Chapter 37 – Management Information Systems

Introduction

Over the past two decades, a transformation to an information society has been taking place, and computers and telecommunications technologies have revolutionised the way that organisations operate. We live in an information age, and no business of any size can survive and compete without embracing information technology. Information has come to be recognised as a resource of fundamental importance to an organisation, in the same way as the more traditional resources of people, materials and finance.

It is not enough to be merely 'computer-literate' in order to become an expert in information systems. It is also necessary to understand how to apply modern technology in a business, commercial or other environment to achieve the goals of the organisation.

Information systems vs. data processing systems

In the last chapter we looked at the different levels of information system in an organisation.

Remember that a data processing system is simply one which records the day-to-day transactions taking place within an organisation. An information system is one which uses this data and turns it into useful information. For example:

- Data on items sold is collected by the **data processing system**, using a barcode scanner and an EPOS system, and stored on a computer file;
- An **operational information system** then reads this data and produces a list of items that need reordering;
- A **management information system** may analyse the sales data to highlight sales trends and use this information to plan a new marketing campaign, adjust price levels or plan an increase or reduction in production facilities.

Internal and external information

Much of the information used by management concerns the **internal** operations of the company. However, **external** information about the environment in which the organisation exists is crucial to all organisations. This may include

- Intelligence gathering about competitors' activities;
- Information about population shifts;
- Economic and social factors;
- Government legislation.

This type of information is of great importance to managers who are trying to shave production costs, find new markets, develop new products, or have strategic decisions to make about the future direction of the company. Information is collected in many ways – through conversations and interpersonal 'networking', reading newspapers, trade reviews and magazines, attending conferences and meetings, browsing the Internet. A **formal information system** relies on procedures for the collecting, storing, processing and accessing of data in order to obtain information.

- **An international car manufacturing company maintains a database holding details of every car that will be made over the next ten years by every other car manufacturer in the world. This data is collected through agencies specialising in information gathering, through trade fairs and reviews, 'leaks' and even industrial espionage.**

  A special department exists to collect and collate this information. One of the manager's jobs is to read every relevant magazine, newspaper article and communication every morning, highlight anything of importance and pass the pile of paper round the department for the others to read prior to the database being updated.

Information flow

Information flows through an organisation through both formal and informal information systems. Informal ways of gathering information include face-to-face conversations, meetings, telephone conversations, reading newspapers and magazines, listening to radio and television and surfing the Internet.

Information is also circulated through company newsletters, memos and notice boards. The problem with newsletters and memos is that readers often have so much information to absorb that they quickly forget it.

Formal methods of disseminating information around an organisation include the following:

- Computerised information systems which allow users to query databases over a company-wide network. Internal data is often collected in the first instance through transaction processing systems. External data can be collected, for example, through agencies such as Dun and Bradstreet which produces an on-line electronic data service called 'DataStream' to both business and academic organisations.
- Software packages such as Lotus Notes enable people at different locations to have the same document on their screens and work on it together. Appointments can be held on the systems so that meetings can be arranged at a time when everyone is free.
- E-mail allows correspondence and files to be transmitted throughout an organisation as well as to others outside the organisation.
- Company-wide Intranets are networks which work on the same principle as the Internet but are for use within the organisation. Information can be disseminated throughout an organisation via the Intranet rather than in the form of written memos and newsletters.

The role of a management information system

The role of a management information system is to convert data from internal and external sources into information that can be used to aid in making effective decisions for planning, directing and controlling the activities for which they are responsible. An organisation may have dozens of different information systems, some of which are useful for the day-to-day operational decisions, and some of which are used in making tactical and strategic decisions.

