regarding technical and procedural aspect
   - cost benefit analysis

This phase is similar to feasibility study in SDLC

2. Structured Analysis

The second stage in SSADM is Structured Analysis which is the most important part. Structured Analysis is a set of techniques and graphical tools. They allow the analyst to develop a new kind of system specifications that are easily understandable to the user. Here the analyst uses graphic symbols, Data Flow Diagrams (DFDs) and Data Dictionaries (DDs) to represent the system.

Note :

1. The DFDs are graphic representation of data movement, process and files (Data Store) used in support of an information system.

2. The Data Dictionary contains a list of terms and their definitions for all data items and data stores of a system.

In preparing the model, the analyst concentrates on 'What' occurs rather than on 'How' it is accomplished. Thus, the focus is on 'logical' rather than 'physical' aspect of the system.

The step 2 in figure 4.1 is exploded in a detailed manner in figure 4.2 to explain clearly what happens in the structured analysis step.

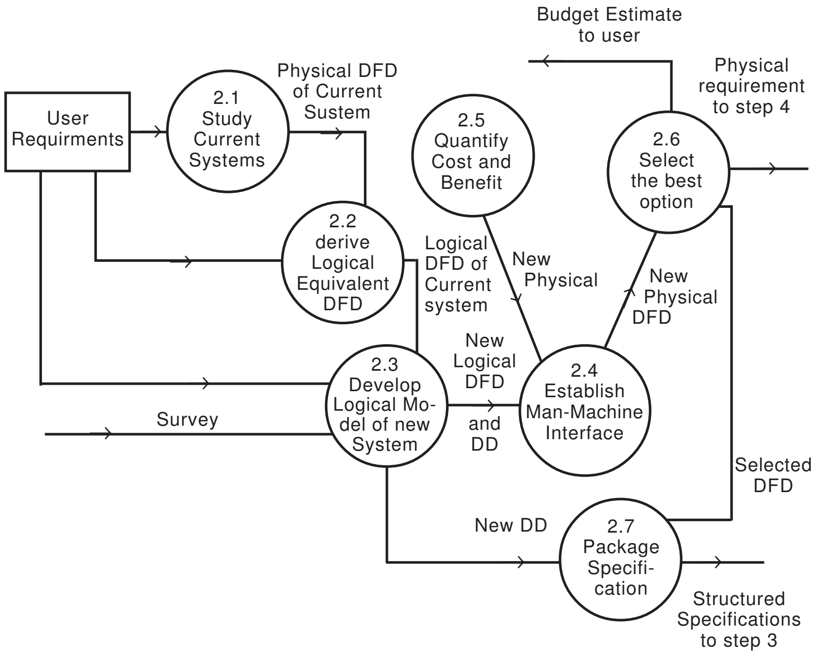

Fig 4.2

The reader will notice clearly the progression from modeling of existing system to modeling of new system in structured analysis. The progress is graphically shown in figure 4.3

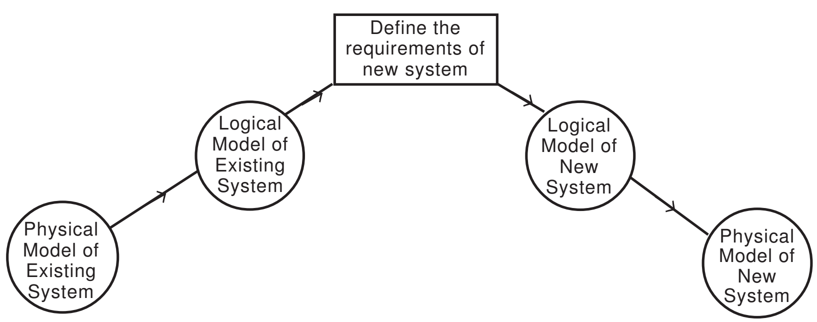

Fig 4.3

We shall discuss the sub processes shown in figure 4.2 to understand the structured analysis.

