A behavioural analysis of the adoption and use of interactive computer systems by senior managers

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A Behavioural Analysis of the Adoption and Use of Interactive Computer Systems by Senior Managers

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Thesis submitted in fulfilment of the requirements
for the degree of Doctor of Philosophy
at the University of Durham.

September 1986

Abstract

The purpose of this research has been to make a contribution to knowledge about those processes and phenomena which influence the use of computer-based decision systems by senior managers for their own decision activities. In the course of the thesis, research questions are addressed which relate to the nature of the role of the directly-accessed computer in the working life of the top manager, and especially to the factors which influence computer adoption and use.

A review of relevant literature enabled gaps in existing knowledge about senior managerial computer use to be identified, and indicated the potential value of exploratory research. A programme of interviews was devised and executed which enabled the exploration of the research problem across a sample of senior managers from private and public organizations. It is felt that the methodology of performing intra- and inter-organizational comparisons among computer-exposed managers was fundamental to achieving new insights into managerial behaviours.

Following qualitative and qualitative analysis of the research data, a dynamic behavioural model of the computer adoption process in large organizations is proposed together with a description of salient behavioural features at key points in the process. This theoretical model contributes to an understanding of the nature and circumstances of the senior managerial behaviours associated with direct computer use.

Acknowledgments

I am greatly indebted to Terry Webb, at Durham University Business School, for his insights, critical evaluation and above all, his never-failing support and encouragement throughout his supervision of the research.

My thanks also go to Professor Charles Baker for his encouragement and invaluable introductions to otherwise recalcitrant respondents in several organizations; Dr Graham Winch helped me with the project during the crucial early stages.

Many people at Durham University read papers, helped, listened or commented during the project; special thanks go to my fellow doctoral students and departmental colleagues who provided a sympathetic and interested environment.

A number of managers at ICL listened to presentations of the research results at various stages in the project and provided valuable feedback and comments.

Senior managers (who must remain anonymous) in a number of organizations gave their valuable time and provided the material for this thesis; their help and patience nearly always went far beyond the call of duty. Amongst several organizational facilitators, Julian Phillips ranked as the most adroit and successful of all.

My wife Ann read several versions of the thesis as it unfolded, and patiently listened to a great deal more during this exercise in terminal monomania; without her support, backing and forbearance it would simply not have happened.

C.J.Martin

Durham University 1986

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Chapter 1

Introduction and Overview

Abstract

The topic of senior managerial computing is introduced, and some of the opening research questions are described. There follows a review of articles which discuss the present position, and some contrasting views are described in order to set the scene for the ensuing discussion. The chapter concludes by describing the need for research and highlighting the principal direction of the research effort. Finally, an outline of the contents and structure of the thesis is provided.

Introduction to the topic

Managerial computing is a fascinating topic; on the one hand it involves the use of the most interesting products of current technology, and on the other it is concerned with subtle and difficult effects involving the manager and his organization. This thesis is concerned primarily with the later aspects, and endeavours to explore the behavioural aspects of computer use in order to enhance understanding of the issues and factors involved.

The research is focussed specifically on top managers. There were several reasons for this: to a large extent our industrial top managers remain an under-researched group in general, and it seems appropriate to examine people to whom, by virtue of their organizational position, computing has, in principal, most to offer. Another reason for this choice was that it was anticipated initially that the top managers would have complete discretion in relation to their computer use; this would enable the research effort to concentrate on "important" issues relating to managers' free choices of suitable systems. The field research quickly showed that these latter ideas (and some others held at the beginning) were quite wrong! Nevertheless, in the course of exploring this particular topic a number of very interesting issues have been examined and the decision to research top management (and the difficulties which this caused) was felt to be more than justified by the results.

The research effort began with a number of questions; these were refined (and in some instances discarded!) as the research

proceeded, but it is worthwhile stating the principle ideas at once: Do top managers use computers, and if so, what do they use them for? How do present day decision support systems impact top level decision processes? Why should some managers apparently use computers a great deal and yet others not at all? What are the characteristics of the systems (or the people, or the situation) which encourages use or non-use? It is hoped that this thesis goes some way towards providing answers to these questions.

There have been a number of articles in the computer and management press, as well as in academic journals, relating to senior managerial computer use. It is to these reports to which attention is now turned in order to examine the "state of the art" as it has been described.

Reports of senior managerial computing

In order to ensure an up to date picture of the way that the topic is perceived, a computer database search was performed, using carefully defined parameters, in order to supplement the wide literature review which will be described in forthcoming chapters. Details of this database search, which was undertaken at the end of 1985, are discussed in Appendix 1. By including sources from within the computing industry and from news articles and other more immediate reporting media as well as academic journals, it is felt that a reasonably up-to-date view has been taken.

One of the main problems with researching application effects in the computer field is the excessively rapid rate of change. Effectively, one seems to be following a fast moving target and

general statements about current practices must be hedged about with caveats. This is certainly true of the field of managerial decision support, which has been particularly volatile during this research project (1983-1986) and in fact the period 1980-1985 yielded three times as many references in the literature search as the period 1974-1979; in addition, there was a significant peak in the number of related article references in 1983 and, to a lesser extent in 1984 (see appendix 1 for details). This flurry of interest has all the properties of the typical computer industry "boom and bust" cycle (King 1981); this is characterised by a cycle of increased awareness followed by rapid application, with a subsequent falling off of interest when results fail to match expectations. Interestingly, there seems to have been a falling off of interest in 1986 - perhaps as newer and more "exciting" topics have attracted attention.

A historic perspective

The idea of senior managers utilising computers themselves in order to enhance their decision-making has attracted considerable interest over the years. However, the direction of the comment seems to fall into two categories: on the one hand enthusiastic reports of use and prognostications of increased use and benefits have appeared; but on the other hand more pessimistic comments have also been seen. It is illuminating to examine some examples from both these camps.

In the 1960s and early 1970s there was increasing enthusiasm for the capabilities of direct computer use by managers - "on-line,

real-time systems" (Boulden and Buffa 1970), which were intended to support interactive decision making. The seminal case-study described by Scott-Morton (1971) seemed to show the value of direct computer use in managerial decision making. Scott Morton was among the first to demonstrate that the use of interactive computer terminals could, in certain situations, influence and support the managerial decision process. The decision support capability which he discussed is based on the concept of "limited rationality", proposed by Simon (1957), and Cyert and March (1963); and Scott Morton contends that the human problem solving capability is directly enhanced by on-line computer capabilities.

However, the use of these systems at top management levels has been in doubt. According to a study by Brady (1967) computing had had little impact at senior managerial levels at that time; nevertheless, the author went on to forecast that:

> "... by 1975 the computer will have had a substantial impact on top executives' decision making..." (Brady 1967)

Other authors had doubts as to the role of computing in top decision making. According to Hall (1973) the use of computer-based strategic planning models had failed to have significant impact on strategic decision making.

> "... there is a serious question as to whether the current direction of strategic modelling will ever lead to the implementation and utilization of these tools."

Hall believed that this situation had arisen because of a misunderstanding of the top-level decision process leading to the creation of inappropriate models based on normative views of the strategic decision process.

"In fact, it would seem that the much discussed concept of top managers using real-time models for strategy formulation will never come to pass..." (Hall 1973)

These pessimistic views are generally supported by surveys of strategy-oriented model-based DSS (Grinyer and Wooller 1975) which show that systems are generally built and used by staff specialists or consultants (external or internal), rather than by senior managers with significant decision responsibilities, and that these systems infrequently impact strategic or policy related decision outcomes (Fromm et al 1974). In a recent survey of financial DSS packages, Grinyer (1983) states:

"... management and directors... seem to be as remote from direct use of models as ever..."

The reasons for the lack of impact of model-based DSS are discussed in more detail by Martin and Winch (1984), but in general it was considered that the model-based systems are inappropriate in relation to the senior manager's organizational role in the strategic decision process.

Despite these apparent failures at top level, enthusiasm for DSS remained unabated, as expressed by Keen (1976):

"... the aim remains and rests on faith - surely the computer can be made useful for top managers."

It has been during the 1980s that significant reports of direct senior managerial use have emerged. Isolated examples of firms who have introduced computers to the top managers have been reported; examples include L.Davis (1983) reporting on general managers' computer use in British Petroleum and D.Davis (1984)

relating his own experience as president of Tate and Lyle plc. According to L.Davies (1983) this development represented a significant change in senior management activity:

"... the most fundamental shake-up of management methods... the computerisation of the executive suite."

But this seems to be only the tip of a newly emerged iceberg. Other enthusiastic comments have been reported recently in the management press and elsewhere:

"The top management office is where basic decisions are made that determine the viability of the organization... the function of the [computer] workstation is to make the information almost instantly accessible... An IDC survey... indicated an unexpectedly high incidence of companies anticipating widespread use of workstations among senior executives." (Data Management - Supplement to Management Today - Sept 1984)

"A recent survey reveals that senior executives in the UK, with access to personal computers and terminals are most likely to use them for financial analysis purposes..." (Financial Times 30th Sept 1985).

According to Rockart and Treacy (1982), writing under the title : "The CEO Goes On-Line", many top managers have now begun to use computers themselves in order to carry out analyses for their own decisions. These authors cite several examples of computer use by chief executives and state that:

"Although these examples do not yet represent common practice for senior corporate officers, they do suggest a trend towards greatly increased computer use in top-executive suites."

The use to which the systems are put by the top managers in this study are described as follows:

"... the top executives who personally use computers do so as part of the planning and control processes in their organizations.... [they] have decided that they need a better understanding of the workings of their corporations. To achieve this, they have sought out the individually tailored access to

the broader, more detailed sweep of data that only computers can provide." (Rockart and Treacy 1982)

Three reasons for the trend towards increasing top-level use are offered:

> "... user-oriented terminal facilities are now available at an acceptable price; executives are better informed of the availability and capabilities of these new technologies; and predictably, today's volatile competitive conditions heighten the desire among top executives for ever more timely information and analysis." (Rockart and Treacy 1982)

In fact, the field research described later in this thesis shows a very different picture of the requirements of senior managers. Nevertheless, the content of these later reports seems to indicate a strong movement towards top-level computing; the validity of these ideas will be explored later.

Discussion

There appears to be insufficient evidence in these reports to support clear views about the processes which would distinguish between those executives who do use computers and the vast majority who apparently do not. What are the characteristics of the situation or the people that lead to the uses described here, which would seem, on the face of it, to be reasonable for many executives?

In the light of the conflicting accounts of senior managerial computing, it remains an open question as to exactly what the extent and nature of direct use really is; further, there appears to be a clear academic requirement to explore the processes which appear to lead to adoption of the technology by the few and the rejection of that very same technology by the many. It is

these questions that have particularly fired the present research effort, and it is to these that the results and conclusions of the thesis will be addressed.

Conclusion

The preceding topic review has outlined the scope and need for research and has indicated the nature of the questions of interest. To sum up, then, the aim of the research is to explore the processes and phenomena which influence the use of computer-based decision aids by senior managers in their own decision making behaviour, and particularly where such behaviour is related to organizational strategy or long-term policy.

An outline of the thesis

The thesis continues in chapter 2 with an examination of the ideas and technology behind the decision support movement, in order to see to what end these technological developments are intended. Particular attention is paid to the intentions and ideals of the movement, as well as to the content of technological systems, and to the theories which underpin the technology. In order to clarify the meaning of the ill-defined and over-worked word "user", a new typology of computer use relationships is proposed.

In order to understand something of the nature of managerial decision behaviour, a review of some of the extensive literature on this area has been undertaken in chapter 3. The work here has not been centred on the normative decision paradigms usually

associated with decision support, but rather on the descriptive elements of organizational behaviour based on diary and observational studies. Particular attention is paid to role theory, which forms an important background for evaluating the field research results.

Although the literature relating to specific studies of senior managerial computer use is sparse, there is a large body of work concerned with the general problem of decision system implementation and it seemed natural to review this work in order to establish a theoretical basis for the study. This is undertaken in chapter 4. In order to make some sense of the broad and varied coverage which the literature provides, a synthesis of the literature is attempted which derives seven groups of factors which may be considered to influence computer use. This synthesis has been taken as the essential theoretical guide and context for the research, and comprises a static model of the factors presumed to affect decision system implementation generally.

Chapter 5 introduces the field research work. In choosing among several alternative research strategies, a programme of direct interviews with senior managers (supplemented with other materials) was felt to represent the most appropriate alternative in view of the generally exploratory nature of the research effort. This chapter discusses access problems and solutions, and describes how the sampling and data gathering methodologies support the emerging theoretical standpoint.

Chapters 6 - 9 are concerned with describing and evaluating the

results from the field work. Chapters 6 and 7 review and analyse the findings from research in five large organizations; emerging theoretical categories are discussed in detail with reference to data from individual respondents. Chapter 8 examines the special circumstances of the owner/manager or chief executive of the small business, and a new typology of behaviours is proposed. Chapter 9 is concerned with the statistical analysis of data in order to test pre-defined hypotheses.

Chapter 10 reviews the key results from the field research and discusses the development of a new theoretical model which describes the behavioural processes of senior managerial computer adoption. An appraisal of the model is undertaken in terms of its usefulness for researchers and practitioners. Finally, the thesis as a whole is briefly reviewed. Some of the implications of the findings for managers and practitioners are discussed separately in appendix 9, and some opportunities for further research are described in appendix 10.

References

Boulden JB, Buffa ES, Corporate Models: On-Line, Real-Time Systems, Harvard Business Review, July-Aug, 1970

Brady RH, Computers in Top-Level Decision Making, Harvard Business Review, July/August, 1967

Cyert RM, March JC, A Behavioural Theory of the Firm, Prentice Hall, New Jersey, USA 1963

Davis D, SMR Forum: Computers and Top Management, Sloan Management Review, Spring, 1984

Davis L, Learning to Walk With a New Computer System : Computers in the Executive Suite, International Management, July, 1983

Financial Times, Different Systems Begin to Emerge, piii 30/9/85

Fromm G et al, Federally Supported Mathematical Models: Survey and Analysis, Report for the National Science Foundation USA 1974

Grinyer PH, Financial Modelling for Planning in the UK, Long Range Planning, Vol 16 5, 1983

Grinyer PH, Wooller J, Computer Models for Corporate Planning , Long Range Planning, Feb, 1975

Hall WK, Strategic Planning, Product Innovation, and the Theory of the Firm, Jnl. of Business Policy, Vol 3 3, 1973

Keen PGW, Interactive Computer Systems for Managers: A Modest Proposal, Sloan Management Review, Vol 18 1, 1976

Kilmann RH, The Cost of Organization Structure: Dispelling the Myths of Independent Divisions and Organization-Wide Decision Making, Accounting, Organization and Society Vol 8 4, 1983

King WR, Strategic Planning Decision Support Systems: Planning, Development and Evaluation, Working Paper WP-440 Grad. School of Bus, Univ. of Pittsburgh, Penns. 1981

Management Today, Data Management Supplement, The Birth of a New Machine, p.iv. Sept. 1984

Simon HA, Administrative Behaviour: A Study of Decision Making Processes in Administrative Organizations, MacMillan 1957

Martin CJ, Winch GW, Senior Managers and Computers, Management Decision, Vol 22 2, 1984

Rockart JF, Treacy ME, The CEO Goes On-Line, Harvard Business Review, Jan/Feb, 1982

Scott Morton MS, Management Decision Systems, Graduate School of Business Administration, Harvard Univ. Boston USA, 1971

Chapter 2

The Technology of Computer-Based Decision Support: A Review

Abstract

This chapter examines the literature on computer-based decision support systems (DSS), and discusses the development, definitions, aims and intentions which are associated with the technology. The theoretical underpinnings of the DSS are found to be based not on the behavioural characteristics of organizational decision making, but are closer to normative paradigms which owe much to the management science tradition. In order to clarify discussions on computer applications, a new typology of computer users is proposed; this typology recognises two separate dimensions of system and purpose connectivity. Finally, the intended benefits of decision support are examined in relation to the senior manager's strategic decision role.

Introduction

Over the last thirty five years, the development of organizational computing has followed a path which seems to have steadily involved both more people, and, latterly, more senior people. According to Scott Morton and Rockart (1983) there are three distinct eras which characterise this movement. During the first era - roughly the 1950s and 1960s - the emphasis was on data processing, ie the economic processing of large volumes of data transactions typically in payroll and accounting applications. The second era - 1960s to the early 1970s saw the extension of these systems to manufacturing, stock control and on-line order-entry applications, systems which incorporate both the technical advance of interactive processing and also the systemic advance of addressing management control rather than just data processing. These latter systems have enabled efficiencies among first-line supervision and junior and middle management.

The third era, starting in the early 1970s, has been concerned not so much with the automation of simple clerical functions but with the provision of information for management - management information systems (MIS) and, latterly, decision support systems (DSS). An important technological feature of the last ten years has been the sharp reduction in costs (combined with a significant increase in effective power) of desk-top microcomputers, resulting in the general opportunity for managers to use a personal computer. It is against this background of rapid, technology-driven, computer development and the resulting changes in organizational uses of computers, that the DSS

movement has developed. The purpose of the following paragraphs is to review the nature and scope of DSS and to discuss especially the aims and objectives to which these systems are directed.

The notion of decision support

An early, perhaps seminal case study of an archetypal DSS has been described by Scott Morton (1971). Here the author depicts the use of interactive computer display terminals which were specifically intended to support management decision making. Scott Morton's description of the purpose and scope of this DSS furnishes illuminating examples of the thinking behind much DSS development, then and now. Primarily, there is the idea that the manager's cognitive decision patterns involve problem search and solution procedures which are intuitive, judgemental and essentially sub-optimal. The manager is therefore to be provided with access to a system which furnishes both data and decision models, which together will improve his decision making capability beyond the level of the individual acting alone. This key point is fundamental to the development of contemporary decision support systems.

> "... the belief that the powerful techniques of management science can make a great difference to the performance of managers, and thus companies. Yet management science techniques have hardly begun to touch the life of a typical manager. The opportunities for the application of scientific decision making are enormous, and the payoffs most rewarding. Interactive terminal systems appear to have the capability of bringing these techniques closer to the manager who has the judgement to interpret the results." (Scott Morton 1971)

These beliefs, which in themselves seem entirely reasonable, have

acted as a focal point and article of faith for much of the DSS movement. An important issue is raised by the notion that the manager and computer acting together achieve better results than either could alone:

> "We may in fact be reaching the point where the manager in combination with the computer is going to be a significantly different and more effective manager than one without the computer. Of course, the computer is not the essence of management planning and control but, at the same time, it is far from clear whether or not the manager alone will be able to exercise effective control in the years to come." (Scott Morton 1971)

The point being made here is not just that computers are important to modern organizations (which few people would dispute), but that the manager will be acting in close harmony with a specifically decision oriented system which has been designed to assist or support his own personal decision activities, and without which he will inevitably be a less effective decision maker. Of course, this latter point makes a number of assumptions about the nature of managerial decision - a point which will be taken up later, and which will be explored in some depth in chapter 3. In general however, the DSS movement represents a specific and deliberate attempt to make computers helpful to managers in a way that had not been achieved before. Generally speaking, these ideas represent the classic statement of the DSS philosophy. Although Scott Morton was perhaps the first to describe a large scale implementation and case study, the ideas themselves have been expressed even earlier (see for example Simon 1960 or Carroll 1966).

Theoretical background

In general, the theoretical underpinnings of DSS are not strong; this may be due in part at least to the comparative recency of the DSS movement, which is characterised by the lack of a coherent literature or academic tradition. This point is made by Keen (1980), and by Eason (1980):

> "... the current literature is bewildering in the variety of terminology and in the apparent contradictions to be found in the findings." (Eason 1980)

Another important factor contributing to the slim theoretical base is that the DSS concept is intended to apply specifically to organizational decision-making, whereas the basis of directly applicable knowledge relating to this topic is itself slim. The mismatch between descriptive theories of organizational decision behaviour on the one hand and prescriptive theories from management science and elsewhere on the other, is well known. (A fuller discussion of this point occurs in Martin 1982). The importance of this circumstance in relation to the development of DSS theory and practice has been well stated by Bosman:

> "... in various sciences studying the topic of decision processes in organizations a hard core for research is missing. It is questionable whether DSS, even in the form of a theory, can deliver such a hard core... it is not possible to define a theory of DSS without considering the methodological problems of defining organizational decision processes. DSS `theories' should not be regarded as a substitute for theories of organizational decision processes." (Bosman 1983)

The most commonly used theoretical background for DSS is one which was developed originally by Gorry and Scott Morton (1971), and expressed as a "framework" which relates together decisional and organizational control paradigms, by Simon and Anthony

respectively. The first of these paradigms is the programmed / non-programmed decision-making typology devised by Simon (1960), which is based on a view of the decision process as a sequence of activities involving intelligence, design and choice. The second paradigm was developed by Anthony (1965) and defines three levels of information use in organizations: operational control, management control and strategic planning.

These two paradigms underlie much of the theoretical work in DSS, and are utilised either explicitly or implicitly by nearly all writers in the field. One of the reasons why these concepts have been found to be so useful is that they provide a convenient organizing principle for discussing DSS topics, cataloging systems and limiting an otherwise unruly topic area. However, as has been pointed out by Bosman (1983) above, they do not in themselves constitute an effective substitute for a detailed and consistent theory of organizational decision processes - a theory which presumably will be only slowly developed over years or decades into the future.

Several alternative views of the specific nature of DSS can be found in the literature. These range from a very specific (if speculative) list of technical elements, through to a much broader view which encompasses any computer system intended to aid decision making. One problem here has been the rapid adoption of DSS terminology in the computer industry; as with other aspects of computing, technical terms rapidly become jargonised to the point where they no longer have a sharp meaning (or any meaning at all, in some cases). This has been particularly the

case with DSS. Initially, the terminology was used for a specialised field of management-science oriented large-scale computer systems, whereas recently (in 1985) almost any software package which is at all business oriented (including spreadsheets and wordprocessors) are described as "Decision Support Systems" by their creators. Sol (1983) expresses the point neatly when he characterises the progression of DSS in the computer industry as moving from from "concept to movement to bandwagon". It is therefore necessary to make clear distinctions about the nature of the systems which are being studied here, and the context in which they are examined in this thesis.

One of the more focussed, technical definitions of DSS is due to Bonczek et al (1981):

> "The approach to computerized decision support systems adopted here is one of utilizing ideas and techniques from the areas of management science, data base management, formal logic, and linguistics, all within the global frameworks of organizational information processing and decision making."

Most commentators would probably view such a definition as an ideal to be achieved at some point in the future, rather than a practical definition of a system which can be found in contemporary use. More speculative ideas about the possible future direction of DSS can be found in Young (1983) and Zadeh et al (1975) and elsewhere.

An example of a much broader approach would be that adopted by Alter (1978), who defines DSS as any systems "designed to aid decision making and decision implementation"; this decision orientation is emphasised by Alter to contrast with those systems designed for transaction processing. Of course this latter view

is a rather catholic one which incorporates many different ranges and types of systems.

A reasonable definition which incorporates several of the key intentions of DSS is provided by Sprague (1980):

> "DSS [can be] characterised as interactive computer based systems, which help decision makers utilise data and models to solve unstructured problems." (Original author's emphasis).

In more concrete terms, a model-based DSS is usually conceived as physically comprising an interactive display terminal, which is linked to (or has contained within it) a powerful computing resource which includes data storage, retrieval, modelling and other facilities. The details of the essential elements vary from author to author, but a fairly complete contemporary model-based system would contain all or most of the following elements:

1. Data storage and retrieval
2. Analytic modes
3. Modelling facility (usually financial)
4. Graphic facility
5. Reporting routines

These facilities are usually made available by a purpose-designed command language, and in a typical commercial package this language would comprise a comprehensive and complex syntactical system. As an illustration of the scope and complexity of such a language, one commercial DSS system generator studied by the author (Reveal from ICL) has a reference manual of some 400 pages (Tymshare 1983), nearly all of which must be understood before a system can be built. Of course, the decision maker himself is not

necessarily the one who builds the system, he may only be required to understand enough of the elements of the command language to be able to access pre-defined routines and sequences. This consideration introduces the analyst, or other expert who has acquired a knowledge of techniques and technical workings of the systems and acts as an intermediary between the technicalities of the system and the decision maker. The role of the analyst and his effect on system adoption are discussed in more depth in chapter 4.

The technology of decision support

In order to widen this review of applicable computer systems, it is valuable to consider Alter's evaluation of decision oriented systems based on a field study of 56 cases (Alter 1975, 1977b). He proposes a typology of the DSS systems which includes seven categories. These may be further subdivided into two types: data oriented and model oriented. The latter model-based category relates to systems which clearly fall into the definition proposed by Sprague (above), and includes systems based on accounting principles and on management science techniques. The former data-oriented category includes systems which are concerned essentially only with information storage, analysis and retrieval. The seven types of DSS are categorised as follows:

Data oriented systems

1. File drawer - allows immediate access to data items
2. Data analysis - allows manipulation of data
3. Analysis information - provides access to pre-specified aggregates of data

Model oriented systems

4. Accounting models - enables "what if" calculations based on accounting definitions

5. Representational models - calculate consequences based on non-accounting models (management science models)

6. Optimization models - explore optimal solutions (eg linear programming)

7. Suggestion models - routine calculations leading to a suggested course of action (eg bank loan applicant assessment)

(Based on Alter 1977b)

In order to complete this review of the currently available decision oriented technology discussed in the literature, it is of course necessary to include Expert systems. These systems, together with the study of Artificial Intelligence techniques generally have been studied academically for many years but have recently enjoyed an upturn in general interest. In principle, management decision aids based on Expert systems principles could well be a very significant development in the future. A review of current developments in this field and the implications to management has been published as Martin (1985b), and this material will not be repeated here. (In practice, no examples of Expert systems in use were found in the field research on senior managers).

The approach generally adopted in this research has been to examine any instance of senior managerial computer use, where such use involves the manager operating the computer himself; but the area of special interest is particularly where computer use

relates to the intentions and ideals expressed in the DSS movement. In practice, many types of system other than those outlined above were found in the field studies (messaging, diary, external database, textual search and telephony oriented systems were clear additions to the DSS categories outlined above) but a full discussion of these will be deferred to the appropriate section.

Towards a better definition of computer "use"

Curiously, discussions of DSS in the literature are often quite vague about who exactly will interface with the technology. In fact, a review of journal articles in the MIS and DSS literature (and for that matter in the computer literature generally) reveals many examples where the word "user" appears, but it is not at all clear whether the term refers to the operator of the equipment or to somebody who receives information second or third hand. (See for example Corbin 1985). Is a "user" somebody who interacts directly with the system (hands on)? Often, what is meant by the term "user" is somebody who interacts directly with the computer but in fact then relays the information produced to somebody else. Often the term "end-user" is applied by computer professionals to refer to people other than the computer personnel who produce information for others. There is also the case of a person who utilises computer information, where the information was acquired second or third hand, perhaps by word of mouth. In a sense we are all computer users in some way or another.

It is well worth being quite clear about this, because this

thesis is particularly concerned with those problems which occur when a computer system is intended for interactive use by the decision maker himself. A second difficulty concerns the nature of the "use". A hands-on interactive user may in fact be acquiring information for somebody else; only at some further point is the information received by the "information consumer" for whom it was intended.

In order to clarify these ideas, two usage dimensions are proposed: 1) degree of system connection and 2) degree of purpose connection.

Degree of system connection

This dimension reflects the proximity of a user to a particular system, ie whether he interacts directly or indirectly. In fact it is possible to conceive of several intermediate positions along the scale, such that it is virtually continuous. For the purposes of this research three discrete positions will be considered.

1 Direct - the user is in a "hands-on" relationship with the system and controls directly himself the input of data, the functioning and direction of the system(s) and the extent and nature of the output.

2 Indirect - the user has no direct physical control over the system or its functions or input, but receives system outputs directly (printout or readout).

3 Remote - the user has no direct control over the system and does not receive direct system outputs. He receives outputs indirectly in written, edited or word-of-mouth form.

Degree of Purpose Connection

This dimension reflects the nature of the user's relationship to the system outputs in respect of his own work role.

A Own use - the user receives system output which is intended to be incorporated in some manner in the execution of the user's own work tasks or role.

B Used for Others' Purposes - the user receives system output which he may manipulate in some way, but which is intended essentially for some other to incorporate in his work role.

C Not used - the user makes no direct use of system output (although he may receive it), but acts so as to transmit the information onward.

These dimensions have been combined together to form a matrix of computer use relationships (see figure 2.1) Some examples are included to indicate the scope of the construct. An example of a 2A user would be a manager who uses a messaging system by asking his secretary to enter memos for him; if he then reviews the system himself he is operating as a direct 1A user. The matrix is intended to be associated with some specific system (rather than some specific user). For example, a payroll system might be controlled by a computer operator (1C); the main outputs received by accountants clerks (2B) and then passed on to payees (2A); reports and summaries received by managers and others (2A,2B,2C); written and verbal information passed to senior managers (3A). Some individuals may fit several categories for the same system; eg the computer operator who later gets a payslip.

Figure 2.1 Matrix of Computer Use Relationships

Degree of system connection (eg mode of input)	Degree of purpose connection: A Outputs Used for 'Own' job Purposes	B Outputs Used for Other's Purposes	C Outputs Not Used
1 Direct (Hands on, interactive)	engineer, author	w-p operator	key-punch operator
2 Indirect (Receive printed outputs unedited, or view screen)	some managers	management accountant	filing clerk
3 Remote (Receive outputs second-hand, eg manually edited summary or word of mouth)	most managers	financial analyst	-

Notes: categories 1-3 and A-C indicate the two usage dimensions indicating connection of system and connection of purpose respectively. Items in the cells of the matrix represent examples of each type.

In terms of the present research we are interested in usage type which occupies the 1A cell of the matrix. In other words, the research focus is on senior managers who use a computer directly to achieve computer outputs which they will incorporate directly into their work roles. As well as clarifying terms for the present research effort, it is hoped that this typology will serve a useful purpose in the field of computer applications generally.

Focussing on the decision maker

For some commentators, for example Keen (1976), Sprague (1980),

Rockart and Treacy (1982) the direct use of DSS for the users' own purposes represents the essence of the DSS ideal:

> "Interactive systems facilitate the use of the computer's analytic power and data retrieval facilities by managers as part of their ongoing decision-making process." (Keen 1976)

For others, the precise nature of the information transmission from system to "consumer" is not important, or is not made explicit. Scott Morton (1971), for example, in his description of the seminal managerial DSS said that it was not important as to whether the manager or his staff used the decision support system (although he said that most of the managers in his experiment did use it themselves). In fact this particular topic has aroused some empirical research interest, for example the work of Culnan (1983) who investigated sets of users who accessed a database either directly or through an intermediary ("chauffeured" access). Culnan found, not surprisingly perhaps, that direct access was more appropriate where the interaction was a regular one, and that chauffeured access was most appropriate where the access was irregular or one-off; but the relationships of these access modes to other variables such as the education, professional background and so on of the subject were not so clear cut.

The topic of the intended benefits of DSS in decision making is another area which is not always made entirely explicit. In fact the benefits have often been linked, either explicitly or implicitly, to specific cognitive deficiencies of the human manager. For example, Zmud (1979) provides a summary of well-documented evidence which shows that that managers display

significant differences in their decision-making styles and abilities. In particular, they do not understand their information requirements and ask for more or less than is economically justified, they delay too long before making decisions and are reluctant to change decisions once made, they violate rules of rational decision making and are unable to take account of new evidence which affects a decision situation. Documented case studies of organizational decision failures can be found in Janis and Mann (1977) and elsewhere. (In fact this area has become an academic field of study in its own right, see for example the Open University undergraduate course: Human Performance and Systems Failures T341 1977)

Other aspects of man's culpability in decision making include his failure to make full use of information provided, his tendency to consider only a few alternatives, and his inability to make use of good strategies even when they are developed. A particular problem identified by Zmud is the manager's reluctance to use probabilistic data, such that "... provision of probabilistic aids would appear to be a necessity in most cases." (Zmud 1979).

These views of man as a limited decision maker are not confined to exponents of management science. There is also a tradition in the management literature which owes much to the work of behaviouralists who have studied organizational decision processes. Amongst these there is the work of Simon who introduced the concepts of "bounded rationality" and "satisficing" to characterise the idea that organizations accept solutions which are sufficient at the time but not necessarily optimal (Simon 1957, 1960). Lindblom (1959) described

incremental decision processes in bureaucratic organizations and justified their effectiveness in terms of "successive limited comparisons". Cyert and March (1963) discussed organizational decision making in terms of uncertainty avoidance and the tendency for dominant coalitions to negotiate mutually beneficial outcomes. This latter view of the decision process as essentially the workings of a political arena has been extensively explored by Pettigrew (1973, 1985) and others.

However, the arguments which relate organizational decisional behaviour to an inability on the part of organization or individual to optimize or make "full" use of computer-based techniques and aids are essentially the arguments of management scientists and computer scientists advocating the use of management science techniques. The alternative viewpoint, which shows the inadequacies of management science-based information systems for human decision, has been ably expressed by Ackoff (1967) and Mintzberg (1975a) and others and will be discussed in more detail in chapters 3 and 4. Nevertheless, a discussion of the human manager's indisputable inadequacies in the field of optimal decision performance does seem to provide a powerful prima facie rationale for employing decision support at all levels, and especially perhaps at top levels where decisions are more far-reaching.

Aims and objects of decision support

In more general terms, the benefits which might be expected to be achieved by the introduction of DSS in an organization have been

variously stated. A representative sample of the potential benefits which have been identified would include: the support and improvement of individual managerial judgement (Hackathorn and Keen 1979), supporting unstructured decisions (Methlie 1983), providing an impartial information resource (Alter 1977a), meeting the needs specifically of top management (Kroeber, Watson and Sprague 1980), helping to solve unstructured problems at upper management levels (Sprague 1980), resolution of conceptual difficulties with management science models (Methlie 1983), reduced cost of data gathering and added value from improved decisions (Carlson 1978), specific contribution to strategic decision making (King 1981, and Scott Morton and Rockart 1983) and improved performance for senior managers (Rockart and Treacy 1980 and 1982).

The benefits of DSS have been discussed less frequently in more specific terms, but for example Keen (1981) analyses eight case studies and identifies twelve distinct benefits in the decision process which may accrue:

1 Increase in the number of alternatives examined
2 Increased understanding of the business
3 Fast response to unexpected situations
4 Ability to carry out "as required" analysis
5 New insights and learning
6 Improved communication
7 Improved management control
8 Cost savings
9 Improved decision analysis

10 Better teamwork and reduced conflict

11 Time savings

12 More effective use of data resources

(From Keen 1981)

In contrast to this, Alter (1977b) in his analysis of 56 cases identifies a much more cautious range of benefits which includes improvements in convenience and efficiency for decision makers under certain circumstances, and a distinct impact on group planning processes where the systems are oriented to this end.

The DSS literature often has a distinctly evangelical flavour to it, resulting in the identification of organizational potential beyond the realms of general practicality in the present. It may be that the enthusiasm shown by the DSS movement is an essential part of the process of creating opportunities for change and progress in organizational computing. Nevertheless, the tendency to "oversell" the potential may result in a later backlash whereby real opportunities are missed. This point has been made by some commentators, including for example King (1981), who describes a "boom and bust cycle" in computer innovations due at least in part to initial overselling in order to overcome resistance to new ideas; nevertheless there remains a significant problem for the student of managerial computing who has to identify realistic and significant trends amongst a barrage of conflicting claims and evaluations.

Attempts to evaluate DSS applications in terms of purely economic benefit have not always been successful, and most commentators

accede (if only reluctantly) to the idea that largely qualitative arguments must be employed to justify their development (Keen and Hackathorn 1979). Examples of approaches to non-economic but rigorous evaluation methodology has been described by Akoka (1981) and King and Rodriguez (1978).

First-hand experience with decision support

In addition to examining the DSS case studies in the literature, reference has been made by the author to commercial and semi-commercial software products available which are aimed at the DSS market. The author has obtained access to some of these, and has made a detailed study of two of them: Reveal, a management science oriented package from ICL (UK) Ltd, and Wizard, a financial modelling oriented package distributed by Comshare Ltd. A review of likely users of commercial model-oriented DSS software has appeared as Martin (1984d).

The author also gained access to an Expert systems shell package, SAGE (Systems Programming Ltd 1982a and 1982b), distributed by ICL, and has experimented with this and various expert systems programs. In addition, a personal computer (pc) was acquired and experience gained with the more popular forms of commercial pc business software. Wordprocessing, spreadsheet and database packages were all used in order to gain some first hand experience of learning effort and interface problems. In general the pc has been used to draft and type this thesis, to maintain research records and to develop an extensive bibliography and for other research-related purposes. A detailed and critical account of the use of the personal computer in doctoral research

administration has been published as Martin (1984b).

An important outcome of these practical undertakings has been to gain a first-hand impression of the scope of contemporary commercial DSS systems and software, and also of the practical implications of own-use computing for the individual. Certainly, it would have been difficult, if not impossible, to discuss adequately various aspects of computer systems with senior managerial respondents and technical personnel without a sound appreciation both of the theoretical and practical ramifications of the technological aspects of these systems.

Discussion

The main purpose of this chapter has been to identify the aims of decision support, to examine the possibilities which are open and to explore the potentialities which DSS theory has to offer. Two themes have emerged from the discussions so far which are worthy of re-emphasis. Firstly that the DSS movement is oriented, at least in part, towards creating systems which are to provide benefits to senior managers (a group which hitherto has not benefited significantly from computer developments), and secondly that systems are expected to have significant impact when oriented towards strategic decision processes. These are not of course the only directions for DSS, far from it, but they do represent some of the stated intentions of the movement, as expressed by some of its prominent exponents.

These points form an essential background to the present research; they comprise the "ideal" towards which the

aspirations, if not the technology, of senior managerial computing systems may be said to aspire. To what extent in practice are these ideals met, and what are the circumstances surrounding senior managerial DSS use? Although there are several case studies of DSS development in the literature (see Scott Morton 1971, and reviews of cases in Keen and Scott Morton 1978, Alter 1975, 1977a and Keen 1980) these studies do not, by and large address the issue of systems benefit to the senior manager as an individual or, more specifically, from the senior manager's own point of view.

It is this latter viewpoint, ie that of the senior manager himself, which is taken as the main stance for the field research in this thesis. The approach adopted has been therefore not to limit the study of applications to any particular definition of DSS, but to examine any instance of senior managerial computer use, where such use involves the manager operating the computer himself. However, the area of special interest is particularly where computer use relates to the intentions and ideals expressed in the DSS movement.

