2 INFORMATION SYSTEMS DEVELOPMENT

2.1 KEY CONCEPTS

In Chapter 1 we discussed what information systems are and provided some context in which they are developed. In this chapter we discuss the need for an information systems development methodology and the requirements of such a methodology. This leads on to Chapter 3 where we discuss the information systems development life cycle, which has had an enormous influence as a general approach to develop information systems.

However, we start by providing some definitions of the main concepts discussed in the book. Of course, we will provide more 'meat' to these early definitions as we explore them in later chapters. We provide these early definitions to help the reader understand what follows rather than provide 'ideal-type' definitions which everyone can accept.

One problem in this area is that many of the terms used in this section are used differently and inconsistently elsewhere. We will attempt to be consistent in our usage or explain where usage differs. This is a fairly new discipline, and differences of opinion are to be expected, but it does not make our task easy.

Data represent unstructured facts about events, objects, or people. When three 'strings' of data '250792', '78700199', and '19873' are associated, they could be used to give the information that a person whose identity number is 19873 possesses a driving licence (number 78700199), even though that person is under the minimum legal age for driving motor vehicles. The string of data 250792 is interpreted as the date of birth, 25 July 1992, showing that the holder is only 10 years old in January 2002. The essential difference between data and information, therefore, is that data are not interpreted, whereas **information** has a meaning and use to a particular recipient in a particular context and can be used for decision making. Information comes from selecting data, summarizing it, and presenting it in such a way that it is useful to the recipient. Too often, this process is not well refined and vast amounts of data are output. This is often referred to as 'information overload', although, strictly speaking, it is not information but data, because it is not useful.

Some writers equate knowledge with information. Buckingham et al. (1987) define information as 'explicit knowledge'. In other words, information expresses what is meant clearly, with nothing left implied. Knowledge may also be seen as accumulated information. Most importantly, people with knowledge know the meaning and implications of the information presented and how to use it effectively. They should therefore be competent in completing their tasks. So, **knowledge** contains the ability to use information effectively for particular purposes.

The distinction between data, information, and knowledge is context-dependent. Let us look at another example where a line manager analyses the departmental figures and presents the results to the planning department. For the line manager, the results are an interpretation of events and are therefore information rather than data. They have meaning for the line manager. For the central planners, these figures are the raw input for their own analyses, not yet interpreted, and are therefore data rather than information. Therefore, information is such because it is relevant and understandable to some person or group. But the central planners need to have the knowledge to use this information effectively. This may be explicit, that is, communicable to others or tacit, that is, only implicitly understood.

Having given a preliminary definition of information, we need to discuss what is meant by a **system**. This is more difficult because it is a term that is used widely in many different fields of activity. Therefore, the ecological system is a view of the world that includes the relationship between flora and fauna which we call the balance of nature, and the educational system could be viewed as our understanding of the relationship between teachers, students, books, and colleges whose purpose is to pass on knowledge to all members of the community. Systems are related to each other. Telephone bills are produced by a billing system, forwarded by a postal system, and paid using a banking system. The banking system will have a customer service system, a cheque processing system, and a payroll system, among others. Smaller systems within larger systems are called subsystems. An information system will also have subsystems within it. An airline information system may have subsystems to report on the status of passengers, report on flights, and to analyse costs and profits. All these examples of systems include a collection of parts or subsystems that work together.

The 'system' part of 'information system' represents a way of seeing the set of interacting components, such as:

- people (for example, systems analysts, business users, line managers);
- objects (for example, computer hardware devices, a user interface, telecommunications networks, the World Wide Web);
- procedures (for example, business processes, an information systems development methodology, business rules).

All this must take place within a boundary that separates those components relevant to the system (for example, to do with purchasing a product or service online) and those concerned with the environment around the system (for example, other information systems, customers, suppliers, governments, laws, and so on).

Systems also have a purpose. For example, many information systems are designed to provide relevant information to users to help their decision making. Information needs to be presented at the right time, at the appropriate level of detail, and of sufficient

accuracy to be of use to its recipient. This will help to ensure that the corporate information resource is utilized fully.

Buckingham et al. (1987) define an **information system** as:

> A system which assembles, stores, processes and delivers information relevant to an organisation (or to society), in such a way that the information is accessible and useful to those who wish to use it, including managers, staff, clients and citizens. An information system is a human activity (social) system which may or may not involve the use of computer systems.

