MANAGEMENT INFORMATION SYSTEMS AND DATA PROCESSING

SECOND EDITION

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Management Information Systems and Data Processing

Second Edition

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MANAGEMENT INFORMATION SYSTEMS AND DATA PROCESSING

To Derek, Nigel, John, Rick, Brian and Ian,
from whom I learned a great deal

To The Student

I have written this book to meet the syllabus requirements of the ICMA and the IMS examinations. It is not, however, a textbook in the conventional sense. When you have passed your examinations and are qualified you will need to apply your knowledge to the design of management information systems. This book, therefore, is also a guide to the new practitioner in the application of his or her knowledge in the real world.

The theory of management information systems is, therefore, explained in the context of its application in a working environment. There are numerous examples showing how this has been done.

The content of every chapter is summarized in the form of revision notes which should make your revision easier and more comprehensive.

There are approximately 60 figures in the book, most of which are original and unique explanations of some part of the text. These, together with the examples, should make the book interesting and readable, both important features of a useful textbook.

My objective is simply to help you pass your examinations and provide a book which you will find of interest and use long after you have qualified. If in addition you enjoy the book, then I shall be doubly satisfied.

T.J.B.

To The Lecturer

As a lecturer in information systems and data processing, I have often wanted a book which linked theory and practice so that my students could learn in a realistic way. I have, therefore, written this book to fill the gap. The primary aim is to meet the syllabus of the ICMA and the IMS, but the secondary aim is to provide the lecturer with a teaching tool which treats the subject in a logical, thorough and interesting way.

There are, of course, sample questions and chapter summaries, but in addition there are two features which should make the book a valuable addition to your tool-kit. These are: a case study covering the first 14 chapters of the book; and approximately 60 figures, many of which will provide material for use as visual aids.

It is also hoped that the approach taken in the book, using practical examples, will provide both an interesting and an informative basis for your course.

If, in addition to finding the book useful, you also find it interesting and readable, then I shall be well satisfied.

T.J.B.

Contents

PART ONE

Management Information Systems

1

Systems Theory

1.1 DEFINITION OF SYSTEMS

The word 'system' is used in many different ways, and mostly in some specific context which provides a definition; e.g. the solar system is taken to mean the system of planets and associated satellites which move in orbit round the sun. Each component of the system moves in some relationship to the other components.

Because of the many uses of the word 'system', some of which are quite specific in a scientific sense, it is difficult to produce a generally applicable definition. The one below will provide a suitable basis for this book.

> A system comprises a number of things which are connected or related, and which are organized, either naturally or by design, to achieve some purpose.

A system must have a purpose or objective and it functions with the achievement of that purpose as its overriding control mechanism. To achieve the purpose the system will have a number of parts or activities, each of which manipulates and feeds off the resources available to the system.

The system receives inputs, works upon them, and converts or transforms them into outputs which meet the objectives of the system. This process is not carried out in isolation, but within an environment alongside or linked with other systems.

A purchasing system in a business can be used as an example of a typical system (Figure 1.1). The system is linked to a variety of other systems including the supplier's sales order processing system, the stores control system (which probably generated the order in the first place), the accounting system and the quality control system.

Each separate purchase is a transaction which flows through the system, which can be described as a continuous system. Systems of this kind are referred to as 'open systems' because they interact with other systems around them, with information flowing in and out at various points in the system.