References

Ackoff RL, Management MIS Information Systems, Management Science, 4, 1967

Akoka J, A Framework for Decision System Evaluation, Information and Management, Vol 4, 1981

Alter SL, A Study of Computer Aided Decision Making in Organizations, Unpublished PhD Dissertation, Sloan School of Mgt., MIT, Mass. 1975

Alter SL, A Taxonomy of Decision Support Systems, Sloan Management Review, Vol 19, 1977

Alter SL, Why Is Man-Computer Interaction Important for Decision Support Systems, Interfaces, Vol 7 2 Feb, 1977

Alter SL, Development Patterns for Decision Support Systems, MIS Quarterly, Sept, 1978

Anthony RN, Planning and Control Systems: A Framework for Analysis, Harvard Business School, Boston, Mass. USA, 1965

Bonczek RH, et al, Foundations of Decision Support Systems, Academic Press Inc 1981

Bosman A, Decision Support Systems, Problem Solving and Co-ordination, in Sol HG, (Ed) Processes and Tools for Decision Support,Proc. of Joint IFIP WG 8.3/IASA Conf., North Holland, Austria 1983

Carlson ED, An Approach for Designing Decision Support Systems, Procedings: 11th Hawaii International Conference, California USA, 1978

Carroll DC, Implications of On-Line, Real-Time Systems for Managerial Decision-Making, MIT Working Paper 165-166, MIT Mass., USA, 1966

Corbin CEH, Creating an End-User CAFS Service, ICL Technical Journal, Vol 4 4, 1985

Culnan MJ, Chauffeured Versus End User Access to Commercial Databases : The Effects of Task and Individual Differences, MIS Quarterly, March, 1983

Cyert RM, March JC, A Behavioural Theory of the Firm, Prentice Hall, New Jersey, USA, 1963

Eason KD, Computer Information Systems and Managerial Tasks, in Bjorn-Anderson N (Ed), The Human Side of Information Processing, North Holland, Amsterdam, 1980

Gorry GA, Scott Morton MS, A Framework for Management Information Systems, Sloan Mgt. Review, Vol 13 1, 1971

Hackathorn RD, Keen PGW, Organizational Categories for Personal Computing, MIS Quarterly, Sept, 1981

Janis IL, Mann L, Decision Making, The Free Press 1977

Keen PGW, Interactive Computer Systems for Managers: A Modest Proposal, Sloan Mgt. Review, Vol 18 1, 1976

Keen PGW, DSS: A Research Perspective, C.I.S.R. Working Paper No 54, MIT Mass. USA, 1980

Keen PGW, Value Analysis: Justifying Decision Support Systems, MIS Quarterly, March, 1981

Keen PGW, Hackathorn RD, DSS and Personal Computing, C.I.S.R. Working Paper No 47, MIT Mass. USA, 1979

Keen PGW, Scott Morton MS, Decision Support Systems: An Organizational Perspective, Addison-Wesley 1978

King WR, Strategic Planning Decision Support Systems: Planning, Development and Evaluation, Working Paper WP-440 Grad. School of Bus, Univ. of Pittsburgh, Penns. USA, 1981

King WR, Rodriguez JI, Evaluating Management Information Systems, MIS Quarterly, Sept, 1978

Kroeber DW, Watson JH, Sprague RH, An Empirical Investigation and Analysis of the Current State of the Art of Information Systems Evolution, Information and Management, Vol 3, 1980

Lindblom CE, The Science of Muddling Through, Public Administration Review, Vol 19, 1959

Martin CJ, Decision Making and the Computer: A Study of Systems Development, Unpublished MSc dissertation, Durham University Business School, Durham University UK, 1982

Martin CJ, The Personal Computer and Research Administration, Graduate Management Research, Vol 2 1, 1984b

Martin CJ, Financial Modelling DSS Applications: Identifying the User, DUBS Working Paper, 1984d

Martin CJ, Expert Systems in a Managerial Context, Industrial Management and Data Systems, Nov/Dec, 1985b

Methlie LB, Organizational Variables Influencing DSS Implementation, in Sol HG, (Ed) Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria , North Holland 1983

Mintzberg H, Impediments to the Use of Management Information, Society of Management Accountants of Canada & NAA, Canada, 1975

Mintzberg H, The Manager's Job: Folklore and Fact, Harvard

Business Review, July/Aug, 1975

Open University Course T341^, Systems Performance and Human Failures, Open University Press, Milton Keynes, 1977

Pettigrew A, The Politics of Organizational Decision Making, Tavistock 1973

Pettigrew AM, The Awakening Giant: Continuity and Change in ICI, Basil Blackwell, Oxford, 1985

Rockart JF, Treacy ME, Executive Information Support Systems, CISR WP No 65, MIT, Sloan School of Management, Massachusetts, USA 1980

Rockart JF, Treacy ME, The CEO Goes On-Line, Harvard Business Review, Jan/Feb, 1982

Scott Morton MS, Management Decision Systems, Grad. School of Business Admin., Harvard Univ. Boston, USA, 1971

Scott Morton MS, Rockart JF, Implications of Changes in Information Technology for Corporate Strategy, C.I.S.R. Working Paper No 98, M.I.T. Mass., USA, 1983

Simon HA, Administrative Behaviour: A Study of Decision Making Processes in Administrative Organizations, MacMillan 1957

Simon HA, The New Science of Management Decision, Prentice-Hall New Jersy 1960

Sol HG , Processes and Tools for Decision Support: Inferences for Future Developments, in Sol HG, (Ed) Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., North Holland, Austria 1983

Sprague RH, A Framework for the Development of Decision Support Systems, MIS Quarterly, Vol 4 4, 1980

Systems Programming Ltd, An Introduction to the `SAGE' Expert System, Systems Programming Ltd SPL Research Centre, Abingdon, Oxon, UK 1982a

Systems Programming Ltd, SAGE Expert System: Language Specification, Systems Programming Ltd, SPL Research Centre, Abingdon, Oxon, UK 1982b

Tymshare Ltd, REVEAL: Reference Manual, ICL Knowledge Engineering Centre, West Gorton, Manchester, UK 1983

Winkler RL, Research Directions in Decision Making Under Uncertainty, Decision Sciences, Vol 13 4 Oct, 1982

Young LF, Computer Support for Creative Decision Making: Right-Brained DSS, in Sol HG, (Ed) Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., North Holland, Austria 1983

Zadeh LA et al, (eds) Fuzzy Sets and Their Applications to Cognitive and Decision Processes, Academic Press, New York, 1975

Zmud RW, Individual Differences and MIS Success: A Review of the Empirical Literature, Management Science, Vol 25 10, 1979

Chapter 3

Characteristics of Senior Managerial Behaviour and Decision Making

Abstract

The purpose of this chapter is to explore key aspects of the senior manager's world; the intention is to focus the thesis on behavioural aspects of senior managerial decisions and to establish a conceptual background from which to address the field-work. In particular, aspects of managerial work, information processing and decision behaviour are discussed in depth. Following the review of the literature on senior managerial behaviour and decision making, conclusions are drawn in the form of a summary of senior managerial characteristics.

Introduction

It has long been supposed that the managers at the top of an organization exert a particularly powerful influence by virtue of their position, power base, and the personal attributes which have brought them to the top. A not unreasonable assumption might be that the senior manager is responsible for the most significant and difficult decision outcomes, and that he at the very least acts as final arbiter on the most important issues facing his organization. This in itself is a powerful argument for examining the use of computer-based decision aids at the top level; according to this logic, who else in an organization could benefit more from the best tools that management science and computer applications technology have to offer?

A review of the literature

The view that the top executive himself is a vitally important ingredient in the process which affects organizational outcomes is not without its critics. For instance Hall (1973) argues that organizational outcomes are determined more by the pressure of events; and an empirical study by Lieberson and O'Connor (1971) showed some evidence that extrinsic situational factors were more important than change of leadership in determining organizational outcomes.

It would be wrong of course, to assume simply that high office is synonymous with control; in practice the power of any top manager is significantly affected by all manner of constraints acting from within and without his organization. However, most

commentators would probably agree that people at the top of the organization have a special and significant part to play in its affairs. This idea of the importance of the senior manager in organizational activities has been effectively stated by Hambrick and Mason (1984):

> "Organizational outcomes - both strategies and effectiveness - are viewed as reflections of the values and cognitive bases of powerful actors in the organization."

These authors reaffirm the key role of the senior manager and argue for reawakened research interest in the area in order to enhance theories which seek to predict organizational outcomes.

The view taken in this thesis is that senior managers are indeed a vitally important link in processes which affect organizational strategies, behaviours and outcomes. But it is considered that the details of these processes are at present obscure at least to some degree, and are not necessarily directly and simply related to specific aspects of the man or his organization as decision-making organisms. In other words the decision making processes and other critical activities of the senior manager may not be simply grounded in decision behaviours of the kind captured in the concepts of "economic man" or even "administrative man" (Simon 1945). Rather, the mechanisms and processes which lead to decision outcomes are considered to be wrapped up in other behaviours and in other aspects of the overall managerial milieu.

This being the case, it is necessary to examine basic aspects of the senior manager's world in order to establish a framework for investigating aspects of his decision behaviours. In particular, what exactly does a senior manager do? What are the crucial

elements of his role that distinguish him from his middle-management brethren? In order to to examine aspects of his computer adoption behaviours and information use, it is necessary to have some understanding of his general activities and the purpose of these activities in the context of his work roles. Ideally, one would like at this point to review comparative analyses of senior managerial behaviour and to discuss these in terms of a body of established research. Unfortunately, there have been few major studies of specifically senior managerial work, although of these the work of Mintzberg (1970, 1973) has been very influential.

It will be useful, therefore, to establish characteristics of managerial behaviour in general first, and then to draw attention to those aspects which are considered to be special to the senior manager. There is, of course, a huge literature on leadership and management; in order to select the most relevant aspects from a potential superabundance of material, only those elements of behaviour which are thought to be key in the context of computer use, decision making and strategic decision will be examined.

In the search for better understanding of aspects of the senior manager's job and working behaviours, studies of managerial behaviour based on direct observational and diary methods have been very significant. Although neither of these methods are by any means foolproof, there is a substantial measure of agreement across several studies about aspects of managerial behaviour. In particular, such studies have provided insights into the

characteristics and specific activities which make up managerial work and form the basic empirical elements from which may be deduced crucial aspects of decision behaviour.

Seminal works in this area include the writings of Carlson (1951), Stewart (1967) and Mintzberg (1970, 1971, 1973, 1975). A review of these and other authors in the extensive empirical literature in this area has been undertaken by McCall et al (1978) and a summary of consistent and replicated findings can be found in their work. More recent studies include those of Kotter (1982a, 1982b), Bennis (1983) and Shrivastava and Grant (1982) whose findings generally supplement (and do not contradict) the arguments and findings of the earlier commentators.

It is possible to pinpoint several distinct themes among the attributes of managerial work, which together characterise something of the essential nature of management. These findings can be summarised and further supplemented by the work on the meaning of managerial activities and on managerial roles by Kotter (1982a,b), Mintzberg (1973) and Pettigrew (1973).

It has been found appropriate to consider this material under five generic headings, although clearly these aspects are all closely related and intertwined, so that any breakdown must inevitably seem a little artificial:

Managerial activity levels and characteristics
Managerial communications and information processing
Characteristics of managerial thinking
The meaning of managerial behaviour
Elements of managerial decision

Managerial activity levels and characteristics

Several studies may be cited (Stewart 1967, Mintzberg 1973, McCall et al 1978, Kotter 1982a) which draw attention to the excessively long hours which managers work. Variations are found depending on rank and functional responsibility, where the hours worked increase substantially with higher levels of organizational rank and decrease where the function is well-defined (as in accounting for example). Higher executives carry out work outside the office in several forms, for example as desk work taken home or in contacts at social or business meetings.

Mintzberg (1973) draws attention to the "unrelenting pace" of managerial work, and argues that managers are perpetually and inescapably preoccupied with managing their organizations. In fact he goes on to speculate that managers become conditioned by their heavy workloads, by the appreciation of the supreme worth of their own time, into adopting a continually superficial (but perhaps most efficient) approach to their work. These findings are of course a more accurate reflection of the stereotyped view of the busy manager to whom every minute is precious. Nevertheless, the truism appears to hold good, and it would be expected that any computer-based aid which saved the manager's time would be heartily welcomed, and conversely one which showed a perceived time cost would hardly be viewed with favour.

Survey materials show that managers cope with large numbers of activities; these may amount to several hundred separate incidents or episodes in a single working day. A significant

element of these activities is represented by "fleeting contacts" (Stewart 1967) with others. The activity rate drops significantly at the higher organizational levels:

Position	Average no. of activities per day	
Foreman	413	
Superintendent	309	
Area superintendent	274	
General manager	91	Thomason (1967, 1967)
Chief executive	19-32	Mintzberg (1970)

A principal characteristic of managerial work, remarked on by many commentators, is the brief and fragmented nature of the work content. Most researchers comment on the rapidity with which managers at all levels switch from one activity to another (or are interrupted by others) to produce a discontinuous flow of apparently unconnected events. At higher management levels, decision stages are longer (Martin 1965, and Jaques 1976) and thus more susceptible to interruption. In this way decision sequences, especially at high levels, are dislocated and interspersed with information gathering and with other disconnected activities and other decision sequences. The disjointed nature of managerial work may not necessarily be dysfunctional; according to Kotter (1982b) this represents the most efficient way of performing essential tasks by virtue of opportunistic use of interpersonal contacts.

Associated with the temporal characteristics of decision is the wide range of different topic contents which are addressed by managers at all levels. The concrete or physical nature of the activities can be described in terms of five separate types (Mintzberg 1973):

deskwork - handling mail, reading reports and other documents and drafting documents

phone calls - although typically occupying only a small proportion of the manager's time, this medium represents a significant number of his personal contacts (Mintzberg 1970)

scheduled meetings - these occupy much of the senior manager's time, perhaps as much as 60% for chief executives (McCall et al 1978), but less for lower ranking managers

unscheduled/informal meetings - these represent a significant proportion of middle to lower management level jobs (Stewart 1967)

inspection tours/visits - these occupied a small proportion of middle and senior managers' time (Stewart 1967 and Mintzberg 1970)

The pattern of the people with whom the manager was in contact was also a significant indicator of managerial rank. All ranks interacted with a wide variety of different people, but the origin of these contacts was polarised. At lower levels these include mainly subordinates, peers and superiors within the organization. At the higher levels, contacts were largely with people from outside the organization; these contacts included government officials, press, members of the public, bankers, shareholders, competitors, suppliers, clients and customers (Kotter 1982b).

The content of the activities, episodes and events which have been discussed is of course a major topic of interest. However,

there is an understandable difficulty in defining the subject matter of managerial work, both in the context of an operational field research definition as noted by Stewart (1967) and also as regards the theoretical focus which is being adopted. Is it of substantive interest, for example, to discuss the simple functional idea of content, ie sales managers dealing with sales matters, production managers with production and so on? It would appear to be more useful to identify subject content as it relates to key objectives in respect of the manager's role set for example, or within a theoretical structure of increasing strategic importance; but such analyses are rarely made.

Nevertheless, within the framework of functional content, it can be shown (McCall et al 1978) that lower level managers deal with a variety of matters, but within their functional area (ie production managers handle many aspects of the production function). However, in the case of senior managers the content variety spreads across many functional areas (ie a chief executive will tackle aspects of personnel, marketing, accounts and so on). Mintzberg noted that the difference between the subject matter of junior and senior managerial work was characterised by differences in orientation:

> "In comparing my study of chief executives with Sayles's (1964) study of lower- and middle- managers, for example, we find that the chief executives collected a wide variety of information to be used in strategy-making of a broad nature; the lower-level managers collected information to maintain the steady flow of their organizational units. Whereas our chief executives negotiated acquisitions, Sayles's managers negotiated delivery dates on orders." (Mintzberg 1973)

The review by McCall et al (1978) found generally that managers at all levels spend much of their time within their own firms.

However, as rank increases so too does the amount of time spent outside the manager's own department and outside his organization.

Communication and information processing

Many studies have shown that the primary characteristic of managerial behaviour is the large proportion of time spent in verbal communication. Studies of middle managers show that perhaps half the manager's time is spent in this way, whereas at higher levels this proportion extends to perhaps 65-75% (McCall et al 1978), with levels of 90% found at the highest ranks (Mintzberg 1970). The proportion of this communication occurring in telephone conversations is less than 10% (Stewart 1967; Mintzberg 1970), so that a significant proportion of the manager's work activity is spent in face to face interactions during formal or informal meetings. At lower management levels, these interactions may be composed largely of individual meetings with others, "fleeting contacts" (McCall et al 1978). At higher levels, more time is spent in formal meetings and with groups of people rather than individuals (Mintzberg 1970, Stewart 1967).

Just as much of the average manager's time is spent inside his organization, so most of his contacts are from within. The mix of interactions between subordinates, peers and superiors appears to follow similar pattern irrespective of level, whereby most contacts are with subordinates - in other words the manager spends more time managing than being managed. Horizontal peer contacts were also important, with substantial amounts of time

being spent interacting with others on similar levels.

However, the patterns of interaction change markedly at the senior levels. Higher executives have fewer peers, and although contacts with subordinates continue to play a large part, contacts with peers are replaced to some extent by contacts outside the organization (McCall et al 1978). This is a significant (although not overwhelmingly salient) feature of senior managerial work, occupying as much as 30-40% of overall contact time. Managers in lower and middle ranks (with the exception of specific roles such as sales) tend to have few contacts outside the organization. Senior executives, in contrast, have a wide range of external contacts with similar organizations, with suppliers and customers, and with clients, associates and consultants (Mintzberg 1970).

A particularly important characteristic of senior managerial communication has been pointed out by Mintzberg (1973) and others, whereby the manager's internal channels do not coincide with the formal lines of authority; on the contrary, he will bypass his own subordinates and peers to get information, and will encourage the subordinates of others to give him information directly.

The use of information in management is still something of an obscure topic. According to the McCall et al (1978) review, the getting of information - as opposed to using it or giving it - occupies a significant proportion of management time, with as much as half the manager's time spent in this activity. Much less time is spent on giving out information in the form of advice or

explanations, or in decision making. However, much of the information received in this way will be informal; ie it will be in the form of verbal communication (much the manager's preferred method of communicating), and the formal channels, as represented by reports and computer printouts will not form the principal basis of decision activity. This is evidenced in a study by Aguilar (1967) which shows that managers' use of personal sources exceeds impersonal sources by 71% to 29%.

Specifically, the formal information base lacks the immediacy and vitality of person to person contacts. Not only are immediate feedback and interaction denied, but much important information is missing: facial expression, gesture, tone of voice and other non-verbal communications are all lost in the formal system. But there are other aspects of the formal-informal information dichotomy for the manager; information is far too important for successful managers to leave this vital area to others:

> "... while the MIS may effectively serve the routine operations of the organization, it may be too limited to serve the organization's higher managers. Experienced managers in turn develop their own information system - networks of contact men, informers, customers, trade organizations and other personal sources who feed them with external information on an informal ad hoc basis. In addition they train subordinates to bring them information via verbal channels..." (Mintzberg 1975)

A similar point is made by Kotter in respect of the interpersonal networks which are developed by senior managers:

> "... the networks these GMs [general managers] created were incredible information-processing systems. They kept the GMs in touch with their responsibilities in a way that no formal or machine-based information-processing system could ever hope to do. These networks were capable of filtering masses of information and of passing on to the GMs only that which was important for agenda-setting purposes." (Kotter 1982b)

As a corollary to the discussion on managerial information-related behaviours, it is possible to catalogue the specific weaknesses, from the manager's point of view, of the formal information system. According to Mintzberg (1975) these are:

- Limitations of the formal system - the formal system lacks information which managers need; in the first place data relating to significant (and particularly external) threats to the organization is missing, and in the second place the system concentrates on the quantifiable (usually economic) aspects at the expense of the non-economic and the non-quantifiable

- Formal systems aggregate data - this results in "bland amalgams" which can be too general for the manager, who requires tangible detail to illuminate the issues and trigger decision activity

- Formal systems are too late - it takes time for events to become facts in the formal system; facts are first reported as rumours and gossip, and the manager pays much attention to the grapevine where information is not so precise, but may be both useful and timely

- Formal information can be unreliable - the use of proxy variables, particularly in accounting information, can be very misleading; in addition, specific data used in important decisions such as market data may be of questionable reliability

In summary, it can be said that managerial information processing is characterised by extensive and detailed (albeit highly personalised) knowledge of the organization at many different levels, which in turn is based on extensive (but largely informal) information gathering which occurs at all times and which has extended over periods of many years.

Characteristics of managerial thinking

In view of the earlier findings as regards the brevity and fragmentation of managerial activity, it will come as no great surprise to find that managers have little time to spend on

solitary reflection and "thinking", and this amounts to perhaps as little as 5% in all. Several studies (eg Carlson 1951, Stewart 1967) show that executives spend less than one third of their time alone, but that this time is composed of brief and fragmented periods; the study by Stewart (1967), for example, showed that they were uninterrupted for half an hour or longer only nine times in four weeks. Time alone is spent largely on reading and writing: handling correspondence, administrative paperwork, reports from subordinates and other written materials such as journals and periodicals.

> "`I'm paid to think,' said an executive of Control Data in England; `the system caught me at it once in 28 days.'" (a comment reported by Dahl and Lewis 1975, and quoted in McCall 1978).

This finding is particularly significant in respect of Decision Support Systems, because it implies that the individual strategic decision making role envisaged by DSS advocates may be largely non-existent.

The manner in which decision-making and other supposedly "higher" managerial activities are grounded in the hurly-burly of everyday activity has been emphasised in earlier sections; the fundamental inseparability of these two has has been well-expressed by Sayles (1964, quoted in Mintzberg 1973):

> "We thus prefer not to consider planning and decision making as separate, distinct activities in which the manager engages. They are inextricably bound up in the warp and woof of the interaction pattern, and it is a false abstraction to separate them."

The question arises as to whether managerial decisional behaviour

is associated with a certain type of person, or whether it is connected with the pressures incumbent in the job by way of a learnt predisposition. It seem reasonable to suppose that the manager's preferred patterns are in fact a natural, and probably highly desirable evolution resulting specifically from the character of work itself:

> ".. we have further indication that the manager adopts particular behaviour patterns as a result of the nature of his work. The pressure of the managerial environment does not encourage the development of reflective planners, the classical literature notwithstanding. The job breeds adaptive information-manipulators who prefer the live, concrete situation. The manager works in an environment of stimulus-response, and he develops in his work a clear preference for live action." (Mintzberg 1973)

In view of this finding, it is worth also emphasising that managers do not always accurately assess their own activities. A number of studies (see McCall 1978) indicate that managers significantly over- or under-estimate crucial parameters of their own work activities and roles. This phenomenon is particularly apparent in reported estimates of time spent, and also in the perceptions of the degree of freedom of choice they enjoy (Stewart 1976).

> "In general, the data suggest that managers perceive themselves as spending more time than they really do on technical, cognitive, and singular activities, and less time on formal and informal interactions. All that can be counted on is that managers make errors - sometimes quite large errors - when they try to estimate how they spend their time." (McCall et al 1978).

This finding has important implications at several levels. There is of course the danger of being misled in field research based on interview or questionnaire methods; however, it also has an important bearing on the way that managers will themselves

perceive the benefits of a computerised decision aid in the context of their own jobs.

The Meaning of Managerial Behaviour

Between the direct observational and diary material on specific managerial activities on the one hand, and organizational studies of strategic decision on the other, there is something of a gap: not a great one perhaps, but sufficient to render the precise nature of senior managerial decision making still somewhat obscure.

> "... multiple method research designs are needed to reconcile how general management responsibilities (such as planning) are played out within the chaotic activity patterns in a manager's daily life. For too long we have accepted the generalities... without examining their meaning in a behavioural context." (McCall et al 1978)

The discussion thus far has focussed on the material aspects of managerial work because it is from these that there appears to have come most understanding of crucial managerial activity. However, it should be possible to discuss the meaning of managerial behaviour in such a way that the outcomes are still firmly grounded in accurate behavioural analysis, and this leads to various interpretations of behavioural research.

An interesting analysis of specifically senior managerial activity by Kotter (1982a and 1982b) describes managerial behaviour in terms of two constructs: agenda setting and network building. According to this analysis, top managers do not begin their jobs with a clear-cut set of objectives and policies; instead, they spend time developing a loose set of goals and plans which together address a broad range of organizational

issues and which encompass events over short and long timeframes. The agendas discussed by Kotter were not the same as the organization's formal plans; they were not inconsistent with these plans, but contained many items not covered in formal planning processes and covered a much more extended timescale ranging from short term objectives a few days ahead through to long range aims stretching decades into the future.

"The process by which the agendas were developed began immediately after the GMs [general managers] started their jobs, if not before. The GMs used their knowledge of the business and organizations involved, along with new information received each day, to quickly develop a rough agenda. Typically this contained a very loosely connected and incomplete set of objectives along with a few specific strategies and plans. Then, over time, the agendas incrementally became more complete and more tightly connected." (Kotter 1982)

The second construct which Kotter uses to explain managerial behaviour is that of network building. According to this view, senior managers expend considerable time and effort in developing a personalised network of cooperative relationships with other people. This network extends far beyond immediate subordinates and includes representatives from many levels within and without the organization. The intensity and type of the relationships in the network varies enormously, but they have in common the objective of enhancing the executive's image, of creating and reinforcing desirable norms and values, of encouraging cooperative relationships and generally promoting the achievement of the objectives on the manager's agenda. Kotter identifies this network activity specifically with managerial effectiveness:

"Almost all effective GMs [general managers] use this network building process, but the best performers do so more aggressively and more skillfully. `Excellent' performers, for example, create networks with many talented people in them and

with strong ties to and among their subordinates. They do so using a wide variety of methods with great skill." (Kotter 1982a)

These constructs are illuminating, but of course hardly provide complete explanations of the wider gamut of managerial behaviour. It could be argued, for instance, that the behavioural paradigms identified by Kotter accurately represent the attributes of certain specific (albeit important) managerial situations, namely that of high ranking executive managers in large organizations, but not necessarily those of senior managers occupying other types of post or in different sized organizations; further, their are many managerial behaviours which are not entirely explained by reference to these two constructs alone. (Some alternative empirical support for these specific constructs can be found in Luthans et al (1985)).

However, in order to widen the conceptual base it is very useful to examine in some depth the role theory used by Mintzberg to describe and explain the behaviours of his sample of senior managers (Mintzberg 1967, 1971, 1973).

The importance of role theory to this thesis is that it provides an insightful and useful framework for reviewing managerial behaviour. In a later section, it will be shown that the fieldwork research of this project directly asks the question as to which of the many managerial roles perceived by the manager is actually being addressed by his own computer use. It will be seen, for instance, that computer adoption behaviours are typically associated with certain role requirements, whilst continued computer use is associated with other (different) role requirements. What is intriguing is that both these sets of role

requirements appear to be substantially different from those which are assumed (by system designers, analysts and so on) to be those addressed by the system. The assumption behind many of the implementations examined in the fieldwork (and indeed that of many computer professionals) is that only the manager's decisional role is salient (or important), whereas analysis shows that the manager undertakes activities which are consistent with many other roles which are equally important.

The concept of role has been variously defined (see Levinson 1973 for a detailed discussion of role concepts); here it will be taken in its broadest sense as implying at the same time aspects of a set of situational demands (expectations, norms, responsibilities) together with the role incumbent's perceptions of the part he has to play, which together result in various identifiable sets of behaviours.

Mintzberg (1973) describes in some detail his theory of managerial roles which is based on his own deductions of the intentions and purposes of managerial behaviour as evidenced by an empirical analysis of senior managerial verbal contacts. In all, Mintzberg identifies ten different managerial roles which he further subdivides into three distinct groups: interpersonal roles, informational roles and decisional roles. In order to illustrate and explain the range of senior managerial behaviours discussed later, these role concepts will be reviewed in some depth. Mintzberg's ten managerial roles are as follows:

interpersonal roles:

figurehead - linked to the manager's status and positional

authority, this role involves interpersonal activities in which the manager acts as a symbol (such as signing certain documents, or presiding over formal meetings)

leader - as leader, the manager exercises power by virtue of his personal characteristics or the positional power of his office; most importantly he influences the whole organization by diffusing certain norms and values and by motivating and encouraging desired behaviour:

> "... in virtually everything he does, the manager's actions are screened by subordinates searching for leadership clues." (Mintzberg 1973)

liaison - this role is characterised by the network of internal and (more importantly for the senior manager) external relationships which the manager creates and maintains, and in which he undertakes reciprocal, exchange relationships with others. This role concept agrees well with the description by Kotter (1982a,b) of the manager's interpersonal networks described earlier. In general, this role is different at different managerial levels. At lower levels, it is concerned with horizontal relationships which assist the organization with its inputs and outputs; at higher levels it is more concerned with gaining special favours and information:

> "Chief executives build and maintain their system of status contacts in a variety of formal and informal ways - by joining external boards and performing public service work, by attending conferences and social events, by `keeping in touch'... to keep the channels open." (Mintzberg 1973)

informational roles:

Here, Mintzberg specifically distinguishes between informational

and decisional roles; he identifies behaviours in which information is moved and/or recombined but which is not used at the time in significant decision activity. In other words, the manager can act, by virtue of his unique and privileged access to various routine and non-routine information sources, as a focus and switching point for information flows around his part of the organization. This leads to a rather favoured position:

> "He may not know as much about any one function as the specialist charged with it, but he is the only one to know a significant amount about all functions." (Mintzberg 1973)

At senior managerial levels he becomes the focal point especially for external information relating to matters both within the organization and in its environment.

> "Tasks involving only one specialist function are easily delegated to the subordinate charged with that function. But what of tasks that cut across specialities or that involve the manager's special information? The manager, as nerve centre, has the best command of the relevant factual and value information, and hence is best suited to handle these tasks."

monitor - in this role, the manager continually seeks (and in practice is deluged with) relevant and irrelevant information concerning the organization and its environment; the object is to identify problems and opportunities and to detect changes which require either further information or some form of action. The manager's preferences for informal information systems and for verbal communication channels have already been discussed; the essential point here is that he both receives and gives out information to a wide variety of internal and external sources and recipients.

"It is evident... that the manager's advantage lies, not in the documented information that is widely available, and which takes time to process, but in the current, nondocumented information transmitted by word of mouth... The manager develops an understanding of his milieu by piecing together all the scraps of data he can find." (Mintzberg 1973)

disseminator - this role is concerned with the transmission of information within the organization. The manager has very special access to information from a wide variety of sources, he acts so as to send external information into his organization and internal information from one source to another. As well as specific factual information, a particularly important function of senior management is the dissemination of desired values within the organization. These transmitted values act so as to influence decision making throughout the organization, so that the senior manager although not having direct influence over all matters, at least has an important affective ascendancy over very many aspects of decision making. Managers at upper levels create, or choose the values which are transmitted, whilst those at lower levels are more likely to act so as to transmit onwards values received:

"Chief executives, particularly those in large organizations with fragmented groups of `influencers', are able to assume much power over organizational values... On the other hand, managers who are dominated by one main influencer (for example the boss of a middle manager), probably exert less influence over the values they express. To a large extent, they merely transmit them unchanged from above to below."

spokesman - this role is concerned with disseminating information outside the organization. Having both formal authority and a central position in his information network, the manager is expected to act as spokesman to various external groups, including customers and suppliers as well as other public and

private groups which may influence the running of the organization. Clearly, this role is more important at higher levels, and is particularly characteristic of more senior management.

decisional roles:

Mintzberg recognizes four distinct role patterns in managerial decision; two of these - entrepreneur and disturbance handler - relate, roughly speaking, to the manager's proactive and reactive decision making requirements, and the other two - resource allocator and negotiator - relate to internal authoritative and external participative positions. These descriptions do not perhaps add materially to our understanding of the content and purpose of decision making, but they do provide excellent constructs for understanding the behavioural roots of managerial activity and for effectively categorising those behaviours. As regards senior managerial decision-making, Mintzberg clearly asserts the top manager's importance in strategic decision making:

> "One conclusion clearly emerges from my study: The manager takes full charge of his organization's strategy-making system... [He] is substantially involved in every significant decision made by the organization." (Mintzberg 1973)

In more detail, the decisional roles are:

entrepreneur - here, the manager is specifically initiating and designing organizational changes from his own free will; he is exercising his discretion - and in the case of the senior manager this may well of course be considerable - and this role therefore encompasses those decisional activities associated with planned

and systematic change. The decision process itself is identified as a sequence of small steps, decisions and activities all intended to change some organizational situation. Mintzberg goes on to further characterise this decision role in terms of three sub-roles: delegation, authorization and supervision, which represent increasing levels of personal involvement in the decision process.

disturbance handler - this role implies that the manager is making decisions which have arisen from matters beyond his control; he is in the position of fire-fighting, of taking involuntary decisions to handle unforeseen events which have resulted in unavoidable pressures on the organization.

resource allocator - here, the manager is seen as the judge of the way in which organizational resources in terms of manpower, money, equipment, time and reputation are utilised. In many ways this is the most salient of managerial decision roles, and one which is most familiar to us from the large literature on normative decision making. Within this category, Mintzberg identifies three elements of the resource allocation role: scheduling his own time, programming the work of others and authorising the work and decisions of others. Of these, the authorisation element is salient, and one which will be discussed in more detail later in the context of strategic decision making. Clearly, the latter element becomes more important, and involves wider issues at the more senior levels.

negotiator - this role concept refers to the part senior managers play in important discussions with significant people and organizations outside the manager's own organization; these

negotiations may concern acquisitions, union matters, consulting arrangements or indeed a whole host of external matters over which the organization has an interest, but not a direct authority or influence.

Following this outline of managerial roles, it is of course necessary to point out that Mintzberg's theory, as it relates to these ten specific roles, is not without its critics. In particular, Luthans et al (1985) cites studies which do not show direct empirical support for these role sets (although interestingly he does support the specific constructs of Kotter). However, it is argued here that what is vitally important for this thesis is not whether certain specific senior managerial role sets are universally prominent or not; rather, what is crucial is that it is recognised that a number of very different role sets exist in managerial work, many of which are not directly concerned with "decision making" or "information processing" as these are commonly understood. Whether these different roles can always be correctly identified by labels used by Mintzberg, such as "negotiator", or whatever, is not of direct concern; what is important is that the multiplicity of roles and the role-based differentiation between senior and middle managers are both recognised as crucial elements in the understanding and description of the meaning of managerial activity.

One purpose of this particular section has been to emphasise the importance of the meanings which we are to ascribe to observed managerial behaviours, to show that various interpretations of similar behaviour are possible, and that differences in

interpretation lead to important differences in theoretical viewpoint. Later, when reviewing the field research, it will be seen that the essence of the discussion revolves around interpretations of the meaning of various forms of managerial behaviour, and in particular the interpretation of the meaning of computer adoption and use in the context of the manager's roles.

Discussion

Following the review of the five aspects of senior managerial behaviour and decision making, we are now in a position to summarise the arguments and to develop some propositions about senior managerial computing. In the first instance, it is useful to tabulate the main managerial characteristics discussed, in order to clarify the essential features under discussion. (See Table 3.1 below.)

Table 3.1 Characteristics of Senior Managerial Behaviour: Some Similarities and Differences

General Characteristic	Senior Management Characteristic
Extensive hours, time at a premium	More extended at higher ranks
Time spent almost entirely within organization	More time spent outside organization
Large numbers of short fragmented activities	Lower activity rates, but decision process fragmented
high variety within functional specialism; local orientation	high variety across many functional areas; strategic orientation
Most communication are verbal	(The same)
Mainly dyadic interactions, informal, short time duration	More group interactions, more formal and longer duration
Many interactions with sub-ordinates and peers	Many interactions with sub-ordinates (fewer peers)
Few contacts outside the organization	Many contacts outside the organization
Little time spent in solitary thinking or planning	(The same)
Informal information system strongly preferred over formal system	(The same)
Overestimation of cognitive and solitary activities	(The same)
Emphasis on functional activities	Emphasis on creation of agendas and interpersonal networks

From this table can be seen characteristics of managerial behaviour generally, with those peculiar to the more senior manager high-lighted. In order to further emphasise key aspects of senior managerial behaviour, it is useful to consider a

further summary of the key features (Table 3.2 below.)

Table 3.2 A Summary of the Principle Characteristics of Senior Managerial Activity

Long hours and hectic pace; every minute considered valuable
More time spent outside the organization
Fragmented decision sequences
High variety across different functional areas
Strategic orientation
Mainly verbal communication
More group interactions, more formal and longer duration
Many contacts with subordinates (fewer with peers)
Many contacts outwith formal channels
Many contacts outside the organization
Little time spent in solitary thinking or planning
Inaccurate appreciation of own activities
Informal information system preferred over formal
Emphasis on selection and achievement of informal agendas
Emphasis on creation and maintenance of interpersonal networks

Having discussed extensively the characteristics which seem to identify the senior manager's work patterns, it is now possible to discuss some ideas relating to his possible computer use. The characteristics which have been discussed so far seem to mitigate for or against own-computer use on several dimensions. It is thus possible to speculate as to the effect of each characteristic on the extent and nature of managerial computer own use, and to

discuss these speculations in terms of specific propositions which can usefully be tested in the field research:

p1. In view of the value placed upon the senior manager's time, anything perceived by him to save his time or maximise his time effectiveness will be welcomed - conversely, anything perceived to subtract from his time efficiency will be deplored

p2. Senior managers spend less time inside their organizations, so fixed desk-top computer systems will be used proportionally less; conversely, there would appear to be scope for use of portable systems and for systems with communication functions

p3. The nature of the fragmented decision process would seem to argue against the intensive own use of exploratory model-based DSS, on the grounds that this use does not fit in with the characteristics of the senior manager's usual work pattern

p4. A strategic orientation would seem to mitigate in favour of DSS which catered for strategic issues, and against traditional MISs offering localised departmental or divisional data

p5. A predisposition against formal information systems seems to mitigate against the use of computer-based decision aids in general, unless these contain data other than the typically economic, quantitative and summarised information traditionally available. An important consideration is that any computer-based information system has to compete with the successful senior manager's own excellent and personally unique interpersonal information network.

p6. Increased group interactions, and more formal and preplanned meetings would seem to argue for the potential of systems which would make information available at these meetings and which would serve to augment arguments presented in the meetings, or to facilitate exploration and discussion of alternatives.

p7. The large number of interactions with subordinates would argue for systems which were relevant to the specifics of those interactions or which facilitated them; but the content of these interactions is not clear.

p8. Similar arguments hold for external contacts, but here it might be expected that traditional MIS and DSS are less likely to offer relevant external information. In view of this characteristic feature of senior managers, it would be expected that systems would be devised which are specifically oriented towards this external orientation.

p9. Managers in general spend little time in solitary thinking; this seems to argue against the developmental use of model-based DSS where strategic options are systematically explored by the senior manager himself

Conclusion

The general trend of these ideas is clearly against the use of present-day computer systems by the senior manager himself. If correct, they argue strongly against his using a computer - although they might be said to support the idea of "chauffeured" use. In fact it can be argued that in order to use a computer himself, the manager must modify certain behaviour patterns and adopt habits of thought and behaviour which up to now have not been conducive to his general mode of managerial activity. The question arises as to whether managerial computer users have in fact changed their habits, or whether they are making use of computers in new ways.

It may well be the case that new systems, methods or techniques have been found which either mitigate against some of the apparent negative characteristics of computer-managerial interaction, or which offer significant advantages which make computer use irresistible. In any event, this discussion emphasises a number of aspects of the research questions; but in particular, if managerial systems are theoretically so unattractive why are certain managers using them, and what are they doing with them?

References

Aguilar FJ, Scanning the Business Environment, Macmillan, 1967

Carlson S, Executive Behaviour: a Study of the Workload and Working Methods of Managing Directors, Strombergs, Stockholm 1951

Hall WK, Strategic Planning Models: Are Top Managers Finding Them Useful?, Journal of Business Policy, Vol 3 2, 1973

Hambrick DC, Mason DC, Upper Echelons: The Organization as a Reflection of Its Top Managers, Acad. of Management Review, Vol 9 2, 1984

Jacques E, A General Theory of Bureaucracy, Heineman London 1976

Kotter JP, What Effective Managers Really Do, Harvard Business Review, Nov/Dec, 1982

Kotter JP, The General Managers, The Free Press New York 1982

Levinson D, Role, Personality and Social Structure in the Organizational Setting, in Salaman G and Thompson K (Eds), People and Organizations, Longman, London 1973

Lieberson S, O'Conner JF, Leadership and Organizational Performance: a Study of Large Corporations, American Sociological Review, Vol 37 1971

Luthans F, Rosencrantz SA, Hennessey HW, What Do Successful Managers Really Do? An Observational Study of Managerial Activities, Journal of Applied Behavioural Science, Vol 21 3, 1985

Martin NH, Differential Decisions in the Management of an Industrial Plant, Journal of Business, Vol 29, 1956

McCall MW, Morrison AM, Hannan RL, Studies of Managerial Work: Results and Methods, Technical Report No9 May 1978, Centre for Creative Leadership Greensborough, North Carolina, USA 1978

Mintzberg H, Structured Observation as a Method to Study Managerial Work, Journal of Management Studies, Vol 7 Feb, 1970

Mintzberg H, Managerial Work: Analysis from Observation, Management Science, Vol 18 2 Oct, 1971

Mintzberg H, The Nature of Managerial Work, Harper & Row 1973

Mintzberg H, The Manager's Job: Folklore and Fact, Harvard Business Review, July/Aug, 1975

Pettigrew A, The Politics of Organizational Decision Making, Tavistock 1973

Sayles L, Managerial Behaviour, McGraw Hill, New York, 1964

Shrivastava P, Grant JH, Empirically Derived Models of Strategic Decision Making Processes, Working Paper Series WP-506 , Univ of Pittsburgh USA 1982

Simon HA, Administrative Behaviour, Macmillan, 1945

Stewart R, Managers and Their Jobs, Macmillan, London 1967

Thomason GF, Managerial Work Roles and Relationships (Part 1), The Journal of Management Studies, 3 1966

Chapter 4

A Critical Review of Previous Work on Decision-System Implementation and Adoption Factors

Abstract

The literature relating to specific studies of interactive managerial computing is sparse (and that relating to senior managerial computing virtually non-existent). However, there is a large body of knowledge concerned with the general problem of decision system implementation. This chapter reviews part of this work in order to contribute to the theoretical base of the study. In order to make sense of the broad and varied coverage which the literature provides, a synthesis is provided which derives seven groups of factors which may be considered to influence computer use. Finally, an outline process model of computer adoption is derived, based on technology-diffusion theory.

Introduction

The general problem of the acceptance of innovation in management decision has been addressed by practitioners and theorists from the very early days of computing and management science.

> "In implementation we deal with the most difficult subject matter confronted by science: people, and social groups." (Churchman, Ackoff and Arnoff 1957).

The authors point out that at that time there was no well-formulated methodology of implementation available, and the current management science discipline was preoccupied with techniques. It is arguable that, although much work on the implementation problem has been undertaken in the intervening years, a well-formulated and generally successful methodology has still to be developed.

Nearly twenty years later Churchman (1975) wrote:

> "Over the years...many of us have been struck by the enormously important contrast between the development of the intellectual base and the implementation of this development into social change."

A large body of work is concerned with the theoretical and practical problems of implementing decision systems, and a review from this perspective will capture a significant element of the relevant literature. The ideas which form the basis of an implementation approach are those which are concerned with the notion of a specific objective or set of objectives held by one group concerning the behaviours of individuals of a different group in relation to some system. Part of the literature is concerned with an `implementation process', ie a progression of

organizational change whereby a significant difference in certain organizational parameters occurs and becomes permanent. This theoretical notion of the change process is based on the Lewin/Schein model (see Schein 1964) in terms of an unfreezing/refreezing process as follows:

1. unfreezing - creating an awareness of the need for change and a climate for receptivity to change

2. moving - changing the magnitude or direction of the forces that define the original situation; developing new methods and/or learning new attitudes and behaviours

3. refreezing - reinforcing the changes that have occurred, thereby maintaining and stabilising a new equilibrium situation.

These concepts underlie much of the literature on implementation processes, both normative and prescriptive. Other authors who have taken up or expanded this basic model include Kolb and Frohman (1970), Sorensen and Zand (1975) and Wolek (1975). This thesis is particularly concerned with implementation as a process, and a theoretical process model specific to individual managerial computer adoption will be developed at the end of this chapter.

Implementation "success" (and this idea is measured in a number of different ways) forms the basic objective of much of the work in this area. However, this often seems to lead to prescriptive theories based on just the one or two areas or themes that a particular author has examined. An example of narrowing a complex field in this way is provided by Ginzberg (1981):

"The implementation literature provides consistent evidence of the importance of only two generic issues for success in MIS implementation. These are management support and user

involvement."

In contrast to this, the view is taken here that there are perhaps seven general topic groups within the subject, each of which contains a multitude of possible subject reference points.