Subprocess 2.1 : To study current system : Here while studying the current system, the analyst identifies

1. The external entities
2. The list of processes performed in the current system
3. Sequence of these processes
4. Data used for the processes
5. How the processes are performed etc.

Ultimately, a physical model of the existing system in the form of a DFD evolves.

Subprocess 2.2 : To derive logical equivalent DFD

A physical model is a pictorial representation showing how the job is performed physically. This includes the sequence of operations, people, computer processing, paper forms etc. But to understand the information system properly it is necessary to know where from the data emanates? How does it move ? Where does it end ? etc.

This requires a pictorial representation of the system that shows what processes must be performed, the flow of the data through the system and the data stores (files) that are required. That is a logical DFD of the working of the current system is needed. This is what exactly the subprocess 2.2 does.

Subprocess 2.3 : Develop logical model of new system

The logical DFD obtained in 2.2 is modified on the basis of the survey conducted and according to users requirements. This new DFD will inform the user which requirements of his will be met. The output of this subprocess is a new logical DFD of the proposed system. The output will also include data elements, files, outputs, inputs etc. i.e. a new data dictionary.

Subprocess 2.4 : Establish man-machine interface

The output of 2.3 is the logical DFDs and DDs for the proposed system. But to bring this conceptual idea to the real life world, we need DFDs relating physical things like people, forms, computers and their relationships. This is done by preparing physical DFDs for proposed system in this subprocess. The activities in this subprocess include identifying

1. How will the new system work ?
2. Processes, sequence of processes, data used for the processes etc. and
3. The interaction between manual and automated process

The output of this subprocess is the new physical DFDs which will serve as the input for the sub processes 2.5. and 2.6

Subprocess 2.5 : Quantify Costs and Benefits :

Here, the various options are identified in terms of costs and benefits

Costs		Benefits	
One time cost	Recurring Cost	Tangible Benefits	Intangible Benefits
1.Cost of converting from present system to proposed system. 2.Construction or remodeling of existing facilities. 3.Hardware cost.	1. Salary of personnel 2. Supplies 3. Equipment maintenance.	1. Reduction in cost of operation. 2. Increased value in sales and net income. 3. Reduced time in completing the tasks.	1.Customer satisfaction 2.Better employee morale due to better facilities. 3.Better company image. 4.Satisfaction to management about entering into newer information technologies

The life span of the new system has to be decided by taking into consideration Net Present Value and Internal Rate of Return of the future cost benefits. The output of this subprocess will be the cost benefit analysis report which will serve as the input for subprocess 2.6.

Subprocess 2.6 : Select the best option

The inputs for this subprocess are cost benefit analysis report and physical DFD of proposed system. In this subprocess, the most important activity of taking the decision of selecting the best option is carried out. This selection outlines the hardware and software requirements.

The estimated budget for the proposed system is worked out. The outputs of this subprocess are

1. Estimated budget
2. Physical requirements and
3. DFDs for the selected option.

Subprocess 2.7 Package Specifications

Now that all the conceptual thinking of the analysis phase is over, the only remaining task is to collect the products of analysis and organize them into finished structured specifications. This process is called “Packaging”. The final result of this is the structured specifications which consists of an interpreted set of DFDs, DDs and process descriptions. This is done through the usage of Structured English, Decision Tables and Decision Trees.

Step 3 : Structured Design

Structured Design is a data-flow based methodology. The input for structured design is structured specifications which is the output of structured analysis. It also receives input from the hardware study. (Step 4)

What we do in the system design process is to convert the logical design specifications (i.e. structured specifications) into technical design specifications. In short, system design involves transforming a logical design into a physical design. This step is much more exacting than designing logical design specifications. Here the important activity is “Software Packaging”. The Software Packaging includes

1. Input-output design
2. Files and Database design
3. Program design and
4. Control Design

Activities that run parallel to this detailed design steps of software packaging are

1. Equipment specifications
2. Test specifications and
3. User interface specifications

In fact, these parallel activities have their roots in structured analysis part. Here we refine and expand their specifications to make each one as concrete as possible. The process 3 in figure 4.1 is exploded into detailed subprocesses in fig 4.4

