Management Information from Data Bases

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Preface

This book is the product of many years of teaching management students about the role of the computer in supporting the function of management in both the public and private sectors. It assumes that its readers are, in the main, managers or management students. It is essential that managers become familiar with this growth area of management practice and participate in the making of any changes associated with the computer.

Although not necessarily computer experts, readers are assumed to be familiar with computers at least to the extent that they have completed a short 'introduction to computer data processing' course. The book should also be useful to data processing professionals and the material has been used in a B.Sc. Computer Science course because the systems development staff need to understand the overall problems and methodology of management information systems (MIS). For the purposes of computer scientists, however, it will need to be supplemented with a more technical text.

The book aims to be both practical and topical. It puts forward a methodology for the development and implementation of MIS. It presents the material in a way that is as non-theoretical as possible and many examples are discussed so as to emphasise the practical nature of its contents. This subject needs to be taught using case studies and a major case study is given in appendix A. Case histories, which are drawn from practical experience, are discussed in the body of the text. It is the authors' experience that students who follow the case study find that it supports the subject of the text by bringing out and reinforcing the major problems of developing a MIS.

Chapter 1 attempts to set the scene. It explores the involvement of management in guiding the rapid evolution of computer-based information systems so that the changeover will be smooth and the results serve the needs of managers and not those of the computer.

A methodology for the implementation of MIS is covered in chapters 2, 3, 4 and 5 together with a case study described in appendix A. The systems viewpoint is discussed in chapter 2 and to make a useful contribution to the methodology the practical aspects of systems theory are emphasised. Chapter 3 shows how a systems planning team can develop a strategy for design and take a view of data that will give management the information they want to control resources.

An overview of the methodology put forward in the book is introduced in chapter 4 and figure 4.1, which expresses this overall methodology, is likely to be referred to throughout the book. The chapter then looks at data analysis, which is part of this methodology. Data analysis will produce a data model of the organisation which will then become the data base from which the information requirements of the organisation can be satisfied. Chapter 5 shows how the MIS is developed and implemented. It discusses how the overall system may be conveniently broken up into interconnected parts called subsystems and how each of these is implemented. Analysing the requirements of the new subsystem, which will precede its implementation, is referred to as functional analysis.

The remaining chapters provide support material essential for an understanding of the implementation problems. Chapter 6 surveys recent technical developments that will have an impact on MIS. It concentrates on those developments that are particularly relevant to the manager; indeed, he will need to understand these aspects in order to use the MIS to his best advantage. Data bases are discussed in chapter 7, and emphasis is placed on the role of the data base administrator who will have overall responsibility for the management of the data base. Chapter 8 looks at the nature of data and its validation. The accuracy of the data in the data base is vital in an environment where each element of data may encounter many different users.

The difficult problem of the cost of information receives treatment in chapter 9. A balance is struck between an excessively quantitative approach and a 'laissez-faire' attitude towards the high costs involved in MIS development. Finally, human problems associated with change are discussed. If management fails to gain the cooperation of those involved, then the technology will also fail. These behavioural considerations are discussed in chapter 10 along with the wider social impact of MIS.

PREFACE

We would like to thank both staff and students of Thames Polytechnic and the University of Aston who have, knowingly or unknowingly, made a contribution to this book. Particular mention should be made of Trevor Wood-Harper, Christine Blundell and Colin Barrow who were helpful in their specialist fields. A grateful thanks to Graham Smith for his work in producing the diagrams and Stella Mayes Reed for the photographs.

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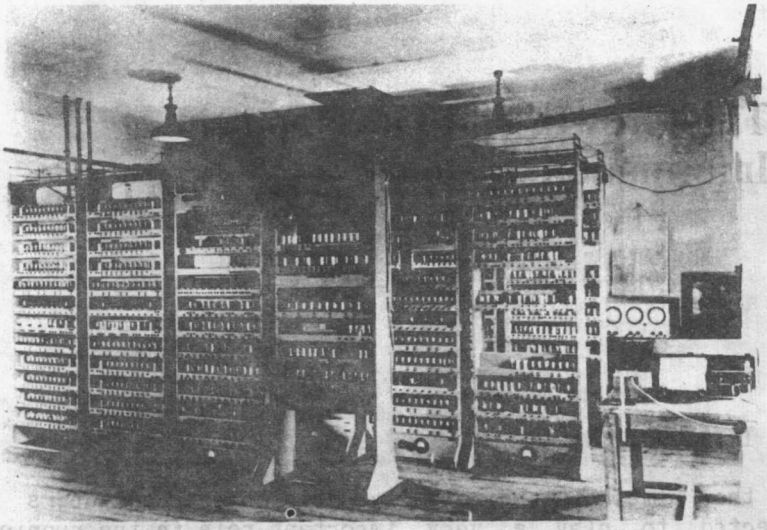
1 The Growth and Development of Information Systems

1.1 INTRODUCTION

At the time of their early development computers were expected to play a very important role in the running of organisations. In fact progress has been slower than expected, and it is only now that the computer is in a position to fulfil its early promise. The computer now has access to large amounts of data on magnetic storage. It is capable of playing a cybernetic role - that is to say a role where the computer is so programmed that it is capable of effective control of quite complex situations and appears to 'think'.