Implementation as an inter-disciplinary subject

Implementation as a distinct field of study emerged largely in recognition of the very distinct gap which has always existed between normative decision theory, by which I mean the extensive literature on Management Science / Operational Research (MS/OR) techniques, and the far less extensive literature on management practice. This field is particularly relevant in the development of this thesis because of the close links between normative MS/OR techniques and DSS design, particularly in the creation of model-based DSS and the emphasis on areas of planning and strategic decision making. However, it is necessary to make clear that there is a difference between the implementation of decision-science recommendations within a social setting, and the implementation of a technological facility at a personal level. Unfortunately, such a distinction is not always established in the implementation literature. However, it is necessary to keep this in mind during the following review in order that the specific relevance of certain factors can be kept in perspective.

The gap between OR/MS theory and management practice was recognised early on and received considerable attention from MS/OR theorists in the 1970s. For example Urban (1974) pointed out that very few of the descriptions of MS based decision theory

in the Management Science literature actually resulted in any distinct management impact:

"In the period January 1971 to June 1973 Management Science: Applications contained over 150 articles, but less than 3% represented implementation in an organization..."

Computer implementation unfortunately has been less well documented, and there are very few examples of empirical work on the success rates of computer implementation in general. In particular, specific evidence relating to implementation with senior managerial subjects is extremely sparse. However, what indications there are (as evidenced by the growing literature on normative implementation prescriptions for example) imply a significant failure rate (depending of course on one's definition of failure). A significant objective of the implementation theorists was to alert practitioners in the OR/MS tradition to the necessity of taking into account human aspects at all stages of design and implementation; there being a tendency to concentrate exclusively on technical aspects of the project.

"In general, few of the implementation failures of management science are due to inadequate or incorrect analysis from a technical viewpoint... The obstacles appear to be human." (Hammond 1974)

Towards a general model of implementation factors

In order to examine the literature in detail an overall framework is necessary, one which will enable a realistic review of all the salient elements and at the same time provide a mental guide through the different themes and approaches. Within the literature the wide variety of diverse topics, themes and approaches almost defies categorization. The main problem seems

to be the widely differing approaches taken by different authors, and more particularly the different focal points adopted. In order to overcome this, the literature will be addressed first with a wide focus and then with increasingly sharp viewpoint. In this way, the attention is drawn logically from the wider environmental and organizational issues through to factors relevant at the individual and human-computer interface level. It has been found convenient and logical to consider the different factors in seven separate groups:

1. wider environmental issues
2. organizational variables
3. situational variables
4. manager/analyst issues
5. individual differences
6. attitudes and expectations
7. manager/system interface

Because of the multiplicity of different perspectives to be found in the literature it is of course possible to pick out different salient elements and to list them in of different ways, but it is believed that most of the main themes and issues can be included within this framework. Apart from its usefulness in anchoring the present research, it is hoped this way of summarising a very wide literature might be useful as a framework for other research efforts in this general topic area.

A review of themes in the implementation literature

Some of the articles in the implementation literature revolve around normative prescriptions of a "how to do it" nature, usually based more or less on one or two key ideas which the author introduces as central to the problem. A key feature of virtually all the literature in this area is that the result of the intended implementation is a worthy object, the desired objective and focus of the effort. The general form of the empirical implementation research articles is one that relates implementation success (the dependent variable) to one or more independent variables which are expected to be associated with the dependent variable. Using the factor groupings depicted earlier, a discussion of key themes follows:

1. Wider environmental issues

This topic relates to problems and issues peculiar to larger social systems, ie groupings of national or international size. Within the social science literature there is of course a wealth of international cross-cultural comparisons and discussions, which show a diverse range of aspects of human existence which are affected by cultural influences. According to Hoffstede (1980):

> "... different nations have different cultural heritages which are largely invisible. The invisible part consists of values, collectively held by by a majority of the population... and transferred from generation to generation through education and early life experience... and through socialisation in organizations and institutions. These values have thus grown into societal norms which, in their turn, determine to a large extent the political and organizational solutions which are feasible within that particular national culture."

The author goes on to point out the inherent difficulties of introducing organizational techniques and solutions from one country to another, and particularly emphasises the exporting of American management theory to other parts of the world. However, an empirical study by De Bettignies and Evans (1977) of cross-cultural issues shows fewer differences between senior managers in Europe and America than between those of European countries:

> "... taken as a whole, the European business elite turns out to be less different from the American elite than popular stereotypes would warrant... In many cases the differences between European countries are highly significant and seem to be affected by the broad stream of cultural tradition in a given society." (De Bettignies and Evans 1977)

In other words, international cultural issues, although undoubtedly they exist, may not play such an important role as is sometimes imagined. It has been said, for example, that American managers have a very different view on direct computing from their British counterparts; but in fact such a belief may not be warranted. Turning to cultural issues in the more specific area of decision support there is far less evidence, and the issues are not so clear. Some direct inter-cultural analyses of MS/OR implementation have been performed, for example in an Indian setting by Mohan and Bean (1979), in Peru by Sagasti (1972) and in Colombia by Vertinsky (1972). The latter study found that co-optation of personnel with the necessary innovating skills and knowledge was a significant factor in technological adoption:

> "Mobility of personnel with... previous exposure to modern management values is... a determining factor in the diffusion of managerial innovation in a developing country." (Vertinsky 1972)

This of course might be expected, but it is altogether a

different phenomenon from the value-based cultural issue of the preceding paragraph. In addition to a national environment, at least one writer has commented on the specific societal milieu existing in respect of computer innovations in society. Kling and Gerson (1977 and 1978) point to the social elements of a "computing world" whose participants include manufacturers, service providers, and users. In all, some 14 participants are identified who play roles relating to technological innovation. Relations between these participants positively affect the diffusion rate:

> "Groups that innovate, diffuse and sell technological innovations can keep those people who wish to use the technology... continually adapting to an ever changing technology which promises to solve new problems with each innovation... Adapting to technological change is a continual demand placed upon participants of the computing world." (Kling and Gerson 1977)

This point is most interesting, contrasting sharply as it does with conventional views which would suggest that adoption is largely demand-led, or needs-led. According to Urban, for example:

> "Most important, the adopter must have a need for change; ie he faces a problem which cannot be resolved from existing technologies." (Urban 1974)

There have been of course many other expressions of this view. For example, Zaltman et al (1973) state that the impetus to consider technological adoption arises from a perceived organizational need, in other words there is a perceived discrepancy between what the organization is doing and what the organizational decision-makers consider it ought to be doing, resulting in a performance gap that stimulates innovation. An

important point here is that there is some contention between the traditional view of needs-led technological development and the idea that, to some extent at least, the change is a self-generating phenomenon fuelled by the computer industry itself.

2. Organizational variables

Surprisingly, there have been few attempts within the perspective of the implementation literature to discuss organizational issues such as size, structure, internal norms and culture. But of these, a study by Bean et al (1975) examined various structural factors including industry type, organizational size, level of decentralization and various other factors relating to the innovating group. Weak correlations between the posited variables and implementation success showed negative correlation with organizational size:

> "It may be determined that it is more difficult to implement a program [sic]... in a large complex organization." (Bean et al 1975)

The specific effects of organizational size in the context of senior managerial computer involvement will be discussed in more detail in chapter 8, when it will be shown that the field research findings from this thesis contribute to knowledge in the area. Returning to the published literature, the study by Vertinsky linked social norms in relation to organizational reception of management science techniques. The same study examined structural components of organizations in terms of their hierarchical or centralised/ decentralised structure:

"...our study singled out organizational structure as the most important immediate bottleneck in the diffusion of innovation." (Vertinsky 1972)

The author goes on to explain that in order to share responsibility, representatives of organizational power groups formed committees and lines of control and authority are ambiguous. Additionally, power equilibrium was maintained by a system of constraints which made change impossible. Few authors specifically tie structure with adoption processes, but MacLagan (1983) discusses the notion that knowledge utilisation, as represented by the adoption of new ideas, is facilitated through hierarchical structures "in so far as people can be ordered to accept them", but that the adoption under such circumstances may be of a superficial nature. Schultz and Slevin (1975) introduce the concept of "organizational validity" as an idea which represents the "degree of fit" of decision systems in organizations; the concept explicitly recognises the necessity of resolving organizational issues, but without specifying organizational variables in detail. Although created initially with reference to MS/OR models, this concept has been shown by Markus and Robey (1981) to be just as relevant to MIS implementation dynamics.

3. Situational variables

This category has received considerable attention from theorists and practitioners. Some authors have concluded that the personal involvement of the intended user-manager in the design and creation of his decision aid is a predisposing variable (if not actually a prerequisite) for later adoption of the decision aid.

"Experience with managerial implementation has often indicated that acceptance is most easily gained from the decision makers who "suffered" through the development. This implies that diffusion horizontally and vertically in the organization will be most successful when new managers are involved..." (Urban 1974)

The point is made succinctly by Senn (1978):

"...successful management information systems efforts require the direct involvement and participation of the managers who will use the system outputs."

Similar normative points are made by Scott Morton (1971), McKeen (1983), Zmud and Cox (1979), Lucas (1975), Swanson (1975), Ginzberg (1981) and many others. However, the situation in practice may be very different; Alter (1978) has identified patterns of implementation involvement occurring in practice which do not conform to the conventional wisdom as regards user involvement and describes situations where the system is "sold to" the user or "forced upon" him. Other authors have also considered the effects of behaviours which influence adoption. Lawless et al (1982) have identified a pattern of advocacy in the introduction of computer-based decision systems whereby an individual personally espouses the cause and provides the necessary organizational energy to mount a project:

"The advocate has been introduced as the dominant need sensing and asserting mechanism where the initiative was internal... a single person... marshalled the resources... and generally sponsored the entire project." (Lawless et al 1982)

The authors go on to describe certain personal characteristics of the advocate; these characteristics amount to a "cosmopolitan" rather than "local" perspective and orientation, as defined by Kelly (1969). In general, the advocate is less committed to

current organizational wisdom and more likely to challenge existing approaches. Having higher than average educational or professional qualifications and a good standing within the organization (Lawless et al 1982), the advocate was able to use specialist expertise to establish credibility and gain confidence in his abilities to mount a new project. As a result of this confidence the advocate performed a key role in initiating and controlling the evolution of the project.

> "... advocates can use their unique position to engage in interpersonal behaviours that enhance organizational acceptance..." (Lawless et al 1982)

In other words, the advocate is able to mobilise resources in order to effect the organizational changes required in order to enable the implementation to proceed. However, the above authors also point out that the advocate often avoided managing the project through to completion, but left the organization or division before the final implementation phase. The role of internal and external advocates is also mentioned by Alter (1977b) in the context of his study of different types of DSS; in particular he notes that certain types of DSS are more likely to be initiated by internal or external entrepreneurial behaviour by systems experts because they are more difficult to conceptualize and require "selling" to management. The role of the advocate is clearly a crucial aspect in managerial acceptance of decision aids; consideration of his role and activities again adds weight to the arguments expressed earlier against the view that technological innovation is purely demand led.

A study by Gibson (1975) of MS/OR implementation gave due weight

to the perceptions of various actors in the system of the role of the system implementation in terms of their own personal career development. One would have thought that, a priori, such considerations would form an essential ingredient in understanding implementation behaviours, but few authors mention these considerations specifically.

A point brought out by many authors in the implementation tradition (see for example Gibson 1975, Manley 1975 and Senn 1978) is the necessity for personnel involved in the implementation process to perceive that their top management support the innovation. This point has been well expressed by Zmud and Cox (1979):

> "... their [top management] direct role in implementation is to develop a sense of commitment within implementation participants. This is accomplished by exhibiting an appreciation for the project and establishing an environment that encourage involvement by and interaction among the participants." (Zmud and Cox 1979)

The nature of implementation as essentially an organizational process is discussed by Gibson (1975). He points out that successful implementation requires the "exercise of influence" and hence requires a power base sufficient for bringing about organizational change of a substantial order.

> "... implementation is best conceived as a process, taking place over time, and as a complex, multivariate process of interpersonal influence..." (Gibson 1975)

The issue of specific resistance to technological innovation is first described in detail by Manley (1975). Essentially, this view identifies a natural pattern of resistance, rather along the lines of organizational development and change theorists such as

Bennis and Benn (1961). Manley identifies several resistance dimensions, among which are general hostility to the technology, conformation with peer group resistance patterns, personal natural resistance to change and learned resistance owing to past performance of similar ideas.

The concept of resistance to implementation has been further developed by Markus (1980). This author discusses various dimensions of resistance theory from different viewpoints but leans towards organizational-political factors in resistance motivation. In general, Markus uses the idea of resistance in the same way that earlier writers discuss implementation "failure" - ie as the general term for the outcome of an unsuccessful implementation attempt. Despite the nature of some of the comments in the more popular press relating to irrational managerial rejection, the concept of resistance as introduced in this context by Manley, and developed by Markus, is a useful one and it remains to be seen what light will be shed on the subject of resistance by empirical field research.

4. the manager/analyst interface

In order for a manager to achieve any benefits from a decision system it is necessary for a considerable technical effort to be expended, in terms of systems analysis, choice, design and the manipulation and modification of various elements of hardware and software. In addition to specifically computer-related activity, there may also be a requirement to investigate, translate or at least understand elements of management science techniques involved in mathematical model building or basic accounting

concepts for accounting models. There is thus an extensive range of expertise, parts or all of which may be brought to bear at some stage in a decision support project.

This gives rise to the necessity for the manager to relate at some stage to one or more "experts" who will undertake to translate his wishes into an appropriate technological solution. There are many different specialisms and experts within the field we are examining, and they are known by a variety of descriptions and titles. In general, there is the management scientist, the OR specialist, decision analyst, systems analyst (in the sense of the generic systems discipline), information scientist, computer systems analyst, and more recently, the knowledge engineer. One or more of these roles may be incorporated in one or more people, and in fact various terms are used indiscriminately in the literature. Kaiser and King (1982), for example, theoretically identify at least six different modes of relationship between user/analyst groupings. The essential point however is that the manager must form a relationship with somebody who is fulfilling a very specialised role; for the purposes of clarity this role will simply be described as "the analyst" unless further discrimination is required.

The problems inherent in this relationship where recognised at a very early stage:

> "... inevitably, these new experts find that other members of the management team do not share their desire for change... The computer technologist... has to get unfamiliar concepts across to line managers... with whom he has little in common." (Mumford and Ward 1966)

Considerable attention has been focussed on characteristics of

the relationship between manager and analyst, in order to ascertain those aspects which may mitigate against successful implementation. Some of this attention has been focussed upon aspects of the manager himself, some upon the analyst and some upon the nature of the relationship between them (often referred to as the "manager/analyst interface"). A succinct statement of an important aspect of the manager/analyst problem has been made by Churchman and Schainblatt (1965):

> "Much management science has been conducted under the very naive philosophy that a certain kind of reason must prevail, and that once this reason has been made clear, the manager will either accept it or be charged with gross negligence or, still worse, gross stupidity."

The extent of the concern with the manager/analyst relationship is due to the many obstacles which appear to materialise owing to the very nature of the relationship. Pettigrew (1974) has pointed out that the analyst has his own needs and ambitions and that these will be reflected in the way that he advises, negotiates with, persuades or otherwise attempts to influence the manager. In other words the analyst and the manager have different political interests (perhaps markedly different) and this will affect the way in which the relationship develops:

> "... different groups of executives and specialists have varying sets of needs, expectations and reference group affiliations. They operate from different cultures. They also relate to others with differing sets of political interests." (Pettigrew 1974).

According to Hammond (1974), there are a number of contextual, psychological and social differences which together form obstacles to successful interaction. These obstacles fall into

three categories: different expectations by both parties as to the purpose of the implementation, different (and strongly held) preconceptions as to the nature of the decision elements in the system and significant cultural and other differences at a personal level which tend to impede effective collaboration.

> "The manager is the problem giver; the management scientist is the problem solver... Each effectively does his own thing with a minimum of overlap... Meetings held while the analysis is under way are more to answer the management scientist's questions and to seek data than to discuss the problem. Changed signals on the part of the manager regarding his perceptions of the problem are annoyances... rather than progress in problem solving." (Hammond 1974)

Hammond goes on to point out that the manager may have a strongly held internalised concept as to the nature of the problem under discussion which may be immune to insights from the analyst. Equally, the analyst for his part may be completely shackled to the solution set as represented by one management science technique (it may be the only one he knows, or the one he feels most competent with); a significant variation on this theme is the computer analyst who has gained considerable fluency (no doubt at great personal cost) in the technical ramifications of one particular DSS package or technique. Under these circumstances it is of course very difficult to break free from such constraints.

However, the differences between manager and analyst are not confined to those created by specialist expertise alone. The third problem area which Hammond discusses relates to the nature of the personal differences in outlook which are likely to characterise the two parties. These differences, which are effectively demarcated along departmental boundaries, may be

essential to the functioning of each separate department but act so as to create obstacles when members from different departments are attempting to work together. Hammond (1974) identifies eight different dimensions of this personal differenciation:

goal orientation - the manager will be pragmatically oriented towards his sub-unit goals and those recognised by the organizational control systems, the analyst's orientation will be towards external (perhaps professional) recognition, and normatively oriented towards organizational as opposed to departmental goals

time horizon - the manager is concerned with shorter time horizons than the analyst (this point will be taken up in a contrary sense later in the analysis)

comparative expertise - the managers expertise will be high in his operational context and low in formal decision technology, the analyst will have the opposite orientation

interpersonal style - the experienced manager will be more concerned with fostering interpersonal relationships, the analyst less so

cognitive style - the manager is expected to be "heuristic" in style and the analyst "analytic" this is discussed in greater depth in a separate section

problem definition - the manager will tend to describe his problem less explicitly but with broad scope; the analyst will have the opposite tendency

validation of analysis - the manager will be concerned more with the method and excellence of the analyst's presentation, and with the presence or absence of mutually shared values; the analyst is more concerned with the internal logic of the solution

degree of problem structuring - the manager is more accustomed to handling ambiguous and ill-structured situations, ambiguity is a source of anxiety to the analyst who tends to deal only with the more structured aspects of the problem

Hammond emphasises that not all manager/analyst pairs will

automatically be differentiated along all eight of the dimensions and notes the danger of typecasting all managers, or indeed all analysts, into a single category:

> "... there is a real danger of stereotyping a particular manager... instead of dealing with him according to his unique characteristics, and a similar danger in lumping all management scientists into a single class..." (Hammond 1974)

Many aspects of the problem are exemplified in the systems analysis "methodology" commonly employed in practice. As has already been mentioned, it is a tenet of good implementation practice for the user to be involved closely in design and development phases; in practice, although lip service may be paid to the principle, a technique known as the "back-room boy" or the "hit and run" approach (Docherty 1980) is commonly used. In this technique, the analyst is initially in close contact with the user while information is being collected; however, the analyst then retires to his office to design a system on his own which is then handed over to the user at implementation time. A significant source of difficulties can be ascribed to the lack of knowledge, on the analyst's part, of the realities of managerial work (and particularly senior managerial work). The characteristics of senior managerial behaviour discussed in chapter 3 will simply not be known by most analysts, who have had little exposure to these issues either by way of training or by practical experience. This state of affairs can only exacerbate differences of culture and outlook and thus reinforce those stereotyped views of managerial attitudes and fears which are often used to rationalize implementation failures. Wright (1984) provides a good example of this stereotyped viewpoint.

The need for non-technical training for the analyst is taken up by several authors (see for example Brightman and Noble 1979). The notion of training systems experts specifically in interpersonal skills is discussed by Weiss (1983), who maintains that this group as a whole are poor at interpersonal relationships and quotes evidence which indicates that the group has a lower than average "social need" score (ie the need to interact with others, similar to McGregor's (1960) need for affiliation, n-Aff.) Weiss's work is based in turn on theories by Argyris (1971) which directly relate interpersonal competence with the ability to realise technical potential, and her training solution was foreshadowed by Mumford almost twenty years previously:

> "This is the essence of our third problem: that of developing the social skills of our technical change-makers." (Mumford and Ward 1966)

However, training as a solution to the manager/analyst problems is described as too simplistic by Kaiser and King (1982); these authors maintain that differences will not be reduced simply by training more analytically oriented managers or more "business" oriented analysts:

> "The differences that exist, whether they are intrinsic or merely learned... are probably too great. Moreover, the "knowledge demands" of each function are so great as to preclude the development of "Renaissance Men" who can know their primary field as well as that of a second field that is quite different in nature and skill requirements."

Nor, indeed has the situation changed much over the last decade; according to the study performed by these authors:

"... the overall results of this study present a negative picture for those who believe that a greater user orientation is critical to progress in MIS. The disparity between theory and practice appears great despite the decade or more that has been devoted to diagnosing and prescribing remedies for problems at the user/analyst interface." (Kaiser and King 1982)

5. Individual characteristics

Personal variables such as age, education, career pattern and previous exposure to computing have not been discussed to any great extent within the literature of the implementation perspective, even though it seems reasonable to suppose that these elements will be relevant. Age, for example, as has already been mentioned, is a putative cause of senior managerial resistance to computing according to some sources. However, a case can be made for including such variables as prior experience, amount of formal computer training and so on; indeed, a case will be made in chapter 5 and chapter 9 for examining such variables. Returning to the literature, Smith and Kozar (1978) make a point about managers' computer education:

"... it is not surprising to see that many new techniques designed to improve the managerial effectiveness of organizations, techniques which are of necessity computer-based, are unused. A vast majority of managers, neither by experience nor education, have come to view the computer as an integral component of their professional roles." (Smith and Kozar 1978)

However, apart from the assertion, no studies seem to have been performed which empirically relate computer education to computer adoption and use, even though a relationship between these two things is assumed in the above quotation (and others like it).

Moving outside the implementation literature, theories of innovation adoption in general have been proposed which do

concentrate on personal characteristics of the adopter; in particular, Rogers and Shoemaker (1971) discuss the social, psychological and other characteristics of early adopters, late adopters and so forth, where these are considered as discrete groups. Much of the Rogers and Shoemaker discussion of innovation adoption revolves around communication and attitudinal processes during adoption; relatively little of their material concerns subsequent discontinuance processes. However, they do describe a disenchantment decision, whereby the adopter ceases to use an innovation because he perceives it to be inappropriate (either realistically or from misuse); they also discuss various social and personal variables in connection with discontinuers as a discrete group:

> "Generally, high discontinuers have less education, low social status, less change agent contact, and the like, which are the opposites of the characteristics of innovators. Discontinuers share the same characteristics as laggards, whom we know to have a higher rate of discontinuance." (Rogers and Shoemaker 1971)

Following this line of reasoning we might expect our senior managers, who will tend to higher education, high social status and more change agent contact to have a very low rate of discontinuance indeed. However, this is not borne out by the research evidence which will be presented later.

A theme that has been discussed extensively from within the implementation perspective is the idea that individual decision makers have certain psychological characteristics which affects their relationship to information and hence makes them more or less likely to utilise a decision system. A frequently used basis for this approach is the Myers-Briggs style indicator, a system

for evaluating individuals along four personal style dimensions (see for example Myers 1980). The approach itself is based on earlier work by Jung on psychological types, and in fact the whole area of "typing" has a considerable body of work behind it from main-stream psychology (cf. the work by Eysenck on dimensions of extraversion/introversion). The four Myers-Briggs style dimensions are:

1. Extraversion - introversion
2. Sensing - intuition
3. Thinking - feeling
4. Judgement - perception

A seminal paper by Mason and Mitroff (1973) discusses the need to take into account more than one psychological type when designing and implementing MIS systems, and argues that management science and information experts have tended to be sensing/thinking types and hence the design of information decision systems has reflected this psychological orientation. The importance of this is that information approaches which are suitable for one psychological type may not be suitable for another:

> "Each of these types has a different concept of information... If one is a pure thinking type, information will be entirely symbolic, eg some abstract system, model, or string of symbols... If one is a sensation type, information will be entirely empirical... For intuition types, information will be in the form of "imaginative stories"...." (Mason and Mitroff 1975)

The general approach and the availability of a ready-made testing instrument has also encouraged empirical studies. A variation of the cognitive style variable was tested empirically by Lucas (1975):

"Individuals with differing decision styles have differing levels of use of information systems, perform different analyses of data and take different actions based on information."

The author reports on an experiment using the Myers-Briggs indicator which, surprisingly, appears to show a positive correlation between intuitive style and information use. This result is in direct contradiction to the work of Botkin (1973) who argues that computer systems are generally designed for and are of value primarily only to systematic types. Botkin goes on to call specifically for a DSS which would support the intuitive type of manager, and claims that it is essential that this type of viewpoint is brought in to systematic organizational decision process. However, he also points out that designing and creating a computer system is itself a systematic activity thus requiring a translation process between the two styles.

"The design and programming of an intuitive system... is a systematic process at the working level. That is, a translation function is necessary to get the intuitive conception into a systematic computer. This translation process must be done by an individual or group of individuals capable of utilizing both cognitive styles." (Botkin 1973)

This seems to place a heavy burden on the analyst (or analyst team), and refers back to the earlier discussion on the manager/analyst interface. McKenny and Keen (1974) working on similar premises, use the cognitive style issue to argue for special care to be taken in the design of computer systems for decision. In particular, they call for the manager and the analyst to recognize the other's differences and to accept that these differences in outlook will lead to different approaches during development and implementation. A better result will be

created by both parties co-operating and compromising at appropriate stages in the process. The effects of these information processing, thinking or decision-making styles are further examined and discussed by De Waele (1978), Robey and Taggart (1981), Schepanski (1983), Wright (1980), Benbasat and Dexter (1979), Benbasat and Taylor (1978), Lusk and Kersnick (1979), Wright (1980), Doktor (1976) and Dermier (1973).

The style or type paradigm has been further extended to yield a more detailed conception called cognitive complexity which has been developed to a behavioural theory (Stabell 1974) within a cognitive science framework. Additionally, there has been some discussion of a physiological basis for the differences in terms of right and left brain processes (Young 1983). Although the terminology and dimensions of individual style or type vary from author to author, the general import of these studies is the recognition of a requirement for systems, techniques and processes which reflect the personal cognitive characteristics of the intended user (and not the style of the creator, or of the MIS/MS/OR tradition). It is of some interest to note that this advice seems generally to have been ignored by MIS and DSS practitioners in the decade since these ideas have been discussed.

Another aspect of the characteristics of the individual which is largely unmentioned within the computing and implementation literature relates to the individual's own personal needs and predilections. For most people, their jobs and organizations satisfy far more than simple financial needs (see McClelland

etc). Working in an organization enables people to engage in activities which satisfy various personal requirements, and these activities will not necessarily be tied simply to the economic wellbeing of the organization. This means that certain aspects of computer use may relate to the satisfaction of purely personal requirements (such as a desire to learn about computing for its own sake, or to express a certain personal image to others within the organization). Behavioural matters such as these are no doubt recognized by commentators, but they seem to remain under the surface and have found little overt expression in any research conducted in this area to date. Part of the reason for this may be methodological or even philosophical; there is a tradition in the computer and MS/OR literature which seems to favour a logical positivist research approach, and this is not always conducive to addressing matters where inner mental states may be significant.

6. User attitudes and expectations

As has already been mentioned, there is a feeling among many computer professionals (expressed in word of mouth discussions as well as in the academic literature) that managers are frightened of computers for their own use. As the use by middle managers of desk top machines has increased, so the view has been changed to one where the more senior managers are frightened of computers. This view has been put to me by several computing practitioners; the prevalent argument invariably is that the older men reject computing, and that age particularly is the ingredient that causes the rejection on the grounds that "you can't teach an old dog new tricks". Myths, legends and apocryphal tales of senior managers who cannot (or will not) touch a keyboard are common.

Computer professionals who work closely with managers are often genuinely astounded at the lack of success of decision aids (see the discussion under the manager/analyst interface) and impute attitudinal and other problems to the manager in order to "explain" the problems. This assumption of irrational managerial rejection of computer-based decision support systems has been taken up by advocates of computer systems:

> "The plain fact is that many people are afraid of the new technology which is invading the office. They are worried about their jobs, their status..." (Business News and Communications 1983)

Examples of such assumptions can also be found in the academic literature, notably in articles by Wright (1984), Kiechel (1984) and elsewhere. According to Wright for example, quoting American sources, some 90% of American managers are "computer illiterates" due to fear of the machine, fear of loss of status and/or general ignorance:

> "... the recent trend to have managers input their own requests for data directly into the machine - thus using a keyboard, a task traditionally reserved for the lowly secretary - has caused resistance throughout North America. Age can also be a factor that contributes to cyberphobia." (Wright 1984)

Similar statements can be found in the computer press and elsewhere; but one further example will suffice:

> "... executives in general have so far been remarkably resistant to using new forms of office equipment personally... even IBM managers... expressed significant apprehension about their personal abilities to use the system..." (Tisdall 1982)

In general the research results presented later indicate that this supposed "fear" reaction of senior managers is largely mythical, and assumptions that managers are too frightened to use

a particular system are more likely to reflect a lack of understanding for the real reasons behind the rejection (or in some cases a refusal to come to terms with the rejection). However, the myth remains a strong factor in implementation lore.

In addition to the "cyberphobia" tradition, there is an extensive literature comprising a number of empirical studies on the various dimensions of attitudes relating to computers. Before examining this literature, it would be as well to discuss the concept of attitude itself in order to establish its relevance to our topic. For most writers in the field of applied psychology, the concept of attitude relates to the idea of a submerged or latent socio-psychological variable which may be used to explain behaviours which otherwise would not be fully explicable. In general, attitudes are considered to be a predisposing force towards action.

> "Attitudes, the end products of the socialisation process, significantly influence man's responses to cultural products, to other persons and to groups of persons." (Shaw and Wright 1967)

Attitudes are an enduring tendency to respond in a certain way. Once formed, attitudes will not only remain constant in the absence of forces to change, but may be resistant to change - particularly where they are especially important to the individual for some reason (Reitz 1977). According to some authors (see for example Thomas 1971, and Warren and Jahoda 1974) attitudes have a more detailed structure, usually consisting of three components: the affective, cognitive and behavioural components; but others deny such a structure. Also, some authors (notably Fishbein 1971 and 1972) seriously question whether there

is a direct and simple relationship between attitudes and behaviour.

Lucas has explored the attitudinal component of implementation failure extensively (Lucas 1973, 1975a, 1975b, 1975c, 1977, 1978). In an early empirical study, he proposed user attitudes and perceptions as one of three key variable areas which affected voluntary information system use:

> "Favourable user attitudes and perceptions of information systems and the information services staff lead to high levels of use of an information system." (Lucas 1975a)

His analysis of attitude questionnaire data suggest that the attitude components which he measured were in fact positively correlated with information system use. However, he also points out that where subjects are forced to use a technically poor system, then unfavourable attitudes will emerge. In other words there is a doubt as to causality - has the presence of favourable attitudes caused use of the system or vice versa? Other writers have stated similar propositions, for example:

> "... surveys and experiments show that attitudes towards various features of an MIS, systems development personnel, and computers in general are related to user behaviour." (Robey 1979)

A review of MIS attitude surveys by Swanson (1981) showed the need for a more detailed understanding of the various components of attitudes and their relationships to various aspects of the computing milieu. Swanson points out that those components of attitudes which are specifically tied to information system use are still not well understood:

"Identification of these usage-relevant components is much needed to advance further research in the field... In the long run the concept of `user attitude' may itself be too broad for useful theory development." (Swanson 1981)

There can be little doubt that prior attitudes play some part in influencing usage processes; the question of interest is the precise nature and extent of the influence. An early study by Schewe (1976) showed the complex interplay of attitudes and perceptions which acted in MIS use, and especially that these variables interacted in a complex way with, and in conjunction with, other variables:

"As the user becomes sufficiently educated about the system, the atmosphere or environment within the company becomes a more important motivator of attitudes and system usage... At this level, top management support... and a feeling of corporate sophistication will do more to initiate use of the MIS than MIS capability and user education. (Schewe 1976)

Schewe's study examined a number of specific attitudinal components; a key result was the general lack of empirical support for propositions which directly linked system usage to positive attitudes. According to the Schewe study, attitudes in themselves were not primary determinants of user behaviour and intervening situational constraints acted so as to override any attitudinal effects in system usage. This study is of course in marked contrast with the work of Lucas and others which appears to show evidence of direct causal links. Taking account of the Schewe evidence and referring back to our earlier discussion of attitude theory it is considered that computer system usage is more likely to be directly influenced by situational and other factors, and attitudes of themselves will play only a minor causal role.

On a different level, the presence and the effect of certain expectations on the part of the user has been discussed by one or two authors. Expectations in this particular context arise as a result of information gathering immediately prior to implementation, and consist of a variety of specific beliefs and assumptions relating to the proposed system. They differ from attitudes in this respect in that the attitudes discussed here can be considered in terms of non-specific predispositions regarding aspects of a computer system, whereas expectations can be regarded as specific beliefs about certain aspects of a computer system. According to Ginzberg (1981) expectations formed prior to implementation have an effect on user satisfaction and usage after implementation, in that the degree of realism of the expectations is associated with implementation success.

"The degree of realism of user's pre-implementation expectations was positively correlated with a range of project success measures."

A review and experimental study of the general phenomenon of expectancy disconfirmation by Weaver and Brickman (1974) indicated that only subjects with high initial expectancies suffered disproportionate dissatisfactions. (It was certainly found in the present study that some managers had unrealistic expectations, and this seemed to affect at least part of their adoption cycle). Ginzberg reviews a more general literature in this area and finds evidence for two separate phenomena: firstly where subsequent ratings of satisfaction are biased towards initial high expectations, and secondly where initially unrealistic high expectations lead to lower subsequent

satisfaction. In general, it might be anticipated that the former relationship will obtain only where the subject has some personal stake in the result.

7. the manager/system interface

This section refers to the issues surrounding the nature of the systems which the manager is intended to use. Clearly, there will be aspects of the system which will mitigate for and against continued use of the system. The quality of the system, its ease of use, the nature of the facilities which it offers, its usefulness and the degree of relevance to the user's job tasks will all affect the extent of use in some way. In the words of Rubinstein and Hersh (1984): "Using a computer should always be easier than not using a computer."!

However, in practice all systems have drawbacks to some extent. Anybody who has himself attempted to use a computer system directly will be familiar with at least some of the issues that arise in this context. A significant aspect of the problem is the mismatch between the way in which a human being thinks, and the way in which information is physically presented to him by the system interface. Attempts to reduce this particular mismatch are usually described as `human factors engineering' and there is an extensive body of literature concerned with the cognitive and engineering aspects of the problem. Natural language processing has itself been a field of intense study for a number of years (see for example Addis 1977, Reitman 1983 or Winograd 1981) and attempts to build problem solving systems and other more "human-like" systems have occupied artificial intelligence workers for decades.

Recent technical advances such as the light-pen, mouse, touch-sensitive screen and partial voice recognition seem unlikely to totally replace the screen and keyboard combination for some time yet. In general, it would seem that it will be a long time (Michaelis, Miller and Hendler 1982) before improvements in the technical interface enable significantly easier man/machine interaction. The problem goes far beyond simple engineering; any human being is possessed of a brain, the subtleties and complexities of which are only now beginning to be realised. Insights into this subtlety can be seen in comparisons between human and computer interactions within the artificial intelligence field (see for example Michaelis, Miller and Hendler 1982). Attempts to improve the man/machine interface essentially require that the machine should possess, or be able to simulate, certain human-like attributes and this would appear to be a very tall order at the present time.

In the meantime, the significant difficulties which face every would-be computer user will remain as a primary stumbling block to computer-based decision system usage. Within present day technology, some systems are claimed to be more user-friendly than others. There has been much discussion of user-friendliness but few attempts to seriously define what such a term could mean in a way that could be experimentally tested. Aspects which are discussed revolve around several factors, a representative list of relevant items (adapted from Reisner 1981) would include the following:

1 ease of learning - time taken to initially learn to use the system

2 immediate comprehensibility - the ease with which system concepts can be employed, once learnt

3 productivity - how well the system can be used by a skilled user

4 retention - how easy the system is to remember

5 relearning - how easy to relearn after a period of time

The dynamics of the learning processes involved here are still being uncovered. Even learning how to use a word processing package requires considerable effort expenditure on the part of a naive computer user:

> "Learners must analyze basic procedures in terms of the context of various word-processing goals. This is not a matter of rote learning and passive assimilation; even the simplest procedures like word deletion or replacing a letter reveals the difficult task of identifying relevant elements of these procedures and trying to integrate them into a smooth operation. Learners' understanding of procedures works by successive approximations." (Carroll and Mack 1984)

An example of recent research into the efficacy of a a particular type of conceptual user interface can be seen in Savage and Habinek (1984); here, the authors examine types of menu-driven interfaces and with subjects who posessed varying degrees of experience. An attempt to establish factors which might make the interface more enjoyable, by referring to pleasurable aspects of computer games has been described by Malone (1984). As with other examples of human factors research, results are largely specific to the particular research situation and it is difficult to generalise concepts that hold true for the general situation. Essentially, apart from some very broad generalisations it is not yet wholly clear why, or under what

circumstances, some types of interface are more effective than others. The problem is not a technical one; it relates to cognitive and behavioural characteristics of users which are ill-understood at present.

Lucas (1974) has empirically tested the relevance of system quality and found, not surprisingly, that its influence was positively correlated with attitudes and system use. Lucas conceives of system quality as a separate or "absolute" entity, and thus his measure of "quality" is taken separately from observers other than the managerial subjects on which the dependent variables were measured. Maish (1979) showed that managers' positive feelings about the information system as a whole were correlated with positive feelings about the perceived on-line system quality; this correlation was shown to be stronger than relationships with feelings about computer staff, or involvement in design for example. O'Reilly (1982) studied a number of personal and situational variables and has shown that perceived information accessibility dominates as an explanatory variable of information use over perceived information quality. A study by Culnan (1983) investigated the choice by individuals of various forms of external information acquisition, and also found that usage of an information source was positively correlated with perceived accessibility (ie perceived ease of access), but that other variables were also involved in the choice.

In general, practical guidelines for systems analysts and programmers on the development of usable systems interfaces are only now becoming available (see Rubinstein and Hersh 1984 for

example), but even here the emphasis is very much on the marginal improvement of existing practices - verbal style of error messages, number of items on a screen menu and so on - rather than significant or fundamental changes in the way that the interface is handled. As in other areas of computer-related literature there is a distinct gap between theoretical aspects of human behaviour and recommendations for practitioners.

Discussion

In order to build an initial model of the implementation process, it is necessary not only to identify key variables but to show how these are related to each other. Many of the discussions of implementation in the literature do not describe a specific model of the implementation process, rather the model in the author's mind remains implicit. However, some authors have attempted an explicit description of theoretical models which relate one or more variables together and these will be briefly reviewed.

Many of the early models of the implementation process are based (explicitly or implicitly) on the Lewin/Schein model which has already been discussed in an earlier section. Essentially, this model considers an overall organizational change process although at a rather abstract level (ie detailed behavioural processes are not made explicit). Kolb and Frohman (1970) have developed this into a normative process model which shows seven stages in terms of an interventionist's behaviour: scouting, entry, diagnosis, planning, action, evaluation, termination. The model shows an

essentially serial pattern with two feedback loops. This model is used by Ginzberg (1981) as the theoretical framework for empirical analysis of several factors relating to MIS usage. The viewpoint of these models is essentially that of the change agent, or interventionist; factors relating to individual subject behaviour are not explicitly entered into the model (although these factors may well be discussed by the author in connection with it).

With a similar viewpoint are those models based on the systems development life-cycle. Many such models have appeared in the literature. A representative example is given by Reisman and Kluyver (1975) who consider six discrete stages: feasibility study, preliminary design, detailed design, prototype, implementation and dissemination-use-revision. McKeen (1983) considers analysis, design, coding, testing and implementation. A more detailed version is provided by Kling and Scacchi (1980) who discuss ten stages of project development and implementation.

Moving on from these distinctly prescriptive models, there have been far fewer attempts to create frameworks which address implementation with a view to describing elements of human behaviour during implementation. Of these, Manley (1975) considers a two-state decision process by the user (described as a "client" in his analysis), whereby the user accepts or rejects a MS/OR proposal. Manley also proposes a system of variables which affect user adoption. These variables fall into two categories: factors creating resistance to implementation and factors creating pressures towards accepting implementation. Manley shows these two sets of variables acting against each

other to create an equilibrium or balance point of user resistance. This resistance is of course seen as something to be overcome by appropriate organizational change techniques; in principle, (if all relevant factors had been included) the model could be used predict the level of resistance which is to be overcome.

Considering specifically computer based applications, Schewe (1976) proposes a model which relates sets of beliefs and attitudes to computer system usage. According to this model, there is a serial process whereby the user's beliefs are evaluated to give a set of attitudes, which in turn affect system usage. Lucas (1974) suggests a model (some of the elements of which he tests empirically) which includes ten distinct aspects relating to system use; these aspects are related in complex ways in the model, which is clearly intended to be a complete representation of the relationships between the variables which affect system use. The most significant elements of the model include: user attitudes and perceptions, situational and personal factors, decision style, technical quality of system, job performance and information services department policies and attitudes. Of all the models considered so far, the one by Lucas is by far the most complete and differs from most others in considering multiple aspects of the situation. This is not intended as a criticism of less complete models where the author is perhaps deliberately separating out specific elements for consideration; however, it does sometimes appears as if some authors writing later than the Lucas study are not aware of other aspects of the implementation process which would be relevant to

their models.

None of the models described above take the viewpoint of the individual user of technology. The intention in this thesis is to create a an adoption model which includes all the likely elements of behavioural variables and establishes a more comprehensive model of adoption behaviour. In other words, the theoretical model should be reasonably complete. Of course, not all of the elements of the model will be tested in field research; the elements for test will be dictated various constraints as well as by decisions on those aspects considered most theoretically suitable - but that is no reason for not showing them all in the first instance.