Closed systems, where there is no interaction with the environment or other

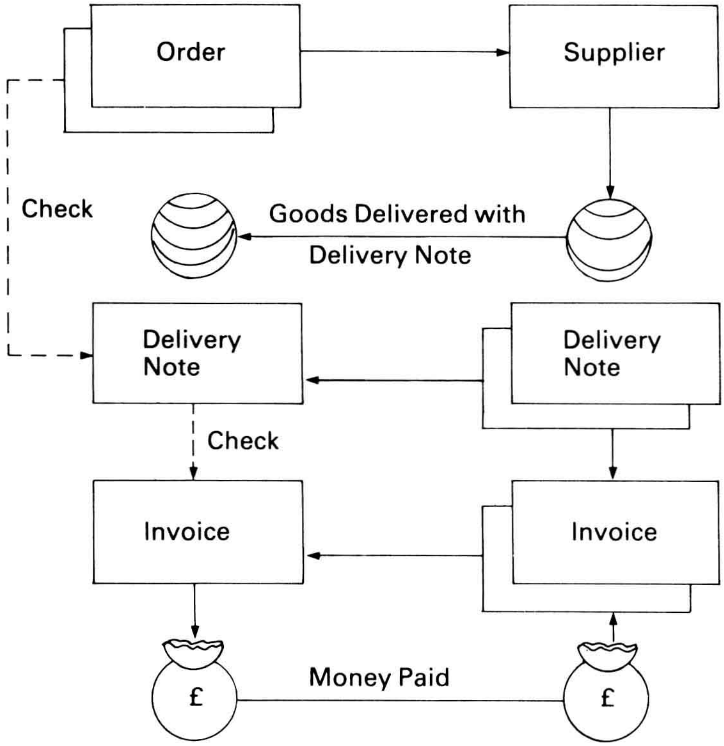

Figure 1.1 *Purchasing system*

systems, are rare, especially in the business environment. A closed system will have no input or output points and would not react to control information from outside.

A business can be seen, therefore, as an open system with an objective, possibly the satisfaction of its customers' needs at a reasonable profit, a number of activities, e.g. production, sales, administration, and resources of materials, manpower, energy and money, working within an environment and linked to other systems, suppliers, customers, banks, etc.

1.2 SYSTEMS HIERARCHY

The individual business is an open system and is also a sub-system of the industry in which it operates, and the economy of the country, which is itself a sub-system of the world economy. Yet within the business there are a variety of sub-systems, each of which is an open system linked to several others.

The enterprise is therefore constructed of a hierarchy of sub-systems and is itself part of an even larger framework. Within the business the sub-systems fit together rather like a jigsaw (Figure 1.2).

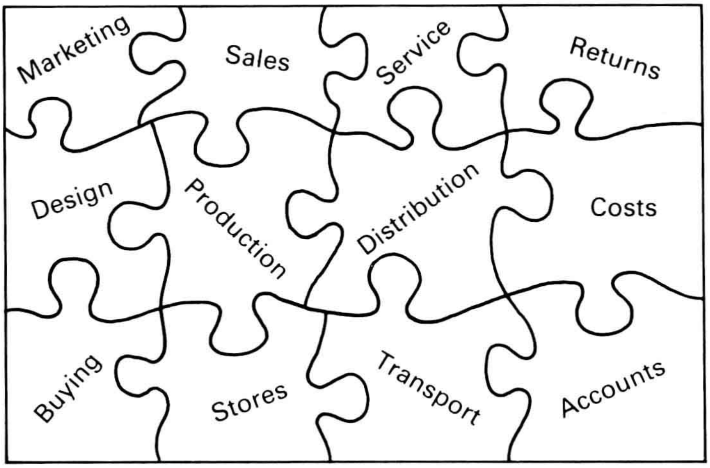

Figure 1.2 *Systems jigsaw*

The importance of the various sub-systems depends on the nature of the business. In a quarrying company, production and distribution are crucial to success, whereas in a construction company design and buying could the the main activities. In retailing, buying is crucial, and in vehicle manufacture, stores and material control, linked to production, are vital. Marketing is, of course, vital for all business enterprises.

The particular systems structure of a business is very important to the design of good systems, placing emphasis on those sub-systems which have the greatest impact on the achievement of the business objectives.

1.3 THE NATURE OF SYSTEMS

Individual systems tend to have a nature of their own: they can be deterministic or probabilistic, adaptive or rigid.

Deterministic systems are those which act in a definite way, devoid of uncertainty. If a certain signal is received by the system, then it can be predicted exactly what the system will do (assuming it works in accordance with its basic rules); e.g. a central heating system will be switched on when the room temperature falls below the setting on the room thermostat.

Probabilistic systems are those in which the outcome is uncertain, where predictions can be made only with the qualification that they are *likely* outcomes or reactions. Most of the broader business systems fall into this category.

Adaptive systems are those which can be adapted to suit the environment when changes take place. All business systems should be adaptive, but it is possible, through poor design, for systems to be rigid.