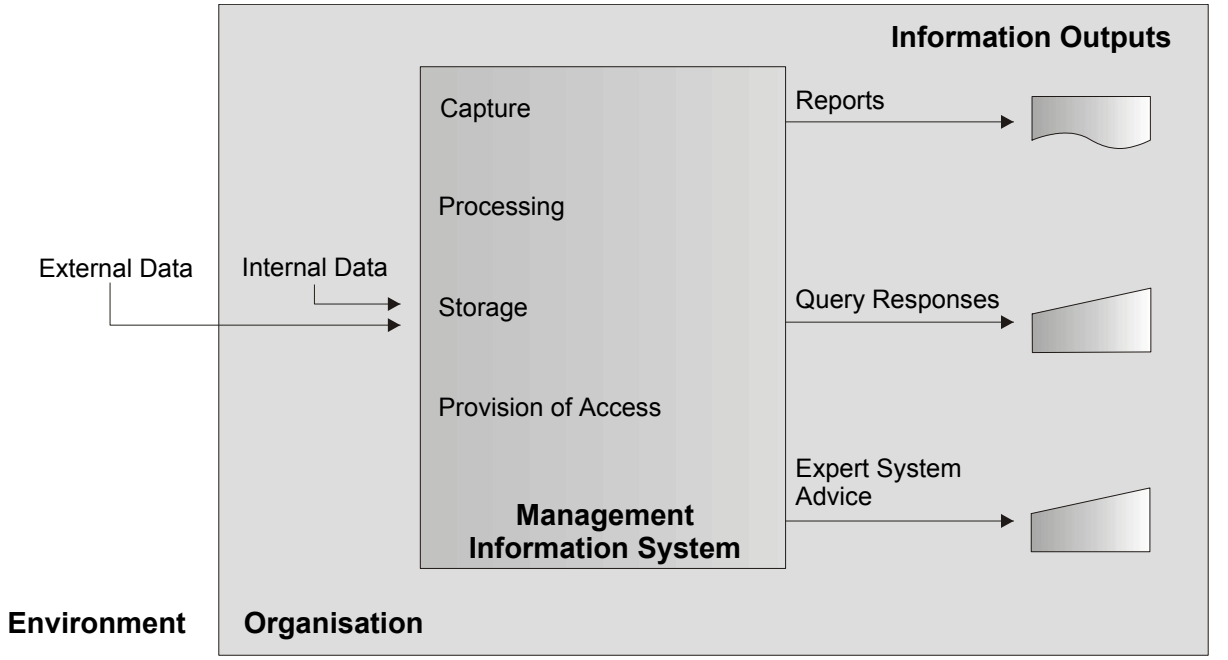

Figure 37.1: The role of a Management Information System

What managers do

To understand how information systems can benefit managers, we first need to examine what the functions of management are and the kind of information they need for decision-making.

The five classical functions of managers (described more than 70 years ago) are:

1. **Planning.** Managers plan the direction a company is to take, whether to diversify, which areas of the world to operate in, how to maximise profit.
2. **Organising**. Resources such as people, space, equipment and services must be organised.
3. **Coordinating**. Managers coordinate the activities of various departments.
4. **Decision-making**. Managers make decisions about the organisation, the products or services made or sold, the employees, the use of information technology.
5. **Controlling**. This involves monitoring and supervising the activities of others.

Management information systems must be designed to support managers in as many of these functions as possible, at different levels (operational, tactical, strategic) of an organisation.

> ➢ **Discussion: How could a MIS help college managers at various levels to carry out activities of planning, organising, coordinating, decision-making and controlling?**

A study in 1973 by Henry Mintzberg found that managers divided up their time as shown in the pie chart below. He described the work of a manager as consisting of hundreds of brief activities of great variety, requiring rapid shifts of attention from one issue to another, very often initiated by emerging problems. Half of the activities of chief executives lasted less than 9 minutes.

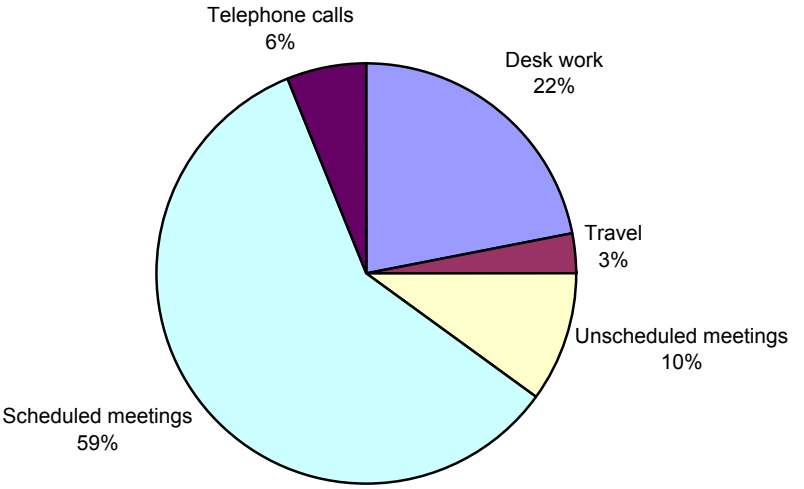

Figure 37.2: How managers spent their time in 1973

> ➢ **Discussion: Today's managers still spend their time divided between many activities. Do you think there are any activities which managers spend more time on than they did in 1973?**

Types of decision

Management decisions can be classified into two types – *structured* and *unstructured*. Structured decisions are repetitive, routine and involve a definite procedure for handling them. Unstructured decisions on the other hand are decisions which require judgement, insight and evaluation. They are often important decisions and there is no set procedure for making them.

> ➢ **Discussion: Categorise the following decisions to be made by a department store manager as structured or unstructured:**
>
> **In which town shall we open the next branch?**
>
> **How many extra staff shall we hire to cope with the Christmas rush?**
>
> **What shall we do about an employee who has had 30 sick days in the last 6 months?**
>
> **Should we try and increase the number of customers who hold a store card?**

Stages of decision-making

Making unstructured, non-routine decisions is a process that takes place over a period of time, and consists of several stages. Think of any important decision that you may have to make, like whether to go on to University or get a job, which college or University to attend, what course or career to follow. You will probably reach any of these decisions over a period of time, having gathered together information from various sources and listened to friends, parents or careers advisers.