Following the review and discussion of factors in the following elements represent the author's distillation of that material and are presented for inclusion in a new general model of computer adoption:

1. wider and national environment

national culture and norms

structural effects (including the availability of technical expertise)

effects of the computer milieu

2. organizational environment

culture and norms

structural and size effects

political and power issues

3. situational issues

user involvement in design and choice

top management influence

advocacy

4. manager/analyst interface

differences in goal orientation,

outlook and cognitive style, and

in knowledge base

5. individual characteristics

personal characteristics

cognitive style

6. attitudes

managerial attitudes, perceptions and expectations

7. manager/system interface

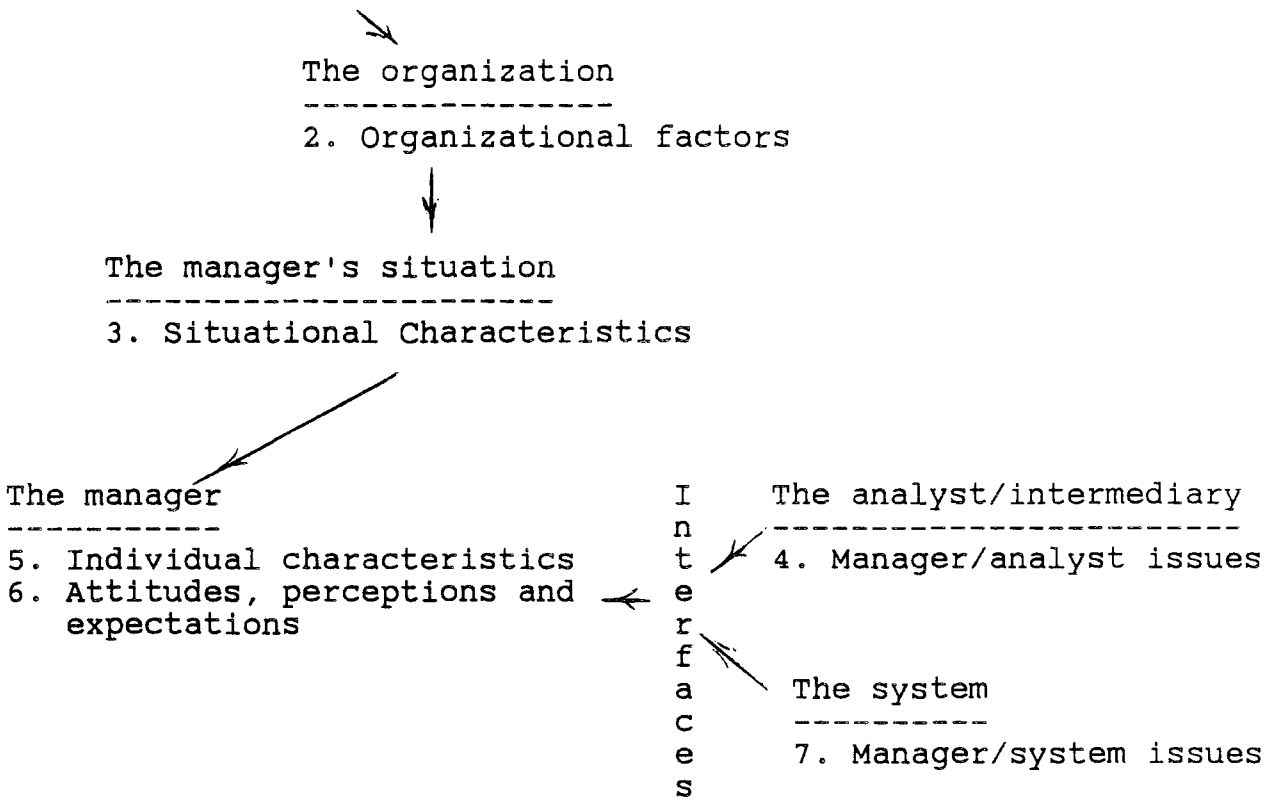
quality of interface

nature of facilities

relevance of facilities

A model showing the interrelationships between between the groups of factors is shown in Figure 4.1.

Figure 4.1 A theoretical model of managerial computer adoption variables



Having selected these items as putative variables, the relationship between them and the dependent variable (computer system adoption and use) could be described simply as follows:

$$p(A) = f(F1 + F2 + \ldots Fn) \quad (1)$$

where the probability of adoption and use, p(A) is some function of the various factors F1 through Fn.

In other words, there are a number of factors which separately or together act so as to predispose a manager towards adopting and using a computer; it is not certain all the factors have been listed, but it is hoped that most of the significant ones have been included. In principle we could experimentally isolate one or more of these variables and determine the strength of its association with the dependent variable. This in fact is the underlying, non-explicit model of many of the studies of implementation discussed in the literature. The model could be usefully extended by considering the independent variables in two groups (rather after the fashion of Manley 1975), ie factors acting in favour of adoption (F1 through Fn) and factors acting against (R1 through Rn):

$$p(A) = f(F1 + F2 + \ldots Fn) - g(R1 + R2 + \ldots Rn) \qquad (2)$$

This formulation is useful both as a mental construct and aide-memoir and also as a theoretical basis for considering research designs; ie experimental evidence may be gathered concerning the relative size of the coefficients in the model - in this way the relative importance of the variables would be determined, an aspect which would be of great interest to implementers. However, it is considered that the variables from the list will act together in subtle and complex ways, and it will be very helpful to attempt to specify further the theoretical direction of some of the main relationships between these variables, and between them and the independent variable. Some of these relationships have already been suggested by previous authors; some even have

been tested empirically. In general, however, the relationships of the model must be based on a synthesis of the implementation literature together with general organizational and behavioural theory.

Towards a process model

The adoption model shown in figure 4.1 shows the principle factors and their relationships in the adoption process. What it does not show is the adoption process itself. In addressing the theoretical basis for this adoption process it is necessary to choose a viewpoint and focus which will reflect the dynamics of the adoption decision situation from the viewpoint of the individual manager within an organizational context and which will provide a framework for discussing his behaviours.

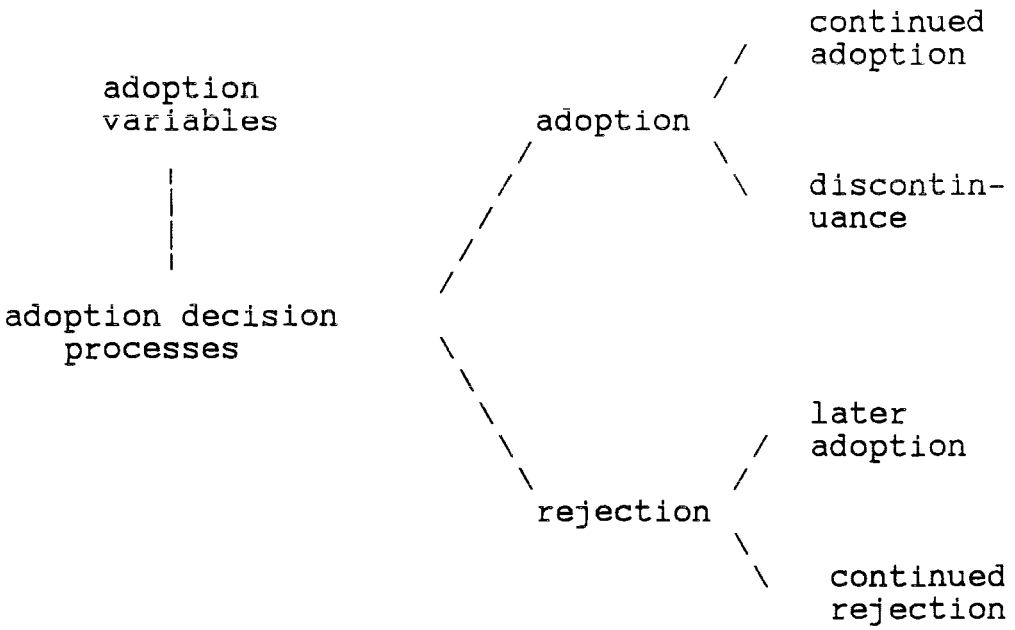
The discussion of models from the implementation literature indicates that it is necessary to go further afield in search of an appropriate framework for the dynamics of the adoption decision process. A suitable process model for our purposes at this point can be found in theories of diffusion of innovation where the wider social processes of adoption have been discussed. The innovation literature does not hitherto seem generally to have been brought to bear on computer system adoption; nevertheless, it would seem that examination of process models from this area will serve our purposes and provide useful insights. In addition, the innovation literature provides a number of useful terms and concepts which will be brought in where appropriate; in particular, the term "adoption" seems more appropriate (and has been used throughout this thesis) to the

senior-managerial situation, where considerable discretion exists, rather than "implementation" which carries overtones of limited choice on behalf of the user.

According to Rogers and Shoemaker (1971), the process of technological adoption can be viewed in terms of four phases: knowledge, persuasion, decision and confirmation. This is of course only one of several versions of this process to be seen in the innovation literature; a review of this literature by Zaltman, Duncan and Holbek (1973) shows at least seven similar theoretical configurations. Although the full process model is not entirely suitable for our purposes, it has the benefit of being more explicit than the Lewis/Schein change model, and more general than the Manley model.

The complete model of the innovation-decision process according to Rogers and Shoemaker concentrates on aspects of social communication which are not relevant to our purpose. Although it is felt that a process view is important, both as a theoretical view and as a research framework, this does not necessarily mean that the particular conceptual view of the process offered by Rogers and Shoemaker is especially relevant; therefore the details of the process will be left to one side pending the emergence of data from the research. The model has therefore been simplified and modified to show its relation to computer system adoption and is shown in Figure 4.2.

Figure 4.2 A dynamic model of the computer adoption process



The main features of this arrangement are that there is a decision process rather than a finite yes/no choice at one instant in time, and that the decision has multiple outcome possibilities. The model shows that the potential adopter moves through a decision process which is influenced by various variables; he then either adopts or rejects the innovation under consideration. Subsequently, he either continues with the adoption or discontinues (if adopted) or (if rejected) he adopts later or continues the rejection.

The original Rogers and Shoemaker model contains three classes of variables (whereas our previously described model of adoption variables contains seven classes of relevant factors). The process model has been shown here to include one set of adoption

variables only, in order to concentrate on the principle process elements. It is not of course clear at this stage which (if, indeed, any) of the items amongst our seven sets of variables will interact at any particular stage of the adoption process. Indeed it is one of the main purposes of the field research to establish empirically the relationships between variables within the framework of this process model. Chapter 10 will show the development of a new process model which is based on the results of the field research, and which shows crucial modifications to the model presented here.

Conclusions

This review of the issues which have been found to affect the implementation of computer systems has been a sampling of a wide and diffuse literature. There have been many different themes and perspectives, and some of the views found are in conflict; much of the literature is normatively oriented and empirical work is sparse. However, a variety of useful concepts and insights has been reviewed, and these have provided the basis for putative theoretical models of the adoption process. Two models have been developed, a general model and a dynamic process model which together can be used to guide the shape of the field research.

References

Alter SL, Why Is Man-Computer Interaction Important for Decision Support Systems?, Interfaces, Vol 7 2 Feb, 1977b

Alter SL, Development Patterns for Decision Support Systems, MIS Quarterly, Sept, 1978

Argyris C, Management Information Systems: The Challenge to Rationality and Emotionality, Management Science, Vol 17 6, 1971

Bean AS et al, Structural and Behavioral Correlates of Implementation in US Business Organizations, in Schultz RL, Slevin DP eds, Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Benbassat I, Dexter AS, Value and Events Approaches to Accounting: An Experimental Evaluation, Accounting Review, Vol LIV 4, 1979

Benbasat IB, Taylor RN, The Impact of Cognitive Styles on Information System Design, MIS Quarterly, Vol 2 2 June, 1978

Bennis WG, Benne KD, Chin R (Eds), The Planning of Change, Holt, Rinehart and Winston Inc 1961

Botkin JW, An Intuitive Computer System: A Cognitive Approach to the Management Learning Process, PhD Thesis, Harvard Business School, Boston, Mass 1973

Boulden JB, Buffa ES, Corporate Models: On-Line, Real-Time Systems, Harvard Business Review, July-Aug, 1970

Brady RH, Computers in Top-Level Decision Making, Harvard Business Review, July/August, 1967

Brightman H, Noble C, On the Ineffective Education of Decision Scientists, Decision Sciences, Vol 10 1, 1979

Carrol JM, Mack RL, Learning to Use a Word Processor: By Doing, By Thinking and By Knowing, in Thomas JC, Schneider ML, (Eds) Human Factors in Computer Systems, Ablex Pub Co Norwood, New Jersey 1984

Churchman CW, Theories of Implementation, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Churchman CW, Ackoff RL, Arnoff EL, Introduction to Operations Research, John Wiley New York 1957

Churchman CW, Schainblatt AH, The Researcher and the Manager: A Dialectic of Implementation, Management Science, Vol 11 4, 1965

Culnan MJ, Environmental Scanning: The Effects of Task Complexity and Source Complexity on Information Gathering Behaviour, Decision Sciences, Vol 14, 1983

Culnan MJ, Chauffeured Versus End User Access to Commercial Databases : The Effects of Task and Individual Differences, MIS Quarterly, March, 1983

Davis D, SMR Forum: Computers and Top Management, Sloan Management Review, Spring, 1984

Davis L, Learning to Walk With a New Computer System : Computers in the Executive Suite, International Management, July, 1983

De Bettignies HC, Evans PL, The Cultural Dimension of Top Executive Careers; A Comparative Analysis, in Weinshall TD, Culture and Management, Penguin Books, Harmondsworth, 1977

De Waele, Managerial Style and the Design of Decision Aids, Omega, Vol 6 1, 1978

Dermier JD, Cognitive Characteristics and the Perceived Importance of Information, Accounting Review, July, 1973

Docherty PHG, Some Mismatches Constraining User Choice in Systems Development, in Moshowitz A (Ed), Human Choice and Computers, Proc. 2cnd Int. Conf. on Human Choice and Computers, Baden, Austria, 1979, North Holland 1980

Doktor R, Cognitive Style and the Use of Computers and Management Information Systems, Management Datamatics, Vol 5 2, 1976

Fishbein M, Attitudes and the Prediction of Behaviour, in Thomas K, (ed) Attitudes and Behaviour, Penguin Books 1971

Fishbein M, The Search for Attitudinal-Behavioural Consistency, in Cohen JB, (ed) Behavioural Science Foundations of Consumer Behaviour, The Free Press New York 1972

Fromm G et al, Federally Supported Mathematical Models: Survey and Analysis, Report for the National Science, Foundation USA 1974

Gibson CF, A Methodology for Implementation Research, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Ginzberg MJ, Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions, Management Science, Vol 27 4, 1981

Ginzberg MJ, Key Recurrent Issues in the MIS Implementation Process, MIS Quarterly, June, 1981

Grinyer PH, Financial Modelling for Planning in the UK, Long Range Planning, Vol 16 5, 1983

Grinyer PH, Wooller J, Computer Models for Corporate Planning, Long Range Planning, Feb, 1975

Hammond JS, The Roles of the Manager and Management Scientist in Successful Implementation, Sloan Management Review, Vol 15 2 Winter, 1974

Hofstede G, Culture's Consequences: International Differences in Work-Related Values, Sage Publications, London 1980

Kaiser KM, King WR, The Manager-Analyst Relationship in System Development, MIS Quarterly, Vol 6 1, 1982

Keen PGW, Interactive Computer Systems for Managers: A Modest Proposal, Sloan Management Review, Vol 18 1, 1976

Kelly J, Organizational Behaviour, RD Irwin 1969

Kiechel W, To Compute or Not to Compute: Why Executives Don't, Cornell Hotel & Rest Admin Quart, Vol 24 4 Feb, 1984

Kling R, Gerson EM, The Social Dynamics of Technical Innovation in the Computing World, Symbolic Interaction, Vol 1 1, 1977

Kling R, Gerson EM, Patterns of Segmentation and Intersection in the Computing World, Symbolic Interaction, Vol 1 2 1978

Kling R, Scacchi W, Computing as Social Action: The Social Dynamics of Computing in Complex Organizations, in*Yovits M (Ed) 1980 1980

Kolb DA, Frohman AL, An Organization Development Approach to Consulting, Sloan Management Review, Fall, 1970

Lawless MW et al, Enhancing the Chances of Successful OR/MS Implementation: the Role of the Advocate, Omega, V10 2, 1982

Lucas HC, User Reactions and the Management of Information Services, Management Informatics, V2 4, 1973

Lucas HC, Performance and the Use of an Information System, Management Sci, Vol 21 8, 1975

Lucas HC, Why Information Systems Fail, Columbia Free Press 1975

Lucas HC, Behavioural Factors in System Implementation, in Schultz RL, Slevin DP (eds), Implementing Operations Research/ Management Science, American Elsevier Pub Co New York 1975

Lucas HC, Empirical Evidence for a Descriptive Model of Implementation, MIS Quarterly, Vol 2 2, 1978

Lucas RW, A Study of Patients' Attitudes to Computer Interrogation, Int Jnl of Man-Machine Studies, Vol 9, 1977

Lusk ED, Kersnick M, The Effect of Cognitive Style and Report Format on Task Performance: The MIS Design Consequences, Management Sci, Vol 25 8, 1979

MacLagan PW, Knowledge Utilisation and Organizational Intervention: A Case Study, Working Paper No3, Dept of OR, Hull University, England 1983

Maish AM, A User's Behaviour Towards His MIS, MIS Quarterly, March, 1979

Malone TW, Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games, in Thomas JC, Schneider ML, (Eds) Human Factors in Computer Systems, Ablex Pub Co Norwood, New Jersey 1984

Manley JH, Implementation Attitudes: A Model and a Measurement Methodology, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Markus ML, Power, Politics and MIS Implementation, CISR Working Paper No 59, MIT, Mass 1980

Markus ML, Robey D, The Organizational Validity of Management Information Systems, CISR Working Paper No 68, MIT, Mass 1981

Mason RO, Mitroff II, A Program for Research on Management Information Systems, Management Science, Vol 19 5, 1973

McKeen JD, Successful Development Strategies for Business Application Systems, MIS Quarterly, Sept, 1983

McKenney JL, Keen PGW, How Managers' Minds Work, HBR, May/June, 1974

Michaelis PR, et al, Artificial Intelligence and Human Factors Engineering: A Necessary Synergism in the Interface of the Future, in Badre A, Schneiderman B, Directions in Human / Computer Interaction, Ablex Publishing Co 1982

Mohan L, Bean AS, Introducing OR/MS into Organizations: Normative Implications of Indian Experience, Decision Sciences, Vol 10, 1979

Mumford E, Ward T, Computer Technologists: Dilemmas of a New Role, Jnl of Management Studies, Vol 3 3, 1966

Myers IB, Introduction to Type, Consulting Psychologists Press Inc, Palo Alto Cal USA 1980

O'Reilly CA, Variations in Decision Makers' Use of Information Sources: The Impact of Quality and Accessibility of Information , Academy of Management Journal, Vol 25 4, 1982

Pettigrew AM, The Influence Process Between Specialists and Executives, Personnel Review, Vol 3 1, 1974

Powell GN, Implementation of OR/MS in Government and Industry: A Behavioural Science Perspective, Interfaces, Vol 6 4 Aug, 1976

Reisman A, Kluyver CA, Strategies for Implementing Systems Studies, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Reisner P, Human Factors Studies of Database Query Languages: A Survey Assessment, Computing Surveys, Vol 13 1 March, 1981

Reitz HJ, Behaviour in Organizations, RD Irwin Inc Ontario, Canada 1977

Robey D, User Attitudes and Management Information System Use, Acad of Management Jnl, Vol 22 3, 1979

Robey D, Taggart W, Minds and Managers: On the Dual Nature of Human Information Processing and Management, Acad of Management Review, Vol 6 2, 1981

Rockart JF, Treacy ME, The CEO Goes On-Line, HBR, Jan/Feb, 1982

Rogers EM, Shoemaker FF, Communication of Innovations, The Free Press New York 1971

Rubinstein R, Hersh HM, The Human Factor, Digital Equipment Corporation USA 1984

Sagasti FR, Management Sciences in an Underdeveloped Country: The Case of Operational Research in Peru, Management Sci, V19 2, 1972

Schein EH, The Mechanism of Change, in Bennis, Schein, Steele et al (Eds) Interpersonal Dynamics, Dorsey Press, Illinois, USA 1964

Schepanski A, Tests of Theories of Information Processing Behaviour in Credit Judgement, The Accounting Review, Vol 58 3 July, 1983

Schewe CD, The Management Information System User: An Exploratory Behavioural Analysis, Acad of Management Jnl, V19 4, 1976

Schultz RL, Slevin DP (eds), Implementing Operations Research / Management Science, American Elsevier Pub Co New York 1975

Scott Morton MS, Management Decision Systems, Graduate School of Business Administration, Harvard University, Boston, USA 1971

Senn JA, Essential Principals of Information Systems Development, MIS Quarterly, V2 2 June, 1978

Shaw ME, Wright JM, Scales for the Measurement of Attitudes, McGraw-Hill 1967

Smith HR, Kozar KA, Underutilization of Computing Technology in University Education: The Problem and Proposed Solution, Proc.

11th Hawaii Int Conf on Systems, Sciences, Western Periodicals Co Cal USA 1978

Sorensen RE, Zand DE, Improving the Implementation of OR/MS Models by Applying the Lewis-Schein Theory of Change, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Stabell CB, Individual Differences in Managerial Decision-Making Processes: A Study of Conversational Computer System Usage, PhD Thesis, Sloan School of Management, MIT, Mass 1974

Swanson EB, Management Information Systems: Appreciation and Involvement, Management Science, Vol 21 2, 1975

Swanson EB, Measuring User Attitudes in MIS Research: A Review, Omega, Vol 10 2, 1982

Thomas K (Ed), Attitudes and Behaviour, Penguin Books 1971

Tisdall P, What Managers Really Do All Day, International Management, Oct, 1982

Urban GL, Building Models for Decision Makers, Interfaces, Vol 4 3, 1974

Vertinsky I, OR/MS Implementation in Valle, Columbia, SA: A Profile of a Developing Region, Management Science, Vol 18 6 Feb, 1972

Warren N, Jahoda M (Eds), Attitudes, Penguin Books 1973

Weaver D, Brickman P, Expectancy, Feedback and Disconfirmation as Independent Factors in Outcome Satisfaction, Jnl of Personality and Social Psychology, Vol 30 4, 1974

Weiss M, The Human Side of Systems: An Experiential Approach, Information and Management, Vol 6, 1983

Wolek FW, Implementation and the Process of Adopting Managerial Technology, Interfaces, Vol 5 5, 1975

Wright PC, Computers, Change and Fear: An Unholy Trinity, Management Decision, Vol 22 2, 1984

Wright WF, Cognitive Information Processing Biases: Implications for Producers and Users of Financial Information, Decision Sciences, Vol 11, 1980

Young LF, Computer Support for Creative Decision Making: Right-Brained DSS, in Sol HG (Ed), Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Zmud RW, Cox JF, The Implementation Process: A Change Approach, MIS Quarterly, June, 1979

Chapter 5

Introduction to the Field Research: Methodological Issues

Abstract

This chapter examines the issues and arguments behind the choice of research strategy. A programme of interviews was undertaken which was designed to explore research questions and create comparative materials for theoretical development. Some of the difficulties in the method are discussed, in particular that of gaining organizational access at high management levels. Finally, the steps taken to enhance the validity and generality of the findings are discussed.

Choosing a research strategy

The purpose of the research was to contribute to understanding of those processes and phenomena which influence the use of computer-based decision aids by senior managers for their own decision activities. Several questions have been developed over preceding chapters and these include the following: what role does the computer (in direct use) play in the working lives of top managers, and how does this come about? What are the differences and variations in the nature of this role, and what causes these differences? Are the senior manager's skills enhanced by the system? How are the ideals and aims of decision support systems achieved given the apparent mismatch between the nature of these aims and the practicalities of senior managerial work?

The problem arose as to how best to research these questions, bearing in mind both the limitations of time and cost which beset a doctoral project and also the need to show a demonstrably valid and appropriate methodology. Several relevant research strategies for investigating managerial behavioural issues have been used successfully by researchers in the past, and these include : participant observation, direct/structured observation using diary studies and other materials, personal interviews, and postal questionnaire survey methods.

There are advantages and disadvantages in all these strategies and it was not immediately obvious which (if indeed any) of them would be the most suitable in the present project. On the one hand small numbers of respondents investigated in depth over time

might yield valuable qualitative materials and insights - but problems of generality, validity and reliability would have to be faced. On the other hand, a large postal survey would provide quantitative data which could be investigated statistically - but, such research would necessitate adopting a clearcut perspective at the outset and would be primarily a verification rather than an exploratory study. Of course, various combinations of these and other techniques are possible; but a danger of attempting too much could be the risk of falling between two stools and not achieving a sufficiently substantial result.

The approach adopted was something of a compromise between these positions. A study was carried out which involved a programme of interviews with top managers from a number of organizations, in order to create materials for intra- and inter-organizational comparisons. The main body of the results came from interviews with senior managers in five organizations (although many other organizations took part in the study as will be explained later). Interviews were also carried out with intermediary and systems-providing staff wherever possible. In addition, reference was made to written materials in the form of reports and memos etc., where these were thought to be relevant to systems implementation considerations.

The interviews with top managers had three elements:

1 pre-defined short-answer questions designed to test specific hypotheses

2 open-ended questions intended to explore specific pre-determined aspects

3 exploration of matters arising in conversation

It is felt that this strategy was a reasonable one for the purposes of the research; it avoided the fixed viewpoint of questionnaire research, which was arguably inappropriate bearing in mind the current state of knowledge of the topic, but at the same time it enabled a good measure of comparison to be made between managers, thus improving confidence in the generality of the findings. Some pros and cons of alternative methods are discussed in the next section.

In the event, it is believed that the information coming from the interview programme has enabled the construction of a conceptual framework which is a useful starting point for other studies using different methods. An additional, and very strong argument was that to the author's knowledge (and bearing in mind an extensive review and computer based literature search), a comparative interview survey of this nature had not been carried out with senior managers before in this context and was long overdue.

Discussion of alternative research methods

The argument against "remote" questionnaire methods is that, used alone, they tend to provide information about, and in terms of, the conceptual framework which is used to devise the questionnaire. In this instance it was felt necessary to explore the validity of the theoretical framework specifically, and to accept (indeed welcome), and explore any modifications which arose out of disconfirming evidence from the direct discussion

with respondents.

An alternative to one-off interviews was the direct observation of senior managerial computer use within the organizational setting, preferably undertaken over an extended period and encompassing the whole of an adoption cycle. The value of this method would have been that the researcher could (at least in theory) directly observe aspects of decision behaviour allied to computer use, in a way this may have yielded better information than could be acquired by simply asking respondents to report their own behaviour. Of course the problems of managerial self-reporting are well known, (see Mintzberg 1973, Stewart 1967, Ives and Olson 1981, and Tisdall 1982), and opting for an interview programme meant taking on board these problems. However, it was felt that given the acknowledgement at the outset that self-reports were likely to be inaccurate and must be checked at every opportunity, then it would still possible to gain reliable information if suitable precautions were taken.

The argument against participant and direct observation was essentially one of resources versus reliability. In a doctoral project the researcher is his only resource and must be used to the most economic effect. Within the constraints of the project timescale it would have been difficult to study more than one or two managers intensively, always supposing, of course, that suitable and willing participants could be found, by no means a minor point, as will be discussed later. The decision was influenced by the conflicting evidence pertaining to senior managerial use presented in the literature (see chapter 1) In the light of this evidence it was felt to be vital that a reasonable

spread of managers was addressed. With the benefit of hindsight, it is felt that the study of only one or two people could have been extremely misleading.

> "It is obvious that however ingenious the testing of hypotheses in one organization, we can never be sure of their generalised validity. On the contrary, we can be almost certain that such hypotheses are only valid under certain conditions and for certain types of organization. This being the case, the only way to find out what these conditions are is by the appropriate comparison of more than one case." (Mouzelis 1967)

A further point about observation methods relates to the difficulty of viewing the interactions which affect the implementation process; there will be significant meetings, significant chance remarks and influences from a host of different directions. The observer would be lucky indeed to be present at more than a very tiny proportion of these perhaps crucial events - and again, the point arises as to the meaning of such events; unless the observer can step in and ask what the consequence of an interaction was, then he is no better off than if he interviews respondents afterwards. The problem with interviewing is of course that the subject will suppress, be unaware of, or be unable to articulate, crucial material. Clearly some variables are better measured by observation and some by interview or other techniques. The choice of measurement method must suit the variable to be measured. At an exploratory level, the interview (providing it was well prepared and conducted) seemed the most likely method to generate the most insightful material at the level of research envisaged here.

An important point has been expressed by Dainty (1983):

"... ideal cases of experimental, survey or ethnographic studies are moderately rare and are not necessarily the best way of tackling a research question. In practice, research is not one that follows styles, but one which tries to answer questions by the most appropriate means. ...the most appropriate means may well be an ad hoc combination of methods designed to maximise generalisability and inclusiveness within the available resources and circumstances."

Another option which was considered after the interview programme had been in progress for a while, was the possibility of supporting interview materials by the administration of a Kelly's grid (Easterby-Smith 1980, 1983) to senior managers in order to explore aspects of their mental constructs at various points in the adoption cycle. Again this was not taken up in view of the anticipated difficulties of gaining access to sufficient willing participants within the project timeframe; however, such an exercise remains an attractive proposition which can be explored at a later date.

Organizations in the survey

The approach adopted was to interview as many senior managers as possible within the project timeframe, selecting respondents and organizations with a view both to the requirements of the research questions already formulated and to emerging theory. In the event, over an 18-month period, over 70 senior managers were interviewed from 42 organizations. A breakdown of the interviews by organization type is shown in Table 5.1.

Table 5.1 Organizations and respondent groups

Organization	Senior Manager Respondents
2 Private multinationals	17
6 Large private companies	8
16 Small firms	16
1 Public corporation	6
12 District councils	11
1 County Council	4
1 Higher Education Establishment	7
Other/miscellaneous	2
	71

In this way, 41 respondents came from private industry and 31 from the public domain. The private firms ranged from a very large multinational through medium-sized and small companies down to one firm of only 4 employees. The firms were involved in a range of activities from chemical process operations through to retailing. Many of the firms were manufacturers however, and service industries are not well represented. See appendix 3 for a full list of these businesses. Organizations in the public domain included a port authority, a higher education establishment, and county and district councils. Confidentiality was explicitly requested by some organizations or respondents, and was implicit with others; in order to preserve this confidentiality, codes are used for all organizations and all respondents throughout this thesis.

In addition to the senior managers, system-providing or intermediary staff were seen wherever possible (and appropriate); the systems providers were interviewed in order to establish the technical nature of the computer systems introduced and also to establish their view of the reasons behind the implementation and generally to achieve an alternative view of the implementation and adoption process.

Table 5.2 Organizations and intermediary respondents

Organization	Intermediary - systems provider or analyst respondents
2 Private multinationals	8
6 Large private companies	1
1 County Council	1
Other/miscellaneous	1
	11

Defining top management

The nature of senior management has been discussed in some depth in earlier chapters; the interest here was in organizational managers who have responsibility for significant decisions in their organizations. In order to operationalise this concept in a concrete way, it was decided to interview only board members (or their equivalent in public organizations) and to check decision significance with questions relating to their resource allocation

authority. This latter enquiry proved enlightening, as in some organizations (notably the multinational computer firm) the title of director and even managing director appeared to be used somewhat indiscriminately. (A further discussion of the pros and cons of various operational definitions of business elites can be found in Giddens 1974, and Pahl and Winkler 1974). Identifying top managers in the public domain was not always straightforward. Departmental directors were selected from the County Council, and chief officers from the District Councils; the higher education establishment had two distinctly separate strands: administrative and academic, so the vice chancellor and three top administrative officers were seen, together with deans of major academic faculties. A more detailed discussion of this issue is contained in appendix 2.

The problem of access

In practice, the selection of managers and organizations proved difficult owing to access difficulties encountered in most of the organizations contacted. It was necessary to gain access to respondents from various points of the adoption cycle, as well as from organizations which represented a reasonable sample of organizational sizes and types. Both these constraints are necessary concomitants of the theoretical aspirations discussed earlier, in order to generate theoretical insights with general validity. In the event, gaining access to managers at the right level proved to be difficult and this in itself acted to constrain the research effort in various ways.

Senior managers are, of course, notoriously difficult people to

gain access to, which is perhaps why relatively few in-depth studies have been undertaken. In a study of company directors by Pahl and Winkler (1974), the authors made the following observations about the access problem:

> "... we anticipated... a very high rate of refusals in ordinary, unsponsored approaches, wasting effort and invalidating the very rigour the formal procedure was designed to achieve. This anticipation proved to be correct. Even with personal introductions, we were refused access to 85% of the more than 130 companies we approached."

In this project, most access attempts were sponsored to some degree and the refusal rate was not so high; nevertheless, access difficulties had an affect on considerations of research design and especially validity, so that a discussion of the implications is essential. The problem was that if a very high rate of access refusals were experienced then inevitably the question of bias could be raised (to say nothing of the practical difficulties engendered by the excessive time and financial costs involved). Alternatively, if the line of least resistance were taken towards acquiring willing participants then a charge of "convenience" sampling could be levelled which would imply, at the very least, that the sample was simply not a sample of anything in particular. These problems were at least partially resolved by gaining access to organizations where possible, but then attempting to interview all the senior managers within the target organization.

In general, although there are substantial amounts of literature on all aspects of research methodology, there is unfortunately very little discussion of the practical (but essential) steps involved in gaining access to difficult respondents. In

addition, most research reports simply do not discuss how access was gained, or mention it but cursorily. More seriously, the more evangelical descriptions of DSS use at senior level found in the literature make no reference to the way in which particular respondents were selected, which leaves room for some doubt, at the least, about the generality of the reported phenomena.

It was found in practice that success in gaining organizational access was critically dependent on the method employed. This was discovered after some expensive practical experience. For example, an attempt to gain access to the board of ABC from introductions at middle management level proved to be an immensely time-wasting failure. Each attempt to move up a rung of the management ladder was met with delays and difficulties of various kinds, so that although useful background information had been acquired, the researcher was still several rungs below the top even after months of negotiation. In the end, board level access was eventually gained by a direct personal introduction from outside the organization (so that all the intervening management levels were bypassed). With hindsight, there are, of course, very good reasons why the "bottom up" access path should be difficult: top managers regard their time as a very precious commodity, a view shared by their subordinates who themselves depend on access to the top for their success; additionally, there will be political and social reasons which make upwards introductions difficult. However, even direct approaches can have their problems. On one occasion, the chairman of a large organization had agreed to be seen; but on contacting his secretary for an appointment the researcher was told: "Yes, he

has agreed to see you, but looking at his diary, this year is out of the question and next year looks very difficult!"

Several organizational access methods were tried over the life of the project; these can be categorised as shown in table 5.3 below. These methods met with varying degrees of success, with method 1 being the most successful, and method 5. the least successful.

Table 5.3 Organizational access methods reviewed

Access Method	Value
1. Indirect approach via facilitator	most successful
2. Direct approach by letter and phone call, naming a contact as reference (sponsor)	.
3. Direct approach as above, but with no named reference	.
4. Indirect approach via senior manager	.
5. Indirect approach via middle manager	least successful

A facilitator, in this context, is a person who is known to the researcher, who personally knows the target respondent(s) and has the necessary standing to arrange contact. Having gained an appointment to see one senior manager, it was then usually slightly easier to arrange to see his colleagues using his name as a reference (although as the above table indicates, this was not usually arranged via the senior manager contact himself). Examples of the different types of introductory letters used are

shown in appendix 4. Although some stress has been placed on the method of access as the first factor in gaining entry, it did seem as if some organizations had a culture which favoured contact with "outsiders" (and academic enquiry) whilst others did not.

In order to overcome access and selection difficulties and to attain as balanced and bias-free a sample as possible, a strategy was developed whereby many organizations were approached at the top level, and their suitability judged in terms of top level computing experience (it being necessary to find respondents at all stages of the adoption process). Having interviewed one respondent, a vigorous attempt was made to see all the board level managers in that organization, even though this move was not always welcomed either by the main contact or by the respondents themselves. The procedure primarily consisted of a carefully worded introductory letter (see appendix 4), mentioning a contact if possible, followed a few days later by a phone call to the manager's secretary. It was generally not sufficient simply to ask to see people; it was necessary to gain the confidence and interest of personnel at various levels, whilst at the same time avoiding leading respondents' opinions. In practice, most respondents required at least one letter and several phone calls to arrange an appointment. It was rarely possible to interview more than one respondent from an organization on one day, so that in general, the accessing and interviewing process was extremely expensive in terms both of time and cost. Interviews were always followed by a personalised follow-up letter thanking the respondent for his time.

In actively pursuing respondents in target organizations, a balance had to be struck between being persistent enough to gain access to the desired respondents, and yet not so assertive as to run the risk of causing annoyance or damaging the efforts of other researchers. Naturally, there were refusals of various kinds; but in five organizations a majority of board-level managers were eventually interviewed, giving five case studies where respondent selection was relatively bias free. These five case studies formed the backbone of the research effort.

Table 5.4 Analysis of interviewed and target respondents

	Interviewed Respondents	Target Respondents
1. ABC Multinational (Division)	7	8
2. BCD Multinational	10	15
3. PHA Public Corporation	5	7
4. CCC County Council	4	6
5. NHL Higher Education Est.	7	10
6. Small firms group	16	20
7. District council group	11	12

In some other organizations, investigations were curtailed owing to denied access. This resulted in individual interviews from respondents which, while interesting in their own right and valuable in general analysis, did not have quite the same usefulness as the organizational case studies where a majority of respondents were seen and important cross comparisons and evaluations could be made. This "miscellaneous" group was used in

statistical analysis (see chapter 9), but not in the qualitative analysis because of the lack of comparative and corroborative materials.

In addition to the organizational case materials, there were two other sets of data, relating to small firms and local district councils respectively. In these two categories of organization, slightly different selection procedures were applied. Firstly, with respect to the small-firms group a decision was made to interview only the managing director/owner manager (referred to as the chief executive, or CE from now on) from each firm. This was done in order to get a larger sample of firms, and in the knowledge that the CE himself occupies an unusually significant role in the direction of small firms (see Gibb 1983). Secondly, with regard to the district councils an opportunity (using a named contact) arose to interview chief housing officers from most of the district councils in the North East of England. This opportunity was accepted in order to explore similarities and differences in one role occupancy across different organizations; time constraints precluded further investigations of different local council officer roles.

The composition of the sample

It was intended to interview respondents at different stages in the hypothetical adoption cycle, and to gain contrasting data about adoption and rejection processes. Using the theoretical process model from chapter 4 (see figure 4.2), respondents were categorised into four groups:

Table 5.5 Theoretical respondent categories

1. Those who had undertaken some recent use of a direct computer facility (in their senior managerial capacity)
   - adoption

2. Those who had not undertaken such use
   - non-adoption

3. Those who had subsequently continued their use
   - continuance

4. Those who had subsequently discontinued
   - discontinuance

A prime methodological consideration therefore was to select organizations so that eventually, a number of respondents in each category would have been seen. This aspect of sampling is described by Glaser and Strauss (1968):

> "The researcher chooses... groups that will help generate, to the fullest possible extent, as many properties of the categories as possible, and that will help relate categories to each other and to their properties..." (Glaser and Strauss 1968)

In fact, the study concentrates more on the issues and processes associated with the categories 1,3 and 4, and not so much on those who have no experience (or no exposure to) computing, in their senior managerial capacities. The district council group fell entirely into category 2, and although respondents provided interesting background and confirmatory materials they unfortunately contributed little to the theory developed later in the thesis, and will not be discussed in detail. This material was not wasted, because experience from these interviews helped to shape the focus of the research effort, and to clarify boundary positions. The interview materials from the

miscellaneous group could also not be used in their entirety because in those instances there was no comparative data available, but at least the data could be used in the statistical work.

In practice, it was rarely possible to ascertain the category of senior managers in any one organization without actually interviewing them personally. It was found that statements made about senior managerial computer use by others were generally unreliable. For example, BCD (a computer manufacturer) publicly announced in the national computer press [reference suppressed to preserve confidentiality] that its top management team were routinely accessing a certain DSS system; this turned out not to be the case when the researcher personally interviewed the managers (and was still apparently not true some 18 months later).

Similarly, while researching in ABC the author was assured by the head of a computer providing team that the directors all personally regularly accessed a certain system, and comments to this effect were made in the organization's house journal; this also was incorrect (most of them had long since discontinued their use). It was also found that senior managers themselves did not know if their colleagues were making use of computers or not, either wrongly ascribing own-use to managers who made no use of their computers, or, less frequently, being unaware that a colleague had a computer on his desk. As research data emerged, it became apparent why some of this obscurity should be found; but in practice it made organizational access and selection a frustrating business because it was rarely clear until much

spadework had been done, as to whether an organization was of interest or not.

Nevertheless, sufficient organizational cases studies were eventually built up to give a reasonable spread of respondents across all categories. A final analysis of the 71 respondents interviewed shows that about half had had recent experience of direct computer use (ie had adopted a system), and about half had not. Of those who had adopted a system, 60% had continued their use and 40% had not. These numbers thus provided an opportunity to investigate and compare the reasons for adoption and non-adoption, continuance and discontinuance, and generally to explore the research questions outlined earlier.