A rigid system is one which does not adapt to change and is therefore of limited value. There are some instances, such as systems for handling dangerous materials, or maintenance procedures on aircraft, in which the discipline of a rigid system is of value. However, both natural and man-made systems must adapt if they are to survive, and survival is one of the primary objectives of the business organization.

1.4 THE NATURE OF ORGANIZATIONS

An organization is a group of people working towards a common objective, within a framework devised to ensure co-operation and co-ordination. This framework or structure is created to allocate authority and responsibility and to prescribe the activities to be undertaken by the people within the organization.

The structure of an organization evolves, adapting to change in the environment, in the objectives of the organization and in the people. In theory the structure should be designed and then the required people fitted in, but in practice the structure is usually designed to fit the people who exist within the organization.

Organization structures, though very real, have no physical form. They are an abstract concept that can be only partly depicted graphically. The formal relationships are overlaid by informal ones, and though the people are working towards the same overall objective, they have many subsidiary and conflicting objectives.

The systems within the organization, both formal and informal, provide the means for co-operation and co-ordination. Though there are many different systems at work, most, if not all, business systems can be grouped into one of three main categories:

1. Planning systems.
2. Operating systems.
3. Control systems.

Planning systems are concerned with the future of the organization, with predicting the need for change, which in turn is used as a basis for adapting the other systems. Planning systems, both long-term and short-term, are probabilistic and adaptive.

Operating systems are the systems that are used to get things done. Production systems, material handling systems, administrative systems, for example, are all designed to provide the product or service that the customer needs. They are mainly deterministic and, though they should be adaptive, are often rigid.

Control systems are rather special. They try to ensure that the operating systems perform in such a way that the targets produced by the planning system are achieved or, if they are not, to direct attention to the cause of deviation.

1.5 CONTROL SYSTEMS

The study of control systems in organizations has evolved into the science of cybernetics, defined as:

The study of the theory of control systems with particular regard to the comparison between machines and the nervous systems of animals and man.

The design of a control system is based on the need for information about what is happening, so that when a deviation from the norm is spotted, it can be acted on and corrected. The process is called the control loop and is depicted in Figure 1.3.

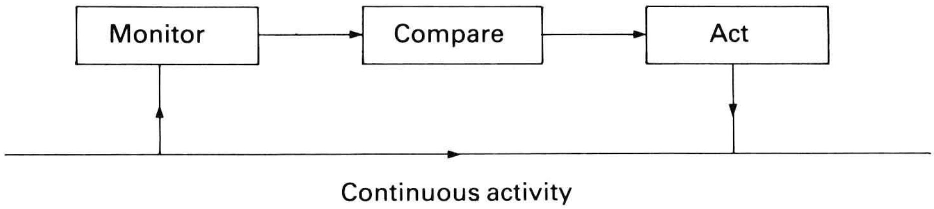

Figure 1.3 *Control loop*

To build effective control loops it is, of course, vital to have a good understanding of the activity or system being controlled, but in addition there are three crucial elements:

1. Measuring devices.
2. Control standards.
3. Regulators.

Measuring devices are needed to monitor what is happening. The accuracy of the information collected depends entirely on the accuracy of the measuring device used. Whether it is temperature, quantity or weight that is being measured, the device used must perform at the required level of accuracy if significant deviations are to be determined.

Control standards are the norms against which the information monitored is compared in order to determine whether or not there is deviation, and whether or not the deviation is significant. When this information is available a decision can be made to do something to correct the activity or system.

Regulators are the means by which action is taken to correct deviations. There are numerous examples of control systems that do not complete the control loop because regulators do not exist or, if they do, cannot be operated in time to be effective.

With the development of microprocessors the potential for designing and building effective control systems has been increased enormously. The accuracy, speed and relatively low cost of the devices are beginning to have a considerable effect on production systems of all kinds.

Control systems operate within different time scales. A quality control system checking glass bottles on a continuous production line is moving through the control loop in fractions of a second, whereas the credit control system is moving through the loop on a monthly interval.

The control loop must therefore be designed to serve the system it controls and must be as fast as is necessary to maintain control at minimal levels of waste.