The manager who has non-routine decisions to make typically goes through the following stages:

1. **Recognition that there is a problem.** An information system is useful at this stage to keep managers informed of how well the department or organisation is performing and to let them know where problems exist. The principle of exception reporting is especially important in this stage – in other

words, only situations which need some action are reported. (For example, customers with outstanding accounts, a sudden drop or increase in sales compared with the same period last year or a rash of staff resignations.)

2. **Consideration of possible solutions.** More detailed information may be needed at this stage, or possibly tools such as a spreadsheet which can model the effect of different solutions such as price increases or decreases, staff pay increases etc.
3. **Choosing a solution.**
4. **Implementing the solution**. This may involve setting up a new management information system to report on the progress of the solution.

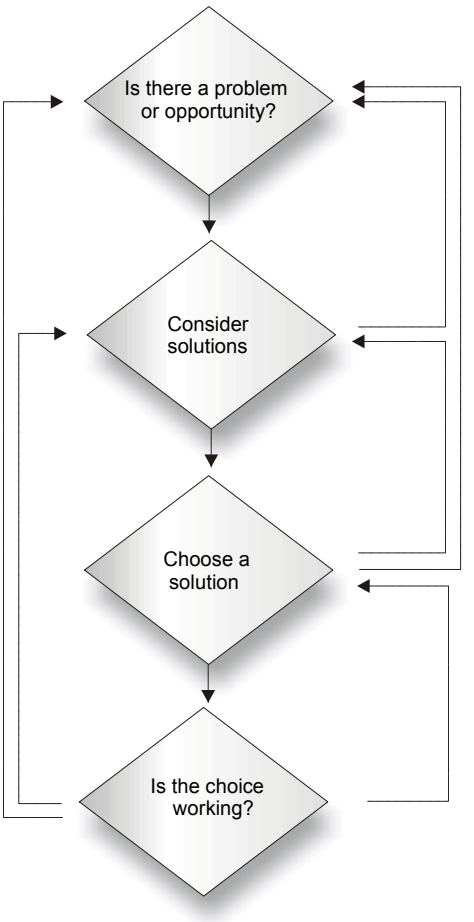

Figure 37.3: The decision-making process

Most decisions do not proceed smoothly from one stage to the next, and backtracking to a previous stage is often required if a chosen solution turns out to be impossible or new information comes to light which offers alternative choices.

Making structured decisions – often of an operational nature – is made easier by having an information system which provides the information necessary to make the correct decisions.

> ➢ **Discussion: A car company gathers information about its customer base through many sources, including market research surveys. One company has discovered that it has relatively few customers in the 18-30 age range. How can this information be used by the company to improve its sales?**

Case study: Buying a new car

If you want to purchase a new car from a Ford dealer, chances are that the make and model you want, in the right colour with the right accessories, is not in stock. It's just too expensive to have cars with every possible combination of options sitting in the parking lot waiting for a customer. In the past, it's been almost impossible for dealers to track down exactly the model that a customer wants.

With the new information system, the dealer can type the details of the required car into a terminal connected to the main Ford plant at Dagenham. The information will then come back to tell the dealer whether there are any cars available of that specification, and exactly where they are. They may be on the Ford parking lot, or there may be only two available, one at a dealer's in Perth and the other in Bournemouth. There may be none available – in which case Ford will make one for you, though this may take some time.

Plant production managers are also connected to the system, and so they know exactly what cars have been ordered and can adjust production to reflect demand every day.

- **Discussion: This is an example of a management information system. How does it help**
  - **– the dealer?**
  - **– the customer?**
  - **– the manufacturer?**

Desirable characteristics of a MIS

Formal information systems are useful at every level of an organisation. Operational systems provide answers to specific, routine questions on screen or through regular daily, weekly or monthly reports. A senior manager is likely to need information which comes to light from a new way of analysing the available data, or information from external sources.

Systems designers need to try to design management information systems which have the following characteristics:

- They are flexible, allowing for many different ways of analysing data and evaluating information;
- They are capable of supporting a range of skills and knowledge;
- They help managers get things done through interpersonal communication with other members of the organisation;
- Because managers are busy people who switch rapidly between different tasks, they should not require extensive periods of concentration;
- They should make it easy to interrupt the work and return to it at a later time;
- They should protect a manager, as far as possible, from information overload.

Factors influencing success or failure of MIS

Management information systems are generally enormously complex, and their selection, design and implementation will involve dozens of people from both within and outside the organisation. The managers and directors who are ultimately responsible for ensuring the success of the system need to have not only an intimate knowledge and appreciation of exactly what they want out of the system. They must be aware of the possibilities that ICT systems can offer, the difficulties that may be encountered and the importance of having in place the proper procedures to ensure the smooth functioning of the system.