The numbers of senior managers from each organization type in each category is shown in Table 5.6 below:

Table 5.6 Numbers of respondents in theoretical categories

Organization	Total	Respondent Category 1 Computer Use (Adoption)	2 No Comp. Use (Non-Adoption)	3 Continuance	4 Discontinuance
Private Multinationals	17	15	2	8	7
Private large Companies (*1)	8	4	4	4	0
Private small firms	16	7	9	2	5
Public corp'n	5	3	2	3	-
County council	4	2	2	0	2
Higher Educ. Est	7	2	5	2	-
District councils (*2)	11	0	11	-	-
Other (*1)	3	2	1	2	-
Totals:	71	35	36	21	14

Notes:

*1. Data used in statistical work but excluded from qualitative analysis

*2. Data excluded from further analysis

The interview: formats and questions

The interview format used was semi-structured. The session started with a short set of factual background questions which the respondent could easily answer from memory. This was followed by the introduction of a set of topics. All the topics to be discussed were noted on a computer printed list (see appendix 4 for details). A topic would be introduced and the respondent invited to describe his experience in relation to it; reference to the detailed questions was made as a checklist to ensure that

all aspects of the topic were covered. The interview took different paths according to responses to early questions. Where the respondent made a point of interest, or said something which the interviewer did not understand, or wished to check or discuss further, then he would be asked to expand on the subject. A summary of the topics introduced is shown in table 5.7 below:

Table 5.7 Summary of interview topics

1. Personal factors

   Position in organization and responsibilities
   Career history
   Age; education

2. General computer exposure

   Formal training
   Past experience
   Home computer ownership and use

3. Computer Facilities in the organization

   General facilities
   Facilities available to the subject

4. Category of user

   Non user, discontinued, slight, medium, heavy

5. Factors in adoption/rejection

6. System introduction processes

   Introduction process
   Subject's relation to design / choice processes
   Training facilities and use
   Manuals and written materials
   Time spent on learning

7. Computer System Usage

   Systems use (amount per day)
   Nature of use
   Most used / preferred systems / what is of most use
   Why used personally
   Perceived difficulties / disadvantages

8. System use in relation to job and job roles

   Job facilitation and general relevance
   Role changes / job changes related to adoption
   Relation to strategic decision - making

9. Changes in perceptions of value of systems

   Views expressed after experience
   Views expressed before experience (4 respondents only)

10. Factors in continuance / discontinuance

Four detailed interview checklists were developed for use in different circumstances: 1 senior managers in large organizations, 2 chief executives of small firms, 3 system providers and intermediaries 4 second (repeat) interviews (only used for two respondents). These checklists are shown in appendix 4. A list of the quantitative variables showing the ranges of values into which responses were categorised is shown in appendix 5.

The sequence of topics and questions was designed to follow a logical flow, but respondents frequently introduced topics themselves so the interview would be allowed to proceed in the respondent's own sequence as far as possible, relying on the checklist to ensure that all the appropriate ground had been covered. The interview was scheduled to last one hour; occasionally, a respondent would continue talking after this time, but more usually he was very conscious of the approach of the end of the session and of his next appointment. Every effort was made to cover all the key areas on the schedule, but inevitably in some instances the researcher's control over the interview situation was somewhat limited.

The interview format was piloted firstly with business school colleagues, and then with middle managers in two of the survey organizations. Some useful reference was made to Gorden (1969), and Seldon (1984) in refining interview technique, but it was found that experience in the interview situation itself substantially improved the quality of data collection. Inevitably, some aspects of the interview changed as experience and insights were gained.

The researcher did not use a tape recorder, but relied instead on long-hand notes together with a pre-printed schedule for scoring "yes/no" and other short responses. There are of course two schools of thought about this, and there are advocates of both systems. The advantages of the note-taking method seemed to be that problems of microphone shyness were avoided and this is an important point when sensitive organizational or personal issues are discussed, also the respondent's responses were pre-analysed to some extent by the nature of the note-taking process. The disadvantage was of course that the respondent sometimes talked rapidly and crucial points could be missed; this seemed to be less of a problem as experience was gained because responses could be anticipated to a certain extent, enabling the researcher to concentrate on significant or exceptional items. Another problem was the difficulty of noting down the response to one issue while simultaneously choosing the next topic for discussion. In practice, some managers interviewed were very sensitive about their computer use (or discontinuance) while others gave very personal or private insights into themselves or their organizations, and on balance it is felt that the avoidance of tape recording was the appropriate choice in this instance.

Controlling content in the interview

The interview situation was not always a straightforward one. A detailed account of the methods employed and some of the difficulties encountered has been described in an early methodological paper, see Martin (1985). One interesting aspect

was the failure of some respondents to follow the conversational "chain rule" (Denzin 1978) and these high-status men would not give the floor back to the interviewer. This required the researcher to cut in on a monologue; not always an easy thing to do with a managing director of a multi-million pound organization. But the main problem was the perspective adopted by some respondents:

> "Managers tend to censor their reports of activities to show themselves in a good light. Activities and behaviours which reflect unfavourably on a manager are "played down". Thus, defensiveness operates to reduce the accuracy of self report data concerning activities which managers... think contradict what is expected of them." (McCall et al 1978)

The same could equally be said of their desire to present the organization, as well as themselves in a good light. With the top management respondents interviewed this was often a significant issue; as has been discussed at length in chapter 3, figurehead and leadership aspects are critical parts of top managers' roles. And of course in many instances the topic under discussion was the manager's "failure" (and some saw it as that) to utilise a computer, at a time when computer use has very significant cultural overtones associated with it. So certain parts of the interview rubbed against emotive issues.

The outcome was that some managers exaggerated their computer involvement; for example the chairman of the large multi-national implied that he used a messaging system to communicate directly with his board colleagues, although the researcher had established that all but one of his colleagues had discontinued their own use, thus making his claim technically (and physically) impossible. Another respondent implied extensive direct use of

messaging systems when in fact questioning revealed that it was his secretary who was directly using the system. Other respondents discussed extensively the systems which they were "about to have installed", or had used in the past, which made exploration of their present use very difficult indeed. In general, topics had to be probed in some depth in order to establish a realistic picture.

> "A participant can fabricate "tales of self" that belie the actual facts, and the other party lacks objective evidence to counter such tales." (Denzin 1978)

The researcher took a sceptical approach to assertions of computer use and invited respondents to describe down-to-earth, factual aspects of their activities (how long used per day, which programs, how outputs used exactly, who they were communicated to, and so on). Wherever possible, respondents' evidence was checked and compared with others in the organization (peers, subordinates, system providers) and in any event they were questioned very carefully about any claimed computer use.

A final example was the manager who spent some time in the interview describing the attributes of a system which was available to him; when questioned closely about his use it transpired that his description was of elements told to him by his system providers, and did not reflect his own personal experience at all (he finally admitted that he made no use of the system he had described). This respondent's interview data had to be abandoned altogether, because his later statements denied the validity of the earlier ones. The point is that the real relationship of this manager to the computer facility only

emerged after some quite intense questioning; it would have been very much easier to have simply accepted the first version as being representative of the respondent's actual relationship rather than his desired image of that relationship. Again, one is left wondering about the reliability of reports of managerial computer use where some form of cross-checking was not done.

Another problem was the wide range of communication skills found in respondents which affected the way they described and reported on issues. An example would be the contrast between the head of NHL (institute of higher education) whose description of aspects of his computer use included some masterly and convincing statements, compared to some of the small business managers who found difficulty in either thinking about, or articulating issues under discussion. At some level, these respondents' accounts are simply not comparable. That some respondents were significantly more articulate than others was not necessarily anything to do with intelligence or other personal attributes, but probably related more to the respondent's working environment. In any event, with some respondents it was necessary to supply concepts and ideas in discussion for them to consider and react to, because they themselves had not considered matters in these terms. With other respondents, they rejected the researcher's concepts and supplied their own.

The point in this section is not to denigrate the respondents, many of whom gave superbly reflective and helpful material and all of whom gave their precious time to be helpful; rather, it is to emphasise that there was a significant problem, one which will

affect all researchers who investigate similar areas, and one which has been carefully addressed in this project.

Data documentation and analysis

Data were analysed in several ways. Short answer questions were tabulated in various configurations, and have been analysed statistically in chapter 9. But the more valuable insights came from qualitative analysis of information from open ended questions, and answers from open discussion. Each interview was written up into a complete summarised account (see appendix 6 for examples of these accounts), showing key questions and answers, and the researcher's comments and notes. There were thus three documents for each respondent: the pre-printed interview schedule with short answers filled in, a separate set of long-hand notes taken at the interview, and the final summary account. In addition, the researcher maintained a separate journal in which were kept notes and self-addressed memos of important points and ideas.

The written summary accounts were content-analysed individually and in groups at various stages of the analysis as the researcher sought categories of factors and other patterns in the data. Full descriptions of the way in which qualitative information was used is contained in the case analyses in chapters 6, 7 and 8 where the data is analysed into conceptual categories and supported by direct quotation from the interview source materials. The statistical analysis is dealt with in detail in chapter 9. Chapter 10 shows a synthesis of the features identified in earlier chapters in the form of a summary (table

10.1). This is used to deduce the variables thought to be most relevant in the context of senior managerial computer adoption in the particular circumstances outlined (table 10.2).

Issues of validity and reliability

The preceding discussion has indicated that the researcher was conscious of (and made stringent attempts to overcome) various kinds of bias arising from the circumstances of the research. These biases include the susceptibilities of the researcher as well as those arising from the circumstances of the research and the different perspectives of the managers. Issues of validity and reliability in this context are dealt with in some detail by Miles and Hubermann (1984) and their treatment has been used as a guide here.

> "When we come up with a finding in a field study, we quickly assume it to be typical, representative, an instance of a general phenomenon. But is it? And if it is, how representative?" (Miles and Hubermann 1984)

The efforts made here to substantiate the validity of the investigation can be considered under 3 headings:

1 majority sampling

In the key case studies, the researcher took great pains to interview the majority of target respondents in each organization (whether the respondents or organization were pleased about the prospect or not). This was vital because it elicited views from managers who were not keen to describe their lapsed computing efforts, or who had views opposed to the more optimistic claims of advocates. In general the method probed views and experiences

which are not usually reported in the pro-computing literature, and forced the researcher to take an overall view. Where the researcher could not see the majority of top managers, then the information from respondents was not included in the main qualitative analysis.

2 comparisons and cross-checks

The information from respondents in the main case study organizations was subject to cross-checks of several kinds. Wherever possible, issues were checked with the respondent's peers, with his subordinates, and with his system-providers or intermediary. As the research proceeded, the researcher had to hand experience of other organizations and situations with which to compare and test emerging issues. In particular, there was the contrast of private and public organizations and of large and small organizations. Finally, rigorous statistical techniques were employed in the evaluation of certain background variables in order to check that more simple variables in the sample did not provide a more parsimonious explanation than the theoretical model proposed.

3 a sceptical approach

Interview questions were included which explored concrete aspects of the managers' experiences, and efforts were made to check assertions from different angles. Wherever possible, statements about the manager's current behaviours were preferred to reports of the past, and certainly over his intentions in the future. The researcher tested his own opinions, concepts and ideas by describing them to the respondents where possible (sometimes to meet scepticism in return!). Finally, the researcher's

qualitative analysis of information from the case organizations was subjected to critical review by colleagues and supervisor, who offered valuable comments and insights on the treatment of data.

Summary

Several alternative research strategies and their associated methodological characteristics have been discussed in the context of the present research aims. A research strategy was adopted which involved enacting a programme of interviews with respondents from several organizations in order to generate comparative materials. A key feature of the method was the majority sampling of top managers from five organizations, which yielded the data from which the bulk of the findings are derived. The aim has not been to describe some "perfect" methodology, but rather to indicate that the problems encountered - particularly those resulting from difficulties in gaining organizational access - have been recognised and successfully addressed.

References

Denzin NK, The Research Act, McGraw Hill, New York 1978

Dainty P, Meaningful Management Research, Graduate Management Research, Vol 1 1 1983

Easterby-Smith M, The Design, Analysis and Interpretation of Repertory Grids, International Journal of Man-Machine Studies, Vol 13 1, 1980

Easterby-Smith M, The Use of Repertory Grid Methods, in Taylor & Lippit, Management Development Handbook, McGraw Hill, London 1975

Gibb AA, The Small Business Challenge to Management Education, monograph, MCB University Press Ltd, Bradford, 1983

Giddens A, Elites in the British Class Structure, in Stanworth P and Giddens A, Elites and Power in British Society, Cambridge University Press, 1974

Glaser BG, Strauss AL, The Discovery of Grounded Theory, Weidenfeld & Nicolson, London 1968

Gorden RL, Interviewing: Strategy, Techniques and Tactics, Irwin-Dorsey, Ontario 1969

Ives B, Olson MH, Manager or Technician? The Nature of the Information Systems Manager's Job, MIS Quarterly, Dec, 1981

Martin CJ, Accessing and Interviewing Senior Managers, Graduate Management Research, Vol 3 4, 1985

McCall MW, Morrison AM, Hannan RL, Studies of Managerial Work: Results and Methods, Technical Report No9 May 1978, Centre for Creative Leadership, Greensborough, North Carolina, USA 1978

Miles MB, Hubermann AM, Qualitative Data Analysis, Sage Publications, London 1984

Mintzberg H, The Nature of Managerial Work, Harper & Row 1973

Mouzelis NP, Organization and Bureaucracy: an Analysis of Modern Theories, Routledge and Keegan Paul, London 1967

Pahl RE, Winkler JT, The Economic Elite: Theory and Practice, in Stanworth P and Giddens A, Elites and Power in British Society, Cambridge University Press, 1974

Seldon A, The Peculiar Problems of Elite Interviewing, unpublished seminar on research fieldwork methodology in the social sciences, Research Centre for Social Sciences, University of Edinburgh, 1985

Stewart R, Managers and Their Jobs, Macmillan, London 1967

Tisdall P, What Managers Really Do All Day, International Management, Oct, 1982

Chapter 6

Senior Managers in the Private Sector: Case Analysis of Two Large Companies

Abstract

This chapter examines evidence from two organizations in the private sector. Interview materials and other data are used to develope a picture of the behavioural features of computer adoption and use. Insights from both cases provide complementary ideas on important situational factors which influenced the managers' behaviour. The structure of the adoption process begins to emerge from the evidence discussed, and is seen in terms of a two-phase process. Ideas about computer systems and managerial roles are discussed in terms of a mismatch between the managers' real roles and the effective outputs from the systems.

Introduction

Information from the study of the large private organizations is presented in the form of two separate case studies. Each study is used independently to develop ideas about the features of various stages of computer adoption and use.

Case 1 : The ABC Organization

Background

Part of a large multinational chemical group, ABC operates as a semi-autonomous division manufacturing organic chemicals. This long-established organization had a multi-million turnover and employed over 6000 staff. The organization has a long standing reputation for conservative (but successful) long-term operation, characterised by slow change and careful investment in new fields [from literature in the public domain]. The top managers had much in common with each other. Five had first degrees (three from Cambridge) and the sixth an equivalent accounting qualification; one had a doctorate - all had further professional qualifications. Five were in their mid-fifties, and one man was in his late thirties. Although initial access was difficult, once this had been gained the respondents displayed considerable hospitality and charm, and were generally very helpful.

Six out of seven directors were interviewed (the seventh having declined); two respondents were interviewed again some nine months later in order to check their progress on a new computer

adoption cycle. Four staff involved in computer systems development and implementation were interviewed and internal reports relating to relevant computer systems were examined. Some study was also made of published materials in the public domain, but these have not been referenced here in order to preserve confidentiality. In addition, the author was able to familiarise himself with at least some of the computer facilities and documentation (mainly those available in the public domain) which were discussed by the directors.

Responsibilities at the top of this organization seemed clear-cut and straightforward, with a traditional board of executive directors each of whom had various functional responsibilities. The respondents described themselves as board members first and functional executives second; without exception they saw their main function as a long term policy-making team, of which members had certain "portfolios" according to personal interests and other factors. For example, the personnel director also presently headed the Management Services division, previously headed by the financial director. All the respondents had very significant personal resource allocation responsibilities according to the financial and personnel measures outlined earlier. In addition to these responsibilities, the respondents had multiple chairmanships and/or directorships of a complex web of subsidiary and associated companies.

The extent of computer adoption

This is of course the primary dependent variable in the study. As regards the respondents' present computer use, the following

table illustrates the position:

Table 6.1 Senior managers and computer use categories

Respondent	Computer use status
S1 Chairman	Non-user
S2 Deputy Chairman	User (heavy)
S3 Dir. of Personnel	Non-user
S4 Dir. of Finance	Non-user
S5 Dir. of Research	Non-user
S6 Commercial dir.	Non-user

A very interesting fact emerged from the study of this organization, which was that all six of the respondents had at some time attempted own-use of a computer facility, but five had subsequently discontinued their use. This came as something of a surprise as, prior to the interviews with the men themselves, the researcher had been given to understand that only two of the directors had any interest in computing. The description of the circumstances of this use naturally differed from individual to individual, but it was possible to piece together a largely coherent picture of past events.

Briefly, five of the six respondents had passed through a cycle of computer system adoption followed by discontinuance (two of them were about to pass through another cycle and were interviewed again later in order to review their experiences and views after this second cycle). The sixth respondent (S2) was a special case; essentially, he had been using a computer himself for some time and acted as an advocate ("opinion leader" in the terminology of Rogers and Shoemaker) in the adoption processes of

th others, he was continually involved in trying new systems personally and was renowned for his enthusiasm for computing.

Features of system introduction and adoption

All the respondents were asked about the events and processes which led to their adoption of the computer systems. Their responses varied, and of course there are several different, but perhaps equally valid, versions of motivations, events and consequences. Understandably, individuals have put their own interpretation on the relative importance of various factors and influences. The intention in this description is to give a simplified account, but without reducing it to a simplistic (and inaccurate) picture.

Over a period of a few months, the directors had been involved in a scheme (sometimes described in retrospect as an experiment or trial) whereby they would accept and utilise computer equipment for their own use. This was part of a specific policy agreed between them, under the strong leadership of the chairman. The deputy chairman, S2 was acknowledged by the others as a powerful advocate of computing who had influenced the chairman and the board generally.

The reasons given for the adoption varied from individual to individual; but they had agreed together to adopt the technology, and the reasons for the adoption were expressed as follows:

> "It was thought [ie agreed by the board as a matter of policy] that each board member should have a hands on relationship... so they could learn about it." (S6)

"I was the MSD [management services division] director, so I had to have a go... It was time for change, we must get the directors behind change." (S4)

"I believe in leading in computing. I took it and did some experimenting and found out about the potential... To see what it was like for others." (S3)

"In order that I should be seen doing it myself. My job is not to have a computer and use it myself, but to see that the business is using it sensibly" (S1)

"I chair the computer and systems steering panel." (S2)

"We must all be wired up; it's the IT era, we must all loose our dark age habits. This was the agreement at the time." (S5)

All the respondents were making a similar point: they felt the need to promote computing within the organization, and one way to assist in this process was to be seen adopting it themselves. In other words they were fulfilling an important duty with respect to their leadership roles. As has been pointed out by Mintzberg (1973), virtually every action taken by top management is monitored by subordinates who are searching for leadership clues; these managers were well aware of this and were deliberately acting so as to encourage others in the organization by promulgating positive values as regards computing. Apart from being a deliberate, preplanned and concerted effort to influence the attitudes and values of others within the organization, this concerted action indicates quite clearly that the attitudes of the directors themselves must have been favourably disposed towards computing generally, otherwise presumably they would not have agreed to take part in the project.

Apart from promoting computing in a general way throughout the organization, one director (S6) had an even stronger reason for encouraging direct computer use. Part of his responsibilities

included a several hundred strong salesforce, who were about to be issued with computer terminals which would give direct messaging (to headquarters) and other facilities. In fact part of the facilities provided to the directors were based on the facilities issued to these salesmen.

"I had a go because the salesmen were going to use it. I had a go - to understand what was happening. If I didn't show enthusiasm for something new, then the others [ie subordinate staff] wouldn't... a need to be knowledgeable because the others were using it." (S6)

This respondent is clearly explaining the importance of his leadership role: if he did not take up the computer-based messaging system, then his salesforce might read this as a cue that he was not wholly in support of the scheme. By visibly taking up the system himself he was making a clear statement: "If I can do it, you can (must) do it!"

Not all the directors were as whole-heartedly enthusiastic about the proposed project:

"I did <u>not</u> agree to using it - I acquiesced! The chairman [S1] said we must all have them." (S5)

This air of compliance (rather than conviction) was also expressed by S4, and in fact may have been an element in the adoption patterns of one or two of the others. Certainly, S1 strongly supported by S2, seems to have been the principal proponent. This finding is quite crucial when considering that it might have been justifiably thought that these powerful senior managers would have had complete discretion in their use of computing; that this is not so, and that part of the board was

acting to some extent "under orders" came as something of a surprise. In any event, it is surely intriguing that none of the respondents mentioned the expected information value of the computing system as a reason for adopting the technology!

As has been pointed out, the respondent S2 played a particularly crucial part in the adoption scheme. It emerged, from the interview with him as well as from the comments of his colleagues, that he was the principal high-level advocate of direct computing for the board.

"I pioneer computing in ABC [group]; I am a champion of computing in ABC [division]... I am a computing buff." (S2)

Here, the respondent S2 specifically acknowledged his role as advocate of own-use systems. But in describing his reasons for adopting the equipment himself, he was less clear:

"I've always pressed for my needs. It takes the pressure off the rest of the board. My colleagues are scared of computers... they won't try them in the office because of their position." (S2)

This really can be understood as a rationale, or case, for acting as the champion of computing. In other words, S2 claims, if he did not advocate and encourage his fellows (peers) they would be too frightened to adopt it themselves. The "fear" myth has been discussed earlier (see chapter 4); in this case, the fact that all his colleagues attempted to use the systems (most of them with apparent gusto, and all with some thoroughness) argues against the value of the "fear" argument. Nevertheless, the value of S2's champion role was specifically acknowledged by at least one of his colleagues:

"[S2] is genuinely enchanted with new things. He helps with change processes; he helps to drive things - he is our most important change agent." (S5)

It is of course possible to speculate on the motives of S2 in his role as computer advocate (and some unkind comments were made by one or two of his colleagues), along the lines that such high level and visible advocacy of the upcoming technology acted so as to create and confirm a public image of himself as a go-ahead, dynamic leader of the new technological era. In a sense, all the directors were acting as "opinion leaders" (Rogers and Shoemaker (1971); but S2 seemed especially keen to be associated with with this role. Such image-building would be useful preparation for any moves to affect power distribution within the organization. In other words, it is possible to impute political behaviour as an element in the adoption processes.

Other sources of advocacy were present in the situation. The adoption of own-use systems at board level was part of a general and much larger movement towards managerial computing use at all management levels throughout ABC; this process was building to a peak at the time that the first round of interviews was undertaken. The high-level advocate S2 had his counterpart among the information providing staff. P8 was a middle-ranking manager in the Management Services Department, interviewed on two occasions with a separation of some months. He gave the impression of being an ambitious, vocal and articulate advocate of on-line management computing at all levels, stressing the importance of new technology in improving managerial decision and performance generally. He was not involved directly in the

technical team which devised the senior managerial systems, but was involved in managing the overall implementation strategy both at the senior and middle manager levels. He claimed to have influenced the board, and particularly S2, and certainly had acted as a high-profile advocate of the new systems. The extent of his influence at the higher level was not clear (and was difficult to check); possibly he and S2 were simultaneously advocating similar broad lines and for similar reasons. In any event, P8 was recognisably the chief middle-management protagonist of managerial computing at ABC. It was learnt, some months later, that he had succeeded to the leadership of the Management Services Department - a prestigious and important appointment within ABC; an event surely not unconnected with his high-profile, timely (and very successful) advocacy. Whether similar benefits would accrue to the deputy chairman (S2) in the course of time is a matter of question.

Systems and facilities

The physical systems with which five of the directors had been provided consisted of the following:

1 A display terminal linked to the organizational mainframe, and hence to certain of the main organizational databases

2 A separate Prestel terminal linked to the general Prestel service (which included ABC generated databases as well as the usual commercial Prestel information on a host of topics ranging from the weather to share prices and train timetables)

These systems were physically located on a separate table next to the manager's desk, so that he could operate the keyboard(s) from his normal working position. Three of the respondents still had

equipment at their desks at the time of the interview, in other instances it had been moved out. At some stage in the development, the two terminals had been replaced by a single terminal giving the same facilities for some respondents. But some of the directors had ceased their usage by this time, so usually their comments refer to the separate facilities.

The information which had been made available at the terminals is summarised in table 6.2 below:

Table 6.2 Computer information provided for senior managers in case 1

a - summaries of internal data (financial and operating data)

b - analyses from internal databases (personnel records, and some production data)

c - Messaging (to other board members and immediate subordinates)

d - A diary management facility (indicating appointments for all board members)

e - access to commercial data on the Prestel system

The sixth director (S2) had the above facilities plus in addition an IBM pc which offered wordprocessing, spreadsheet, database and modelling facilities. He also had access to other mainframe-based files, including an external technical information archiving system.

None of these items fall easily into the DSS categories outlined by Alter (1977b). The summaries and analyses were more akin to ordinary traditional financial or operational management reports,

ie they were not "single data items" but on the other hand manipulation of the data was not possible from the terminal. The messaging and diary facilities do not form part of Alter's scheme, and neither do the data items available on the commercial Prestel system. This leads to an extension of the Alter classification to include the facilities found; a point which will be taken up later.

System implementation

Questions naturally arise as to how these particular systems were chosen and the nature of the senior manager's own involvement in system design and choice processes. Although it might be imagined that as much, if not more, effort would have been expended on designing the directors' information systems as would be expended on any other new system, this does not appear to be the case. Instead, it appears that they were simply given certain facilities which already existed and/or which had been designed for use by other personnel. It was not clear how the choice of these facilities (amongst many that were available) was made, but apparently the directors themselves had little say in the matter:

"It was an experiment. The MSD people said: `We'd like you to try this.'" (S1)

"It wasn't developed for me... it was designed by MSD in conjunction with [S6's subordinates]. I was not involved at all."(S5)

"THe system was put up by MSD. I don't know who exactly first suggested it." (S6)

"MSD did the whole thing - I was not personally involved at all" (S3)

S1 and S4 also said they had had no input into design or choice mechanisms. S2, on the other hand, who was the advocate of the systems introduction and described himself as a "computer buff" claimed that the impetus had come from him:

"Occasionally, chaps downstairs [MSD] say: Have you seen this? But usually it comes from me." (S2)

This refers to the fact that this respondent had a continuing interest in computing, and had experimented with various systems over an extended period of time. (This was learnt from a discussion with systems provider P05). Nevertheless, the systems which he had acquired were all either standard ABC systems (or standard IBM pc packages), and they had not been designed specifically for him. He had selected from what was available on an apparently largely experimental basis. The other five respondents had had virtually no say at all in the systems which they were offered by MSD, and certainly little attempt seemed to have been made to investigate their personal information needs.

In fact the system implementation process seems largely to have followed the "backroom boy" or "hit and run" approach, as described by Docherty (1980). According to this characterization, low ranking system-users are excluded from design and decision processes owing to the prevailing organizational norms relating to both expertise and management control issues. However, in this instance the intending users were of course major organizational power holders who could easily have insisted on choice at all stages. In fact, the circumstance seems at first rather extraordinary, if the main intention had been to provide

personalised information systems; but if the primary objective, as far as the managers themselves was concerned, was "pour encourager les autres" then perhaps one system would serve as well as another. (But it must be said that the managers attempted to use the equipment as if they were expecting it to be of use to them).

An internal organizational report on the systems described the project as an "experiment", and implied that the object of the exercise was primarily to "test out the viability of the systems" (and not, by implication, actually to help the high-level users). This is of course, a completely different rationale from that used by the managers themselves, who seemed to see it as a means of encouraging others to use computers (and again, by implication, not to help themselves particularly).

The systems in operation

In practice, not all the respondents had found the systems particularly easy or pleasant to use. Difficulties at the man/machine interface were identified by four respondents as follows:

"The palaver of [entering] in security codes" (S5)

"Some bits were irritating. The time element was the worst... I don't get enough practice." (S6)

"I would get into the system, then get lost and not be able to get back. It's OK if you become expert, but... you have to know the [incantations, command and code sequences]. It was too slow, too frustrating." (S4)

"Getting into the system was a problem - the codes and so on. Having to use the keyboard was an irritation - not being able to type fast." (S3)

Five of the respondents had discontinued their use of the systems after various periods of attempted use. The sixth, S2, who was the strong advocate of computing, was still making considerable use of his own system and his case will be discussed separately. The others had all experimented with the system, and in anticipating that it would be useful to them personally had learnt how to use all (or most) of the facilities. The researcher checked this by asking the respondents to describe the facilities, which they all did in sufficient detail to indicate that they had indeed extensively familiarised themselves with the equipment.

The five who had discontinued made various comments about the systems and their reasons for discontinuing. These can be taken in two groups; those referring to the information facilities, and those referring to the messaging.

"I spent a few days working through every thing they had on it, but found nothing on it that was of any use to me personally. A week out of date production figures were on it; personnel numbers and grades. But of no interest to me. I don't need to know if the chaps worked overtime last week, or if sales were up last month." (S5)

"A waste of money; the information you want is just not on the computer... the key things aren't in it. I don't need to know that we employ 6500 people!" (S4)

"There's nothing on it that I want. I don't use it because seeing the piece of paper is quicker - more convenient. If I'm digging too much into the data I'm doing the job of the next chap down." (S6)

"The limited personnel data was of only marginal use... as it is at the moment, it's no use." (S3)

"I couldn't get the trends that I wanted... I wanted to analyse the data for my own personal use, but I couldn't" (S1)

The point being made consistently here is that the information systems provided were not relevant, or rather, not sufficiently relevant. The systems appear to be addressing aspects of the managers' informational and decisional roles; but in practice, the managers were finding that there was a mismatch between the information on the systems and reality of their work roles. A point made by several of the respondents was that the information available on the system was more relevant to lower management levels; for example:

"The amount of hard information I require is low. My assistant can do that." (S4)

And very similar points were made by others, either in this or in other contexts. Essentially, the information was aimed at the wrong functional orientation. As has been pointed out in chapter 3 senior managers use a wide variety of information in strategic decision making, whereas lower managers are more oriented to operational matters; the information presented on the systems was criticised by the managers because of its incorrect orientation.

The messaging system had addressed a different aspect of the senior managers' job, but here again the respondents had not found it useful:

".. I didn't use it. Maybe I'm too well served - people can phone my secretary. My contacts are 50% outside ABC, and on the inside few of my contacts are on the system." (S5)

"I'd use it maybe once or twice a week; time is the reason that I didn't use it more.... typically, I'm away 2 or 3 days each week." (S6)

"I was not prepared to put in the vast amount of time required to use it." (S4)

"At board level you don't write letters to each other - you need the meeting of minds!" (S1)

The reasons for lack of use here are not so clear cut; but generally it seemed that the messaging system did not convey sufficient advantages to the managers to warrant the effort of using it. Certainly, having regard for what has been said about managerial communication in chapter 3 it seems most unlikely that the system could realistically convey any sensible advantage. In general, all five respondents agreed that no aspects of the system were relevant to their jobs; in particular, they all said that the systems did not relate to any strategic decisions which they were involved in. Respondents did discuss some aspects of the nature of their jobs and felt information needs, by way of illustrating the incompatibility between the present system intentions and their real work:

"My timescale is years, decades... I monitor today's prices to monitor my staff. But I act on trends." (S1)

"I need to watch science and newspapers and Universities... A profile of papers and magazines in my area... I would like to improve my own reading and sampling... A more effective way of keeping abreast." (S5)

"Little data or information requires instant action or response by me... At the end of the day, decisions are made by debate about judgements." (S3)

"The next level down - they need to know precisely what is happening; but my role [is to] establish and agree general guidelines... We [board members] pull away from day to day control... For example, we need to guide politicians and lawyers... ABC are the biggest so we need to fulfil this role... I need data on what's happening in Europe; I need to talk to [senior officers of commercial and political organizations]... face to face. We agree... negotiate... " (S6)

These comments all illustrate aspects of the senior managers' informational roles, interpersonal roles or decisional roles. But

the present computer systems did not address these aspects sufficiently well.

The question arises as to what extent man / machine interface difficulties occasioned by the technical design of the hardware and software facilities influenced the eventual abandonment - ie whether this would have happened anyway even if the systems did deliver some value to the users. It could be argued that if the respondents had perceived sufficient value to themselves (in terms of enhancing or in any way benefitting their work effort in any role) then they would have continued their use despite difficulties (after all, they had adopted it initially on this basis); the fact that they did not do so seems to argue that there was insufficient value to warrant the continuing expenditure of the time and effort.

Following discontinuance

The managers' views about the systems which they had tried appeared to have changed in the light of their personal experience; in particular, although some gave a positive cast to their views, there was a noticeable disenchantment effect:

"It is OK for some people. But not worth having for me. It's the wrong system for my type of work." (S1)

"It's limitations have been exposed more clearly. I took it and did some experimenting and found out the potential. I will now chuck it. I know the potential; it has served its purpose." (S3)

"Yes, I realised that it was useless, for me!" (S4)

"The system might be good for people two levels down, but they provided it!" (S6)

Despite this disappointment in the value of these systems for themselves, the directors all expressed strong continuing enthusiasm for computers in the organization generally.

A new adoption cycle

Not only were strongly positive attitudes still being expressed about computers in the organization, but two of the directors (S1 and S3) had agreed to undertake a second "trial" of direct computing, using some different equipment; in other words, they were about to undertake a new adoption cycle. They were most enthusiastic about the new venture and felt sure that the problems which they had experienced before would be overcome by a different approach. On this occasion the trial was not co-ordinated between the two senior managers, who proceeded along independent lines. There appeared to have been a tacit admission that direct computing was not every board member's forte, and there was no longer an overt united policy on the matter.

In the second trial, the expression of the leadership role as the reason for intended adoption was accompanied by a clearer belief (particularly with S1) that the new system would offer specific benefits to them personally:

> "You have to lead by example... Do as I do, not as I say. Everybody who walks in that door will see me using it! ... I saw [S2] using his pc. It really does look as if it is a big help to him." (S1)

Clearly, S1 was intrigued by S2's apparent success with the pc and was anxious to involve himself in the technology. S3 on the other hand was responsible for the MSD (computer) division, and

was taking up a new trial at least partly because of this position. However, he too expressed specific intentions for the new system:

> "I will use my new PC for access to personnel database, messaging; getting a feel for the age structures of the workforce, because of the need to reduce the workforce - what will happen to the age structure ? I hope to play with the database myself... Maybe use it for budgeting." (S3)

Both expressed considerable enthusiasm for the new project, and seemed convinced that direct personal benefits would accrue. These respondents were both interviewed again some months later in order to explore their experiences in the new adoption cycle. In many respects, the features of the previous cycle had been repeated. Neither respondent had had purpose-specific systems designed for him; S1 had been issued with an IBM pc with standard pc software packages, and S3 had a terminal with a personnel-oriented database package which his subordinates planned to acquire for their own use. Both respondents had expended considerable personal effort on learning to use the system, and both had virtually discontinued their use at the time of the second interview. Again they had found that, despite their previous enthusiasm and their beliefs concerning the forthcoming effectiveness of the new systems, that these systems did not in practice provide sufficient value to them personally to warrant sustained use.

Both were able eloquently to justify their involvement in this trial in terms of benefits accruing to the organization generally, but their actual usage (or lack of it) demonstrated that the new systems were of no more benefit to them personally

than the last, in terms of tangible personal advantage which would vindicate their continuing efforts.

The computer's role in the work of the senior manager

Five of the respondents had abandoned their use of the computer after finding out that its capabilities did not seem to match their work tasks sufficiently well; they had all specifically stated that their job was not facilitated by the system. The sixth respondent, S2, had not followed this pattern. He had been making use of the computer for some time on his own behalf and had at his disposal a number of facilities. The respondent used the computer for over an hour each day at work, and perhaps more at home. This placed him in the "heavy user" category (ie using his computer for more than one hour per day). The facilities which he had available included:

Summaries of internal data (financial and operating data)
Analyses of internal databases (personnel records, plant output, sales etc)
Messaging (to other board members and immediate subordinates)
Diary management
External databases (Prestel)
Internal database (eg reviews of press references to ABC)

In addition, the IBM PC had available various software packages: Database (DB2), Wordstar and Starindex (Word Processing), Brainstorm, Spreadsheet (Lotus 1-2-3 and Symphony), ESP Adviser (an Expert System shell) and Visischedule (PERT networking).

The respondent was asked about each facility in turn in order to find out how the computer was assisting in his work tasks. In some instances there seemed to be a direct application of the computer facility:

"This [internal database] gives reviews of all press conferences referring to my division. I look for triggers - looking for problems to solve... I use it [Visischedule] for scheduling the division as a whole - otherwise I would need a tame planner. I can't keep that many entities in my head, so I use the system." (S2)

Here the respondent is describing two areas where the system appears to be offering benefit: firstly helping him in an informational role, monitoring the external environment, and secondly helping him to visualize the overall organizational plan. He also described his use of the wordprocessing package in the context of confidential board meetings, where he would take minutes and circulate confidential material himself. However, his answers were not always as informative. The respondent was able lucidly to describe the capabilities of each facility in abstract, but was less forthcoming about the way in which it actually helped him personally. For example:

"... this shows salesman messages, client details, credit data, staff overtime and so on... [this shows]... oil and gas prices daily, and money rates... Heathrow departures... often we have visitors... I get plant output, budget control and sales - say twice a month..." (S2)

Here the respondent provided few details of the context in which this information was useful to him, and, when pressed on this point argued that further comment was not possible for security reasons. A similar impasse was reached on other areas of his use. Of course, other directors had rather contemptuously dismissed this level of information, on the grounds that it was not suitable for their level of work. Was this director then operating at a different level or in a substantially different way? Unfortunately, this issue could not be fully resolved within

this study. A methodological difficulty was apparent; in order to establish in a full way the nature of the relationship between the respondent's work roles and the computer facility, it would have been necessary to observe the respondent in situ over a period of time and to incorporate knowledge of the details of the context in which he operated. Then if, for example, he developed a spreadsheet and used it to communicate some problem or requirement with others, the exact nature of this transaction could be observed and understood in the context of his work roles. In the course of a one hour interview it was simply not possible to investigate properly these aspects of his work behaviour.

Other questions to this respondent relating to the amount of use he made of various facilities revealed that he used one facility (the spreadsheet package) most of the time, and the other facilities but little - perhaps in the ratio 95% to 5% (figures mentioned by him). In this way it is possible to consider that although he had familiarised himself with all aspects of the facilities which he had available, he used only a small part of it at all frequently. The question remains as to why this respondent was occupying a significant part of his time with the computer, in contrast to his colleagues who had abandoned their use. It is tempting to consider that much of the respondent's claimed computer use was simply part of his "act"; he was fulfilling a significant evangelical role as computer advocate and change agent, and much of his computer activity may have been oriented towards these ends rather than strictly towards impacting the efficiency of his own managerial decision

processes. This is not to suggest that these uses were in any way wasteful or not legitimate, on the contrary, the respondent's role as change agent was acknowledged by his peers as a useful function; however, the uses were not those which are traditionally expected according to the ideals of the DSS movement.

ABC's view of senior managerial computing

There had been a review of the progress of the system, and an internal report published (reference withdrawn). As has been mentioned earlier, this report described the project in hindsight as an experiment, intended to test out the value of the systems. The report concluded that the project had failed, and identified part of the reasons for this (lack of training and support, and poor man/machine interface, for example); however, its recommendations (roughly, that there should be "more of the same") seem curious in the light of the evidence presented here. There was no direct acknowledgement that the computer information presented was unsuitable in any way.

Discussion - findings from the case study in relation to theoretical materials discussed in earlier sections

This study throws light on several aspects of the adoption of computers by managers for their own use, and particularly on the nature of the mismatch between the intended uses of computer systems and the behaviour which it is intended to support. These two aspects will be discussed separately.

As regards the adoption of computing, this has been seen in this case study to follow a clear cyclic pattern whereby the adopter is initially enthusiastic, spends considerable effort on learning to use the system but later becomes disenchanted and abandons his use (or attempted use) of it. There are several salient features of the adoption cycles outlined in this case study. These can be outlined as follows:

1 the presence of a high level evangelical advocate at board level

2 the presence of a powerful middle manager advocate within the systems providing department

3 adopters were enacting aspects of their leadership role by promulgating positive values regarding computers

4 systems were "issued" to the managers, who had little or no say in the choice or design of these systems

5 systems were issued to the managers which were "off the shelf", or based closely on existing systems, and seemed to take no account of any special features of senior managerial work

6 the managers experienced difficulties at the man/machine interface, such that access was effortful and time consuming

7 the systems failed to address successfully aspects of the managers' real roles; (or failed to do this well enough to compete with their present information resources)

8 the systems were abandoned when it became clear that, for most of the respondents, little advantage was to be gained for the effort and time costs required to access the systems

As regards the models of adoption processes and factors discussed in chapter 4, it would seem that some of the features which appear to be salient here are not altogether surprising. For instance, the presence of advocacy at different levels has already been discussed theoretically (although not perhaps in terms of the high-level advocacy which is an important feature in

this case), as has the man / machine issue.

However, what is new in this case study is the identification of the usefulness of role theory in improving understanding of the behavioural processes in the adoption cycle. Firstly, the leadership role itself can be seen as a feature in adoption - it was the further enactment of this role in particular which seemed unexpectedly salient in the adoption, rather than anticipated gains in the efficiency of decisional or informational roles. Secondly, the computer systems can be viewed as intended to address various aspects of the managers' roles (other than the leadership role), but failing to to do this because they were incorrectly oriented as regards the particular nature of senior managerial work. (This point will be discussed in more detail shortly).

