Systems Analysis and Design

- It is a method used to develop a new system for an organisation
- There are many stages involved: 1) investigation and analysis, 2) design, 3) development and testing, 4) implantation, 5) documentation and 6) evaluation

1. Investigation and Analysis

A company would employ a system analyst to perform the following tasks:

i. Research or collect data from the current system
ii. Describe the current system (establish the inputs, outputs and processing being done)
iii. Identify the problems with the current system
iv. Identify and agree with customer requirements
v. Produce a cost-benefit analysis
vi. Identify suitable hardware and software
vii. Produce a data flow diagram

Feasibility study

This will look at whether the new system is:

- Technically feasible: if the new system us technically possible within the given time
- Economically feasible: if the new system will make the organisation more profitable or efficient

System Investigation Methods

Interviews

A face to face meeting between the user of an existing system and the person analysing the system

Advantages:

i. It gives the opportunity to motivate the employee into giving open and honest opinions
ii. It allows the analyst to probe for more feedback, as it is easier to extend questions
iii. Once can observe moods and gestures
iv. One can modify questions to ask questions specific to the interviewee
v. It is easier to clarify a difficult point

Disadvantages

i. It is time consuming
ii. It is relatively expensive
iii. The interviewee lacks anonymity
iv. It has the inconvenience of recording all responses

Questionnaires

This is a method where a series of questions are prepared to be answered by the users of the existing system. They can be electronic or paper based.

Advantages

i. Questions can be answered quickly
ii. You can reach a large target group-can be distributed to many people

iii.   It is a relatively inexpensive method

iv.   Individuals can remain anonymous if they wish

v.   It allows for quick analysis of data

Disadvantages

i.   Most of the questionnaires may not be returned

ii.   Some questions may not be clearly stated and there may be no room for clarification

iii.   The questions are inflexible

Observation

The existing system is observed during its normal operation. The customers or users of the system should continue working without interference from the observing team

Advantages

i.   The analyst obtains reliable data

ii.   It is possible to see the main problem

iii.   It is a relatively inexpensive method

Disadvantages

i.   People are uncomfortable being watched and may work in a different way

ii.   If workers normally perform tasks that violate standard procedures-they may not do so whilst being watched

iii.   It can be time consuming

iv.   Without asking questions you may not yield valuable information

Document Review

This is looking at existing documents in an organisation. This allows the analyst to see how paper files are being kept. The documents include: policy documents, accounts statements, log book, receipts, invoices, order lists and correspondences.

Advantages

i.   It does not interfere with work

ii.   It allows information to be obtained that was not possible by any other method

iii.   The analyst can see for themselves how the paper system operates

iv.   The analyst can get information such as memory size requirements and type of input and output devices needed

Disadvantages

i.   It can be time consuming

ii.   Documents may be difficult to understand and cumbersome to read

iii.   It is expensive

Data Flow Diagrams

- The need to identify inputs, outputs and processing of the current system
- The need to identify problems with the current system
- The need to identify user and information requirements for the new system

- System specifications:
    a) Identify and justify suitable hardware for the new system
    b) Identify and justify new software for the new system

2. Design

All important components are designed. The following are some of the components that need to be designed:

1) Data capture forms/input forms
2) Screen layouts
3) Output formats
4) System flow charts/pseudo codes
5) Output forms and reports
6) Data file structures
7) Algorithms or program flowcharts
8) Hardware and software specifications
9) Test plans

Data Capture forms

Properties of a well-designed paper based data capture form

- Heading that makes the purpose of the form clear
- Clear indication of where to place answers
- Use of boxes that both ensures for sufficient information and limits excessive information
- Makes use of tick boxes
- Uses clear texts and colours making it easy to read

Properties of a well-designed computer based data capture form

- Use of text boxes to capture key data clearly
- Use of on screen help when completing the form
- Use of drop down/combo boxes where there are limited choices
- Automatic validation of data as it is entered
- Control buttons (next form, clear entry, save etc.)
- Double entry boxes to check correctness of key data

Screen displays and printed reports

Screen outputs should be designed:

- To make sure the size of all output fields is correct
- So that any instructions/ descriptions are clear
- So that the full screen is utilised
- So that colours and fonts make the output clear

Verification

Verification is a way of preventing errors when data is copied from one medium to another.

