

The analyst/project leader writes a report at the conclusion of the feasibility study detailing the characteristics of the favoured option with explanations as to the reasons it was chosen over other options including discussion of the advantages and disadvantages of rejected alternatives. The report usually contains the following:

- Project title page
- List of contents
- Problem definition/requirements definition



- Requirement report
- Summary of investigation, feasibilities/constraints
- Alternative solutions
- Recommendations (including design specifications for the next stage)
- Project plan (schedule for new system development)
- Appendix (supplementary materials, references, glossary of terms).



### 3.3

## DESIGNING SOLUTIONS

### Top-Down Design

Once the analysis of the existing system and the proposed new system is completed, the analyst or project leader designs the new system by identifying large modules of the problem to be solved and then breaking each of these down into smaller parts. This technique is called a top-down approach.



## **Hardware, Software, Input/Output, Processes, Personnel**

The new solution will probably require new hardware or software and this needs to be specified at this stage. As the technical feasibility of this hardware and software was determined previously it will be incorporated into the design. The hardware obviously needs to be available as determined in the technical feasibility study and at this stage the actual **technical specifications** need to be documented. Once these specifications are in order, specific quotations can be obtained from various suppliers of hardware.



There are a few different aspects of the software that need to be decided or designed. Firstly, is it satisfactory to purchase software 'off the shelf' using packaged software such as Microsoft Office Professional or Claris Works or will it be necessary to have **custom software** written by a programmer to meet the exact specifications? Secondly, the way in which the software will be used to produce the user interface needs to be considered. The **design of the interface** affects the user friendliness and the potential benefit to the users. Within the design stage not only do the **benefits to the users** need to be clarified and clearly documented but also consideration must be given to the 'human' needs, including the constraints due to organisational policy and goals.



The following screen design principles need to be considered in developing the user interface:

- Consistency in design so that the user becomes familiar and comfortable with the screen layout
- Use of appropriate messages for unambiguous communication between the user and the computer both as instructions and error messages
- Legibility of all screen elements including suitable fonts and colour



- Justification, alignment and the use of borders where applicable
  - Spacing and layout of all screen elements.
- The screen design will also impact on the input and output of data and information.
- The type and format of data that is to be input and the type and format of the information that will be output is confirmed. This will impact on the type of peripheral devices that need to be purchased. For example, if a receipt docket is required, a dot matrix receipt printer may need to be purchased if carbon copy receipt papers are used. If colour graphics will be scanned and high quality output is required, a high resolution colour scanner and printer will need to be purchased.

The type of processing that is to be done on the data will determine the software to be purchased. The skills, experience and adaptability of the personnel should be considered as part of the design process.

During the design stage a **prototype** of the new design is often developed. A prototype is a working model of the new system, and may be used for training, trialling to see if the new system will work and/or for demonstration purposes. As a working model which can be used for training purposes, it usually incorporates relevant snapshots of the hardware and software, screen design, input, output and processing.



## Design Tools

The design of the hardware, software, input output processes and personnel can be shown diagrammatically using the design tools that were used during the investigation stage. In the design stage, however, they refer to the new system rather than the existing system. These **design tools** include the following:

- Context diagram
- Data flow diagram
- System flow chart.



## **Documentation**

It is most important for the analyst to document all design decisions in line with the previous reports written in the investigation and feasibility/analysis stages. During the design stage the new system should be tested thoroughly before implementation. Test data is carefully selected to demonstrate that the system operates smoothly as planned and/or to identify any potential problems. Before the system is



completely released **beta tests** are done by selected participants. If errors are discovered in software, program patches (small 'fix up' programs) can be produced.

To ensure that the system is easy to maintain in the future, it is important that the analyst completes thorough documentation, including user documentation for on-line help with software as well as technical specifications for programmers and computer operators.



### **3.4**

## **IMPLEMENTING SOLUTIONS**

The implementation of the new system includes the installation of hardware and either packaged or custom programmed software, and the final 'in-situ' testing phase.