This role-based view does not necessarily invalidate any of the factors previously put forward in the adoption model, but it does cast a significantly different light on the matter. For example, how important is the quality of the man/machine interface in managerial adoption? According to some commentators this is a vital issue - but in fact it can be seen from this case that the managers overcame severe problems in order to use the systems, only to abandon them because they were not sufficiently relevant. It seems reasonable to assume that even if the man/machine interface had been superb, the managers would still have abandoned the systems because they could not compete with their existing resources. It is also surely not too unreasonable to assume that even with the poor man / machine interface, if the systems had in fact conveyed significant advantage then the

managers would have made use of them. In other words, the man/machine interface issue may be important, but another issue seems to be more important and may override it.

This leads on to a second major point, and this is that certain features seem to be more important at certain times during the adoption cycle. Prior to the adoption, the presence of powerful advocacy at various levels seems to have been significant, as does the enactment of the leadership role; but after the adoption had occurred, other factors became more important. It seems reasonable to suppose that neither the advocacy nor the leadership requirement suddenly disappeared, but rather the presence of other overriding factors forced the managers to ignore them. This leads to a modified model of the adoption process which shows <u>different</u> factors acting significantly at different points in the cycle. This point will be taken up again in chapter 10, when a new process model will be developed based on features from all the case studies.

A mismatch between systems and managerial behaviour

Considering now the computer systems, these clearly were intended to suppport various aspects of managerial roles. The systems in the first adoption cycle were identified in Table 6.2 as follows:

a - summaries of internal data (financial and operating data)

b - analyses from internal databases (personnel records, and some production data)

c - Messaging (to other board members and immediate subordinates)

d - A diary management facility (indicating appointments for all board members)

e - access to commercial data on the Prestel system

These systems could arguably be addressed to various managerial role behaviours (following the role sets identified by Mintzberg 1973 and discussed in chapter 3) as follows:

Table 6.3 The Relationship Between Systems and Managerial Roles

Role	System				
	a	b	c	d	e
Interpersonal					
1. Figurehead					
2. Leader					
3. Liaison			x	x	
Informational					
4. Monitor	x	x			x
5. Disseminator			x		
6. Spokesman					
Decisional					
7. Entrepreneur	x				
8. Disturbance handler	x	x			
9. Resource allocator	x	x		x	
10. Negotiator	x				

But most of the managers found these systems unsatisfactory, in terms of the roles to which they were intended to be addressed. (Intriguingly, at least one manager used the systems to address his leadership role, not a function intended by the system designer!) The reasons for this can be described in terms of the key features of managerial behaviour discussed in chapter 3. The data available was not suitable for their monitoring or resource allocation roles because it reflected issues which would be of

interest at a lower managerial level - senior managers tend to have differently oriented information needs from lower ranking managers. In addition to this orientation failure, it is likely that the computer based data could not compete at any level with the quality of information which these managers had available via their personal networks and other sources which they would have developed over long periods. Similarly, the liaison and dissemination roles were not enhanced by the computerised messaging system because the system did not include important contacts who were part of the manager's interpersonal networks, and because it lacked the immediacy of face to face contacts or the efficiency (bearing in mind the managers' secretarial assistance) of traditional methods.

This is not to say that computer systems could not of themselves be useful to managers; but rather that these particular systems were not useful to these particular managers. It is always possible to envisage circumstances where similar systems could successfully address aspects of a manager's role set and be permanently adopted into his working methods. Examples of such apparent successes will be described in subsequent case descriptions.

It is possible to speculate that if the man / machine interface difficulties had not been quite so severe, the managers might have altered their roles to reflect the new sources and methods available to them. But there was little evidence of any such alteration, and it may well be that the roles enacted by these managers were largely prescribed by constraints embedded in the

organizational milieu in which they worked, and as such were hardly likely to be altered as a result of minor changes in computer system availability.

The exception here was of course S2, the one respondent who had adopted and continued to significantly utilise various systems; significant in that he expended an important segment of his working day on the systems. However, there was little evidence to suggest that he had altered his roles in any way as a result of the technology he was using; rather, it seemed as if he had incorporated certain aspects of the systems into his present roles in a way that provided various rewards in terms of his influence within the organization, and not necessarily in terms of the efficiency with which his work tasks were enacted. In the next case, that of BCD, a number of continuing adopters were interviewed and some salient features of their continuation were identified which shed some light on the behaviour of this respondent.

Summary of case 1

The general picture which emerges here is that the directors agreed together to adopt or trial the equipment, that they were all influenced by S2 who acted as a strong advocate, and was evangelical in his approach. This approach was endorsed and legitimised by the chairman S1, who used his authority and effectively insisted that the trial went ahead. The reasons for adopting the systems were mainly to do with influencing others. At that time they all believed strongly in the value of computer technology generally for the organization, and were concerned

that they should encourage others as much as possible. In other words, the respondents were acting in their role as leaders. Of course, the details of these events are inevitably more complex than this; for example, some respondents mentioned their curiosity about, and interest in the systems and there will undoubtedly be other situational elements present. Design of the system was left largely to the technical providing team; there was little communication between it and the would be users, so that standard systems (ie designed for other purposes) were issued to the senior managers.

Following their adoption of the system, the directors generally found that not only were there difficulties and frustrations involved in using it, but that the real, tangible benefits which they perceived after some direct experience did not appear to warrant the expenditure of time and effort involved, so that the usage was discontinued. In particular, the systems did not seem to successfully address the real roles which the managers were in fact enacting in the organizational setting. Some disappointment, or disenchantment was perceived because the system did not live up to their expectations. Despite this, all the respondents still expressed strongly favourable attitudes towards computing in the organization, but this no longer extended quite so favourably towards own-use computing for themselves. Nevertheless, two respondents (S1 and S3) undertook further trials of new systems which they were convinced would be useful to them, only to display a similar pattern of learning and attempted use, followed by discontinuance.

Case 2 : The BCD Organization

Background

The BCD organization is a large multinational company (in excess of 20,000 employees) whose business is manufacturing and marketing computers and computer products. Within the UK the organization is dispersed geographically into a number of manufacturing and administrative centres. In the course of the research the author visited three sites in central London and other locations in the home counties and in the north of England.

In accordance with its physical dispersal the organization was structurally complex, being comprised of a number of seemingly overlapping responsibility areas which altered over time. As an illustration of the structural changeability encountered, the formal organization chart of April 1984 shows a structure with two boards and twelve business entities; six months later the formal chart has changed shape, and although the two boards are still present, only four of the business entities show any similarity to the previous chart. This structural flexibility may well be a reflection of the need to cope with the rapidly changing conditions in the computer market; a market which was showing greater than usual volatility at this time. In this and in other ways, the organization was in marked contrast to the previous case.

In addition to having a naturally ephemeral structure, the organization was the subject of a take-over during the research period which added further complications to the top management

disposition. In order to overcome the difficulties created by the labyrinthine (and rapidly changing) structure, it was decided to take only the two top main (and partially overlapping) executive boards of directors and to exclude incoming directors from the takeover organization.

Ten directors from a target population of fifteen were eventually interviewed. Although three respondents proved too elusive (or specifically declined to participate) two of the target directors were in the process of leaving the organization and could not be contacted, so that the ratio of refusals is not quite so severe as it might appear. Additionally, four systems-providing personnel were interviewed and some use of internally published materials was made. Published material in the public domain (mainly press announcements) were accessed, but these will not be specifically referenced here in order to preserve confidentiality. In addition, the researcher was able to familiarise himself with at least some of the computer facilities and documentation (mainly those available in the public domain) which were discussed by the respondents.

The directors did not form a cohesive social group in the sense of the previous case, and there was a broad range of ages, backgrounds and responsibility levels among respondents; the average age (44) however, was significantly less than that of ABC. Unlike the last case, the functional responsibilities of the respondents were by no means clear cut, for example there appeared to be significant overlap of responsibilities between some directors, and little consistency in the scope of their responsibility. Similarly, the respondents' strategic influences

were by no means straightforward. Some directors were clearly part of what might be termed a "strategic club" (whose membership did not appear to coincide with either of the formal board alignments) and who mentioned similar long-term interests, whilst others did not seem to be part of this world.

Most of the respondents had taken part in one or more computer adoption cycles, although with a significant exception these seemed to be singly initiated, sporadic and separate events, rather than a result of a generally agreed strategy. The exception was a significant one and involved the highly publicised trial of a direct-use computer-based DSS facility by some of the directors as part of a specific policy. According to a report in the national computing press, BCD had issued extensive DSS facilities to its senior management, as a prelude to marketing these facilities to the top 5% of managers in large companies. (Although in practice it was found that only three BCD directors had received these specific DSS facilities, even some months after the announcement).

Discussion with members of the providing team for this project indicated that the publicised DSS implementation had been initiated by the BCD chairman (unfortunately not interviewed directly), in the form of a directive to the effect that BCD was to make greater use of its own products internally - to be seen as "taking its own medicine". The provider p01 described the project as a "showcase" activity; ie executed specifically for its public relations and marketing value. The top managers involved in this project were, as far as he was concerned,

effectively guinea pigs for the development of a product which was to be marketed externally. This feature of the computer adoption process is described here because it is an issue that naturally runs right through the discussion of this case study. Clearly, because BCD is a computer company, it has special circumstances as regards computer adoption. Nevertheless, it will be seen that this particular issue is not quite as important or all-pervading as might be thought, and the nature of the adoption factors not so very different from the previous case.

The extent of computer adoption

All but one of the respondents had passed through one or more adoption cycles. The present status of respondents' direct computer use is shown in table 6.4 below:

Table 6.4 Senior managers and computer use categories - case 2

	Respondent	Computer use category
S11	Director External Technical Relations	non-adopted
S12	Group Managing Director	discontinued
S13	Director of Finance	discontinued
S14	Director of Sales	discontinued
S15	Director of Management Support Centre	discontinued
S16	Director of Information Services	user (slight)
S17	Director of Technical Services	user (slight)
S18	Director of Personnel	user (medium)
S19	Managing Director (UK board)	user (medium)
S20	Director Mainframe Division	user (heavy)

Thus out of the ten respondents five were currently utilising some form of direct computer system, four had discontinued use of a system and were not currently using anything, and one had not

passed through an adoption cycle at all.

A case of non-adoption

The respondent S11 is the first example so far of somebody who has computer resources theoretically available to him, but does not adopt the technology for his own use. In the description of the previous case materials, the circumstances surrounding respondents' computer adoption have been discussed and certain features which seemed salient have been identified; the position here is one where it seems necessary to "explain" why the respondent has not done something - a somewhat less satisfactory task. It was clearly not simply a matter of "awareness" (a factor much beloved of commentators in the computer press) because here the respondent was surrounded by computers and computer users on all sides. Nor was it a matter of simple availability. In common with other directors at this location, there was in principle directly available to him a whole range of computer facilities including mainframe terminal access to extensive organizational databases, external databases, messaging and diary systems, and a wide range of pc facilities including spreadsheet, wordprocessing and database packages. Again, in principle, he could, as a director of the UK's largest computer manufacturer, have virtually anything feasible in present-day technology made available to him simply for the asking.

Neither was it simply a matter of computer knowledge; the respondent had been involved in the design of computer hardware over many years and probably knew as much about this aspect of computing as anybody in the UK. Nor was it a matter of systems

understanding - he was able to describe in general terms the theoretical benefits of certain aspects of own-use computing in particular and managerial computing in general. Nor was it simply a matter of "attitudes"; the respondent expressed quite strongly positive values and attitudes concerning computers and computing in organizations. When asked directly why he had made no attempt to even try out direct computing for himself, he answered as follows:

"I've considered my job content and what aspects could be assisted. I think having hands-on access would not make a measurable difference. [What is important is] .. the ability to interpret data - the considerations as to why it's up or down or whatever. For example at the moment I can ask the [financial] controller: he can interpret the data. The exact numbers aren't important; it is the forces that make it so - and this man knows the forces." (S11)

Here the respondent is effectively saying that his present information sources (including especially the information interpretation) are superior to that which he expects from the computer.

"I've not ever given anything a trial... I've not found a use. I keep myself aware of what's available. My activity now is policy, rather than running specifics... I spend my life on the phone - not on the keyboard. Basically, I spend 99% of my life talking - only 1% manipulating in the abstract. My business is not concerned with numbers on a database... It's much easier to walk down the corridor and get the bloke who's used to it... Messaging - my secretary does it much better than I." (S11)

Here, the respondent is referring to his role attributes and pointing out that direct computing is not oriented correctly, for him. He also infers (perhaps correctly) that the effort involved in his use of the messaging system may be more efficiently expended by his secretary. In general the respondent's comments represent a view (and perhaps a well-informed view) which he has

taken about direct-use computer systems. But there is something missing from these statements. The respondent was asked why it was then, that many of his senior managerial colleagues used computers themselves - what did they find useful that he did not? And here, the respondents answers were not altogether accurate; he had an incomplete view of of his colleagues' computer activities (a phenomenon which has been noted before).

"The answer must be job content... [Why do other people use messaging themselves?] They don't have secretaries to do it for them! ... People who do it are more using it as a means of access to stored information... People who use [the messaging system] have staff geographically spread." (S11)

The first point implies that his colleagues worked at a lower managerial level; this might be true in some cases, but definitely not in the cases of S19 or S20 who had very substantial responsibilities relative to S11. His remarks about his colleagues' use of the messaging systems are not correct because they certainly had secretaries, and geographical considerations were not among the main reason which they advanced for their use of the messaging, a point which will be explored later.

However, there are other issues which can be put forward as important. This respondent had not been involved in the publicised DSS trial - indeed, he did not seem even to have been aware of it; this may be partly a reflection of the convoluted organizational structure. It is possible that the parts of the organization concerned with the DSS trial had passed him by - certainly he mentioned that he spent much of his time on European matters, and he was uninvolved in issues pertaining to the UK

exercise. In any event, there did not appear to be a high-level advocate of own-use systems within his direct orbit. Also, having only a small personal secretarial staff, there appeared no direct reason for him to personally advocate computer use among them himself. In other words, the salient features present in other instances of computer adoption - powerful advocacy, and the requirement for leadership role enactment - were not present in this instance, and the lack of these features are interpreted here as a significant element in his decision not to adopt. It does not seem entirely accurate to portray this respondent as having specifically rejected systems available to him; it seems to be more a case of the requisite adoption factors being absent from his milieu.

Features of adoption

The respondent S15 was head of a division whose function was to market "end-user" computing and "management support" products. The reasons he gave for his adoption related directly to his capacity as leader of this division:

> "When people come to see me - they see that I am automated." (S15)

This referred to the fact that he had a terminal on his desk; although he no longer used it directly in the sense of entering data or retrieving information. In other words, people from inside and outside the organization would infer from the presence of the system that the owner was a direct user. This was partly a leadership function and partly a figurehead function; he was

making statements about himself and the organization which carried messages both to subordinates and to potential customers.

"I had it put in to find out how difficult it was to use. I am a test-bed... a guinea pig." (S15)

There is an interesting parallel here with the respondent S3 from ABC who was also a guinea pig in a trial of application software. In this case, however, the respondent is putting himself in the place of a potential customer, in order to establish his own view of a product as well as to provide feedback for his developmental staff. This behaviour relates to several managerial roles, but mainly informational ones in conveying intelligence about a product to his subordinates, and in forming a view about the product himself. The latter role parallels that of S6 from ABC, who also was forming a view about a computer system. What this behaviour clearly does not relate to though, are the presumed direct informational and decisional roles for which the systems were designed. This contrast between the roles to which the systems are addressed on the one hand, and the roles in which the senior manager incorporates his systems use on the other has already been discussed in the discussion section of the preceding case and elsewhere, and each case adds weight to this finding.

The respondent S12 (although referring to an adoption cycle which took place completely separately from S15) made very similar statements which related to both these role aspects:

"To encourage others, I had one installed. To be head of a large computing organization and not to use one! [ie it would be inappropriate]... To test out what people were saying about ease of use. To help me understand customer views... To help understand my own use of the terminal." (S12)

As with previous respondents, this manager is referring both to his leadership role (encouraging others by sending positive messages about computer use) and to his own informational needs regarding the efficacy of the system as a potential product. S13 on the other hand, whose adoption cycle again took place under separate circumstances, refers to slightly different strands in his adoption:

> "A policy decision was made to see if these things could improve managerial performance. It was installed as an experiment. As a deliberate test... I was in charge of the data - so I championed its being made available. Somebody has to champion new ventures, [it's] worth a punt on a speculative basis." (S13)

Here the leadership role is again referred to, but in the context of advocate for the manager's own division ("I was in charge of the data - so I championed its being made available..."). The other strand is again the idea of the manager as guinea-pig, finding out for himself and for others if the principle was an effective one.

The adopters who were still using systems at the time of the interviews gave similar reasons for the adoption:

> "... in my role as IS [Information Services] director. It's my job to provide [internal information systems]. I used it to find out how good they are, what they're like, how user friendly and so on. Messaging was developed as a product by IS for internal use..." (S16)

Here the respondent is championing his own division's product; he is acting in a leadership role in order to disseminate values internally concerning his division, as well as providing information to his subordinates about their product. This is

different from advocating computer use through the organization generally, and it seemed that the respondent was as much concerned with divisional as with whole-organizational issues.

In the case of S18 and S19, the respondents referred to the publicised DSS system which had been issued to certain directors under a directive from the company chairman, and which required their participation. For example:

"It was developed as a showcase; to show our products. If it works, I'll use it; if not I won't" (S18)

Here, both respondents had had previous experience of direct computing and had passed through earlier adoption cycles; the chairman's directive refers to their present system. The last respondent S20 had a strong interest in direct use computing which he had developed over many years; in some respects he resembled the respondent S2 who had been such a powerful advocate of computing in ABC, and took a close interest in development of direct systems:

"I have been using this , or something like this for about 6 years... [the messaging system] was developed for me - then I sold it to the rest of the group. Of course, I am hooked up to my own product... to see what my customers will make of it... The best way of making my reports [direct subordinates] use it is for me to use it." S20

Here, the respondent makes several points about his computing adoption. He describes his general computer advocacy in similar terms to S2 of ABC ("... then I sold it to the rest of the group."); then he refers to the "experimental" function which has been mentioned by several of his colleagues ("... to see what my customers will make of it."); and lastly he describes a specific

leadership role, whereby he encourages computer use by his direct subordinates.

The effect of high level advocacy has been described at the beginning of this case study, whereby the chairman had prescribed the use of BCD products internally. The direct effects of this dictum could be seen specifically in the adoption patterns of S18 and S19; it was not possible to ascertain the more general effects of this encouragement although undoubtedly they existed. The respondent S20 described his own evangelical role in the promotion of the internal messaging system, implying that his influence encouraged the development of this system and its spread throughout the organization.

The presence of middle-level advocates among providing groups was inferred after discussions with representatives from four of these groups. Unlike the organization in the previous case (ABC) which appeared to have a single and largely monolithic systems development organization, BCD had several separate groups which appeared to be not only overlapping, but to be in active competition with each other. (For example, the author met no fewer than three individuals from three separate internal organizations who each claimed personally to have devised the organization's messaging system). Some of these groups had the responsibility of developing saleable products (which might also be used internally), others had responsibility for devising internal application systems (which might eventually be developed for sale outside), including managerial DSS systems; all the groups would benefit from internal use and exposure of their own "products", whether these were sold outside or not.

The general features of the adoption part of the respondents' adoption cycles can be described as follows:

1 High level advocacy. The company chairman had specifically encouraged senior managerial adoption of internal direct DSS systems. Of course it was difficult to establish the precise extent of the influence of this advocacy; but there is no doubt that it was present for at least two of the respondents (S18 and S19) who were participating in the prescribed DSS project. The respondent S20 described his own evangelical role in the promotion of the internal messaging system.

2 Middle level advocacy within providing groups. Systems-providing groups competed for internal exposure of their systems. Even though the effects of the continual surrounding buzz of influence about computers and application systems could not be measured directly, it was undoubtedly present, and presumably constituted a factor in adoption even where the precise initiation source could not be directly ascertained.

3 Enactment of the leadership role. Most respondents referred to this role requirement in one context or another; either for the organization as a whole (eg S12) or as regards the promotion of their own divisional interests (S13, S16).

4 The experimental sampling by senior managers, on their own behalf or on behalf of development staff, of systems as products for internal or external consumption (S15, S12, S13, S16, S20)

Although differing somewhat in detail and emphasis, these issues

do not vary so very much from those discussed in the context of the ABC case. A new feature is the special interest in systems as a product for internal or external consumption.

Systems and facilities

The computer facilities which had been provided for the directors varied considerably from one respondent to another. As has been pointed out, with the exception of the formal DSS project the respondents' system adoption appeared to be the result of separately initiated, sporadic activities. A generalised list of all the facilities found is as follows:

A Mainframe based

a Summaries of internal data (financial, product, personnel and competitor data expressed, mainly financially, at company and divisional level)

b Analyses of (or details from) internal databases (eg personnel records, stock, production and accounting data)

c Graphical analysis of internal data

d Financial modelling of certain internal data (in practice the managers could not access the modelling language directly, so this consisted of pre-defined data analyses)

e Commercial databases (Prestel; sometimes provided on a separate monitor with special keyboard)

f1 Messaging (internal, to some BCD UK sites)

f2 Messaging (external, to some BCD international sites)

g Diary management

h Project management (PERT based)

B PC based

a Spreadsheet, wordprocessing, database packages and Basic (the programming language)

b Telephony features (the PC was connected to the internal and external telephone networks and provided a directory, plus special dialling and switching facilities, and personalised answering messages)

The formalized DSS project entailed the provision of a set of facilities which included elements of most of the above features. (Details of these provisions were elicited from the manager in charge of the technical implementation, provider p10.) In particular, it featured the provision of board-level financial data on company and product status and profitability, and competitor activity. Graphic features were provided in the shape of about twenty fixed graphs (ie showing the same standard variables). The financial modelling element consisted of two models which had been assembled by analysts and presented in the form of a company financial (budgetry) analysis, and a manpower analysis.

This group of facilities represented by far the most comprehensive and sophisticated set of computer-based decision aids which was encountered during the whole study; by any yardstick, it must represent the current technical leading edge of managerial decision support systems. The technical intentions of the systems are quite clear, and were confirmed by provider p10 and others. These intentions included particularly:

1) the provision of information for managerial decision (and particularly strategic decision, as indicated by the company wide financial status and manpower information) and organizational monitoring

2) support of internal (organizational) communication

3) support of decision making with the aid of personal spreadsheet and database facilities.

Respondents had attempted use of various parts of these systems during their adoption cycles. Not all the systems were physically available to all the respondents, for example S15 had only a pc with no mainframe connection because his site (outside London) was not physically connected to the central organizational mainframe network at that time. The question of "availability" is in general more subtle than this however, because in principal a link could easily have been established to the mainframe via an acoustic coupler, for example, and so the non-availability is an organizational matter rather than a technological one. In fact S15 was provided only with "one or two spreadsheet and wordprocessor files" by a subordinate, and made no use of the software facilities himself. At the other extreme, S20 seemed to have tried everything and was acknowledged as a "computer buff" by himself and others. The nature of both discontinuance and usage of these systems will be taken up shortly.

System Implementation

In most cases, the system adopted had been issued (by a providing team or department) to the respondent who had had little or no say in the choice or design of the facilities he was to receive. For example:

> "It was not designed for me... I was involved to some extent [in the choice of facilities] but I did not put enough time into it." (S12)

"Messaging was designed by [my division] as a product for internal use. No input by me into its development... It was there when I came" (S16)

"IS [Information Services] put the system up. I wasn't involved at all in the design or the specification - the system is a standard product." (S17)

This lack of involvement of the respondents in the design and choice of their systems parallels that found in the ABC case. It is tempting to blame the systems providing staff for failing to communicate effectively, or to understand the requirements of the users for whom the systems were developed. However, as a member of one providing team pointed out, it was by no means easy to establish what would be useful for the directors within the sort of project framework in which these systems were developed (usually as a product for other purposes).

"The senior managers really could not say what it was they wanted; we could not nail it down. So in the end we just said: `This is what you're going to get; take it or leave it.'" (p01)

This, of course, is the classic computer and management science implementation syndrome which has been discussed in the implementation literature since the early sixties. More effort was expended at implementation time, but even here difficulties were encountered. According to the system provider:

"There are two teams involved with the implementation: the development team and the implementation team. Unfortunately, they don't talk to each other much, and part of my job is to try and improve the communication between these two sides. One lot has to put up with all the flak and the other lot [the development team] are more or less working in an ivory tower." (p01)

Not all the respondents were remote from the systems choice; one or two said that they had asked specifically for a certain system:

"[the messaging system] was asked for - by me... I have a small development group. Five years ago, I was involved... but now no... [But] Information Services Division offered the corporate stuff to me." (S20)

In general, though, it seems clear that the systems were not developed specifically for the senior managers, but were modifications of existing systems and designed for internal use or as products for marketing outside the organization.

Features of discontinuance

The four discontinued users had all passed through an adoption cycle, and had subsequently discontinued their use. This cycle was not apparently a commonly shared event; each respondent's circumstances were different and had not arisen from the same situation. Nevertheless, there were common factors in each case and it is possible to discuss the circumstances in terms of these factors.

	Respondent	Computer use category
S12	Group Managing Director	discontinued
S13	Director of Finance	discontinued
S14	Director of Sales	discontinued
S15	Director of Management Support Centre	discontinued

A very interesting analysis of his discontinuance was given by the managing director, S12:

"People who designed the system have a completely different idea on 'easy to use' from my idea. They underestimate the ease of getting information from people... They are at different organizational levels, so they don't understand that." (S12)

Here the respondent is describing the man/machine interface

difficulty associated with his use, together with the value of the system in relation to his present, highly developed information networks (formal and informal).

He then goes on to describe further these key aspects of the discontinuation:

"The basic problem is, it's hard to get through the security harness; therefore I don't bother. Anything that takes more than a couple of minutes I don't use. Any manual that takes more than half an hour - then I won't use it. I never got to grips with the security codes. It's not friendly. Anything that takes more than a couple of minutes - I don't use it. I spend 60% of my time out of the office. It took too much time." (S12)

In other words, the system took time and effort to use - more time than he was prepared to spend in view of the rewards he could expect to gain from using it.

"It was set up to give group financial numbers - but it's just as easy to get these from a printout. Now, we think we're using it for the wrong information. My chaps use it for ad hoc enquiries. Pulling down standard data is not useful [for me]. Chaps below could get me anything I wanted. Also, a person can interpret it and tell you what's what. You need the interpretation." (S12)

The "group financial numbers" here are the mainframe system facilities listed earlier under items a and d. Here, the respondent is not criticising the information itself so much as the relative value of the system in relation to his current information resources. As discussed in chapter 3 most senior managers make extensive use of highly developed information sources based on personal relationships to a far greater extent than they do formal information systems. However, he then went on to describe a crucial aspect of the way in which formal information is created at lower levels and then utilised by senior management in strategic decision:

"Strategic decisions here are made using presentations - not by manipulating data at the time. Decisions are made by judgement. [When making strategic decisions] ... my people below put together the data, the information. People who are experienced in these matters [ie the decision in hand] make judgements. Day to day - operational - decisions are made by looking at data, but the serious strategic stuff - like do we attack the German market - are made judgementally." (S12)

Here he is saying that the information systems are giving him data that normally is utilised at a lower level; senior managers engage in strategic bargaining and group judgemental decision behaviours (see chapter 3) and do not as a rule arrive at strategy frameworks as a result simply of formal data manipulation.

To sum up, the respondent has identified three key issues relating to his discontinuance: the personal time and effort costs involved in utilising the systems, the lack of value of the data relative to his present highly effective personalised systems and finally the incorrect orientation of the data as regards his own decisional activities.

Elements of these three issues are echoed in the following comments from other discontinuers (the systems to which their comments refer are noted at the end of each set of comments):

"I kept on trying to see if it came up with anything useful. And I found that I couldn't. I could see how it would be useful to people below me. But not me." (S13) [summaries of internal financial and marketing data]

"The system was hard to use. Otherwise I might have made more use of it. Commands were complex. Things would go wrong. I couldn't retain all the commands in my memory - there were too many; it was too complex. If one were using it all day, every day then OK. But using it spasmodically was hopeless. Also, there was always something different that I wanted, so new commands had to be devised. After a while, my assistant worked out some short

cuts and macros for me. He tailored it. But even then, it was relatively complex. I would spend 10 minutes getting what I wanted - or maybe not getting it and abandoning the session!" (S14) [messaging and summaries of internal data]

"I had it put in to find out how difficult it was to use; and it is very difficult to use! The spreadsheet is difficult - it has a page full of instructions. The reason there isn't enough information on it to be useful is because I have not had time to sit down and specify what I want in it. My use is so casual that I forget how to use it. I spend maybe half my time out of the office." (S15) [pc only, spreadsheet files]

"Not happy with the keyboard; I don't know how to type. This is a major frustration. The system can be frustrating - time wasting - 3 or 4 passwords, then screens, menus... It's quicker to look up the mail. Nothing is easy." (S16) [messaging]

"I want databases that don't exist. I ask my accountant [for financial data] - he's down the corridor. I ... get my planner to do planning for me. If I was one level down I would use it. I would do more if I had the time. Messaging is not useful. My secretary uses the messaging extensively - I tend to use it through her. " (S17) [extensive facilities, virtually the entire range of mainframe-based systems]

Respondents were able to give a detailed picture of their discontinuance circumstances because for most, the discontinuance had been fairly recent.

As with the previous case, it is possible to distinguish common elements of the discontinuance among the respondents. The general features of the discontinuance part of these respondents' adoption cycles can be summarised as follows:

1 Difficulties at the man/machine interface

There seemed to be two separate issues here, one concerned with learning difficulties experienced prior to using the system, or in exploring different aspects, and the other concerned with on-going inconvenience associated with non-productive effort and time expenditure.

2 High relative cost of the information

The difficulties of use, resulting in time-wasting and frustration, were particularly significant when considered in conjunction with the relative ease of gaining high quality information from the manager's subordinates or from his personal network of contacts. As discussed in chapter 3 senior managers usually have extremely well developed information sources.

3 Inappropriate orientation of the information

The information available from internal databases, irrespective of the form which the data took, was of a kind more suitable for direct consumers at a lower level than the managers who were accessing it. In general, the systems were intended to suppport various managerial roles, but in fact failed to address specifically the actual roles of these senior managers. In this respect, this case directly parallels the ABC case and much of the comment already made about the mismatch between the systems and the behaviour which they are intended to serve applies here with equal force.

A final word here is left to the Group Managing Director, who was asked if his view of the systems had changed after his experience:

> "I have a better idea now. There is a tremendous amount of bullshit around, about DSS. Only after using one yourself do you understand - it certainly depends on the organizational level. [ie as to whether it is relevant]. There is no doubt that some men are personally fascinated by the idea of computing. This leads to overoptimistic statements about potential uses and benefits - [here he named S15 and S19] In some cases there is a need to believe in or create propaganda for their division's use." (S12)

This comment neatly characterises the leadership role enactment

which predominated in certain managers' adoption patterns, and also the problem of achieving systems relevance. But primarily it reveals that that this manager had crucial insights into the efficacy of own-use DSS computer systems.

Systems in use

Five respondents were making some regular direct use of their systems at the time of the interviews, as shown in table 6.5 below:

Table 6.5 Continuing users in case 2

	Respondent	Computer use category
S16	Director of Information Services	user (slight)
S17	Director of Technical Services	user (slight)
S18	Director of Personnel	user (medium)
S19	Managing Director (UK board)	user (medium)
S20	Director Mainframe Division	user (heavy)

The respondent S16 had been issued with the DSS systems described earlier, which included mainframe facilities a to d inclusive. In addition, he had the messaging system. These facilities were delivered via a pc, but the pc facilities (spreadsheet, wordprocessing and so on) were not used at present, so effectively it was being used simply as a mainframe terminal. The respondent said that he used the system for perhaps 15 minutes per day on average, and his use of the system was almost entirely confined to the messaging facility.

"The financial DSS is no use at all. The financial data doesn't directly apply to me. The financial modelling might be useful, but I don't use it at the moment." (S16)

"I use the messaging extensively. I am a prolific corresponder; 10 - 20 memos per day. Mainly to direct reports [subordinates]. Not outside IS [Information Services] so much because we haven't got a lot of [messaging system] users." (S16)

The respondent explained that much of his "use" was through his secretary:

"I do use it extensively through my secretary - say 2-3 hours per day. [It] has the facility to amend, so for incoming input I will amend the message and then pass it on." (S16)

Thus most of his use of the messaging system might best be described as "chauffeured", in that his secretary entered the bulk of the data. In terms of the computer use matrix developed in chapter 2 the secretary was a category B1 user in these circumstances and the manager an A2 user. The manager's category A1 (direct) use was confined to reviewing messages (an important application in these circumstances) and the occasional message amendment.

"If I want to see the incoming mail... if my secretary's not around... I can do it more quickly. [The difficulties of access are] ...offset by being able to look at two-minute-old messages rather than two-day-old messages." (S16)

Of course, a number of other managers in this and other cases have specifically decried the value of such "instant" information at senior management level.

The purpose of this respondent's use of the messaging system included considerations other than straightforward efficiency of communication with his staff. As has already been pointed out,

the messaging system was his division's major product which he was anxious to promote internally. The respondent implied that he used the system extensively at least partly to enforce its use within his own division, so that the system would receive increased exposure, and encourage others to use it by example; he would send his subordinates memos, notes and instructions on the system so that they had to use it to find out what he wanted; ("... I have influenced its use.").

The respondent S17 had been issued with a similar range of systems as the previous respondent S16, ie a full set of mainframe-based facilities (items a through h) delivered via a pc. The pc facilities were not used at all. The respondent said that his use of the system was slight:

"... minimal. One or two hours per week at most. I know I should use it, but... if the right systems were there... I don't spend much time in the office." (S17)

In complete contrast to the previous respondent, this manager said that he used only certain financial data:

"Messaging is not useful. My secretary uses the messaging extensively - I tend to use it through her. The financial system is the most useful. The others aren't used." (S17)

It proved very difficult to get the respondent to relate any aspect of his use of the financial DSS to specific work tasks or roles. He did not agree that the system was irrelevant to him, but acceded that it was of "marginal use generally" and that it did not relate at all to strategic decision making.

The personnel director S18 had been issued with the full set of mainframe facilities (items a through g) delivered via a

terminal; he also had access to a personnel database (item b) through a separate terminal, and in addition he had a spreadsheet package on a separate pc (ie there were three separate hardware items in his office). The respondent said that he used the system for up to an hour each day. In contrast to both the previous respondents, his usage was largely confined to the pc spreadsheet facility, and access to the internal personnel database:

> "I don't use the DSS. It's too limited. The DSS is all financial. I want skills and headcount. When I refer to financial data, I don't need the interactive stuff - the monthly report will do. [The messaging facility] is very cumbersome; it's labour intensive getting data in. It's easier to tell my secretary [who uses it]. Personnel data I use a lot." (S18)

The respondent described his use of the spreadsheet package in terms of the evaluation of "manpower planning, and trends" and for departmental budgeting, using his own spreadsheets (ie he has developed the spreadsheet format himself using the software package facilities). He said specifically that the direct computer use was relevant to his job and gave brief instances. Firstly he used "what if" capabilities of the spreadsheet in order to revise aspects of the organizational manpower plan. Secondly, he used the outputs from the spreadsheet as communication documents, both with his own staff and with board colleagues. He specifically said that these uses were "supportive of decisions", and that the use was most effective for small, simple applications. In relation to strategic decision processes, the respondent said that the information from these sources had specifically influenced manpower decisions. Certainly, such decisions can be described as significant, in that they affect

the organization as a whole, are concerned with the future, and therefore meet our constraints as regards their "strategic" nature. The fact that this strategic influence has been achieved using the humble spreadsheet in preference to a highly sophisticated and broad-ranging decision support system is surely indicative of the extent of the mismatch between the intentions of these systems and the practicalities of managerial decision processes.

This respondent's circumstance is particularly significant as it appears to be the first reasonably clear-cut case of senior managerial computer use where the traditional informational and decisional roles appear to be directly addressed by the facilities in use, and where the use is not influenced by enactment of other role requirements resulting in "symbolic" usage of the computer facilities primarily as a means of influencing others. It might be argued that this director is operating at a lower level than some of his colleagues, in that he is directly manipulating data himself whereas his colleagues would use staff assistance for this particular purpose (see for examples the comments of S12, and also those of S19 later in this chapter). Nevertheless, the use is there and it seems necessary to enquire as to what the special circumstances are surrounding this case which have contributed to the special instance. Although a number of variables have been examined pertaining to previous computer use, training and education and so on, none of these shows any outstanding features which clearly explain his present behaviour.

However, reviewing the respondent's career background shows that he had occupied his present position for only four months at the time of the interview. Prior to this he was personnel manager (UK grouping only), and therefore operated at a lower managerial level and without the staff support to which he now presumably has access. It can therefore be conjectured that he has retained his working habits and direct information sources from his previous working environment, and perhaps will do so until he can establish the informational networks and staff support which his senior colleagues utilise. Further, it can perhaps be surmised that the nature of senior managerial work will force him eventually to adopt similar work patterns to his colleagues and his current levels of direct computer use may drop or cease altogether.

The UK board managing director S19 was presently transferring between two systems. He had been using a terminal linked to a mainframe which provided the full range of DSS facilities (a through g), but was currently using (or learning to use) a separate pc (also linked to a mainframe) which provided the common pc packages (spreadsheet, wordprocessor and database) together with the special telephony features. He estimated that his computer use was up to one hour per day and that this included time when he was doing other things; he also mentioned that he experimented with the facilities outside normal working hours.

It was not easy to directly elicit this respondent's computer usage in a concrete and specific way. He seemed determined to present a very optimistic picture of the value of the systems and

of computers generally (which is not altogether surprising considering his position, and see the comments by S12 about him in this respect) and it became difficult to establish concrete relations between his computer use and his work roles or tasks. However, he said that he accessed operational data from the databases and examined (but did not enter) messages on the messaging system. He ranked the usefulness to him of these systems as follows:

1 telephony facilities

2 operational information (daily/weekly cash receipts, order and inventory data, accounts ledgers)

3 messaging

He seemed to make no use of the general financial information included in the mainframe facilities a,c or d. He mentioned that he made no use of the wordprocessor or graphics facilities, and he had not yet used the spreadsheet (although he said he had tried to, but found a "learning problem" with respect to its use) nor had he written any Basic programs. The telephony features of the pc may have helped this manager to some extent in the mechanics of communicating with his internal and external contacts. The use of operational data is an interesting contrast to most other subjects who so far have not been at all interested in directly accessing raw operational data; certainly it is the first mention of anybody interested in stock and ledger data. This type of information is clearly oriented towards localised, short-term aspects of the organization's activities and it is perhaps unusual for a manager of this seniority to regularly access it directly. It is possible that his role as managing

director within a complex managerial hierarchy was as much operations-oriented as strategic, and so accessing this level of information was useful to him. On the other hand, as the comments about him by S12 indicate, there is a strong element of role enactment in his circumstances such that he was concerned particularly with transmitting strongly positive values and attitudes about computing (and also perhaps about himself as a computer user) both internally and externally.

As regards the use of his directly acquired information in strategic decision processes, the respondent said that his use of the systems did not relate at all to strategy:

> "I would expect others to provide generic strategic information for me. I could envisage a strategy meeting when data is pulled off a screen; but I doubt it... It involves preparing and circulating stuff in advance ... a meeting of minds. When I talk about strategy a group of us get together to discuss it. It's a question of management style perhaps. But that [computer-based interactive data] wouldn't be the key for me. DSS has no bearing or interest to the chairman of BCD!" (S19)

The last remark seemed to be a comment on the chairman's dictum regarding the use of the DSS for the top management of BCD.

The respondent S20 was the major direct computer user among the BCD respondents. He had the complete range of mainframe software (a through h) and pc (item a) facilities with the exception of telephony facilities, all delivered via a pc linked to a mainframe; there was a separate Prestel terminal. In addition to the systems listed earlier, he had access to division-specific information relating to computer mainframe engineering status. He said he used his systems (as a whole) for about an hour to an hour and a half each day, although he spent half his time out of

the office with customers and other contacts in the UK and abroad.

The respondent was asked in detail about his computer use, and it is worth examining his responses and comments in some detail with regard to each type of use. His use of the computer systems appears to address various aspects of his managerial roles, and it was not always clear as to which elements of his work roles were touched upon. In order to simplify the responses without imposing a possibly misleading framework, it is perhaps best to consider the respondent's computer use in terms of three general aspects:

1 communicating through the messaging system

2 monitoring of affairs

3 personal resource management

1 communicating through the messaging system

"The system is on all the time. It's mainly used for messaging; I tend to pull off the mail in the morning. Myself, I use the messaging daily - it's up all the time [displayed on the screen]. Mainly my own division staff. I use the [messaging system] most. Mail comes in all the time. Most of my system use is messaging."

[Why do you use it yourself rather than through your secretary?] "There's not always somebody there. ... because I've read the mail; and I can send a message there and then. I use my secretary for big updates." (S20)

2 monitoring of affairs

"I monitor the project data daily." (S20)

This refers to extensive manufacturing projects which are project-managed using computer-based PERT networks by his

subordinates; the respondent monitors the progress of the projects, as shown by the PERT data.