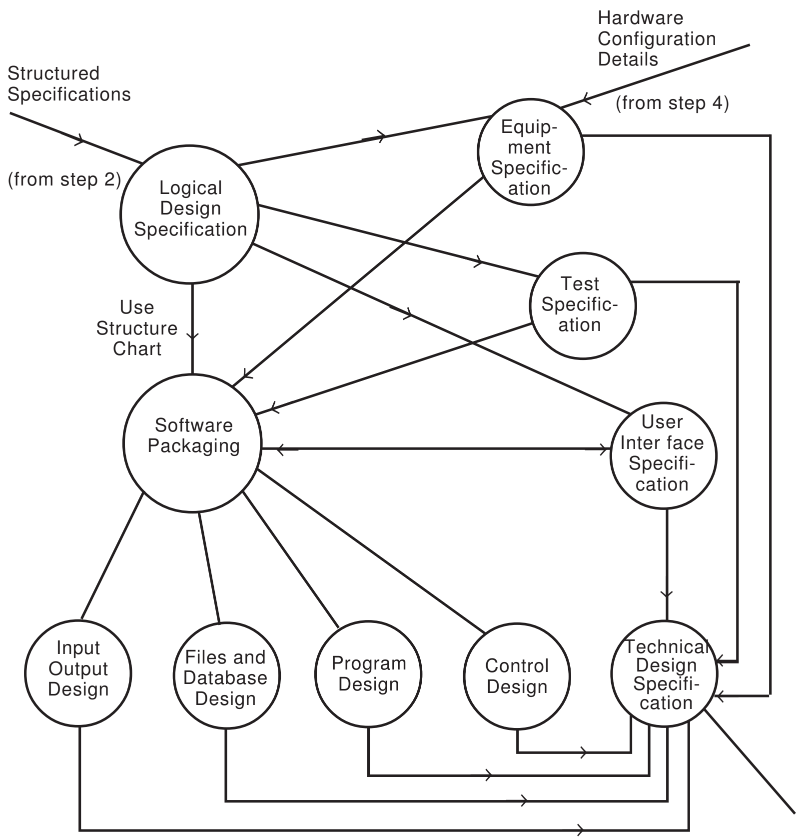

Fig. 4.4 The System Design Process

The main input, structured specifications (i.e. logical design specifications) is used to derive structure charts. The most difficult step in SSADM is that of converting DFDs of structured specifications into software packages. To do this, we need to construct what is called *Structured charts*. A *Structured chart* is a documentation technique. It shows the hierarchy of modules and their interrelationships in a program or a system.

While a DFD considers a sequential order of processes the structured chart begins with the most important process (BOSS) and then goes on to its subordinate processes. The top level of structured chart shows the most important division of work, the lowest level at the

bottom shows the details. This is essential to divide the total design process into smaller independent modules which in turn help to have flexibility in the design, i.e. any changes made in one particular module will not affect the other modules. Hence this technique provides a top-down, flexible design which is easier to maintain.

To maintain a dialogue with users during the process of system design is often difficult. Wise designers make it a point to involve users at several stages in the design and more particularly in the earlier stages of the design itself. For this, they use a technique called Structured Walk through. A Structured Walk through is an organized step by step tracing through of a design by a group of people. The group may be peer group or users. The purpose of Walk through is to find where improvement can be made in the system or in the development process. There are two types of Structured Walk throughs

1. A Preliminary Design Walk through
2. A Detailed Design Walk through

In addition a Pseudocode Walk through is performed just before a design is coded.

Walkthroughs are conducted

1. To catch design errors in advance
2. To improve communication and
3. To fine tune a design

Step 4 : Configuring Hardware Study

This step considers the physical requirements of the proposed system. It is based on the new physical DFDs, DD of Step 2.

Here we should specify the details of the configuration to be used in the implementation stage. These configuration details go as input for equipment specification process in Step 3. The cost involved and the present worth of the benefits to be accrued are considered here for hardware specifications.