Failure of management information systems can attributed to a number of reasons such as:

- **Inadequate analysis.** The potential problems, exact needs and constraints are not fully understood before the design or selection of a new system;
- **Lack of management involvement in design.** It is essential that all those expecting and needing to benefit from a new system are involved in its design. Without this involvement, any system is doomed to failure either by providing information which nobody needs (or, worse still, nobody understands) or management having expectations from a new system which cannot be delivered.
- **Emphasis on the computer system.** Selecting the right hardware and software is clearly essential as the basis for a modern computer system but appropriate procedures for handling both data input and output must be established before a system is implemented. The objectives of the new system need to be clearly thought out. Users often request the population of fields on a database for no explained reason and often request management reports which are neither useful nor read!
- **Concentration on low-level data processing.** One of the fundamental functions of a system within a company is the day-to-day processing of transactions, including sales and purchase orders, invoices, goods receipts and credit notes. When designing a basic system, the management information available from the system must be both easily accessible and easily understandable by users who may be neither computer literate nor managers.
- **Lack of management knowledge of ICT systems and their capabilities.** Managers require information for running companies or departments, and among other things, for producing budgets and forecasts. Managers must know what they want from a system but it cannot be assumed that these same managers have a full (or even a slight) grasp of the technology which will provide the information they need.
- **Lack of teamwork.** The needs of the accounts department, the marketing department, the sales department (home and export), and the storage and despatch departments are all likely to differ and an ICT manager needs not only to lead his team but also to be able to take on board the whole company's requirements. Teamwork needs leadership and a good leader is one who can convince all the members of a company team that the ICT system being designed is going to meet everybody's needs – but not necessarily in quite the way that the different players may have pictured.
- **Lack of professional standards.** Clear documentation written in a language that not only the ICT manager can understand is essential for training, implementation and daily use of a new system. Operators need to know exactly what to do in their work (including what to do if they need to undo some action); managers need to feel reassured that, if necessary, explanations are available to help them to interrogate the system for the information they require, and all people using the system must feel confident enough to be able to help others.

(Thanks to John Walsh of BEBC for contributing these thoughts after the installation of their new computer system – which, I hasten to add, is a complete success!)

Exercises

1. (a) What is the purpose of a Management Information System? (1)
   (b) Why is such a system required by managers of an organisation? (1)
   (c) Give **one** example of the use of a Management Information System within an organisation, clearly stating its purpose. (2)

   NEAB IT04 Qu 1 1997

2. List **three** desirable features of a management information system, stating in each case why the feature you have specified is useful. (6)

   New question

3. A school is planning the introduction of a computer-based attendance system for classes and registration groups. The purpose of the system is to produce information for the following end-users:

   - Class teachers
   - Tutors/Head of Year
   - Senior managers (e.g. Deputy Head)

   (a) Describe **three** alternative ways of collecting the information for the system. (6)

   (b) For each of the different end-users describe, with the aid of an example, information that the system might produce in relation to their requirements. (6)

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4. With the aid of appropriate examples, explain the difference between formal and informal information flows. (6)

   NEAB IT04 Qu 2 1998

5. A company keeps records of its sales and uses a Management Information System to produce reports for its sales personnel and for its shareholders.

   (a) Describe two differences between the information needed by sales personnel in their day-to-day work, and by shareholders reading the annual report. (4)

   (b) Describe, with the aid of an example, one characteristic of good quality information that might be produced by this system. (3)

   AQA ICT4 Qu 6 June 2002

6. Company management sometimes introduce new information and communication systems, giving little advance notice to their staff. This may contribute to the failure of these systems, and cause other problems for their staff.

   (a) State **six** factors that may cause the failure of a system that has been introduced too quickly. (6)

   (b) Describe three problems that staff might encounter in this situation. (6)

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Chapter 38 – The Information Systems Life Cycle

Overview of the systems life cycle

Large systems development projects may involve dozens of people working over several months or even years, so they cannot be allowed to proceed in a haphazard fashion. The goals of an information system must be thoroughly understood, and formal procedures and methods applied to ensure that the project is delivered on time and to the required specification.

The systems life cycle methodology approaches the development of information systems in a very methodical and sequential manner. Each stage is composed of certain well-defined activities and responsibilities, and is completed before the next stage begins. This approach was popular in the 1960s and 70s, when systems were largely transaction-processing systems and had a much heavier reliance on programming than most modern information systems, which are database-oriented.

