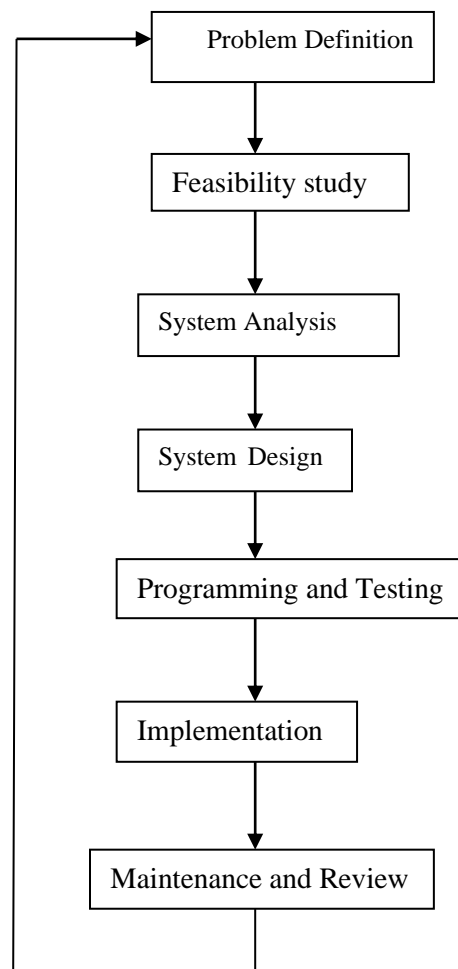


# **SYSTEM DEVELOPMENT LIFE CYCLE**

It is concerned with development of computer based projects which is an iterative process that involves working to some detail and backwards to recheck.

Even if the system is successfully completed and is operational, the initial objectives must always be ascertained that they are being met hence the term cycle is used to describe the development process.

## **Stages of System Development Life Cycle (SDLC)**



## ***Problem Definition***

It identifies the problem to be solved and how it fits with current business opportunities and technology in line with the organisation goals and objectives.

This will be when the organisation realises that it can't cope with certain business needs because the existing system (manual/computerised) is failing, unsatisfactory or there is a lag in modern developments.

A steering committee is formed which looks into the project under question and constitutes personnel from affected department.

*The project initiation document defines:*

- The problem
- Objectives
- Scope of investigation
- Boundary of project
- Resources required/available
- System limitations/constraints.

## ***Feasibility Study***

It is a research into the possibility of developing a solution to a problem.

*Objectives*

The study is to justify or nullify the change of modification of the current system. It is therefore supposed to:

- Allow the organisation management to decide whether or not to commit further resource to a project.
- Outline the present system and summarise its cost.
- Provide standards against which future performance can be monitored.
- Highlight any other problems in the system.

## **Types of feasibility study**

A system is feasible if it can be successfully implemented. When feasibility is analysed the following types must be considered:

### *(i) Technical Feasibility*

- Tries to see whether the existing technology will support the new system e.g. can a system be developed using the organisation 's current computer facilities.
- If the current facilities are not adequate, are the necessary hardware and software technologies available in the market.

### *(ii) Economic Feasibility*

- In this, the analyst determines if the benefits to be derived from the system recommendations are worth the time, money and other resources required to achieve the recommendation i.e. establishing whether the projected benefits of the proposed system outweigh costs in developing/purchasing, installing and operating it.
- Its often reffered to as cost benefit analysis.

### *(iii) Operational Feasibility*

- It's the determination that the system will be able to perform the designated functions within the existing organisational environment with its current personnel and existing procedures.
- The system will be used once it has been developed and implemented. If end user resists a new system, then it might not be used to its potential.
- The operational aspect is really a human relations problem.

### *(iv) Legal Feasibility*

- This factor mandates that no conflicts exist between the system under consideration and the organisation's ability to discharge its legal obligations.

### *(v) Schedule feasibility*

- The analyst must estimate when the proposed recommendation will be operative assuming that its eventually accepted. The use of PERT and Gantt charts are helpful to the analyst in this area.

At the end of the project feasibility study, a project feasibility report is produced and its contents are:

- Description of the existing system with particular reference to any problems and difficulties which can be identified.
- Outline of the proposed new system using system flowcharts. The inputs to the system, master files maintained and the output produced should be described.
- Justification and costs should be stated e.g. development, running costs etc. Benefits of the new system should also be quantified in financial terms.
- Development plan for the proposed system should be drawn up, showing the stages involved in its implementation and the required.
- Recommendations as to the next steps to be taken.