"I can see if any machine is down - how it's running and so on." (S20)

This last comment refers to the company's principal computer mainframes, which support all the internal systems and are used extensively in software and hardware product development and for other purposes. The respondent is ultimately responsible for their operation and accesses a special system which indicates their status. The respondent mentioned that he was was able to monitor his subordinates through this and other systems. (For example, he described how one of his people was claiming some kind of problem with a mainframe system; but with the aid of his monitoring of the subordinate's system activities, he was able to show that this was wrong). His monitoring activities seemed oriented primarily toward his subordinates and concrete aspects of job, as the following comments show:

"I only look at the internal stuff [ie the corporate databases on sales, personnel etc] when preparing corporate reviews - say weekly. I only look at the financial data monthly, prior to financial reviews. Then I tend to prefer paper reports. I look at these figures with somebody. It's no good looking at them in isolation without the explanation. There are bits of the personnel file which I use a lot - an extract [for his divisional subordinates] is on the pc." (S20)

3 personal resource management

"I keep `do lists' on the pc [using a dBase II software package], and a copy of who I've met [names and other details, so that he can refer to this when next he meets them]. I use the spreadsheet for personal expenses - I have a specific sheet for that. My secretary runs the diary management - for good reason." [ie so as to prevent multiple booking and misunderstandings] (S20)

The respondent made these comments about the most and least useful facilities:

"Messaging is of most use. Anything else somebody else could get. No, I don't use any financial modelling. I don't use the wordprocessor." (S20)

The corporate DSS (and its associated facilities) was generally discounted during his discussion of the facilities. Finally, he was asked what aspects of his work were directly facilitated by his use of the systems:

"None. If I'm honest. ...if you took the system away I would probably be more efficient! ...Because I wouldn't be playing with it. I could always ring somebody and find out." (S20)

He also offered other, role related reasons for his systems use:

"Of course I am hooked up to my own product... to see what my customers will make of it." (S20)

This reflects the "experimental" mode of use mentioned by other respondents. And:

"The best way of making my reports [subordinates] use it [the messaging system] is for me to use it." (S20)

As with some of his colleagues, (particularly S16) there was an evangelical approach to encouraging his subordinates to use direct systems. In this case, it appeared to be the promotion of company systems in an organizational rather than divisional context, because the messaging system appeared to be "owned" by S16's division.

However, in general he seemed to have successfully woven the computer systems into the fabric of his work roles, although his

comments would suggest that having done so does not yield any significant advantage - on the contrary, he specifically states that he would be "more efficient" without it! In other words he is paying a price, in terms of effort and time costs, which his colleagues are not prepared to pay. Nevertheless, he appears to be regularly and effectively utilising the systems to a far greater extent than other respondents, with the exception of S18. In the latter case, it was surmised that the respondent was carrying over information-gathering behaviours from a previous function. But no such considerations apply here, neither are there any obviously compelling reasons in his job content. Why then, does this respondent continue to make extensive use of direct computer systems, when there is no obvious advantage (and perhaps some disadvantage) in doing so?

This question cannot be dismissed lightly. In the context of the discontinuing respondents there were usually concrete factors which clearly mitigated strongly against their continuance, but it is difficult to ascribe equally concrete reasons why this respondent should behave in a completely antithetical manner.

It simply may not be possible to state with any certainty why this respondent should pay a high personal price in order to utilise direct computer systems whereas his senior managerial colleagues in similar circumstances do not. What can be said is that he made use of a computer at home as well as at work (linked to the organizational mainframe), and had been involved with computers in one way or another throughout most of his career. He therefore had developed extensive knowledge and experience,

particularly in the skills involved in microcomputer use, and that he maintained these skill levels by constant use and experimentation. It could be argued therefore, that the learning effort required in each adoption cycle was somewhat less than for his colleagues because of his well-developed skills, and therefore the effort and time disincentives were correspondingly less.

It would be wrong to discuss extensive direct computer usage without mentioning the personal satisfactions which can be gained from using computers. The allure which computers hold for some people has been discussed by several authors (see for example Smith 1980), and this fascination has been explained in terms of the considerable gratification obtained from intellectually wrestling with software structures, and the satisfaction of applying well-developed skills in a new context. Smith mentions the effects of positive reinforcement on the shaping of behaviour which can arise from intensive computer interaction, and the semi-compulsive activities which result in "hacking" (purposeless intellectual solution of software problems) or other inappropriate behaviours. Both S20 and S2 (from ABC) were described by systems-providing staff and colleagues as "computer freaks" (ie unusually intensive users) and their may be something of the "hacker" in their behaviour. An inkling of this was discernible in discussion with S20 (...if you took the system away I would probably be more efficient! ...Because I wouldn't be playing with it.[S20]). On the other hand it must be stressed that whatever predilections they may have had towards computers, both these managers were clearly highly successful men who had

risen to the top of their respective organizations and therefore any negative impact of their computer use (if any) must have been very slight.

Features of continuance

It is difficult to ascribe simple features to the circumstances of these five instances of continued senior-level computer use. Each respondent appeared to be unique in his circumstances and behaviours and especially in the choice of systems which he used, making it no simple task to generalise or draw conclusions regarding salient factors in their continuation.

As regards the latter point, the respondents' systems preferences in terms of commonly available features were as follows:

Table 6.6 System preferences in case 2

	Preferred system	Least preferred system	Amount of use
S16	messaging	financial DSS	slight
S17	financial DSS	messaging	slight
S18	spreadsheet	messaging, financial DSS	medium
S19	operational data	messaging, financial DSS	medium
S20	messaging	financial DSS	heavy

This table highlights the polarised preferences exhibited by the managers in respect of systems which were (in technical terms) the same. As has already been pointed out, usage patterns for each respondent showed a distinctive preference for the employment of one system in much greater proportion to all else. What is so curious is that two managers made considerable use of

messaging, whereas the other three derided this system and conversely, one manager (albeit a slight user) thought the financial DSS most relevant whereas none of the others made use of it. It is difficult (if not impossible) to explain these polarised and entirely contrary preferences, which co-existed in managers within the same organization, in terms of work tasks or managerial informational requirements.

These differences, together with the lack of clear informational advantage imply most strongly that the system preferences, and indeed the continued computer usage in general, were due to factors other than simple informational or decisional needs in the sense implied in the implicit objectives of the systems. In other words, the same mismatch between system intentions and efficient managerial behaviour which has been stressed in discontinuance action is still probably present in continuation, but these managers have found ways of at least partially overcoming the disadvantages (for example by utilising mainly one feature only), or have found other compensating rewards (perhaps from leadership or informational role enactment, or personal rewards from the intellectual challenge) from the continued use.

Key salient (but not always general) features of continued system usage can be summarised as follows:

1 polarised system usage patterns; given a broad choice of facilities, users will settle on one system which is used to the exclusion (or virtual exclusion) of all else, perhaps as a means of reducing learning and skill maintenance requirements (all respondents exhibited this pattern)

2 diversified system usage patterns; given a broad choice of facilities, users settled on systems preferences (and disliked systems) diametrically opposite to colleagues for no clear informational reason (S16 and S20 versus S17, S18, S19)

3 the successful interweaving of system use within the manager's present role set; eg messaging as a monitoring or communication medium (S16, S20), or the manipulation of personnel data on a spreadsheet for the communication of ideas (S18), or the monitoring of subordinate performance (S20)

4 lack of effective advantage; there was no clear evidence that system use conferred a distinct personal informational or decisional advantage to the user (all respondents; and specifically denied by heaviest user, S20)

5 enactment of the leadership role; the encouragement, direct or indirect, of others in the use of computers or specific computer systems (particularly S16 and S20)

6 expression of values; the dissemination of information, attitudes and values relating to the manager, his division or organization (perhaps all respondents, but particularly S19)

7 technology fascination; the gaining of purely intellectual rewards from exercising computer skills (S20)

8 atypical senior-managerial behaviour; a carry-over of direct information sourcing from lower management levels (S18)

9 Rejection of the organizational financial DSS as a strategic decision support resource (all respondents)

Summary of case 2

Examination of the materials in this case study has covered a considerable amount of ground and has provided insights into several areas of the adoption cycle. Firstly, an instance of non-adoption has been examined which appears to lack the features either of overt advocacy or leadership behaviour which mark adoption behaviour. Secondly, the adoption circumstances of nine respondents have been examined in detail and key features identified; these features confirm and extend the features found in case 1. Next, the discontinuance behaviour of four respondents has been discussed in some detail; again, features of this category both confirm and extend in an important way the results from the previous case.

Lastly, the circumstances of five continuing users have been analysed and several key features of their use in a managerial context discussed. Throughout the analysis, reference has been made to earlier discussions on the nature of senior managerial thought and behaviour, and attention has been drawn to characteristics of information use, decision behaviour and role requirements which throw light on the phenomena described. In order to clarify the separate stages of the findings which have been considered here, the diagrammatical form of the theoretical model introduced earlier has been extended to show the disposition of the findings within the adoption cycle.

References

Alter SL, Why Is Man-Computer Interaction Important for Decision Support Systems?, Interfaces, Vol 7 2 Feb, 1977

Docherty PHG, Some Mismatches Constraining User Choice in Systems Development, in Moshowitz A (Ed), Human Choice and Computers, Proc. 2cnd Int. Conf. on Human Choice and Computers, Baden, Austria, 1979, North Holland 1980

Mintzberg H, The Nature of Managerial Work, Harper & Row 1973

Rogers EM, Shoemaker FF, Communication of Innovations, The Free Press New York 1971

Smith HT, Human-Computer Communication, in Smith HT and Green TRG (Eds) Human Interaction with Computers, Academic Press 1980

Chapter 7

Senior Managers in the Public Sector: Case Analysis of Three Organizations

Abstract

This chapter examines evidence from three organizations in the public sector. As with the previous case studies, interview materials are used to develop and extend the picture of behavioural features of computer adoption and use. In particular, instances of initial rejection are compared with instances of adoption occurring in the same organization in order to identify salient features of rejection behaviours. The importance of organizational context is discussed with reference to the effect of organizational resource considerations on the nature of managers' roles.

Introduction

As with the previous chapter, information from the study of organizations is presented in the form of separate case studies. Here, three organizations from the private sector are analysed and used independently to develop ideas about features of the adoption process.

Case study 3 : The PHA Corporation

Background

The PHA authority is a largely autonomous public corporation which is responsible for running one of the country's ports. This organization employs over one thousand personnel and collects operating revenues amounting to #28m (from published accounts in 1984). The organization has been in existence for a number of years and has seen a long term decline in traditional trading volumes; however, recently there has been an upturn in business occasioned by oil exports and, in addition, the authority is attempting to establish revenues from new areas. The present position therefore is one in which healthy profits are being made and there is every hope for a steady growth in the future.

The port authority is managed by two boards. First there is the non-executive board which comprises representatives from local industry and government, and from the executive board, and which meets monthly. Secondly, there is the executive board which comprises the senior executive officers who are responsible for running the organization on a day-to-day basis and which constitutes the senior management team of the organization.

Respondents were drawn from the latter group. Out of the seven board members, five respondents were interviewed; of the two who were not seen, one had very recently joined the organization and was excluded from the survey for that reason and the other could not be contacted within a reasonable time. The respondents did not have an equable share of responsibilities; the chief executive seemed to have a large responsibility area (including multiple directorships of associated organizations) and, at the other extreme, the harbour master acted more like a middle manager and seemed more concerned with the day-to-day operational matters of his specific department. The other respondents seemed more equal in their responsibilities, ranking somewhere between the first two.

The authority had recently undertaken to computerize some of its administrative systems, and in addition, some of its top management team had adopted computers themselves. The systems which were available in the organization can be described as follows:

Computer systems in the organization

The organizational systems comprised three hardware elements. There was a central mainframe on which most of the principal management systems resided, separate micros which ran the harbour master's records and a private Prestel facility which was used for messaging and also for the display of ship arrival data. In detail, the systems were as follows:

Mainframe-based
Financial systems:
Accounts, wages, fixed assets. Budgetting. Management data.
Financial planning system: PROSPER (financial modelling package)
Budgetting and 5 year forecasting.
Tenant/lease and property inspection systems.
Messaging

Micro-based
Ship records (used mainly by harbourmaster)
Engineering stocks
Plant maintenance records, breakdowns, availability, planning
roster of dock labour
Wordprocessing

Prestel system
Closed system for port authorities - messaging related to IR problems and issues
Closed system for ship movement data - ships at anchor, ships coming in and leaving etc - (shown on screens around the building; this represented a subset of a more detailed operational system carried on the harbour office micros)

Senior managerial computer use

At the time of the interviews three senior managers were utilising computers directly and two were not, as shown in table 7.1 below.

Table 7.1 Senior managers and computer use categories - case 3

	Respondent	Use category
S31	Chief Executive	User (heavy)
S32	Personnel Director	User (slight)
S33	Harbourmaster	User (medium)
S34	Finance Director	Non-user (non-adopted)
S35	Company secretary	Non-user (non-adopted)

What is particularly interesting here is firstly that the chief executive himself was the major direct senior managerial computer user in the organization, and secondly that two of the management

team had not adopted computing. The latter circumstance is unusual because in the last two cases, for example, managers had usually at least experimented with a system before discontinuing their use; whereas here we have two instances where senior managers have not adopted at all, despite the fact that their board-level colleagues have done so. The question which naturally arises as to what are the special circumstances which mitigate in favour of adoption by three of the board, and non-adoption by the others.

In terms of our model of computer adoption and in line with the two previous cases it would make sense to analyse materials in terms of non-adoption, factors in adoption, and so on. However, it is thought that in view of the special part which the Chief Executive (S31) played in the adoption processes that it would make more sense to begin with him and discuss the others, as individuals, in the light of that analysis.

Features in adoption

It became clear after talking to the chief executive S31 (and this was confirmed by his colleagues) that he was the principal driving force behind the introduction of computing into the organization, both in terms of the organizational systems and the senior managerial computer use. Something of the flavour of the organization's computing image can be had from the fact that within the main offices reception area was a computer monitor mounted so that it could be seen by (and only by) visitors passing in and out or waiting for attention; the monitor showed,

in colour, information on ship movements and was updated after every few minutes in a way reminiscent of an aircraft departure monitor at an airport.

Inside the chief executive's office there were three separate computer terminals surrounding the desk; the impression of "high-tech" was heightened by the presence on the walls of large photo-pictures of aircraft cockpits (showing the multitude of dials and switches). There were a number of elements of the chief executive's computer adoption:

"I find it fascinating; I like technology! ...It's great fun!" (S31)

Clearly he revelled in the technological aspects of computing, and this showed in the delight with which he discussed and displayed the various systems during the interview. Another element of his personal involvement was described by one of his colleagues:

"He (S31) was a [large company] sales director and this has made him aware that he needs to be different; to stand out from the crowd. So the technology is a way of being different." (S35)

A similar comment was made by another colleague. But the image-building element was not confined to the man himself; on the contrary, important messages are conveyed both internally and externally about the organization:

"... he (S31) perceives the need to make sure the company is seen to be in the forefront, by customers and other ports and outside organizations generally. Also, the need to motivate staff, so they can see they are in a technologically aware company." (S35)

Here the respondent has described an important aspect of the

chief executive's leadership role; the requirement to promulgate desirable values and attitudes about the organization (and also about himself) inside and outside the organization. This was echoed by the chief executive's own comments relating to his "crusading" activities which he was now taking outside the organization:

> "Now, I want to persuade other ports to come into a communications system... I'm on the national committee - I'm advocating these things..." (S31)

In general, therefore, there are two or three different aspects of the adoption behaviour. Firstly, there is the leadership requirement which is a clear element of the adoption. This manifests itself in the way the respondent seeks to influence others, inside and outside the organization. This element has of course been noted in previous cases; what is different here is that the respondent has personally initiated, and driven through, the computerisation within the organization - in previous cases senior level respondents had approved of, and acquiesced in computerisation at lower levels but did not seem to have driven it personally.

Secondly, there is the personal fascination with technology; this was seen as something rather different from the "hacking" behaviour of respondents S2 and S20 from previous cases; here, the respondent did not display the detailed knowledge and expertise of these latter users and seemed perhaps more interested in what the technology represented rather than in exercising technical skills. For example, in demonstrating some of the systems to the researcher the respondent could not make

many of them work and had to call for assistance; also in discussing the systems he did not display anything like the depth of detailed, specific technical knowledge shown by S2 or S20. Finally, it can be mentioned that the respondent had a powerful, ebullient and dominating personality (indeed, the researcher's control over the interview situation was somewhat limited in this instance).

Turning now to the personnel director (S32), we have a somewhat different picture. The respondent had two screens at his desk side, and was asked about the circumstances of his adoption:

"I decided the personnel dept should be computerised. I forced it upon my deputy... my number two was not enamoured at first. It was a joint decision; three [directors]... Personnel would have their own programs and 5 terminals." (S32)

Here, the respondent is referring directly to his leadership role in ensuring the implementation of computing in his own department. When asked why he himself personally had terminals at his desk, he replied as follows:

"To appreciate the difficulties - to see what's going on. And to get the data myself. The people who I could ask might be out. Everybody should be able to use one... In five years time, there will be one on every desk." (S32)

There are three elements here: the leadership requirement, the need for a specific data resource (one of the few times this has been mentioned) and a very interesting comment about the need to "keep up" with technology.

This latter point represents a thread which may well be present in many senior managers' adoption patterns - ie a fear of being left behind in the technological race, of being without the

necessary skills or knowledge essential for success or even survival in a competitive management arena. There is no doubt that some members of the computing world deliberately play on such fears, and this can be seen especially in press advertisements which emphasise both youthful imagery and also imply the dangers of failing to keep up: "You can't win tomorrows' business battles with yesterday's office technology" is an example from a management journal (Management Today, March 1986 pii). Government pronouncements at various times also seem to emphasise this aspect; for example, a recent television programme on computing highlighted a government minister's statements to the effect that all children must be "computer literate" or, (so it was strongly implied) they would be unable to get jobs.

Bearing in mind the strong advocacy (and powerful personality) of the chief executive (S31), the personnel director was asked if he had been influenced at all by him. He said that he had not (and his comments above indicate his own decision to implement computing). However, another respondent (S35) described how he had been present when the chief executive had specifically ordered the personnel director to use the computer. Whatever the strength and importance of the various influences and factors affecting the personnel director's computer adoption, there seems little doubt that the direct and powerful advocacy of the chief executive will have played an important part.

Unlike virtually all other respondents in this and other cases, the respondent did not display overtly positive attitudes about

computers; indeed, he did not seem to enjoy the discussion about computers, or his own use of them:

> "I have no personal knowledge of computers; no time for one thing. It's too late in life - I'm retiring in 18 months time! Maybe I don't have the capacity - my brain is not as sharp as it was for something new. I have too many other things of more importance! My priority is to make [PHA] pay!! Other people have greater facility and are paid less." (S32)

Yet despite this, he had the two screens by his desk and used them daily. There seemed to be something of a contradiction among some of the respondent's statements, and also between his stated attitudes and actual behaviour. In fact, this latter phenomenon has been discussed by Rogers and Shoemaker (1971), and somebody in this position has been referred to by them as a "dissonant adopter"; ie there is a discrepancy between the person's attitudes and the overt behaviour required by the organization. In this instance it may be conjectured that S32 could not directly escape the dilemma occasioned by the requirement to comply with S31 against his wishes, either by repudiating S31 or by changing his attitudes and therefore he had decided to live with the discomfort occasioned by the dissonance until his retirement. Interestingly, many of the respondents in previous cases were "dissonant rejectors" in the sense that they had discontinued their use while still maintaining strongly positive attitudes towards computing.

The last respondent to have adopted computing was the harbourmaster (S33). In a manner similar to the last respondent, S33 was primarily concerned about implementing computer systems in his own department. He saw this as a means to replace inefficient card systems and to improve efficiency generally; in

particular, he was aware of specific limitations of the card records and could think of ways in which the computer would give better detailed information and enable better control over the day to day affairs of his office. (Although he said that these benefits had not been entirely realised in practice).

However, when asked why he himself was using a computer (he had two screens by his desk), the answers were not entirely clear or straightforward:

> "Because my staff have their own terminals... I'd have to interrupt them. With cards, I could go and look, but now... I'd have to stop him and look at his screen. We originally planned for me not to have one; but I wanted one... because it took three times as long... because of my interference of others." (S33)

In fact the specific occurrences which he described related to ship movements which happened perhaps three or four times per week; so the rationale for his own personal systems adoption and use in the first instance is by no means clear. Of course, it is possible to speculate on the effect of the powerful advocacy of S31 which may have been a factor, or the leadership requirement which is common in many other cases. According to S35, the chief executive had influenced S33 as well as S32:

> "[The chief executive] told [S32 and S33] to have one!" (S35)

Also, S35 perceived that the harbour master was making a statement about himself in his personal computer use:

> "[S33]'s system is useful, but to have it on his desk is a status symbol - a switched-on harbour-master! [S33] was not influenced so much by [the chief executive]" (S35)

A generalised list of the characteristics of the adoption patterns in this case can be summarised as follows:

1 High level advocacy; the chief executive was clearly a powerful advocate and had directly influenced other adopters, particularly S32.

2 Leadership role enactment; all the adopting respondents were initiating and encouraging computer use within their spheres of influence, and this was seen as a primary adoption consideration

3 Information role; the chief executive particularly was concerned to make certain statements about the organization's technological position, and about himself, both inside and outside the organization

4 Technological fascination; the chief executive's fascination for new technology (almost for its own sake) was quite apparent and acknowledged both by himself and his colleagues

5 Need for technological involvement; a requirement for the individual manager to feel that he is up to date with current technology, and will not be left behind with the wrong skills (expressed perhaps by S32)

Features of non-adoption

As was mentioned at the beginning of this case study, the fact that there were two senior managers who had not adopted the computer technology is particularly interesting in this instance,

because it is possible to directly compare the circumstances under which the non-adoption decisions were taken with those of respondents who had adopted the technology.

The finance director S34 had theoretically available to him the complete range of organizational systems described earlier, amongst which were a significant number of financial systems. His departmental finance staff were significant users of the computer systems; in addition, the computer department was his responsibility and the data processing manager reported directly to him. In other words there were strong leadership role requirement reasons for him to adopt computing himself; many other senior managers in similar circumstances have done so, as we have seen in previous cases. In addition there was the powerful advocacy of S31 which had undoubtedly influenced S32. In general, therefore, it seemed that there was as much if not more reason for the financial director to adopt direct computing than there was for anybody else. Yet this senior manager had not attempted direct computer use. Neither, interestingly, did he receive computer printouts himself. Nor did he intend to explore the possibilities of direct use at some future time. When asked why he did not have a computer terminal, he replied as follows:

"I made sure I didn't get one! I have seen them working [ie computer terminals]; I can get the same data a lot quicker by picking up the phone and speaking to the right person. Also I can get at the information behind the figures - my management accountant will know or will find out why a figure is big or whatever. It's a luxury I can manage without..." (S34)

When asked about specific systems which seemed "obviously" relevant to him, he said:

[About the formal financial modelling system]

"In fact the Prosper summary that [S31] sees [on his screen] is a waste of time because he has to ring somebody (like me) to get behind the figures anyway!" (S34)

[About what-if financial spreadsheet modelling]

"Yes. But it's quicker to to ask my management accountant, who is familiar with the system... I think you need to be doing it regularly. He is familiar; he has done the programming..."

[About the other financial management information]

"I may be missing out on the interesting parts of accounting... but I'm not failing to provide proper information or service, because the management accountant does it. I question the value I would get out of a system." (S34)

The respondent was asked if he felt that the personal learning costs involved in his use outweighed the rewards he might get:

"It's very simple these days isn't it? No problem... I know I'm very slow on the keyboard...." (S34)

This is undoubtedly unrealistic, and it perhaps contradicts his earlier remark about the accountant being familiar with the system; but the point here is that this factor is not necessarily what has put him off. The respondent was then asked directly why it was that S31 and S32 used their computers whereas he did not. Although he was loath to say anything which was directly critical of S31, it had become clear from earlier remarks that he felt that some of the systems used by the chief executive were not strictly necessary (for example his comment on the Prosper modelling system, and his reference to the "luxury" of direct systems employed at PHA generally). His explanation of the personnel director's use was that the latter has a specific operational requirement for his system:

"[S32] gets straight data that is not published elsewhere - so he has to use it." (S34)

This comment is partially correct, in that after the personnel records had been computerized, perhaps the quickest (but by no means the only) way for the personnel director to examine individual records was for him to access the file from a terminal; however, the financial computer systems also contained much data which was not published elsewhere, too, but this had not forced the financial director turn to use these systems in the same way.

In general, the view can be taken that the financial director had formed an opinion about direct computing to the effect that it would not improve his personal efficiency or effectiveness in any way and that he would continue to satisfy his information needs from his present sources. It would seem that he did not feel the need to "lead from the front" as regards his departmental staff; neither presumably did he feel that it was necessary for him to use a computer in order to make a statement about the organization's technological stand. He had decided, therefore, not to adopt any direct computer systems; unlike the personal director, however, he seems to have been able to resist any pressures applied by the chief executive. That such pressures were applied directly can only be conjectured (the respondent sidestepped questions put to him on this issue); but a comment by S32 indicates that such pressures were probably present:

"The finance man should have one, but doesn't!" (S32)

And a similar point was made by S35. The comment seems only reasonable; as has been already pointed out, the financial director had more reason than anybody to adopt computing himself. It might be mentioned here that during interview the respondent showed himself to possess both considerable interpersonal skills and force of character, such that it was quite easy to imagine that he had sidestepped any pressure applied personally by the chief executive.

The second instance of non-adoption concerned the company secretary, S35. As with the previous respondent he had theoretically available to him all the company systems, and again, some of these systems - although a small part - were specifically relevant to his own function, (tenant/lease and property inspection systems). His staff of four secretaries made extensive use of wordprocessors for leases and other legal documentation. However, he explained that direct systems (however useful they might be in his department) were not relevant to him personally:

"It wouldn't be cost effective; I can't imagine it in the present state of the art. I use law reports; if they were on computer, great, but at present it wouldn't be cost effective. Maybe legal document storage [currently held on microfiche] on computer; that would be very attractive. Maybe in 5-10 years time it will be done." (S35)

The respondent was asked about specific systems which might be of use to him:

"Messaging? Might be nice - but not very exciting or important... I would want to be sure that my messages were properly retained... [Spreadsheets?] Might be nice in some circumstances... At the moment I ring my management accountant... If I was an accountant and numerate... But why have an accountant? [ie why have a dog and bark yourself?]" (S35)

In other words he perceives the available systems to be not relevant to him personally in the specific context of his own real work tasks and roles. He already possesses adequate and convenient information sources and sees no reason to do detailed work himself.

He made the following point about the "negotiator" aspect of his role (Mintzberg 1973) which had particular application to relations with people and organizations both inside and outside the port authority:

"Most of my work involves negotiation and bluff..." (S35)

In other words the essence of his work tasks are largely unrelated to most of the information contained within the organization's present systems. Similar points have been made by a number of discontinuing managers in previous cases. The respondent went on to say:

"I've avoided hands on use... not because I'm reluctant, but because I don't want to waste time with things that others could do with less cost. I could spend a lot of time keying in data... I don't want to twiddle knobs myself... I want the information. Computing is good when it makes for efficiency - like word processing - but I'm sceptical about the Prestel ship data - this is gimmickry!" (S35)

The respondent perceives that using a computer himself would be an inappropriate use of his time and effort. Also, he does not seem to have the leadership requirement in the shape of sizeable staff responsibilities which might influence his adoption. Whether he came under pressure to adopt from the chief executive and resisted it, or whether no such pressure was applied could

not be ascertained.

A summary of the non-adoption characteristics of these last two respondents is by no means easy. On the one hand there is the financial director, S34, who had as much reason as anybody to adopt computing personally as any of his colleagues, including his own departmental leadership requirements as well as the top-level advocacy of the chief executive, but appeared to have successfully resisted taking part in what appeared to him to be a time wasting exercise. The latter respondent, S35, on the other hand, had less reason for adoption because he had less departmental requirement for the main organizational systems and seems also to have resisted adoption because he perceived that the systems available would not help in making him more "efficient".

Salient features of the non-adoption patterns can be described as follows:

1 Successful resistance to high-level advocacy pressures (S34)

2 Perception of the available systems as failing to offer a better alternative information source than present (human expert) sources (S34 and S35)

3 Perception of available systems as not directly relevant to respondent's real tasks or roles (S34 and S35)

4 Perception that using the systems would be time and effort wasting (S34 and S35)

It is interesting to compare these features with those of

discontinuing users; the perceptions of the non-adopters (who in this case had had no prior experience of direct computer use) seemed remarkably similar to those of the discontinuers who had of course gained practical experience.

Systems implementation

In the two previous cases, systems had been issued to the senior managers which were intended specifically for their own personal use (albeit, in the ABC case some of these were originally designed for other purposes and in the BCD case were intended for external marketing). In this case however, things were rather different. Here, systems had been developed largely on a departmental basis to serve operational and management needs, and the senior managerial use was an extension of this departmental activity. For example, the personnel records had been computerised in order to improve departmental efficiency, and the personnel director accessed these same records. Similarly, the harbourmaster accessed systems which had been devised to serve the functional requirements of his office. The chief executive accessed all of the organization's systems, none of which seemed to have any special features applicable to his own role.

Given this important proviso about the nature of the systems, all three computer senior managerial users appeared to have made some inputs into system choice processes. These inputs seemed mainly confined however, to initiating, monitoring and approving activities at various points in the systems development process. The chief executive for example had been especially involved in

initiating computer developments in the organization, and had involved himself in matters such as equipment choice:

"We discussed, but I chose; I know the ropes. I chose [an equipment manufacturer] primarily because... (S31)

In general, though, it appeared that he knew little about the systems in detail and although he had initiated development he had stood back from detailed design decisions.

The personnel director's specific involvement in choice and design considerations was not altogether clear; his departmental systems had been designed by the computer department in conjunction with his own staff, but his personal role seemed to have been one of approving these choices:

"It was a joint decision; three senior officers... The computer department is under finance; I gave them a list of priorities 2 years ago... We designed it. We planned it. I went through it and approved it." (S32)

The harbour master said he had little involvement in detailed design considerations, although he initiated, monitored and approved system choices. There had been in the organization a "management trainee", who had been undertaken the detailed systems and technical work. He was spoken of with great respect by the respondent; it seemed that the management trainee had advocated various systems and had achieved their design and implementation with great skill.

"Not me; it was [the management trainee] who chose, because he knew the system. He [the management trainee] did the details [designed the system]; I specified which systems to be tackled." (S33)

Systems in use

Three of the respondents were making direct use of computers at the time of the interviews. The nature of the chief executive's crusading computer adoption has already been discussed; what is of interest now is the manner in which the systems were utilised. He had three terminals close to his desk, two giving him access theoretically to all of the organization's systems and the third being a specialised device with telephony features and a diary system. Despite his obvious delight in the technology, he seemed curiously inexpert in the detailed use of some of the systems (compared to respondents from other cases, like S20 for example). He had an assistant who was called in at various times during the interview to clear up some technical point, or to help make a system work. It appeared that this assistant helped the respondent considerably with his own computer use, performing tasks such as reading the manuals ("I found them difficult") for him and showing him how to use the systems.

Although he enthusiastically described the attributes of various systems, and attempted (often unsuccessfully) to put some of them through their paces, it often proved rather difficult to elicit precisely the way in which these systems related to his real work tasks or roles. Three concrete examples only were given: where he used the financial budgetry system when personally authorising capital expenditure over a fixed amount, use of the personnel record system for accessing an individual's records and the messaging system for messages from home (ie to his wife) and with the harbour master.

This is not to say that the respondent did not have other uses of the systems, but rather that it was difficult to elicit these uses in conversation with him. In general however, it is hard to resist the impression that the important aspects of his computer use related primarily to his leadership role and the transmission of certain values and attitudes regarding the organization and himself, and hardly at all to significant informational or decisional aspects of his work. His personal fascination for "technology" has already been discussed and needs little further elaboration; of his work. His personal fascination for "technology" has already been discussed and needs little further elaboration; a comment from S32 seems to sum it up:

"He likes it! It's new... it's different... He is the chief executive so he can do the things he likes doing!" (S32)

The personnel director himself was a slight user (up to 15 minutes per day); he had two screens which gave him access to all the organizational systems and to the Prestel shipping and messaging systems. As regards the Prestel system, the respondent showed how he received messages from other port organizations regarding meetings and other information; it was understood that in its present form this system represented little more than an electronic newsletter to port authorities and other interested parties. Of the organizational systems he made most use by far of the personnel information (indeed he seemed to have forgotten how to use the financial systems so it can be assumed that this aspect was rarely used).

He seemed to use the terminal in exactly the same way as he would use a personnel record card file: when he wanted data on an

individual he would display it on the screen. The personnel record data had details of 1100 employees, with very full details including absences, pay, strikes and so on. He mentioned that the personnel record system had only three years of back data on it (as opposed to seventeen years on the previous cardex system) and that this was a drawback.

He described his direct personnel system use particularly in the context of absenteeism - a subject that was apparently of prime importance to him, and in which he took a great interest. The use seemed most often to arise when he had been triggered into action by some internal report about personnel absence; he would then look up an individual's personnel details to get background information. He described this activity mainly in terms of keeping middle managers on their toes (ie a monitoring function). He also described the system use in terms of his personal handling of difficult (exceptional) cases, ie he used the terminal to display information to people as he was talking to them, and gave examples of this occurring in a discussion with a middle manager and also in a discussion with an employee whose own absence record he was examining.

In general, therefore, he seems to be using the personnel record system as a direct replacement of the previous record cards (which had been replaced by the computer system). In fact the system did not appear to have any functions which would not be found in a paper filing system. The respondent was asked whether he thought the system facilitated his job in any way (in comparison with the old card system):

"I can get information quicker. We have now equalised the card system; it's now equivalent to the card system. The girls say it's quicker than cards. [For you?] Well, we operated for 15 years without it!! But in due course we will be more efficient, possibly." (S33)

However, later on in the interview, the respondent gave a different view about the computerised personnel records, whereby he felt he was worse off - particularly as regards the fact that the computerised records only went back three years. Some of these contradiction may well reflect the respondent's rather ambivalent attitude towards the computer systems, as described earlier.

In general, therefore we have a continuing computer user who has successfully incorporated a direct computer system into his present work tasks; his direct computer use as described forms a part in his activities in monitoring, communicating and negotiating with others. This successful use seems to be undertaken at a cost, however, because the respondent feels that to some extent he would be better off with a manual card system. Reference has already been made to the idea that the respondent was a "dissonant adopter", and it is possible to describe him as a "dissonant continuer" as well, because it seems only too likely that he would discontinue his use if it were not for the fact that there was no ready alternative to the computerised personnel system and if it were not for other implicit pressures arising from the chief executive.

The harbour master used his systems for up to an hour each day, making him a moderate user. He had two terminals close to his desk, one of which was the Prestel system with shipping data and

messaging described earlier. The other was a specialised microcomputer system which carried shipping systems specific to the harbour office. Unlike the other respondents, the harbour master had no access to the main organizational systems which were held on the mainframe. The respondent made no use of the Prestel ship data which he described as "just a bloody gimmick".

As regards the direct access systems on the specialised micro, these included operational data on ships in much greater detail than that carried on the Prestel system; this data was purpose-designed for the harbour office and represented a development (and replacement of) earlier card records and systems. As has already been mentioned, the respondent had played a significant part in initiating and implementing computer systems within his own department; the data contained within the systems was largely operations oriented, and was utilised extensively by his staff. Although the precise relation between his systems use and work roles was not entirely clear, he did describe specific monitoring activities which he carried out using the systems. A specific use of the on-line system was acceptance of a ship into harbour; and he would access the on-line system at this time:

> "I use it to find out what ships are in - what ships are coming in. I look to see if there are conflicts of interest. I look to see if there are delays caused by some reason - which would cause heavy costs for the ship owner. These things have to be continually monitored." (S33)

In discussing his direct system use, the respondent made some very interesting comments about the nature of interactive computing. Firstly, he mentioned drawbacks associated with the lost benefits of a visual colour-coded card system - with the old

system he could see the "shape" of the situation at a glance, whereas he now has to assemble information mentally before arriving at this same conceptual picture of affairs.

Secondly, he described a particular dysfunctional effect on social relationships which he believed was occasioned by computer use. For example, he said that he spent less time talking through things with his staff; they too are sitting in front of their terminals and he has to make a conscious effort to communicate. In general he described the social isolation which was caused by not having the requirement to go and communicate personally with other people for information; now, he had to make a special effort in order to avoid isolation and non-communication. He described a loss of effective communication through the verbal medium, occasioned by both himself and his subordinates being tied to their screens. He saw the dysfunctional effect in terms both of himself and his staff. The isolating effect described here must be a very real hazard for medium or heavy users, but rather surprisingly no one else has mentioned this problem.

The general characteristics of continued computer use in this case can be summarised as:

1 Leadership role behaviour; the chief executive's computer use was closely connected with his initiation and advocacy of organizational computer systems, and both S32 and S33 showed similar role enactment in respect of their own departments. All three respondents seemed to being making statements about themselves through their computer use, although this seemed to be especially true of S31.

2 Successful incorporation of direct computer systems into present work tasks and roles; both S32 and S33 had interwoven the computer use into some specific aspect of their work tasks. S31 could point to only very minor aspects of his work. All three respondents described specific system use which was effectively a direct replacement of identical functions hitherto performed on manual systems.

3 Polarised system use; both S32 and S33 referred mainly to one specific system (although S32 particularly had a range of systems at his disposal). S31 showed no particular polarisation, but then his overall system use seemed much less expert. None of the respondents appeared to make any direct personal use of the financial planning or modelling facilities.

4 Atypical senior managerial behaviour; both S32 and S33 (but especially the latter) referred to operational (and local departmental) work tasks in the context of computer use which were more characteristic of middle management roles. None of the systems used in this case appeared to have been created specially for management information per se, but rather they were operational systems which the manager used in their daily departmental work.

5 Lack of distinct effective advantage; there was a lack of clear evidence that system use conferred any distinct personal advantage in informational or decisional terms on the user (S31, S32 and S33).

6 Disadvantages of system use; S32 viewed the computer system as

less effective (for him) than the previous manual system; S33 pointed out distinct and specific dysfunctional consequences attendant upon his computer use.

7 Technology fascination; this was displayed by S31 to an almost exaggerated degree, but not by the other respondents.

Summary for case 3

As in previous cases the salient features of each stage in the adoption cycle have been identified and discussed. The case materials largely confirm and extend the picture of senior managerial computer adoption developed in previous cases; in particular, instances of rejection occurring alongside adoption have been examined in detail and our understanding of these processes extended. Although the structure of the emerging adoption model has not been altered, the materials reviewed here have added to and confirmed the nature of the overall adoption cycle.

Case 4 : ACC County Council

Background

ACC county council is a large organization by any standards, with over 20,000 direct employees and handling revenue expenditures in excess of #300m per year. Unlike previous organizations, the county council is linked directly to political affairs at local, regional and national levels and the reconciliation of various facets of multiple and conflicting objectives and requirements was a significant part of the strategic decision process as described by its senior managers. This aspect of local authority management, and the new pressures which changing circumstances have brought for senior officers, are discussed at length by Laffin and Young (1985).

At the top of the council organization is a group of senior officers who control major segments of council affairs and who discuss and agree policy matters. Apart from the overtly political character of their environment, respondents described their key tasks and role requirements in terms which largely matched the top managerial tasks described by respondents in commercial environments. One senior officer had been designated chief executive, but owing to some internal wrangle this title had been abandoned in favour of a less emotive term; nevertheless, he was the acknowledged leader, and this more descriptive title will be used here. Out of the six senior officers who headed the various council functions, it was only possible to see four respondents, the other two being unobtainable within a reasonable timescale.

Computing had been long established within the organization, and in fact the head of the computing services division was of chief officer status and was one of the respondents interviewed. Of particular interest here was the fact that some of the senior officers had commenced, or were about to commence a trial of direct use facilities. In previous cases, respondents had already passed through various stages of the adoption cycle. Here, it was found that the trial had just commenced and three of the respondents were currently at interesting points in the cycle. The trial was a co-ordinated affair for the four senior managers who were taking part (only three of these were interviewed); however, the objectives of the trial were stated differently by each respondent. The positions of the respondents at the time of the interviews are shown in table 7.2 as follows:

Table 7.2 Senior managers and computer use categories - case 4

	Respondent	Computer use category
S41	Chief executive	adopted; mid-trial
S42	Director of social services	adopted; pre-trial
S43	Dep. Director of education	adopted; pre-trial
S44	Director of Mgt. Services	non-adopted

In fact S41 and S43 had computer terminals at their desks, and S42 expected to receive his within a few days.

Non-adoption

The director of management services was directly responsible for

the extensive computing organization (which served other regions and districts as well as the council's requirements). He was not taking part in the present trial of direct computing facilities, neither did he have any direct facilities from any other source.

"I couldn't see the need to have one personally... but it's indispensable for my secretary." (S44)

His personal non-adoption may seem curious in the light of adoption patterns described earlier, particularly with regard to his leadership requirements. However, it became apparent that there may have been other reasons for his disinclination. It was established from the other respondents that in fact this senior officer trial was being organised by a separate department (planning and research) and the main computer department had been sidestepped. That neither he nor his department was involved in what was clearly a high-profile and prestigious project may have been something of a disappointment to the computer director. The respondent's distaste for the project showed in some of his comments about the facilities in the trial:

"... there are degrees of user-friendliness, degrees of hype... also the bullshit about how easy they are to use. We don't really have anything they will find useful... they aren't prepared to spend the money." (S44)

(Where "they" are his senior officer colleagues). The respondent indicated that he felt that the present trial, or pilot study was "not significant", except that it might make the senior managers involved more likely to listen to him because it would improve their understanding:

"... take for example sub-second response; none of them will believe how important this is..." (S44)

Here, he explained that the other senior officers would not let him upgrade his computer equipment to achieve this performance level, because they did not understand the importance of it and therefore would not listen to him. He hoped that the trial would show them that he was right about this and other matters. Finally, he asserted that the reason for the trial was to promote the interests of the present organizational computerisation programme (executed by his department), which he felt spearheaded, or at least facilitated, organizational change and progress.