- Double entry: in this method when data is entered twice, possibly by two different operators, the data is than compared against each other and a warning is given if the data does not match

- Visual check: this is the checking for errors by the person entering the data, whilst comparing it to the original data

Validation

Validation is a process where data is checked to see if it satisfies a certain criteria when input into a computer, the following are the different types of validation checks used:

i. Range check: checks whether data is within given/ acceptable values
ii. Look-up check: checks whether the data entered exists and is stored in a table of data
iii. Length check: checks if the input data contains the required number of characters
iv. Character/type check: checks that the data does not contain invalid characters
v. Format/picture check: checks that the data is in a specific format
vi. Presence check: checks if the data is actually present and hasn't been missed out
vii. Consistency check: checks if the fields correspond with each other
viii. Check digit: this is an extra digit calculated from digits of a number and added to the end of a number

File structures

The fields used in the files need to take the following into account:

i. Field length
ii. Field name
iii. Data type

3. Development and Testing

It is essential to test the data to ensure:
- It meets the agreed client requirements
- Removes bugs/errors from the system
- It produces the required output for data where the correct output is already known
- Checks that the software doesn't crash under certain conditions

Development

- During this phase the software and hardware engineers work together to develop a working system, following the designs from the previous design stage
- Each stage is tested as it is developed
- Once all the development has taken place the whole system will be tested using the design stage
- If any test results are not satisfactory then changes will be made and the system tested again
- The file structure is finalised at this stage and also tested
- Validation routines and verification methods are used to ensure file structure is designed

Test Data

- Once the system is developed it needs to be tested
- Each module is tested individually and then the whole system is tested
- Testing will use many different types of data which can be:
  a) Normal test data- this is data which is acceptable or valid, it is also data within the limits of acceptability
  b) Extreme test data- this is data at the limits of acceptability/validity

c) Abnormal test data- this is data outside the limits of acceptability/validity and should be rejected or cause an error message to be displayed

d) Live test data- this is data from the old/current system

4. Implementation

Direct Implementation

- With this method the old system is stopped overnight and the new system is introduced immediately

Advantages

i. The benefits are immediate
ii. Costs are reduced (since only one system is used there is no need to pay for two sets of staff)
iii. Less likelihood of a malfunction since the new system will have been fully tested

Disadvantages

i. This method can be disastrous if the new system fails since the old system is no longer available
ii. Most difficult to train staff

Parallel Implementation

- The old and the new systems are run side by side for a time before the new system takes over altogether

Advantages

i. If the new system fails, the old system is still available
ii. It is possible to gradually train staff

Disadvantages

i. It is more expensive than direct since extra staff are needed to run both systems altogether
ii. It is more time consuming than direct since data needs to be entered into two systems

Pilot Implementation

- The new system is introduced in one part of the company
- If the system is successful in one part of the company then it will be introduced to all branches

Advantages

i. If the new system fails only part of the company is affected
ii. Easy to evaluate since both systems are running
iii. It is possible to train staff in one area only, which is much faster and less costly than parallel

Disadvantages

i. It can be slow to get a pilot to completely replace the whole system
ii. A pilot may not show the problems that a full scale implementation would. This is because a system may work well as a small scale but have problems when data is used
iii. It is more expensive than direct implementation since each pilot needs to be evaluated before the next stage is introduced

- Only part of the system is introduced
- When successful the next part is introduced until the old system is fully replaced

Advantages

i. Each phase can be evaluated before moving to the next one
ii. A well planned and controlled introduction of the new system
iii. Easy to train staff by letting them learn new skills on each phase as it is introduced

Disadvantages

i. It is more expensive than direct changeover since it is necessary to evaluate each phase before moving to the next stage
ii. Slower than direct changeover
iii. Although each phase can be evaluated you have to wait for all the phases to be completed to evaluate the whole changeover

5. Documentation

- This is the detailing of all the steps taken to solve a problem
- It is done for future reference during maintenance or at system review
- The documents produced here are useful for the developers of the system as well as the users of the system

User Documentation

Designed to help users learn how to use the software or system, it consists of the following:

- The purpose of the system/software package
- How to log in/log out
- How to save files
- How to do a search
- How to sort data
- How to handle error messages
- How to do printouts
- How to add, delete or amend records
- Screen layouts
- Hardware and software requirements
- Sample runs
- Troubleshooting guide
- Tutorials

Technical Documentation

It is designed to help programmers and analysts who need to make improvements to the system or repair/maintain the system, it includes the following:

- Purpose of the system/program or software
- Program listing/coding
- Programming language used

- Flowcharts/algorithms
- Input formats
- Hardware requirements
- Software requirements
- Known bugs in the system
- List of variables used
- File structures
- Samples runs (with test data and results)
- Output formats
- Validation rules and meaning of error messages

6. Evaluation

- Evaluation is carried out to see if the system is performing as planned or according to laid down objectives
- In other words, evaluation is fine to check if the system meets the original requirements
- The following are a list of things considered when evaluating a system:
  i. Compare the final solution with the original requirements
  ii. Identify any limitations in the system
  iii. Identify improvements that need to be made
  iv. Evaluate the user's responses using the new system
  v. Compare test results from the new system with results from the old system,
  vi. Compare the performance of the new system with the performance of the old system
  vii. Observe users performing set tasks comparing old with new
  viii. Measure the time taken to complete tasks
  ix. Interview users to gather responses on how well the system perform
  x. Give out questionnaires to gather responses on how well the system performs