## **Methods of Implementation**

The implementation or conversion from the old system to the new system can occur in one of four ways. It is important for the analyst to clarify the implications of each conversion for the ease of the user.

Conversion choices are:

- Parallel
- Direct
- Phased
- Pilot.

The following table shows a description of each conversion with their advantages and disadvantages.



Conversion method	Features	Advantages	Disadvantages
Parallel	<p>The old system is left functioning while the new system is installed. Both systems operate simultaneously for a short time until the new system is confirmed to be working satisfactorily.</p>	<ul style="list-style-type: none"> <li>• Staff can learn the new system while still operating the old system.</li> <li>• Less likely to lose data.</li> <li>• Staff less likely to be stressed because they can refer to the old system while taking time to learn the new one.</li> <li>• Any problems with the new system can be solved before the old system is removed.</li> <li>• Staff can re-enter data if required.</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive.</li> <li>• Time consuming.</li> <li>• Takes up double the space.</li> <li>• Likelihood of data redundancy or loss of data integrity.</li> <li>• Staff need to operate on two different systems.</li> <li>• Staff may be overworked and/or confused by a completely new system.</li> </ul>



required.

### Direct

The old system is completely removed and the new system begins operation immediately.

- Least expensive unless a major error occurs.
- Least time consuming.
- Staff need to deal with one system only.

- Staff have little time to learn the new system.
- More likely to lose data between systems as staff have limited time to re-enter data if required.
- Staff more likely to be stressed.
- Any problems with new system cannot be solved before the old system is removed.



**Phased**

The new system is installed and begins operation in one section of the company at a time until the entire system is installed.

- Staff can learn the new system while still operating the old system.
- Staff less likely to be stressed.
- Any problems with new system can be solved before the old system is removed.
- Staff have time to re-enter data if required.
- Staff have more time to plan and be trained.

- Staff may become confused working across two parts of the company.
- Indecision may make staff uneasy.



**Pilot**

The new system is installed in one section of the company only and if it is suitable then the rest of the system will be installed.

- Decisions can be made to better meet staff needs over time.
- Any problems with new system can be solved before the old system is removed.

- Indecision may make staff uneasy.



## **Training**

When a new system is installed, especially if drastically different software is involved, it is important that management allow time and money to train staff in using the new system. Adequate and timely training ensures that staff efficiency will not be compromised and that they will not be placed under excessive and unnecessary stress. It is most efficient and least stressful for staff if some training is completed before the new system is installed, with on-going training where needed. An important part of training is establishing exactly what training is required and by whom.



Staff preparation/training for using a new system can include:

- **Hardware vendors** explaining the features and methods of use of their hardware, including on-going technical help desk support
- **Software vendors (programmers)** explaining how to use their software, especially its 'built-in' tutorials, on-line help and **user manuals**. Most companies have on-line and/or **help desk** support for specified periods of time
- **Software training specialists** teach staff how to use specific software to meet the company goals as expressed in the first stage.



### **3.5**

## **TESTING, EVALUATING AND MAINTAINING SOLUTIONS**

Once the new system has been successfully installed, it is important that the analyst and the company management evaluate not only the efficiency of the new system, (in particular if it is in fact more efficient and performs better than the old system) but also if it meets the needs that were specified in the initial stages of the development.



The new system is tested using carefully selected test data (usually fictitious) and is often tested in a beta test form by small groups of users (usually with real data). Test data can be chosen to test all possible types of scenarios, called scenario testing, or large amounts of miscellaneous data can be tested to see how the system operates under volume testing.



At this stage of the development cycle consideration should be made of the effects that the introduction has had on the users, participants and all those in the environment who are affected by the introduction of the new system.

Maintaining the new system includes modifying problematic parts of the system, applying software patches, undertaking virus protection, installing new software where required and keeping the system running smoothly.



**3.6**

## SOCIAL AND ETHICAL ISSUES

One of the most important and often least considered aspects of introducing a new information technology system is the social and ethical impacts on the user and on society.