The game of chess can be analysed in three phases: the openings, the middle game and the end game. In our use of computers in industry the openings have been played. We are now in the middle game, a phase characterised by its complexity and possibility of many moves; it is at this stage that the game is often won. Management must be deeply involved in the next stage in the development of management information systems for their organisation. They must control this process if they are not, either as individuals or as management in general, to lose the game.

Figure 1.1 and Figure 1.2 illustrate the dramatic development in computer technology during the last 30 years. Figure 1.1 shows an early computer which was not only unreliable because it depended on its operation on the use of valves, but also was less powerful than the modern pocket calculator shown in figure 1.2. The last 30 years have seen the slow but steady development of computer systems in



(Reproduced with permission from the Computer Laboratory, Cambridge and the Science Museum, London.)

FIGURE 1.1: THE EDSAC I COMPUTER

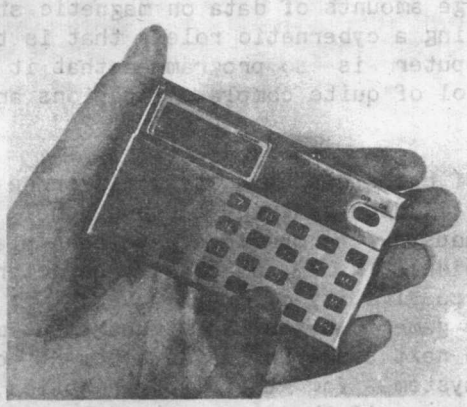


FIGURE 1.2: A MODERN POCKET CALCULATOR

industry and commerce. Gradually suitable applications have been transferred to the computer. This has normally been done on the basis of cost justification, and as computers have become cheaper more of the applications that provide the basic clerical processes in organisations have proved amenable to computerisation. Quite small organisations are now able to justify the use of a computer. This early period

saw the computerisation of such applications as: billing, invoicing, bought ledger, stock accounting and payroll (not the best of applications for those early machines).

Computerisation during this period was very much an 'ad hoc' affair with applications being implemented in isolation. This is what Blumenthal [1] referred to as islands of mechanisation. Only small sections of the organisation were affected and the detail of such high technology could be ignored by general management.

1.2 THE EXPANDED USE OF COMPUTERS

Today it would be a foolish manager (or one very close to retirement) who ignored the computer. Management needs to be informed about the principles of processing information. Information is the 'life blood' of management, managers need to have more than just an appreciation of computers.

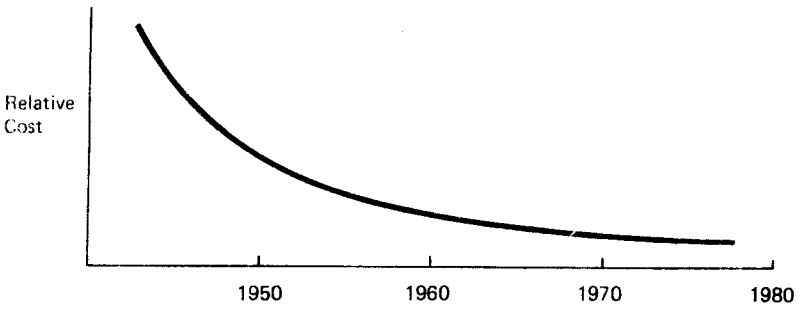


FIGURE 1.3: REDUCTION IN THE COST OF COMPUTERS

As more and more applications have gone over to the computer we have arrived at a stage where in some situations large parts of an organisation are affected by the computer. The separate islands of mechanisation have come together. The professional manager can no longer afford to ignore the increasingly significant role played by the computer in his organisation. It is appropiate here to mention that over the same period that the use of computers has been developing, the science of management itself has made massive advances