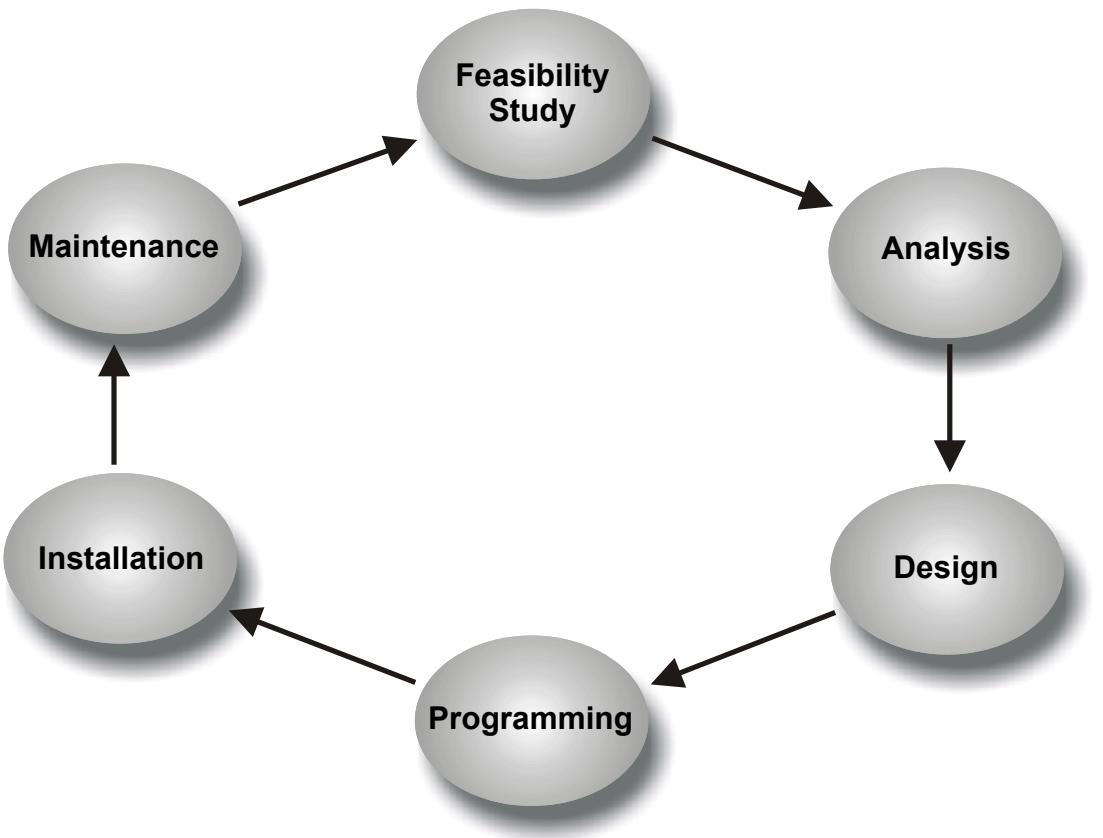

Figure 38.1: The systems life cycle

- **Discussion: In your experience of practical work on information technology projects, is this a good representation of the process of implementing a system from scratch? If not, why not?**

The waterfall model

The systems life cycle approach to development is also known as the 'waterfall model', and a variation on the basic diagram of 38.1 is shown in Figure 38.2.

Note that the arrows go up and down the 'waterfall', reflecting the fact that developers often have to rework earlier stages in the light of experience gained as development progresses.

A project milestone terminates each stage of a life-cycle-oriented approach. At this stage, the 'deliverable' resulting from that stage – such as the documentation for the analysis or the design, or the program code or finished database application, is *signed off* by all concerned parties and approval is given to proceed. The 'concerned parties' usually include the end-users, the management and the developers, as well as other experts such as database administration personnel. This sequence continues until the evaluation stage has been completed and the finished system is delivered to the end-users.

In this model, the end-user has very little say in the development process, which is carried out by technical specialists such as systems analysts and programmers. He or she is presented with the finished system at the end of the development cycle and if it is not quite what was wanted, it is generally too late to make changes. Therefore, it is extremely important that the system requirements are very clearly specified and understood by all parties before being signed off.

Such levels of certainty are difficult to achieve and this is one of the major drawbacks of the 'waterfall model'.