As society becomes increasingly dependent on technology for its survival it is important to be aware of the impact of a change from a 'human-centred' work environment and society to a 'machine-centred' work environment and society.

## **Machine-centred vs Human-centred**

A **machine-centred system** is designed to simplify what computers have to do, sometimes at the expense of participants. For example, new and complicated software may do fast reliable calculations but be user-unfriendly.

A **human-centred system** makes participant's work as efficient and satisfying as possible. For example, using software that is user-friendly even if it is not as fast and sophisticated as other software.

The table below outlines a comparison between machine-centred and human-centred systems in terms of specific social and ethical considerations or issues.



issues.

Environment	Advantages	Disadvantages
Machine-centred	<ul style="list-style-type: none"><li>• Efficient processing (<b>efficiency</b>)</li><li>• Less data redundancy</li><li>• Easy to search and sort data</li><li>• Easy to access data</li><li>• Easy to store and edit</li><li>• Specialised programs, eg. graphics CAD, don't require expert skills</li><li>• Speed of electronic communication</li><li>• Persons with <b>disabilities</b> have access to information (<b>equity</b>)</li><li>• Flexibility in work environment/ conditions, telecommuting (<b>changing nature of work</b>)</li><li>• Increased access to information for all minority groups (<b>equity</b>)</li><li>• E-commerce and shopping on-line (<b>competitive and efficient</b>).</li></ul>	<ul style="list-style-type: none"><li>• Easy to invade privacy (<b>privacy</b>)</li><li>• Easy to collect, share and misuse unauthorised data (<b>ethics</b>)</li><li>• Skilled persons can be replaced by unskilled persons (<b>deskilling</b>), (<b>changing nature of work</b>)</li><li>• Access to unauthorised data, hackers, criminals (<b>crime</b>)</li><li>• Persons with technology skills can control information (<b>power and control</b>)</li><li>• Non-ergonomic environment can cause health problems (<b>OH&amp;S issues</b>)</li><li>• Ease of unauthorised access and copying data (<b>breach of copyright</b>)</li><li>• Inequitable access to information for the economically disadvantaged or computer illiterate (<b>equity</b>)</li><li>• E-commerce and shopping on-line (<b>disrupted social relationships</b>)</li><li>• Work could become meaningless, repetitive and boring (<b>changing nature of work, deskilling</b>).</li></ul>



of work, deskilling).

### Human-centred

- Judgement on special cases or exceptions
- Logical judgements reducing redundancy (same person with changed address in a database)
- Human contact with clients (social relationships)
- Considerations about ergonomics (**OH&S issues**)
- Retraining and multi-skilling (**changing nature of work**)
- Expanding/changing career prospects (**changing nature of work**)
- Provision of meaningful/challenging work that matches skills.

- Less efficient processing because more importance placed on software being user-friendly
- Less competitive and efficient without e-commerce and shopping on-line (**efficiency and competitive**).



## Safety in the Workplace

Safety in the information technology environment has two important aspects:

- Ergonomic hardware and software, furniture and environment
- User work routine.

The following table describes the function of key aspects of an IT workplace and work routine.

Work environment aspect	Ergonomic features	Consequence of poor ergonomic features
Furniture		
Chair	<ul style="list-style-type: none"><li>• Adjustable height</li><li>• Back support</li><li>• Stable base, preferably with five star base and on wheels.</li></ul>	<ul style="list-style-type: none"><li>• Neck and back strain</li><li>• Muscular aches</li><li>• Reduced blood flow in legs if feet <del>not</del> touching the floor.</li></ul>
Desk	<ul style="list-style-type: none"><li>• Adequate width for computer, keyboard and wrists</li><li>• Approximately 670 mm in height</li><li>• Footrest if required.</li></ul>	<ul style="list-style-type: none"><li>• Neck and back strain</li><li>• Muscular aches</li><li>• Stress from inadequate room on desk</li></ul>



## Hardware

### Screen

- Tilted backwards about 15°
- Adjustable angle, brightness and contrast
- Anti-glare screen or filter
- Positioned so that the eyes are level with the top of the screen.