#### *Problems of Feasibility Study*

- Deciding exactly how the feasibility is to be assessed.
- Rapidly changing environment and yet any proposed system has to be evaluated in terms of its usefulness in the future.
- Identifying the people to be considered affected by the system.

### ***System Analysis***

It's the process of collecting and analysing facts in respect of existing operations, procedures and systems in order to obtain a full appreciation of the situation prevailing so that an effective computerized systems may be designed and implemented.

#### *Activities of Fact Finding*

Determine:

- Problem and difficulties of the present system.
- Data inputs to the current system.
- Volume of data.
- Timings of output information.
- Methods of processing.

- Expected growth of the organisation.
- Controls built in the system.
- Organisation structure.
- Cost of running the present system.
- Objectives of the system
- Files maintained.

#### *Objectives of Analysis*

- To provide an assessment of the existing system.
- To help evaluate all the possible alternative solutions.
- To ensure that the weakness are identified and are removed from the new system framework while the strengths are retained.
- To ensure that the new system caters for the procedures required to generate information required from given sets of data items input.
- To produce statement of requirements (requirement specification).

#### *Fact Finding Techniques*

- Interview
- Questionnaire
- Observation
- Record inspection.

#### *Interview*

It's a face to face communication between the analyst as the interviewer and the affected personnel as the interviewee.

They are formal meetings where the analyst attempts to obtain information by asking questions. They are used at various stages of development to get data on procedures and operations, verify

understanding of the system with the user, validate different aspects of the proposed system and to build user confidence in the new system.

The process basically consist of six steps:

- Determine who to interview.
- Establish the objectives for the interview.
- Prepare for the interview.
- Conduct the interview.
- Document the interview.
- Evaluate the interview.

#### *Problems which deter interviewees from responding*

- Perceived threat to interviewee ability to respond.
- Emotional reaction to stressful subjects
- Forgetting key facts.
- Language barrier.
- Lying to hide key facts.

#### *Advantages*

- Analyst accessible to first class information.
- Make interviewee feel as part of the system.
- Fast as compared to questionnaires.

#### *Disadvantages*

- Make interviewee feel they are being summoned or grilled by the analyst.
- Some interviewee give answers which are not actually proven facts but opinions.
- Demands for so much patience and persistence especially when one has decided not to give out information.

## *Questionnaires*

Is a document containing a number of standard questions set to be asked to a large number of people in order to gather information from them.

### *Guidelines in Designing Questionnaire*

- Decide on the scope and content of the questionnaire.
- Decide before hand on how data is to be analysed.
- Explain clearly who is collecting data and the purpose of the questionnaire.
- Questions should be simple, unambiguos and easy to understand.
- Each question should have a simple single answer.
- Test the question on a sample respondent.

### *When to use Questionnaires*

- Limited amount of information is required from a large number of people.
- There is a large number of people involved in the system project.
- The peolpe you need to gather information from are vastly dipersed.

### *Advantages*

- Answers filled in less tense environment.
- Presented consistently to all respondents without bias.
- Best suited when no detailed or long answers are required.
- Saves analyst time especially where respondents are geographically scattered.
- Applicable when the same information is required from different users.

### *Disadvantages*

- A slow way of facts gathering.
- Response can be disgusting as the return may be low.
- Designing a questionnaire requires expertise.
- Because questions are usually phrased so that a 'no' answer indicates a weakness, some respondents give a 'yes' answer to nearly all if not all.

- Some questions can easily be misunderstood no matter how well they are expressed so ambiguous replies will be received.
- Analysis of questionnaires requires a lot of time.

### *Observation*

- Is a method where the analyst becomes part of the organisation to see for himself what the system is doing and its work flow. This gives a real picture of the system unlike other fact finding methods.

There are two forms of observation:

- *Passive Observation* – Aims at observing people in their natural environment without disturbance.
- *Active Observation/Observation by Participation* – Analyst becomes a member of the working team in order to understand the social environment, motivation, attitudes and interactions at work.

### *Advantages*

- It's the only positive means of measuring dependability of statements made during interview or responded to in questionnaires.
- Observation can correct 'hazy' understanding or erroneous impression.
- Helps analyst become acquainted with operating personnel.
- Help analyst acquire 'knowhow' needed to assist in changes that have been recommended.

### *Disadvantages*

- It's costly and time consuming.
- Users are not comfortable when they are being watched.
- Users will improve their performance when they are under constant observation.