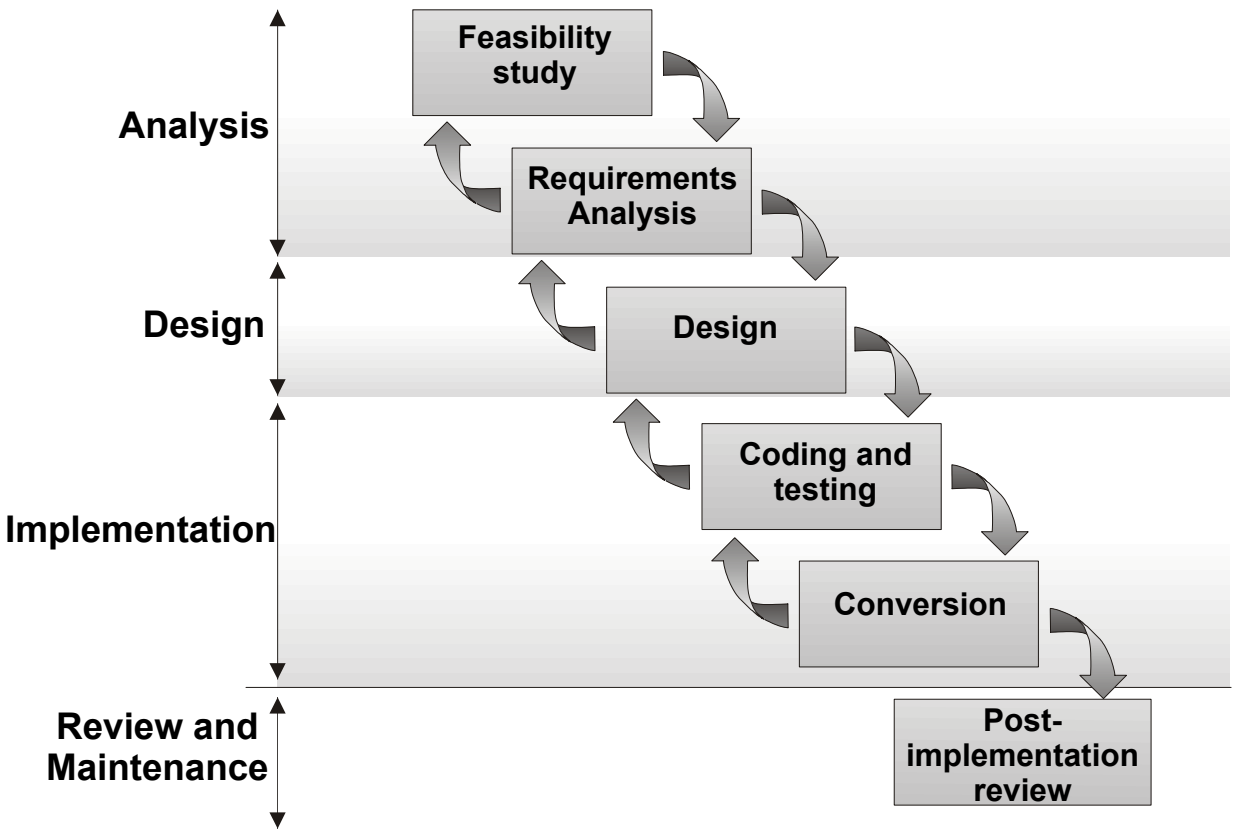

Figure 38.2: Systems development life cycle (the 'Waterfall model')

What prompts a new system?

The development of a new information system is a major undertaking and not one to be undertaken lightly. Wal-Mart, an American discount store, spent $700m on its new computerised distribution system in the 1980s. Tesco, Sainsbury's and Marks and Spencer have spent massive sums of money on their computer systems in the past decade. Businesses must adapt to remain competitive. Some of the reasons for introducing a new system may be:

1. **The current system may no longer be suitable for its purpose**. Changes in work processes, expansion of the business, changes in business requirements or the environment in which the organisation operates may all lead to a reassessment of information system requirements.
2. **Technological developments may have made the current system redundant or outdated**. Advances in hardware, software and telecommunications bring new opportunities which an organisation cannot ignore if it is to keep ahead of its rivals.
3. **The current system may be too inflexible or expensive to maintain**, or may reduce the organisation's ability to respond quickly enough to customer's demands.

Feasibility study

This is the first stage of the systems life cycle. The **scope** and **objectives** of the proposed system must be written down. The aim of the feasibility study is to understand the problem and to determine whether it is worth proceeding. There are five main factors to be considered:

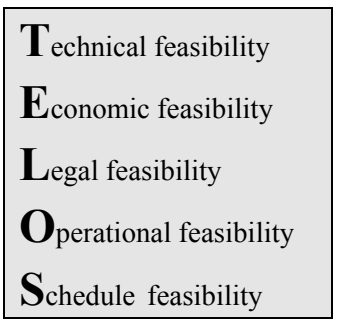

Figure 38.3: TELOS – a mnemonic for the five feasibility factors

- **Technical feasibility** means investigating whether the technology exists to implement the proposed system, or whether this is a practical proposition.
- **Economic feasibility** has to do with establishing the cost-effectiveness of the proposed system – if the benefits do not outweigh the costs, then it is not worth going ahead.
- **Legal feasibility** determines whether there is any conflict between the proposed system and legal requirements – for example, will the system contravene the Data Protection Act?
- **Operational feasibility** is concerned with whether the current work practices and procedures are adequate to support the new system. It is also concerned with social factors – how the organisational change will affect the working lives of those affected by the system.
- **Schedule feasibility** looks at how long the system will take to develop, or whether it can be done in a desired time-frame.

The completion of this stage is marked by the production of a feasibility report produced by the systems analyst. If the report concludes that the project should go ahead, and this is agreed by senior managers, detailed requirements analysis will proceed.

Requirements analysis

The second phase of systems analysis is a more detailed investigation into the current system and the requirements of the new system.

Gathering details about the current system will involve:

- Interviewing staff at different levels of the organisation from the end-users to senior management.
- Examining current business and systems documents and output. These may include current order documents, computer systems procedures and reports used by operations and senior management.
- Sending out questionnaires and analysing responses. The questions have to be carefully constructed to elicit unambiguous answers.
- Observation of current procedures, by spending time in various departments. A time and motion study can be carried out to see where procedures could be made more efficient, or to detect where bottlenecks occur.