Step 5 : Constructing the System and Implementation

The implementation process begins after the management has accepted the new system. System implementation consists of five components

1. System Acquisition
2. Programming
3. Testing
4. Conversion
5. Documentation

1. System Acquisition : It involves the purchase of hardware, packaged software and software services. Here the systems analyst and designer work together to determine the best place to make these outside purchases. Another important part of system acquisition is the actual purchase of goods and services.

2. Programming : It is the writing of instructions to be read and executed by a computer. Programming is performed by computer programmer or programmer/analyst rather than by systems analyst or designers. Normally a team of programmers work under the direction of lead programmer-typically a system designer. Tasks in programming include writing the coded instructions, testing each segment of the code and testing the entire computer programme once it is completed.

3. Testing : It consists of putting together the various coded pieces of a design, testing them and correcting the parts of the code or the design that are not correct. At this stage some errors are introduced purposely to test whether they will be spotted by the program.

4. Conversion : Once the system has been tested successfully then the part which remains is that of putting them into the operation. The conversion team must manage the smooth changeover from the old system to the new system. This requires

1. Training of personnel
2. Modifying parts of the old system
3. Running parallel system or dual system until everything goes as planned.

5. Documentation : Documentation means putting it in the written form about how a system is designed or functions. The documentation includes

1. Design Documentation : It describes the overall system design and includes system flowcharts, all input/output formats, file description, control requirements and report specifications.
2. Program Documentation : It consists of programming specifications like program logic, graphic aids, input-output formats etc.
3. Training Documentation : It includes user training manuals and materials to be used in the conversion and the installation of new system.
4. Operations Documentation : It contains instructions for normal operations as well as directions for handling problems and breakdowns.
5. User reference Documentation : It carries on after training is over and the system is installed. It should provide quick, clear answers like a dictionary.

Step 6 : Maintenance : This is the last step in the system life cycle. However it takes the longest duration. Maintenance may be corrective, adaptive or perfective. In corrective maintenance errors or bugs are rectified. In the adaptive maintenance the user requirements if any are still considered and the necessary changes are made. In perfective maintenance efforts will be constantly going on to perfect the system in terms of response time and resource requirements.

4.3 Advantages of SSADM

Some of the important advantages of SSADM are :

1. Good Documentation : In the structured methodology well defined documentation takes place. Hence it is easy for the analysts, users and programmers to understand and use.
2. Better Communication : Since structured methodology is graphic it provides easy to understand presentation of the application. The DFD, for example, presents a better picture than any other comparative tool.
3. Standardization : Before the emergence of the structured methods, the systems analyst used to have their own methods of designing computerized system. But structured methodology offers very little scope for individual approach.
4. Modularisation : The process is partitioned so that we have clear picture of the smaller modules which is essential to understand the system thoroughly.
5. Logical Design : The SSADM is more logical than physical. The elements of the system do not depend on vendor or hardware.
6. User oriented : The SSADM consults user at every stage of development thereby leaving no scope for rejection after the system is implemented.
7. Maintainability : The need for maintenance arises due to errors, modified user requirements and enhancements. The structured methodology takes into account this aspect, hence maintenance becomes cheaper.

REVIEW QUESTIONS

1. State the limitations of SDLC.
2. What is SSADM ?
3. List the stages of SSADM.
4. Discuss in brief :
   a) Survey in SSADM
   b) Structured Analysis
   c) Hardware Study

5. What are the outputs of Structured Analysis ?
6. Explain the aspects to be considered in Costs and Benefits Analysis of a system.
7. "The system design part in SSADM is converting Logical Design Specifications in to Technical Design Specifications". Elaborate.
8. Write a short note on :
   a) Structured Walk through
   b) Software Packaging.
9. Represent diagrammatically
   a) Structured Analysis Process
   b) Structured Design Process
10. System implementation consists of System Acquisition, Programming, Testing, Conversion and Documentation. Elaborate.
11. Write a short note on system documentation.
12. "Though maintenance is the last stage in SSADM, it is most costly and time consuming. Hence it needs more attention". Give your opinion.
13. State the advantages of using structured methodology in system development.