This definition is useful in that it emphasizes the human and organizational aspects of information systems. It suggests that the information system is useful, in other words, has a purpose, usually improving the effectiveness in the way that the organization does things – information systems do not exist for their own sake. The definition also makes clear that not all information systems use information technology, though this book is mainly about information systems that are computer-based – they use information technology for at least some of the work.

This book is about **information systems development**, that is, the way in which information systems are conceived, analysed, designed, and implemented. In Chapter 3 we suggest a generic approach to information systems development called the information systems development life cycle. At first, it might sound like a prescriptive, mechanistic process. In reality, however, it is very often far from that. Indeed, there are different ways of developing information systems: there are many methodologies, techniques, and tools to help support the development process.

2.2 NEED FOR A METHODOLOGY

The early applications of computers – say, until the 1960s – were largely implemented without the aid of an explicit information systems development methodology. In these early days, the emphasis of computer applications was toward programming, and the skills of programmers were particularly appreciated. The systems developers were therefore technically trained but were not necessarily good communicators. This often meant that the needs of users in the application area were not well established, with the consequence that the information systems design was sometimes inappropriate for the application.

Few programmers would follow any formal methodology. Frequently they would use rule-of-thumb and rely on experience. Estimating the date on which the system would be operational was difficult, and applications were frequently behind schedule. Programmers were usually overworked, and frequently spent a very large proportion of their time correcting and enhancing the applications that were operational.

Typically, a member of the user department would come to the programmers asking for a new report or a modification of one that was already supplied. This might occur because the present system did not work as specified or because of changes in the organization and its environment. Often, implementing these changes had undesirable and unexpected effects on other parts of the system, which also had to be corrected. This

vicious circle would continue, causing frustration to both programmers and users. This was not a methodology, it was only an attempt to survive the day.

As computers were used more and more and management was demanding more appropriate systems for their expensive outlay, this state of affairs could not go on. There were three main changes:

- There was a growing appreciation of that part of the development of the system that concerns analysis and design and therefore of the role of the systems analyst as well as that of the programmer.
- There was a realization that, as organizations were growing in size and complexity, it was desirable to move away from one-off solutions to a particular problem and toward a more integrated information system.
- There was an appreciation of the desirability of an accepted methodology for the development of information systems.

2.3 INFORMATION SYSTEMS DEVELOPMENT METHODOLOGY

It was to answer the problems discussed in the previous section that methodologies were devised and adopted by many organizations. We have already discussed the term methodology. An **information systems development methodology** can be defined as:

> A collection of procedures, techniques, tools, and documentation aids which will help the systems developers in their efforts to implement a new information system. A methodology will consist of phases, themselves consisting of subphases, which will guide the systems developers in their choice of the techniques that might be appropriate at each stage of the project and also help them plan, manage, control, and evaluate information systems projects.

But a methodology is more than merely a collection of these things. It is usually based on some 'philosophical' view, otherwise it is merely a method, like a recipe. Methodologies may differ in the techniques recommended or the contents of each phase, but sometimes their differences are more fundamental. Some methodologies emphasize the human aspects of developing an information system, others aim to be scientific in approach, others pragmatic, and others attempt to automate as much of the work of developing a project as possible. These differences may be best illustrated by their different assumptions, stemming from their 'philosophy' which, when greatly simplified, might be that, for example:

- a system that makes most use of computers is a good solution;
- a system that produces the most appropriate documentation is a good solution;
- a system that is the cheapest to run is a good solution;
- a system that is implemented earliest is a good solution;
- a system that is the most adaptable is a good solution;

- a system that makes the best use of the techniques and tools available is a good solution;
- a system that is liked by the stakeholders is a good solution.

Techniques and tools feature in each methodology. Particular techniques and tools may feature in a number of methodologies. A **technique** is a way of doing a particular activity in the information systems development process, and any particular methodology may recommend techniques to carry out many of these activities.

Each technique may involve the use of one or more **tools** that represent some of the artefacts used in information systems development. A non-computer-oriented example may help. Two techniques used in the making of meringues are (1) separating the whites of eggs from the yolks and (2) beating the whites. The methodology may recommend the use of tools in these processes, for example, an egg separator and a whisk. In this text, tools are usually automated, that is, computer tools, normally software to help the development of an information system. These tools might enable some development tasks to be done automatically or semi-automatically. Indeed, some tools have been designed specifically to support activities in a particular methodology. Others are more general purpose and are used in different methodologies.