The systems analyst's report will examine how data and information flow around the organisation, and may use **data flow diagrams** to document the flow. It will also establish precisely and in considerable detail exactly what the proposed system will do (as opposed to how it will do it). It will include an in-depth analysis of the costs and benefits, and outline the process of system implementation, including the organisational change required. It must establish who the end-users are, what information they should get and in what form and how it will be obtained.

Alternative options for the implementation of the project will be suggested. These could include suggestions for:

- Whether development should be done in-house or using consultants;
- What hardware configurations could be considered;
- What the software options are.

The report will conclude with a recommendation to either proceed or abandon the project.

Case study: Computer-dating the customer

When it started a century ago, marketing treated all customers the same. By the 1960s, marketers were able to break that anonymous mass into segments. Now customer databases allow them to treat customers as individuals. They may know consumers' names and addresses, what they buy, what they have stopped buying and even how they respond to a rise in the price of dog food.

For big multinational retailers, this is the equivalent of going back to the days of the individual store owner who knew and greeted each customer personally. The benefits are potentially huge: instead of spending millions on advertising beamed at people who may be indifferent or even hostile to it, retailers can use databases to help them hang on to their existing customers and persuade them to buy more. But it is not trouble-free: databases are expensive to collect and analyse, and some customers may see such individual marketing as an invasion of their privacy.

Talbot's, a 385-store women's clothing chain based in Massachusetts, has compiled a database of 7m names that includes information about customers' sizes. This has enabled them to forecast more accurately which sizes will sell in particular stores. It also asks all customers for their post codes when they pay, to help it plan new store openings. The effort seems to be paying off. For the past five years the company has been opening around 50 new stores a year.

Source: The Economist 4 March 1995

- **Discussion: A system like the one above would have cost millions of dollars to install. What were the major costs? What were the benefits?**

System design

The design specifies the following aspects of a system:

- The hardware platform – which type of computer, network capabilities, input, storage and output devices;
- The software – programming language, package or database;
- The outputs – report layouts and screen designs;
- The inputs – documents, screen layouts and validation procedures;
- The user interface – how users will interact with the computer system;
- The modular design of each program in the application;
- The test plan and test data;
- Conversion plan – how the new system is to be implemented;
- Documentation including systems and operations documentation. Later, a user manual will be produced.

Implementation

This phase includes both the coding and testing of the system, the acquisition of hardware and software and the installation of the new system or conversion of the old system to the new one.

The installation phase can include:

- Installing the new hardware, which may involve extensive recabling and changes in office layouts;
- Training the users on the new system;
- Conversion of master files to the new system, or creation of new master files.

Methods of conversion

There are several different methods of conversion:

- **Direct changeover.** The user stops using the old system one day and starts using the new system the next — usually over a weekend or during a slack period. The advantage of this system is that it is fast and efficient, with minimum duplication of work involved. The disadvantage is that normal operations could be seriously disrupted if the new system has errors in it or does not work quite as expected.
- **Parallel conversion.** The old system continues alongside the new system for a few weeks or months. The advantage is that results from the new system can be checked against known results, and if any difficulties occur, operations can continue under the old system while the errors or omissions are sorted out. The disadvantage of parallel conversion is the duplication of effort required to keep both systems running, which may put a strain on personnel.
- **Phased conversion**. This is used with larger systems that can be broken down into individual modules that can be implemented separately at different times. It could also be used where for example only a few customer accounts are processed using the new system, while the rest remain for a time on the old system. Phased conversion could be direct or parallel.
- **Pilot conversion.** This means that the new system will be used first by only a portion of the organisation, for example at one branch or factory.

➢ **Discussion: For each of the following examples, state with reasons what type of conversion method would be suitable.**

(a) A bakery is introducing a system to input orders from each salesperson and use this data to calculate how much of each product to bake each day, and also to calculate the salesperson's commission.

(b) A chain store is introducing EPOS terminals connected to a mainframe computer which holds details of stock levels and prices.

(c) A public library is introducing a computerised system for the lending and return of books.

(d) A large hospital is introducing a computerised system for keeping patient records and appointments.

(e) A College is introducing a computerised timetabling and room allocation system.

(f) A Company manufacturing electronic components is introducing an integrated system for production control, stock control and order processing.

(g) A Local Authority is introducing a computerised system for the collection of a new type of tax.

Post-implementation review

An important part of the implementation is a review of how the new system is performing, once it has been up and running for a period of time. Minor programming errors may have to be corrected, clerical procedures amended, or modifications made to the design of reports or screen layouts. Often it is only when people start to use a new system that they realise its shortcomings! In some cases they may realise that it would be possible to get even more useful information from the system than they realised, and more programs may be requested. The process of **system maintenance**, in fact, has already begun, and the life cycle is complete.

System maintenance

All software systems require maintenance, and in fact the vast majority of programmers are employed to maintain existing programs rather than to write new ones. There are differing reasons for this, and different types of maintenance.