### *Record Inspection*

- Involves perusing through maintained records to obtain quantitative data to confirm or quantify information already provided.



It may give information on:

- Type of transactions, frequency of transactions and volume of data handled.
- Frequency of updating files.
- Accuracy of data.

The record inspection should round up all the manuals maintained in connection to the areas of interest e.g. organisational charts, procedures, manuals, standard manuals etc. It helps assess the usefulness of any type of data.

#### *Disadvantages*

- Time consuming as analyst has to be selective.
- Manuals may be obsolete if they have not been modified to reflect the current state of affairs.

#### *Reasons for Recording Facts*

- Analyst can't retain all the information in his mind and so he needs to commit things to paper.
- Often several people will be working on the system investigation simultaneously and all will need access to the information.
- Often it is necessary to confirm findings with users and they will need written records.
- Findings need to be analysed and the fact of recording helps the process of analysis.

#### *Principles to follow when Recording Facts*

- Record all the information as you obtain it.
- Record your information in a way that ensures consistency and completeness.
- Record your findings in such a way that they can be understood by someone who is not a member of the IT staff.

- Arrange your records as they relate.

## ***System Design***

Requirement specification is the reference for product architects to come out with the best architecture for the product to be developed. Based on the requirements specified, more than one design approach for the product architecture is proposed and documented in a DDS - Design Document Specification. This DDS is reviewed by all the important stakeholders and based on various parameters as risk assessment, product robustness, design modularity, budget and time constraints, the best design approach is selected for the product.

A design approach clearly defines all the architectural modules of the product along with its communication and data flow representation with the external and third-party modules (if any). The internal design of all the modules of the proposed architecture should be clearly defined with the minutest of the details in DDS.

## ***Programming and Testing***

The actual development starts and the product is built. The programming code is generated as per DDS during this stage. If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle.

Developers have to follow the coding guidelines defined by their organization and programming tools like compilers, interpreters, debuggers etc are used to generate the code. Different high level programming languages such as C, C++, Pascal, **Java**, and PHP are used for coding. The programming language is chosen with respect to the type of software being developed.

### ***Testing***

- The programs designed must be tested to find out whether they are performing the intended tasks correctly.
- Logic of the program is tested using test data which could be real or dummy.

- Only logical or semantic errors are corrected using test data by the programmer (grammatical or syntax errors are detected by the language translators and reported to the programmer/user who then corrects them).
- A poorly tested system is a frequent cause of problems during and after system implementation.

#### *Characteristics of Test Data*

- Both real and dummy data should be realistic.
- Real data can be checked against the previous system results.
- No data at all in the record (blank).
- Oversize and undersize items.
- Incorrect format.
- Zero or negative amounts.
- Invalid combination

#### *Testing process*

- Should be done in stages starting with a small part and building up the tests towards the whole system.
- The stages are:
  - Unit testing
  - Module testing
  - Integration testing/system testing
  - Acceptance testing

*Unit Testing* – testing of functional units within a system as the main building block. Individual components are tested to ensure correctness.

*Module Testing* – A module is a collection of related components e.g. procedures, functions etc which perform a sub function of the system. The module's components are tested together to ensure correctness of that sub function of the system.

*Integration testing/system testing* – it's the testing of components integrated to create a system or sub system. The entire system is tested as a whole incorporating hardware, software environment/ operating system and the database.

*Acceptance Testing* – it is intended to prove to the user that the system meets the functional and user requirements. The system features are demonstrated to prove that what the user requested has been done. The user finally signs the acceptance documents subject to the correction of errors that may exist.

*Personnel involved in testing are:*

- Analyst
- Programmers
- End users
- Management
- Auditors

Each group has special contribution namely:

- System manager checks if the system conforms to the policy of the organisation.
- Operation manager checks on the operational weakness of the system.
- System analyst checks if objectives are being met and the system is error free.
- Programmers debug the program in case of errors.
- User department ensure the system is tested to their satisfaction.
- Auditor checks the controls in the system.

## ***Implementation***

It's putting the system into live operation. This is after the system is fully tested, well documented and the staff to be involved in the running of the system are trained.

It involves:

- File creation and conversion
- Change over.

## **File creation and Conversion**

It is a process of converting one file format into another.