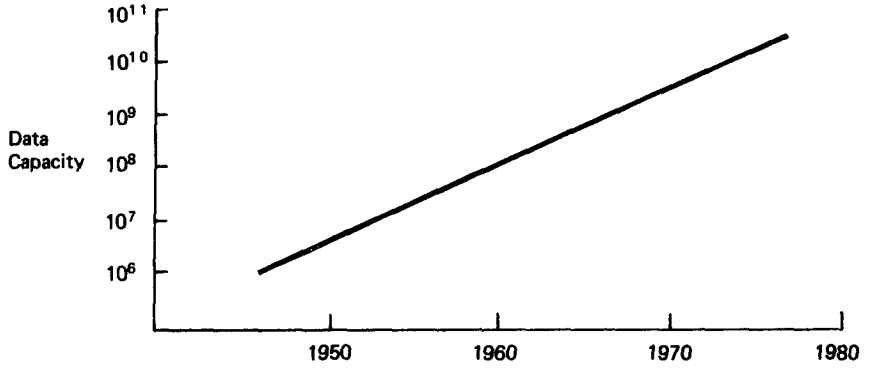


FIGURE 1.4: ON-LINE DATA CAPACITY OF COMPUTERS

and it is doubtful whether modern management would want to ignore the computer which managers now see as an essential partner in their more sophisticated management role.

1.3 THE NEED FOR A POSITIVE METHODOLOGY

The intention of the authors is to provide a text that will enable the manager not only to defend himself against the ever pervasive growth in the use of computers, but to equip him with a positive methodology to direct and harness the new information technology to his advantage. Any new methodology must address itself to the problem of implementing large integrated computer systems that are often required to provide a management information system (MIS).

The methodology put forward in this book is another stage in the development of techniques for the study, design and implementation of information systems. Its strength lies in the fact that it stems from a study of the nature of the management process and the way management actually use information. New techniques of documentation and design for data bases are introduced.

In the same period that computers, and the managers who use them, have undergone an evolution, so too have the computer professionals in the way that they attempt to design and implement computer systems. In the early days computers

were treated like any other minor technology such as electric typewriters, lifts, heating systems or air conditioning - technologies that required special programming but which were not considered as impinging to any great extent on the organisation as a whole. It was expected that these clever devices would be programed by specialists, preferably mathematicans, who would be confined to their own specialist section - the computer department.

This approach soon proved too superficial and those early programmers (or coders as they were known) were soon supplemented by systems analysts. The use of the systems approach, an approach which is interdisciplinary rather than disciplinary, was taking place wherever the complexity of the problem precluded a simplistic disciplinary approach. The Pentagon, for example, use this approach to evaluate complex systems where, amongst other advantages, it helps to balance the competing pressures of the professionals arguing their own causes. The complexities of programming the operations of billing, invoicing or stock accounting was recognised to be more complex than was first realised. The implementation of a successful computer system, it was realised, needed a more sophisticated approach.

It was at this stage, about the early 60s, that the first simple methodologies started to appear (BISAD was put forward by Honeywell, and IBM had a Systems Survey technique). These early methodologies set clear objectives for the design of the new system and the approach tended to be quantitative and mechanistic. The short-comings of these approaches, from which management suffered, were recognised and there have been attempts to reflect in the later methodologies an understanding of the human problems of change involved in systems design.

1.4 CURRENT TRENDS IN SYSTEMS THEORY

There is a lot of research currently aimed at developing a general systems theory. This research if successful should aid understanding of the organisation and the smooth implementation of large computer systems; these aspects will be discussed in more detail in the next chapter. However although this work is important, developments within the computer technology itself makes it less urgent. Developments which should enable the users to 'design' their

own systems. It could be argued that one of the major problems was the extent to which the early crude computers required that the user systems be bent to suit the computer. This meant that although systems were produced that 'worked', they were less than what the management wanted. Recent advances, particularly in the programs that can be provided, mean that the computer can achieve greater 'transparency', that is, the end user need not fully understand and in some cases even be aware of the technology that is between him and his problem. Transparency means that the user need not be forced to bend the solution to fit an inadequate computer technology.

Perhaps a good analogy here would be to compare it to the design of a transport system. With transport systems based on railways one had to make a very careful study and design of the actual and potential traffic patterns. With the advent of the motor car the precise use of the vehicle did not need to be determined in advance. This is considered to be primarily the concern of the end user. Modern computers may soon be able to provide the same sort of solution.

1.5 THE INVOLVEMENT OF MANAGEMENT

Where does that leave us today? Certainly with the extent and integration of computer systems it is reasonable to talk in terms of integrated computer systems that not only carry out many of the basic operations but should also be able to provide useful management information. Management cannot stand aside and leave it to the specialist to design and produce the new systems. Firstly because so many functions are being put onto the computer that the very survival of the organisation is now at stake. Secondly specialists can often be carried away by their enthusiasm for their technology and management involvement will ensure that the design centres around the organisation and not the technology.

The fact that so much of the organisation's information is on magnetic storage media means that managers are able to have access to vast amounts of information. All this is going to create a new world for the manager, with the advent of good information retrieval, management style will change.