- Neck strain
- Eye strain
- Fatigue.

### Keyboard

- Positioned so that forearms are parallel to the floor
- Slight angle to desk.

- Arm and wrist muscle strain.

### Mouse

- Fits the hand
- Easy to manipulate.

- Arm and wrist muscle strain.

e.g.



<b>Software</b>	<ul style="list-style-type: none"> <li>User-friendly and ergonomically designed using design principles.</li> </ul>	<ul style="list-style-type: none"> <li>Fatigue</li> <li>Stress.</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>Lighting sufficiently bright, uniform and non-glare</li> <li>Climate temperature about 20° without excessive humidity</li> <li>Noise should not exceed 55 decibels.</li> </ul>	<ul style="list-style-type: none"> <li>Eye strain</li> <li>General discomfort leading to inefficiency.</li> </ul>
<b>Work routine</b>	<ul style="list-style-type: none"> <li>Varied to prevent RSI</li> <li>Meaningful without undue pressure (eg. information overload).</li> </ul>	<ul style="list-style-type: none"> <li>RSI</li> <li>Tenosynovitis</li> <li>CTS</li> <li>Fatigue</li> <li>Stress.</li> </ul>



## CHAPTER SUMMARY

There are five stages in the system development cycle and an acronym to help remember them is Ugly Dogs Dance In Tapshoes (UDDIT). The five stages are:

- Understanding the problem
- Making Decisions
- Designing solutions
- Implementing
- Testing and evaluating.

**Understanding the problem** is another way of expressing the requirements definition. The process of understanding the problem involves data collection — using surveys, interviews and observation; report writing; creating a project plan; and obtaining and using information management software and project management software. The Gantt chart is used at this stage to graphically represent the sequence and time frame of the project.



name of the project.

... can usually represent the sequence and time

**Making decisions** involves conducting feasibility studies to examine a series of optional solutions. Each possible solution is considered using the four constraints: economic (budget), technical, scheduling and organisational. The solution that is recommended is examined in more detail using analysis tools such as data flow diagrams, context diagrams, system flow charts and organisational charts. A report is written outlining the findings of the analysis and generating a design specification.

The **designing solutions** stage is concerned with developing the design of the new system using the graphical tools of data flow diagrams, context diagrams, system flow charts and organisational charts. The design stage includes internal and external specifications for the new hardware and software and consideration is given to choices such as the use of off-the-shelf software packages versus custom designed software. It is important that adequate documentation is completed during the design stage for both users and technical personnel.

During the **implementation** stage the new system is installed at the company site. This stage



During the **implementation** stage the new system is installed at the company site. There are four ways in which a new system can be installed **direct; parallel; phased** and **pilot conversions**. Immediately after implementation the staff are trained to use the new system.

The new system is thoroughly **tested** to ensure that it is functioning correctly and **evaluated** to ensure that it meets the needs of the management as expressed in the problem definition stage. The system is **maintained** to keep it working correctly.

A **social and ethical issue** involved in the planning, implementation and testing stage is, for example, ergonomical furniture. Ergonomic environmental factors such as adequate lighting and minimal noise are also necessary considerations. Management need to be aware of potential **health hazards** including **RSI** (repetitive strain injury); **CTS** (carpal tunnel syndrome) and **tenosynovitis** as well as Australian standards **AS3590.2** and **WorkSafe Australia**. The work routine is another important factor in maintaining good health for workers.



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Adequate rest breaks as well as changes of routine minimise the risk of RSI and so on.

Management need also to consider other factors such as job design and information overload.

Social issues involved in the implementation stage of the development cycle include: skilling and deskilling, privacy, copyright, changing nature of work, crime, equity, occupational health and safety issues, social relationships, efficiency and competition and power and control.