For successful conversion, a conversion plan is required, which includes –

- Knowledge of the target system and understanding of the present system
- Teamwork
- Automated methods, testing and parallel operations
- Continuous support for correcting problems
- Updating systems/user documentation, etc

Many popular applications support opening and saving to other file formats of the same type.

## **Changeover**

It's the take on phase to the new system. It should be planned and effected at the most suitable time for a smooth transition of the new system.

### **Approaches to Changeover**

#### *Direct changeover*

Process in which the old system is abandoned immediately as the new system is put into place. The management must have complete confidence that the system will work well.

The approach is meaningful when:

- The system is not replacing any other system.
- The old system has so many weaknesses (that a parallel conversion would serve no useful purpose).
- The new system is either very small or simple.
- The new system design differs so much from that of the old system or the old system is judged absolutely without value.

#### *Advantages*

- A relatively inexpensive system implementation approach.
- It's quick and most complete.

### *Disadvantages*

- Extremely risky – there is no fall back system if the system fails. It places the organisation in a do or die situation.
- Requires preparation so that conversion exercise is carried out when it will least inconvenience operations.

### *Parallel Changeover*

Process of converting from an old system to a new system by running the new system simultaneously with the old system to allow for direct conversion. This is for a period of time. Both are fed the same data and the processed data is compared for correct operation of the system functional units and to build confidence in the new system.

The resultant outputs from each system are then compared and any differences reconciled when the analyst is satisfied with the functioning of the new system. It completely replaces the old system.

### *Advantages of Parallel Changeover*

- The new system may be checked prior to the first production run.
- Provides a method of training in the new system where personnel becomes familiar with the new system prior to the actual 'cut over'.

### *Disadvantages of Parallel Changeover*

- Additional cost of running the two systems.
- Cross checking is difficult and taxing.
- Requires more staff hence need for training additional staff.

### *Pilot conversion*

Process of converting from an old system by installing the entire new system but using it in only part of the organisation. If pilot test is successfully implemented in the other sections, it may be implemented in two modes:

- Retrospective parallel running - new system runs on already processed data by the old system and compares the results of the two systems. This reduces the problems of staff and business disruptions that may arise due to errors in the parallel run.
- Restricted data running - A complete logical set of data or department of the organisation is used to undertake the pilot run using the new system. If it works well then the other sections of the system are implemented.

### *Phased conversion*

Process of implementing only part of the new system at one time or a step by step approach where a portion of a system is implemented in all sections or departments of the organisation. It's continued over a period of time until the entire system has been converted.

It's suitable for large projects that may be dispersed in a different geographical locations.

### *Advantages of Pilot and Phased*

- Allow for training of personnel in the new system.
- Cause minimum disruption of the company operations.
- Risks associated with errors or failures are often limited.
- No need for additional personnel.

### *Disadvantages of Pilot and Phased*

- Interfacing the old system and the new one is problematic.
- Problems on ensuring that the first phase is implemented and converted.

### *Factors to consider when choosing method of changeover*

- Cost.
- Time.
- Quality of new system after changeover.
- Impact on the customers and employees.
- Technical issues.

## ***Review and Maintenance***

### *Review*

Periodic reviews are necessary to ensure that the initial aims of the system are being closely met. The system performance should be established to be as per the predictions

in the designed frame work. It's conducted by the EDP team of users and auditors after which a review report is produced which reports on the state of the system.

#### *Purpose of the review*

- To assess whether the benefits of the system which were identified at the feasibility stage have been achieved.
- To bring to light areas within a system which can be improved by system modification.
- The achievements of the system are compared to the objectives originally set.
- To provide information about system development and design which may be beneficial to future projects.
- The evaluation provides valuable feedback to the analyst so that he may learn the system.

#### *Maintenance*

Include all the activities associated with changing any program, procedure or documentation for an operational information system to keep the system operating correctly, to adapt the system to meet the changing requirements of the system end users or to make the system operate more efficiently.

#### *Types of Maintenance*

- *Corrective maintenance* - Refers to changes or action in response to problems or errors and is intended to correct errors in the system that were not detected and helps to keep the system in operation.
- *Adaptive Maintenance* - Refers to changes in the system to accomodate expected changes in the processing environment such as changes in hardware, software and user specifications or new company and government policies. This adds some new functions to the system.
- *Perfective Maintenance* - Refers to enhancement in the system in response to requests by users. It's intended to improve performance, efficiency and extend facilities to more users or to make it more user friendly.
- *Preventive Maintenance* - Refers to changes in the system structure in order to simplify and reduce cost of future maintenance.