Managers, in developing their careers, often enter organisations serving a specialist function, such as accountant or engineer, but as their careers develop and they

wish to enter general management it is normal for them to broaden their knowledge and experience. The accountant must understand how the product is made and the industrial chemist must learn about accounts and budgeting. In the age of the computerised information system the general manager must understand something of this new technology. He must strive to understand how the new techniques will impinge on the management function. So equipped he will be able to participate in the design of new information systems creatively and to emerge as a satisfied user rather than as another victim.

A lot of the problems with computer systems in the past stemmed from either a lack of appreciation of their power and capabilities or a naive expectation of what they could do. On balance the over-optimistic situation was more difficult to manage. After the early heady days of approval and design the reckoning came with the problems of implementation as disillusionment set in.

A realistic knowledge of the technology must mean a reasonable expectation of the computer system in terms of cost and performance. To the manager who can achieve a good understanding the reward is fluent use of that most precious resource of management - information.

1.6 HISTORICAL DEVELOPMENT, AUTOMATION OF THE CLERICAL PROCESS

It is worthwhile quickly reviewing the development of computers over the last 30 years. In particular it is neccessary to understand the significant developments that took place in the 1960s - developments that have made MIS realisable. These developments, the perfection of direct access storage techniques and the wide availability of visual display units (VDUs), have put information literally at the fingertips of management.

The first generation of computers, apart from being expensive, were also unreliable. At that time a vast amount of data processing was not done with computers, although they were around, but used tabulators which were becoming increasingly sophisticated. The second phase of development saw the widespread use of the computer which by this time, due to the introduction of transistors, had become reliable. In the 1960s the number of computers being used increased six fold. By 1970 any organisation of any size was making use of

a computer. In spite of the earlier expectations that the computer would play a cybernetic or 'thinking' role, the decade of the 60s is characterised by the use of computers for mundane clerical tasks. It would not be overstating the matter to describe this essentially as a process of automation of the typing chore. The repetitive programmable tasks have been ideal breeding ground for the early generation of computers.

> 'The widespread use of computers in the non scientific area was characterised by their use as adjuncts to or more efficient replacements for the regular clerical processes'. (Blumenthal)

Of course, from the very early days of computing, there were specialist developments which made fuller use of the computer's potential. This was not only in the scientific fields but in areas such as airline reservations, process control and message switching where the computer's participation has been extended from a purely clerical role to a more operational involvement.

More recently the role of the computer has changed. Slowly it has been able to take on more sophisticated tasks. In applications like stock accounting, complex operational research routines have been inserted which allow the computer to make forecasts and to suggest reorder levels if not actually to affect the order process itself.

1.7 INFORMATION IN ORGANISATIONS

Most organisations can be looked at from a hierarchical point of view, as shown in figure 1.5. This is the classical model of an organisation commonly used in management studies. The directors are responsible for determining the strategies and hence the policies of an organisation. The managers are responsible for the implementation of the policies and the management of exceptional circumstances. The operators are responsible for the repetitive programmable tasks in the day to day operation of the organisation.

It is in the area of operations that the computer has made the most progress. In what has been essentially a process of automation.

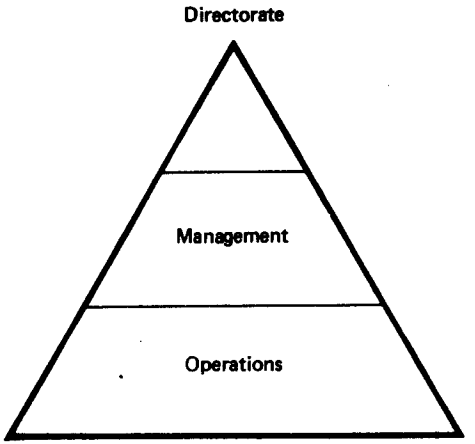


FIGURE 1.5: STRUCTURE OF ORGANISATIONS

Each time the computer takes over a purely repetitive, task it has normally created a pool of data related to that task. The by-product of the invoicing operation where invoices are printed by the computer and the sales accounts are updated, is a large file containing the names and addresses of all the customers and other data related to the sales process.

There is likely to be another large file giving the history of all the transactions that have taken place with the company. Now the computer, having laid the foundations by creating these large pools of data, will be able to fulfil at least some of its earlier promise, a promise best epitomised by the work done in the areas of chess and language translation. A cybernetic role if achieved will be all the more formidable if it is supported by an adequate data base.

Figure 1.6 illustrates how the computer, having automated the operational tasks, has now created a data base. This is a large reservoir of accessible data on magnetic storage media. The foundation is now laid for the next phase