This book is about methodologies, the differences between them, why these differences exist, and which methodology might be appropriate in given circumstances. As we shall see, methodologies differ greatly, often addressing different objectives. These objectives could be:

1. *To record accurately the requirements for an information system*. The methodology should help users specify their requirements or systems developers investigate and analyse user requirements, otherwise the resultant information system will not meet the needs of the users.
2. *To provide a systematic method of development so that progress can be effectively monitored*. Controlling large-scale projects is not easy, and a project that does not meet its deadlines can have serious cost and other implications for the organization. The provision of checkpoints and well-defined stages in a methodology should ensure that project-planning techniques could be applied effectively.
3. *To provide an information system within an appropriate time limit and at an acceptable cost*. Unless the time spent using some of the techniques included in methodologies is limited, it is possible to devote an enormous amount of time attempting to achieve perfection.
4. *To produce a system which is well documented and easy to maintain*. The need for future modifications to the information system is inevitable as a result of changes taking place in the organization and its environment. These modifications should be made with the least effect on the rest of the system. This requires good documentation.
5. *To provide an indication of any changes that need to be made as early as possible in the development process*. As an information system progresses from analysis through design to implementation, the costs associated with making changes increases. Therefore, the earlier changes are effected, the better.

6 *To provide a system that is liked by those people affected by that system*. The people affected by the information system, that is, the stakeholders, may include clients, managers, auditors and users. If a system is liked by the stakeholders, it is more likely that the system will be used and be successful.

An information systems development methodology, in attempting to make effective use of information technology, may also attempt to make effective use of the techniques and tools available. Information systems development methodologies are also about balancing technical aspects with behavioural (people-oriented) aspects. As we shall see in the book, there are many views as to where this balance lies and how the balance is achieved in methodologies. At one extreme are the methodologies aiming at full automation of information systems development as well as the information system itself. However, even in these systems people need to interact with the system. At the other extreme, perhaps, are attempts at full user participation in the information systems development project and user-led design. Even here, user solutions may make full use of the technology, and there are a growing number of tools designed to aid users develop their own information systems. The balance between technological aspects and people aspects is one that we will return to as it is a continual theme in information systems development.

Having stated that this book is about information systems development methodologies, not all organizations use a standard methodology. They might have developed their own or adapted one to be more appropriate for their own circumstances. Many organizations may only use some aspects of a standard methodology. Other organizations use no methodology at all. The ways that organizations use (or do not use) information systems development methodologies will be another theme of the book.

2.4 SUMMARY

- Data represent unstructured facts about events, objects, or people.
- Information has a meaning and use to a particular recipient in a particular context and can be used for decision making.
- Knowledge is accumulated information and contains the ability to use information effectively for particular purposes.
- An information system is a system that assembles, stores, processes, and delivers information relevant to an organization (or to society), in such a way that the information is accessible and useful to those who wish to use it, including managers, staff, clients, and citizens. An information system is a human activity (social) system that may or may not involve the use of computer systems.
- An information systems development methodology is a collection of procedures, techniques, tools, and documentation aids which will help the systems developers in their efforts to implement a new information system. A methodology will consist of phases, themselves consisting of subphases, which will guide the systems developers in their choice of the techniques that might be appropriate at each stage of the project and also help them plan, manage, control, and evaluate information systems projects.

QUESTIONS

1. Discuss the definitions of data, information, knowledge, information system, methodology, technique, and tools, and look for alternatives in the literature. Do you think our definitions are adequate? Do they miss out on any important aspect?

2. Why do you think there is a need for a methodology to develop information systems? Why do you think that many organizations do not use them?

3. Of the six objectives for an information systems development methodology discussed above, what for you counts as most important, and why?

2.5 FURTHER READING

Kendall, K. and Kendall, J. (2002) *Systems Analysis and Design*, 5th edn, Prentice Hall, Englewood Cliffs, New Jersey. This is one of a large number of American texts that cover the basic field of systems analysis attractively and thoroughly. Most texts of this type tend, however, to emphasize technological aspects.