- **Perfective maintenance**. This implies that while the system runs satisfactorily, there is still room for improvement. For example, extra management information may be needed so that new report programs have to be written. Database queries may be very slow, and a change in a program may be able to improve response time.
- **Adaptive maintenance**. All systems will need to adapt to changing needs within a company. As a business expands, for example, there may be a requirement to convert a standalone system to a multi-user system. New and better hardware may become available, and changes to the software may be necessary to take advantage of this. New government legislation may mean that different methods of calculating tax, for example, are required. Competition from other firms may mean that systems have to be upgraded in order to maintain a competitive edge.
- **Corrective maintenance**. Problems frequently surface after a system has been in use for a short time, however thoroughly it was tested. Some part of the system may not function as expected, or a report might be wrong in some way; totals missing at the bottom, incorrect sequence of data, wrong headings, etc. Frequently errors will be hard to trace, if for example a file appears to have been wrongly updated.

Prototyping

The waterfall model of the system life cycle has major shortcomings and often bears little relation to what happens in practice. One reason for this is that it doesn't allow for modifications to the design as the project proceeds, with both user and developer learning as they go along. Users frequently have difficulty in explaining their requirements at the start of a proposed system since they do not know what is possible and cannot visualise how the final system will work. This can result in a system which does not really match their requirements. (See Figure 39.2.)

Using the **prototyping** approach, a model of a new system is built in order to evaluate it or have it approved before building the production model. Applied to software projects, this means, for example, using special software to quickly design input screens and create a program to input and validate data. This gives the user a chance to experience the 'look and feel' of the input process and suggest alterations before going any further. The earlier a user is involved, the easier it will be to make changes.

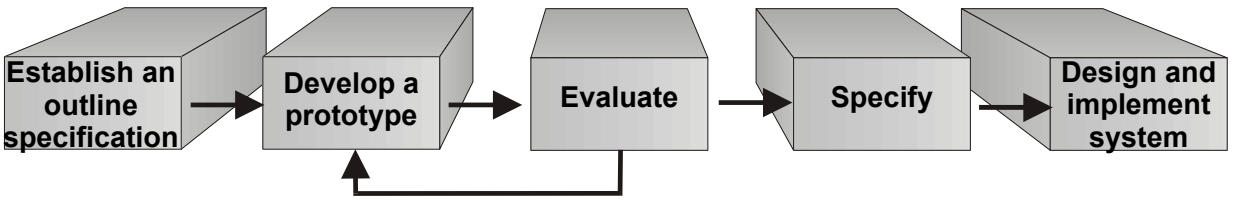

Figure 38.4: The prototyping approach

Benefits of prototyping

The benefits of prototyping are:

- Misunderstandings between software developers and users can be identified when the prototype is demonstrated;
- Missing functions may be detected;
- Incomplete or inconsistent user requirements may be detected and can be completed or corrected;
- A prototype version will be quickly available to demonstrate the feasibility and usefulness of the proposed system to management;
- The prototype can sometimes be used for training before the final system is delivered.

Prototyping may be used in a number of different ways, and various terms have been coined to describe them:

- **Piloting** – using a prototype to test the feasibility of a design proposal;
- **Modelling** – building to develop an understanding of the user's requirements;
- **Throw-away prototyping** – both piloting and modelling are 'throw-away prototypes': once they have achieved their purpose the real system is built;
- **Evolutionary prototyping** – each prototype built represents a step closer to the final solution.

Exercises

1. A feasibility study will often be carried out at an early stage of system development. As well as finding out if the proposal is technically possible the study will also consider economic and social feasibility.

   In the context of a feasibility study describe **one** cost, **one** benefit and **three** possible social effects that would be considered. (5)

   AEB AS Computing Qu 7 1996

2. Often the most critical phase in the systems life cycle is the changeover from the old system to the new one. This may be implemented by *parallel running* or by *pilot running*. Briefly describe these installation methods. (3)

   AEB AS Computing Qu 4 1997

3. State **three** different methods of fact finding available during the systems analysis stage of the systems life cycle, and for **each** of these three methods, give **one** reason for its use. (6)

   AEB Computing Paper 1 Qu 11 1996

4. State and briefly describe **two** different types of program maintenance. (2)

   NEAB Computing Paper 2 Qu 1 1995

5. Describe **five** main stages in the full life cycle of a computerised system. (10)

   NEAB Computing Paper 1 Qu 11 1995

6. Some of the steps in computerising an existing manual system are:
   - systems analysis
   - systems design
   - programming
   - testing
   - changeover to the new system
   - operation and maintenance.

   (a) Describe **three** aspects of the existing manual system which would have to be investigated so that the analysis could be carried out. (3)

   (b) Briefly describe **four** tasks which will be performed during the design process. (4)

   (c) Explain how it is possible for all the individual component modules to pass their tests and yet for the system still to fail. (3)

   (d) The changeover to the new system from the manual system can be achieved in three ways:
   (i) immediate change;
   (ii) running the manual and computerised systems in parallel;
   (iii) gradually introducing the new system a subsystem at a time.
   In **each** case, state an application for which the technique is most appropriate. (3)

   (e) Briefly describe the responsibilities of the systems analyst once the system is operational. (2)

   London Paper 1 Qu 13 1994