> "We are doing this pilot scheme in order to promote the interests of the scheme... [whereby it is possible to achieve] ... changes in structure and working habits." (S44)

In fact, his non-involvement in the senior officer trial either as participant or as protagonist may turn out to be fortunate. Insights developed in this thesis so far enable us to predict with some confidence that the trial will be a failure, in the sense that it is most unlikely that the senior officers will find sufficient benefit from the system to continue their personal computer use. Thus this respondent will avoid not only some wasted personal effort but also the opprobrium attendant upon project failure. Whether he was aware of this or not was not clear.

Features of adoption

The initiator of the trial appears to have been a middle- to senior- ranking manager of a staff function, referred to here as

P11. Unfortunately, it was not possible to interview him directly. Interesting comments on the nature of the implementation are provided by the chief executive under the "discontinuance" heading.

The chief executive, who had a computer terminal beside his desk, gave the following reasons for his own personal involvement in the trial:

"It's being tried on the senior officers who are least computer literate. That we'd got it and needed to see if it worked... To see what the package is worth. I'm a guinea pig. It will encourage others." (S41)

[to help you personally?] "That's not really an objective in a very strong form." (S41)

These comments show the leadership requirement and the "experimental" aspects already observed in previous cases. Another purpose of the trial was described by the director of social services, who had not yet received his terminal:

"The middle manager computer man [P11] wanted us senior officers to understand as much as possible... That person wanted to bring computers into my consciousness - to let me know what the potential was." (S42)

He also described his own wish to find out about computing in respect of his leadership role:

"The knowledge that we were installing a system into the department - and my naive desire to be master of the whole thing. I want to see if it works or not. It may be useful." (S42)

Finally, he was asked if there was any pressure on him to adopt:

"Yes, there is subtle pressure - people who are involved do try and involve people... " (S42)

However, there appeared to be more than a little ambivalence in his attitude towards the forthcoming trial. In particular he seemed to resent the chief executive's influence, and finally he expressed some distaste towards the project:

"My stance is that it's vital... [that the organization takes full benefit of computing]... But I have a very difficult organization to manage - and I have staff to look at the computer stuff." (S42)

[So why are you taking part?]

"I will get one imposed upon me!! The [chief executive] has asked if we can benefit from... He's been got at by [the computer director] who is trying to convert us!" (S42)

In other words, the respondent appeared to be acquiescing in the trial in order to avoid any direct confrontation with the chief executive who had been advocating adoption. In this respect he appeared to be a "dissonant adopter", rather like S32 from PHA. (The respondent was wrong in assuming that the computer director (S44) had initiated the trial; the main protagonist was P11).

The last respondent, S43, had a terminal on his desk but had not yet started to use it. His reasons for adoption were as follows:

"I'm in on it because my boss is not interested and you can't have education not involved... [S44] and [P11] know about computing but we don't so we agreed that we should have personal experience of it. So that we will appreciate what to do with it... So it's got an educational purpose to begin with. But I will use it operationally when I get familiar with it." (S43)

Because they had not yet started to use their equipment, both the latter respondents were asked what they thought the direct computer system would do for them, and the ways in which it would help them in their jobs. Neither respondent was entirely clear about this and required some prompting about the nature of the

systems; but both seemed enthusiastic about certain benefits:

"It may be useful... it has great potential. I've not given it a lot of thought, but say finance data that I can monitor... [messaging?]... I'd be happy to do it if it's possible. I'd like to see trends... For the speed and convenience of it." (S42)

"It's convenience - it will be as easy for me to punch in a request as ring up a clerk. It will really eliminate paper. I will use it for accessing individual personal data files. I want to be able to aggregate data myself for analysis purposes... for operational planning. I'd want to know, for example, how many middle managers are retiring next year... For the one off ad hoc enquiries. In order to answer ad hoc questions from others... from members of council... from people who are important enough not to be put off to underlings! Central government - MPs and so on... [messaging?] I don't know, quite honestly." (S43)

In the light of what senior managerial respondents in previous cases have had to say about the real value of their systems in terms of their real work roles and tasks, these views seem unrealistic to say the least. Additionally, both respondents were asked about the nature of the learning effort which they thought they might have to make:

"It will be a problem of finding the time and the will to master it. As long as I can take time out of the working day... [ie the respondent expressed resentment at his involvement, and did not wish to work on it in his own time] These things evolve... maybe ten hours - maybe four afternoons at the most required. Of course, I will have a personal teacher who will plug me right in quickly... So I expect to be plugged in very quickly." (S42)

"I'm waiting to be shown how to use it; I've no idea... maybe an afternoon of being shown. I doubt I'll use it half an hour per day." (S43)

Both respondents, but particularly the latter, had unrealistic views about the amount of learning required and about the amount of effort needed to access and utilise direct computer information. The disenchantment effect which this is likely to induce was expressed strongly by the chief executive (see below).

It is understandable that the respondents should not be very clear about the facilities which they were to receive; but both expressed enthusiasm for the potential of the systems. What is particularly interesting is the contrast between these views and the much more critical opinions of managers from previous cases who had gained experience of direct systems. In particular, these respondents expectations appear most unrealistic in terms both of the benefits which they expected and in the personal effort costs involved.

A generalised list of adoption features would include the following:

1 Middle-level advocacy; the current senior officer trial had been specifically initiated by a middle manager who was personally directly associated with the implementation

2 Senior-level advocacy; the chief executive had strongly supported the trial both verbally and by virtue of his own adoption (without this advocacy it is doubtful if S42 would have adopted)

3 Pre-trial adopters had unrealistic views about the personal benefits and the personal learning, time and effort costs of utilising the computer facilities; (the post-trial adopter expressed significant disenchantment); both pre-trial respondents seemed to believe that it would confer significant informational or decisional advantage

4 Personal evaluation of computer potential; this was described

in two forms: experimental evaluation of the trial system specifically with the senior officers acting as guinea-pigs, and the gaining of personal understanding of computers in general in order to improve contribution to general discussion on computers in the organization

Features of discontinuance

Although apparently in mid-trial, the chief executive seemed to be on the point of abandoning his system; in fact he appeared to be making his mind up about this as he spoke to me. (A telephone call made some months later confirmed that he had discontinued his use of this system). That he seemed to be on the boundary position was illustrated by the apparent conflict of his views as he thought about aspects of his use from different angles; he was disappointed with the system features he had tried but was still hopeful about some aspects which he had not been able to test yet.

"I am getting on very slowly - still learning. It needs massive commitment for training - it needs constant exposure. It is very difficult to retain the skills." (S41)

The respondent made the following comments about the systems he had tried:

"Messaging - completely useless. After the fifth or sixth attempt... it was very frustrating. Anyway, who should I send stuff to? To make the trial work we'd need everybody on it. It's inferior to telephone or letter. [Of the diary system]... the effort cost would be phenomenal - I'm looking at my secretary doing it." (S41)

However, he seemed to perceive that certain information and

analysis features which he did not yet have available would be useful:

"The data side is potentially very good. File storage would be most useful." (S41)

There was thus a curious mixture of disenchantment with those facilities which he had actually tried out, together with continuing enthusiasm for those aspects which he had not yet experienced. This phenomenon was very similar to that found in other respondents from previous cases, for example S3 from ABC. In general, he seemed to be very disappointed, even angry with some aspects of the system - and some of this bad feeling was aimed at the principal advocate and initiator, P11.

"I am becoming progressively more disenchanted. Also, aspects of security are not too good. A management disaster area! The system was bought without proper authorisation... [P11] bought the system. He bought the system in circumstances that don't bear close examination. He oversold us on it. He was oversold by IBM!" (S41)

In these and other comments, it became clear that the respondent perceived that this project, and his own involvement in it, might turn out to be not only a managerial mistake, but more importantly a serious political error in that he would be seen as having associated himself with something which was not only unsuccessful but which might be seen as a "folly". Certainly, he cannot have been unaware of the hostility of the computer director and also the social services director towards the project and, by implication, his own role in it. This respondent's awareness that he may have "backed the wrong horse" on this occasion may be contrasted with the senior manager in the next case, who, while in a very similar position, sensibly

declined to adopt in order to avoid exactly this outcome.

Although there was only one respondent in the "discontinuing" phase, the immediacy of his experience threw crucial elements of the situation into sharp relief; this particular respondent was especially conscious of the man/machine difficulties which entailed substantial time and effort investments on his part, and also of the importance of the expression of his own leadership role in the adoption. A summary of key elements is as follows:

1 Realisation of considerable initial personal learning effort required;

2 Realisation of the need for ongoing practice in order to develop and retain necessary skills

3 Appreciation of ongoing effort required to service the systems

4 Substantial disenchantment with systems under test;

5 Continuing apparent enthusiasm for systems not yet tested

6 Awareness of the impact of leadership role in the advocacy and adoption of an unsuccessful system

7 Continuing positive views about organizational computing in general

Summary of case 4

The details from this case confirm the features of adoption and

discontinuance which have been built up in the computer adoption model so far. In particular, the respondents who were at boundary positions in the adoption cycle (ie adopted, but at a pre-trial stage and at mid-trial prior to discontinuance) provided important confirmatory insights into behaviours at these points in the cycle.

Case study 5: NHL institute of higher education

Background

An institute of higher education has of course a different purpose from that of the commercial organizations discussed earlier; nevertheless, in terms of its ability to survive in a currently somewhat hostile external environment, and in terms of its need for resolution of internal management and strategic problems it faces similar issues and problems to those of any large organization. The formal structure of the organization recognized two distinct functions: academic and administrative. The administrative function was headed by three senior officers, each having specific hierarchical responsibility for certain aspects of the organizations affairs. Two respondents were available for interview. The academic function was managed by a number of regular and irregular committees and working parties, with membership drawn from members of the academic staff. Additionally, academic departments were headed ("first among equals") by departmental chairmen; these departments were in turn combined into faculties, each headed by a dean of faculty.

It was by no means certain that the deans, for example, represented the top "management" of the organization in terms of the criteria developed earlier, because decisional power and resource allocation responsibilities (particularly with regard to financial matters) were in many instances dispersed among the various committees, or enacted by departmental chairmen; however, the interviewees may be said to represent a sample of senior members of the academic community. Finally, administrative and

academic functions came together under the leadership, effectively, of the vice-chancellor. The latter, and four deans of major academic faculties were interviewed.

The organization possessed a large academic computing resource, which was dedicated to the interests of teaching and research; on the administrative side there was a smaller, more recently formed and separate function used for administrative data processing in the treasurer's department. Additionally, some faculties and some departments possessed their own separate facilities for teaching and research or for administrative purposes. There appeared to be no links of any kind between the two major facilities, and this distance perhaps reflected the organizationally separate nature of the academic and administrative functions. There had been no formal trial of direct computing facilities for the senior academic personnel of the organization as a whole, although the treasurer was currently involved in such a trial and the vice-chancellor had recently declined to take part in one.

Two respondents were making some use of computing themselves at the time of the interviews, although the circumstances were different in both instances.

Table 7.3 Senior managers and computer use categories - case 5

Respondent		Computer use category
S51	Vice-chancellor	Non-adopted
S52	Dean of faculty (a)	Non-adopted
S53	Dean of faculty (b)	Non-adopted
S54	Dean of faculty (c)	User (slight)
S55	Dean of faculty (d)	Non-adopted
S56	Treasurer	User (slight)
S57	Director of estates	Non-adopted

Pre adoption-decision phase

The roles of the academic deans were described somewhat differently by each respondent, but in generally they seemed to occupy a liaising and representational role between their faculty departments and the organization's main committees. In practice each individual exercised many roles, including for example lecturer, researcher, author and academic and financial administrator, and in addition exercised academic authority through chairing or sitting on various committees and working parties.

Three deans had had no experience of direct computing in their work roles:

"I simply don't wish to expend the time and effort in learning how to use one just now. My perception of what is needed may be displaced, I may think it's harder than it is. So I keep putting it off. But I regret not doing it; I feel that I should. My customers [ie students] expect me to know what's going on. I don't know what the possibilities are. I'm frightened I'm missing something. But what I want to do, I want to do right, not pissing about like an enthusiast..." (S52)

"No. There are no plans in the immediate future. I could have one on my desk and look stuff up... it would be nice to be able look up a student when a query comes up. But I don't think it would be worth the expense... maybe an extravagance that the [organization] could not afford. As a way of keeping records. If

I had one available on my desk I would keep records on articles, books, cross-referenced in some way. As a word processor - I type 10% of my stuff myself at the moment. Maybe...if it was directly available, I would do some data analysis that I wouldn't bother with now - some cross coefficients... Useful for revising handouts... things you revise slightly... I might use it a lot" (S53)

Neither respondent had any immediate plans to use a computer, although both could imagine certain aspects of their roles which might be enhanced by using one.

The third dean (S55) appeared to have decided on adopting a computer in order to address specific aspects of her teaching and research roles:

"Yes. I will use one. I intend to get a word processor and use it at home... drafting conference papers, student handouts... my next book. My secretary would do the bibliographies on the main computer... I haven't got round to it. A combination of money, time and space. But it is a project for this year." (S55)

Although all three respondents could see potential uses for direct computing in the context of one or more of their academic work roles, only the latter seemed so far to have made a specific adoption decision. None of them had begun the adoption cycle as portrayed in the behavioural model developed so far.

The director of estates (S57) had sizeable direct responsibilities in terms of resource allocation and staffing; in these respects he more closely resembled managers from earlier cases. Although he had had no experience of direct computing so far, it appeared that his department would shortly be involved in computerising aspects of its administration:

"... my deputy will coordinate this project. I won't punch information in, but I intend to get a terminal to look at the data. Presumably I will be able to do this? ... you just push a

button and get it... these things are OK now, but will be much easier when you can just push a button... the name of the game is accountability... it's the climate of opinion that these things will be computerized." (S57)

In general, this project had not developed far enough for concrete applications to have emerged or for the respondent to have clearly identified specific applications which he might use. As with many other pre-trial respondents, he had unrealistic ideas about the learning costs involved in his personal use in terms of the time and effort required:

"I would think about a day. If it arrived one morning I would be fairly confident that I would use it at the end of the day... if I am instructed properly." (S57)

The project was being undertaken using the internal administrative computer department as the main resource for computer expertise, and the systems would be physically linked to and based upon the computer systems already in place in the treasurer's department.

Features of non-adoption

The vice-chancellor described himself as the "head of the [organization]"; he exercised a key role in controlling, directing and influencing affairs both internally and externally.

"Head of the [organization]... student welfare, social education and so on; I see myself as the [organization's] eyes and ears; a chief executive role; chairman of senate; - leader of the house and prime minister - I can seize authority by virtue of my office - if I'm foolish I could lose that power. It's 50-50 inside to outside at the moment... Sir Keith will ring me or write... for advice. Senior civil servants... ministers... will talk to me." (S51)

Additionally, the respondent held chairmanships/directorships of a number of commercial and other bodies: "Public roles; it lets me see the other world." (S51) As regards computing, the respondent appeared to have experimented extensively with a home computer and in many respects this private "trial" paralleled the learning experience of other respondents who had adopted a system within the direct context of their work roles and environment. In fact, because of the close intertwining of the respondent's private and public lives it might be said that he had to all intents and purposes experienced an adoption and discontinuance cycle. (However, he had specifically rejected a trial of a direct facility at work and so he is categorised as non-adopted here.)

"I got it for the children; then I felt I ought to know what these toys were. I enjoyed playing silly games on the computer... Tremendous. Felt ashamed of only playing games, so we decided to put it to use... we have a wine cellar, so I put on a program to catalogue wines... and as a talking point for guests... but a notebook would be better. Then we did mortgage re-payments...". (S51)

As in other instances of specifically work-related adoption, there were a number of factors which seemed to have influenced the adoption choice:

"It was important that I knew what my colleagues were talking about when discussing computers. I could see what the students were doing... what they were saying about other places having better facilities. I enjoyed playing chess... It was also curiosity driven..." (S51)

Here the respondent refers to aspects of his leadership roles as well as simple curiosity. However, it appeared that after a while he had discontinued his use, and he made the following comments relating to this which match comments made by other

respondents about this point in the adoption cycle:

"But once you've done it, you've done it! I can see now that it has very limited use in the house; it's main function is games. I thought it might have been more useful than it turned out. I had visions of it telling me how many standing orders..." (S51)

Here he describes a familiar response to the lack of directly relevant system features. He also mentions the man/machine interface difficulties and the learning efforts required:

"If it had been quicker... and better... if I had better training... then I might have tried to simplify my financial life (which is very complicated). But I didn't have the time or patience to put all this on. I don't have the time to do it. I would need training, and I don't have the time for this." (S51)

As regards a formal trial of direct computing in his working environment, this had apparently been suggested recently but specifically rejected by him:

"We did look at something. It was put to me that the V-C's office should have an electronic mail facility to encourage the others... We did look at this very carefully, but... It may have been seen as a gimmick... so not have been a good thing." (S51)

In other words the respondent says he has rejected the adoption trial (advocated by others on the grounds of leadership role requirement in order to encourage more extensive computer use) specifically because he felt that his involvement was inappropriate at this time ("... at some stage it may be useful, but not for me just yet."). It is clear that he has formed his own opinion about the value of direct computing based at least in part on his direct personal experience of the home computer, and as such seems better informed than many other pre-trial respondents have been. Most importantly, it is the consciousness

of his role and the importance which would be attached to his adoption which has caused him to reject the trial ("It may have been seen as a gimmick."). A direct comparison may be drawn here to the chief executive in the ACC case who did accept the adoption in very similar circumstances and later seemed to have regretted the decision. It is also interesting to note the reactions to the chief executive's adoption in the PHA case, where some of his peers regarded aspects of his systems use as "gimmickry".

Adoption and use

S54, the dean of faculty (c) was a lecturer in electronic engineering and used a computer in teaching aspects (for example digital electronics) of his subject, as well as in pursuing his research interests. It was therefore arguably something of a requirement of his post that he be familiar with aspects of the computer as a technological manifestation of his taught subject. However, he had roles other than in teaching and it is his use of computing in these that is of special interest here. In particular, the respondent held several senior posts in the organization; as well as a professorship, he held the rank of pro-vice-chancellor - ie second in line to the vice-chancellor - and in addition, was head of a residential college. This latter role entailed the leadership of what was in some respects almost a separate "business", in that the college generated revenues and was responsible largely for its own administration and policies. This small organization employed over thirty staff and served the non-academic requirements of several hundred students.

The respondent explained that there was no relationship between his computer use and his professorial or p-v-c activities and this is particularly interesting because it reflects the distance between these senior organizational roles and his computing behaviours. This distance appeared to be despite the fact that he clearly had quite extensive computing skills. In other words, the respondent could see no relationship between the demands of these roles and the facilities of computing of which he was aware.

However, he was presently engaged in introducing administrative computer systems into his college organization, and in this respect he enacted the role of both initiator and expert:

> "Everybody has talked about it for years... Nobody else in the colleges apart from myself has done anything... There will be an Apricot for word processing and for student records. I am developing and implementing a student record system based on dBase II... I felt it was about time we did something." (S54)

The respondent had given this project much thought and had planned in detail for several specific record systems, and also had ideas for some elementary financial systems, although these latter were not at an advanced stage. It was quite clear that the respondent was himself the main protagonist and that he was involving himself at a detailed level, including designing systems and programming them in the dBase II language. It was also clear that these systems were not intended for his own personal use; rather they were intended for the improvement of efficiency in his organization:

"... increased efficiency. Economic advantage? It remains to be seen! Could possibly lose one staff - but no. It's the efficiency; staff will be able to do things that aren't being done... it may save his [ie the college finance officer's] time; may improve his ability to make good decisions about marketing the college to schools..." (S54)

The respondent intended to design, program and implement the systems, train key personnel in the use of them, and then cease his own direct computing activities. Here the respondent is acting in an important initiating capacity and in a way which has not been found in earlier case studies. In the earlier studies the respondents, with one or two specific exceptions, were adopting systems which had been issued to them, as it were, by a specialist department. The purpose and objective of the managers' own direct system use was to have been the support of various aspects of their own decisional and informational roles, although the adoption of these systems was usually undertaken with a view to the encouragement of others in some way.

Here, however, this senior manager (and there is no doubting his senior and important position within the academic hierarchy) is undertaking a personal technical role in the initiation of systems which are intended for the specific direct use of others. Clearly he is acting in a leadership capacity, but the use of his own personal skills, effort and time are being exercised in an entrepreneurial manner in his "own" part of the larger organization (ie the college) in order to achieve an organizational end which he sees as desirable, rather than his own personal efficiency. This relationship to the computing activity of the organization may seem a little unusual in such a senior man; but, the respondent seemed to have undertaken the

task primarily because there was no effective organizational resource to which he felt he could delegate it.

In general therefore, the pattern of "adoption" and "continued use" described here is completely different from the patterns described in earlier cases, and appears to be an aspect of the respondent's relationship to computing which seems to have arisen at least in part because of the lack of an appropriate alternative organizational resource. (He made it clear that he did not intend to use either the academic or the administrative computer departments, but his reasons for this were not clearly established). In fact, this instance of computer use approaches the situation most frequently found and described in the next cohort of respondents - the small business group. In addition, the circumstances are particularly interesting because it is a good example of the transference of skills and knowledge from one role (teaching) into another (management).

The second respondent currently making use of a computer was the treasurer, S56. His role more nearly equated to that of a financial director in a large commercial organization, and he exercised similar powers and responsibilities to the holder of such a position. One of his responsibilities was the administrative computer department. He was currently undergoing a trial of a pc with spreadsheet and wordprocessing facilities:

> "I've had it for two months. I'm using spreadsheets, developing them myself. I've not made very much progress. It's a trial; an experiment to see if it's of any use to me." (S56)

The respondent described how he experimented with it mainly out of office hours. He said that no specific aspects of his work

were facilitated at this time, but he felt that they would be as he became more proficient. He had specifically declined a link to the departmental mainframe with its access to organizational data:

"I didn't want a [mainframe] terminal. I need data that isn't on the [mainframe]!" (S56)

As regards the circumstances of his adoption he mentioned one or two factors which seemed to have influenced him, including especially, perhaps, the advocacy of the computer department manager:

"I've been aware for some time that it might be useful... I saw a demonstration. [The DP manager] drew my attention to it. I thought that there might be some way of making me more efficient." (S56)

In many ways this instance parallels examples of adoption seen in previous organizational cases, where a senior manager adopts computing advocated and supplied by the organizational specialist computing resource, and does so at least partly on an experimental basis. Here, the respondent seemed concerned especially with his own efficiency and unlike many previous instances, the overt leadership role enactment appears to be missing.

Summary for case 5

This case displays a mixture of circumstances and contexts within which the issues of senior managerial computing occurred. The situation of some of the academic deans was one where, although

the respondents could visualize instances in which some aspects of their roles might be supported by direct computing, the necessary environmental forces (such as strong internal advocacy, for example) seemed to be missing, so that they had not yet commenced an adoption cycle. On the other hand, the vice-chancellor had specifically rejected a direct use system on the grounds that it may not have represented a satisfactory organizational statement in terms of his leadership role; a view based, ultimately, on his extensive personal experience, unusually, of a home computer. (This rejection was contrasted with the adoption, in similar circumstances, of the chief executive in the last case where the adoption may well have represented something of an error of judgement).

The two instances of adoption and continued use represented very different circumstances. The adoption pattern of the treasurer paralleled closely the situation in previous large-company cases, whereby the respondent had accepted a system which was intended for his own efficiency on an experimental basis from a specialist providing department. On the other hand, the fourth academic dean (S54), although not using computing in respect of his larger organizational role, was engaged in personally implementing elementary business systems in the smaller organization of which he was the head. This last instance anticipates the position often found in smaller firms, the circumstances of which will be discussed in more depth in the next chapter.

References

Laffin M, Young K, The Changing Roles and Responsibilities of Local Authority Chief Officers, Public Administration, Vol 63, Spring 1985

Management Today, March 1986, pii

Mintzberg H, The Nature of Managerial Work, Harper & Row 1973

Rogers EM, Shoemaker FF, Communication of Innovations, The Free Press New York 1971

Chapter 8

The Effect of Organizational Size: Analysis of Sixteen Small Firms

Abstract

Small firms may be considered to possess certain attributes which set them apart from larger organizations and in this chapter the different context in which direct computing occurs is identified and described. The chapter investigates computing with particular reference to the chief executive, and it is established, for example, that he often adopts a more proactive approach than his large organization counterpart. A typology of behaviour patterns is proposed which identifies the relationship of the small firm chief executive to his organizational computing resource.

Introduction

The field studies discussed previously were undertaken in large organizations and endeavoured to establish the nature of the circumstances surrounding senior managerial use of computing in decision processes. One of these circumstances was the presence within the organizations studied of internal specialist computing departments who provided a fund of expertise and acted as providers of a computing service to senior managers. In fact it was normally the case that providing departments "issued" standard systems to senior managers who attempted to make use of them on the assumption that the system would enhance their personal efficiency in some way.

In order to provide a contrast to these large organizational cases studies, a group of small companies was contacted and the owner/manager or managing director interviewed (in order to simplify the terminology, he will be referred to as the chief executive or CE from now on). In fact considerably more research materials were generated from this small-firm group than are covered here (see Martin 1985d for other aspects), but space precludes further inclusion of issues not directly associated with the focus of the thesis.

The literature on DSS and decision-behaviour generally does not mention the small firm milieu, or take account of the very real differences in context which arise. Similarly, the small firm computer literature makes little mention of the issues and ideas contained in the DSS tradition with respect to the potential of these in the small firm context. The inclusion of this piece of

research in a thesis about senior managerial decision is an attempt to bridge the gap between the two separate streams.

There is a sizeable literature associated with the special problems and concerns of small business. In particular, it has been shown (Gibb 1983, and Gibb and Scott 1985) that there are particular factors associated firstly with the special influence of the owner/manager himself (for example his personalised task structure and leadership style), and secondly with the sheer size of the organization (for example the lack of specialists and the resulting adoption of multi-functional roles by senior management). In view of the special influence of the CE in small business management, (he would be likely to carry responsibility for much of the resource allocation decision making within his organization) and in order to achieve a wider spread of companies in the sample it was decided to interview the CE only.

Out of twenty firms visited, sixteen provided useable interview materials. Firm sizes in the sample ranged from 5 employees up to 210 (see item 4 in appendix 3 for business activity distribution).

Table 8.1 Firm Size Distribution in the Small Business Sample

Firm size		Number
Up to 10	employees	2
10 to 50	"	7
50 to 100	"	4
100 to 150	"	2
150 to 200	"	0
200 to 250	"	1
		16

(Average size of sample: 69)

Control of two of the largest firms had been passed to professional managing directors, and in this and in other respects these more closely resembled the characteristics of big companies. In two cases the CE had a partner who shared the responsibilities (but only one respondent was seen by the researcher).

Characteristics of computing in the smaller firm

All the firms in the sample except two had some form of computing resource available on site. The two firms which had no computer facilities were both of fairly recent origin (two and four years since start-up respectively); one was of very modest size (9 employees) and the other (50 employees) had expanded to its present size only very recently. The relative ages of firms in the sample differed widely, and this was associated not only with the recency of computer adoption but with the experience of multiple system changes:

Table 8.2 Age of Firm and Number of System Changes

Age of Firm	Systems Status 0	1	2	3	Totals
Up to 5 years	2		2		4
5 to 10 years		2			2
> 10 years		3	3	4	10
Totals	2	5	5	4	16

"System status" represents the category of the presently owned system, ie 0 means no system has been acquired and 3 means that the firm now has its third system. Over half the sample were on their second or third system. In these small businesses, the initiation and choice of computer facilities may best be regarded as a progression from one stage to another in a general escalation of investment, associated with an organizational learning process. System selection and implementation decisions were embedded in a complex, incremental process consisting of choice, learning and correction cycles which took place over an extended timescale as the organization developed. Particularly in the smaller firms, the chief executive played a key part in these processes.

With the exception of a mainframe in the largest firm, the computer resource in most businesses consisted of one or more microcomputers; only two firms had teleprocessing connections to a bureau or other office. The nature of the operational information systems which each firm used varied enormously - most had been developed on the small firm's behalf by a software house, or from standard packaged software offered by the computer

manufacturer or other supplier. Only three firms had a regularly used internal programming capability (a distinction is made here because several CEs had themselves undertaken or attempted detailed system development work at the time the system was first introduced into the organization, but had since ceased this activity).

Although the details of individual application systems differed enormously, they can usefully be grouped together into broad categories as shown in table 8.3 below.

Table 8.3 Categories of Application System and Percentage of Firms in the Sample Who Used Each Type

	% (N=14)	n
1. Accounts (sales, purchases or nominal)	86	12
2. Order processing / invoices / sales analysis	50	7
3. Production control / stock control	36	5
4. Word processing	36	5
5. Spreadsheet analysis	29	4
6. CAD / design or product calculations	29	4
7. Payroll	21	3

Note: These systems were currently operational; many organizations had extensive plans to implement further systems.

Most firms used computerised accounting facilities of some kind, but only three had payroll (predictably, these were the larger firms). Other systems related to production or stock control, word processing and technical calculations; four firms had a spreadsheet capability. The systems developed seemed to have been

chosen largely for their relevance to operational aspects of the organization rather than to higher-level management decision making areas of direct concern to the CE himself.

A key point is that the emphasis of the systems was almost entirely on either transaction processing or operational systems; only two managers mentioned computer information directed specifically to forward planning, strategy or policy issues. In general, these findings are not incompatible with other studies of small business computing, see for example Delone (1981), Easton et al (1983) and Malone (1985). The operational emphasis implied by the orientation of the applications systems was confirmed in discussion with the respondents; many of them identified the role of the computer as one which affected their organization per se - it was not intended for their own personal decisional efficiency, but for that of the organization.

The Relationship of the Small Firm CE to the Organizational Computing Resource: Development of a Behavioural Typology

In the larger organizations of earlier studies, senior managers who were involved in computing did so using systems developed for them (as personal management aids) by specialist providing departments; senior managers themselves were not involved in any way in the low-level data processing activities of the organization. In many of the smaller firms in this sample however, the reverse was true: where the CEs were involved in computing, this was primarily in respect of the organization's operational systems.

In general, then, the nature of the relationship between the CE and the computing resources in his organization was in many cases completely different from that of senior managers in the larger organizations. However, respondents in the sample did not disclose one uniform characteristic relationship; rather, a range of different involvement patterns was discernible (this was first proposed in Martin 1985d). The observed range has been developed into a typology which is intended to classify the behaviours according to the closeness of the CE's personal involvement:

Table 8.4 The Relationship of the Chief Executive to the Computing Resource: A Typology of Behaviour Patterns

	Behaviour Pattern
1	CE remote from management of the computer resource
2	CE involved in a managerial, overseeing capacity
3	CE closely involved in implementation of the facility (ie: detailed choice and/or design decisions)
4	CE directly involved technically in computer implementation (ie: programming and/or spreadsheet development)
5	CE routinely interacts directly with computer

This set of behaviour patterns has been arranged in order of increasing personal involvement; this generally implies increasingly large investments of time and effort on the part of the CE and also requires him to possess increasing technical expertise. The categories are not intended to be mutually

exclusive - managers involved at a lower level, say category 4 may well also be involved in higher categories as well, ie involvement in technical aspects does not preclude involvement in detailed choice and design considerations. However, placing a respondent in one category implies that this is his closest level of involvement - if he is placed in category three, it is because he does not engage in any activities of categories four or five.

1 The first pattern, where the CE was remote from and had little influence on the computing resource was found mainly in the larger businesses in the sample. In three instances, the CE was the managing director rather than an owner-manager, had been employed from outside the business and had considerable prior managerial experience at senior levels. Generally, managerial involvement with the computing resource was undertaken by a financial director or other manager. (However, in one case the CE had a partner of equal standing who handled all aspects of computer implementation). For example:

> "The financial director controls the day to day running. The accounts have gone on without me knowing anything about it. But when it comes to the sales side I will get more involved..." (S69)

The CEs in the remainder of the sample were more closely involved in initial computer acquisition and implementation processes and acted in a managerial capacity in overseeing the introduction into their organizations of the computer resource.

2 The second pattern involved the CE in a more direct relationship with computing, whereby he acted in some measure as an overseer of the computer implementation process, but without

being specifically involved in technical choices or system design considerations at a detailed level.

"The [financial controller]... is a very competent systems man - he puts in the systems. I was playing devil's advocate - checking criteria and asking them [ie his staff] to prove that it could do what they said." (S74)

3 The third pattern shows the CE directly participating in technical choices and design considerations, but without involvement in programming, spreadsheet development or other technical activities.

"I set it up and decided what to do... we chose a standard package and bent it a bit. [Now]... the accountant looks after it. I did a systems analysis for the stock control system..." (S62)

4 The fourth pattern shows direct technical involvement in programming, spreadsheet development or database creation (all these make roughly equivalent demands on the user in terms of expertise required, learning effort and application effort). Most CEs in this section of the sample emphasised that only they personally had (or had acquired) the necessary skills - skills which were just not available elsewhere in the organization at the time the activity was undertaken.

"I set up the spreadsheets in the first instance... the secretary does the [spreadsheets operations] now. Any queries on spreadsheets come to me. I haven't taught anyone else to set one up yet." (S66)

"I did the design calculations [programmed in Basic] because I'm the only one who can." (S72)

"I was involved initially with the set up... wrote programs in dBase..." (S76)

These activities contrast sharply with the those of senior

managers in larger organizations, who were seldom involved in detailed technical work and never in respect of organizational systems which were intended for delegation to others.

5 The fifth pattern involved the CE regularly using a computer himself directly (in the sense of operating equipment and controlling inputs and outputs). In this pattern of involvement, the CEs in this section of the sample estimated that they spent a substantial proportion of each working day working on the computer (over two hours on average each day).

As this may seem unusual for a chief executive, the circumstances will be described in a little detail. One firm had only four employees and the CE used the computer in two senses. Firstly, he had himself set-up systems (customer records, billing and stock recording) which at the time of start-up he had operated himself, although he had now delegated some of the data entry to his employees. He was currently devising and testing new systems. This pattern of system set-up and delegation is consistent with pattern four. However, in addition the CE continued to operate certain systems himself: notably cash controls, expenses and cash flow forecasting. This latter use is a little unusual and presumably if the firm expands these activities will also be delegated at some stage.

The second firm had twenty eight employees and the CE was not presently involved in setting up operational systems. Instead, his direct computer use consisted of the manipulation of spreadsheet formats associated with forward planning (sales forecasting and budgetting).

"At this time of year it's the budget I use most; I'm putting in actuals - developing next years budget. It's the cash flow which we use most frequently." (S65)

This is the only instance in the sample where the CE was using the computer directly himself in a planning related capacity; when asked what were the circumstances of his use he said:

"Only recently have I tried using one myself... I've just done a course at the... Business School - they forced us to use a spreadsheet there..." (S65)

In the other four behaviour patterns, the computer was regularly used by staff other than the CE himself. He may have received information in the form of printouts or less directly, but the system and its inputs and outputs was controlled by others. Thus the other CEs in the sample made use of computer information indirectly, either by way of printouts received or via verbal or written reports from subordinates or colleagues. These patterns of indirect information use again varied widely between individuals, from respondents who received no computer direct computer outputs at all through to the CE who made extensive use of own-designed printouts in order to control operational aspects of the organization.

Contributory factors associated with the behavioural typology

The primary factor associated with the range of behavioural patterns described above seems to be associated with requirements dictated largely by organizational resource constraints. The necessity for the CE to adopt the role of computer implementer is part of a pattern of "multi-role" behaviour in small businesses

which has been described elsewhere (see Gibb 1983 for example). Although the availability of organizational resources seems to be the key variable, firm size (as measured by number of employees) is clearly an associated variable and this was tested directly using an appropriate non-parametric statistical method. (See appendix 8 for details of the statistical method employed.)

As might be expected, firm size was correlated negatively with the CE's position in the behavioural typology; Kendall's tau (Siegal 1956) yielded a value of -55% correlation which was significant at the 1% level. This statistic illustrates the intuitively reasonable hypothesis that the smaller the firm (and hence, generally, correspondingly fewer organizational resources) the more likely it is that the CE himself will be more closely involved personally in detailed aspects of computer implementation and use.

But of course there will undoubtedly have been other factors involved: personal characteristics, experiences and predilections will all have played a part in defining the nature and scope of the role which the CE adopted. This was particularly apparent for example where the CE seemed to be following personal goals, such as fulfilling his perceived education needs, or establishing a measure of exclusivity (and hence perhaps personal irreplaceability) by personalising the operational control systems.

The incidence of formal computer training, prior interactive experience, and earlier managerial involvement in computing were examined (see Table A.1 in appendix 7 for details) as potential

predisposing factors. Most of the managers had had very little formal training, and generally less than that experienced by their large company counterparts (although it must be pointed out that with one exception little of the training received by any respondents was directly relevant to the roles adopted). Few of the sample had had direct computer experience (in the sense of hands-on use); but, interestingly, several - about one third - had had prior management involvement with computer systems in previous large-company experience. There was little evidence, however, that these factors played a significant part in predisposing the CE to adopt any particular pattern.

Discussion

Clearly, the typology of behaviours should not be regarded as a set of static positions which, once adopted by the CE, remain immutable. On the contrary, as organizations change and as individuals' experiences and predilections alter it would be expected that role patterns will change. In general, it would be predicted that as organizations develop and expand their resource base over time so the CE's behaviour patterns would shift up the hierarchy from the more direct to the less direct modes of involvement. However, personal needs, interests and predilections also change over time and increasing technical involvement (if only temporary) is also possible. In fact, movements in both directions were discernible in the sample although a longitudinal study over a reasonable timescale would be required to illustrate and clarify the position.

There was little evidence to suggest that any one set of behaviours might be more successful than another in terms of overall operational success as regards the computer resource. Certainly, some of the behaviours (particularly at the extremes of daily use and of remoteness) seemed a little inappropriate in the context of the generally accepted nature of the CE's role on the one hand, and the importance of the computing resource on the other; however, there were no obvious deleterious effects in either position.

The one significant pattern which was missing from these small businesses is the one where the senior manager interactively uses a computer system which has been developed for him by a providing department. The key features of this pattern which have been identified from the study of the previous cases are firstly that the manager himself typically has little involvement in the choice or design of the facilities which he is to use, and secondly that the facilities are ostensibly designed to support his own personal decision activities. The provision of these systems (usually incorporating extensive and sophisticated data retrieval and analysis facilities) requires considerable development effort by the providing team together with other expenditures, and few small businesses will have sufficient organizational resources to even contemplate such activity.

Evidence for a cycle of involvement/disengagement activities

Although only two of the respondents were routinely engaged in direct interaction with the computer, half this small business sample had had a detailed technical involvement at the time of

initial system implementation. This technical involvement ranged from writing programs for design calculations through to devising spreadsheets and specifying file transactions in a database package. In most cases, the CE delegated routine operation of the system to other staff after a period of time, as part of a cycle of development, implementation and delegation. For example:

"I got really involved... at that time we only had thirty five employees, so I used it myself." (S61)

"I set it up and decided what to do..." (S62)

"I don't do it now; the sec. does the spreadsheets... I set up the spreadsheets in the first instance." (S66)

"I've derived all the spreadsheets. The accountant now has improved on some of these..." (S71)

"I was involved initially with the set up; involved in program writing... I never touch it now." (S76)

Additionally, the majority of the sample of CEs were involved in the implementation of computer systems in a managerial, project leader sense, and would have had to accomplish the integration of a great number of disparate elements in order to accomplish a successful implementation. In view of the inadequacy of the training they had experienced it is hardly surprising that many of the first attempts were not successful. In larger organizations, there would be a fund of professional skills including the necessary technical, data processing and man-management experience. In the smaller firm, the CE has to provide his own expertise and this seemingly is gained only after some hard-won experience.

Summary

In contrast with the larger organizations covered in the previous case studies, it was found that where the chief executive of the organizations interacted directly with the computer, it was usually in a rather different context from that of the senior manager in the large organization. None of the managers in this sample had been issued with DSS or related systems by a specialist providing department. In general, the top management computer involvement was linked to the implementation of organizational systems intended for organizational efficiency at an operational level, and not for the personal efficiency of the senior manager himself. This different context is in large part a reflection of the lack of internal resources which, in a large organization would be available to handle the implementation of operational systems.

However, the depth of personal involvement of the chief executives in the sample varied dramatically, and this has led to the proposal of a typology of behavioural patterns which has been formulated to reflect the range of involvement levels found. Some managers were remote from the organizational computing activities (in the way that nearly all the large organization senior managers were) whereas at the other extreme, some interacted daily in the operation of data processing systems. Between these extremes, managers were involved to a greater or lesser extent in the details of the computer implementation processes (as no doubt they were closely involved in the implementation of any important activity in their organization).

In particular, about half of the sample had been involved in detailed technical work at the time of system implementation; in most instances, routine operation of the system was delegated to other staff after a period of time, as part of a pattern of development, implementation and delegation. (This pattern was itself part of a larger pattern of whole-system development cycles, which seemed to follow incremental processes of organizational learning over a period of time). The chief executives' personal involvement/disengagement cycles were, of course, dissimilar to the adoption/discontinuance patterns found in senior managers in earlier cases because of the different context in which they occurred.

References

Delone WH, "Firm Size and Characteristics of Computer Use", MIS Quarterly, Dec 1981

Easton G et al, "Small Computers in Small Companies", Dept of Marketing, University of Lancaster, 1983

Ein-Dor P and Segev E, "Organizational Context and MIS Structure: Some Empirical Evidence", MIS Quarterly, Sept 1982

Faulkner TM, "Information Technology and the Small Firm: the Future Role of Non-Technical Higher Education", Small Business Research Conference, Glasgow, Sept 1982

Gibb AA, "The Small Business Challenge to Management Education", Journal of European Industrial Training, Vol 7(5) 1983

Gibb AA and Scott M, "Strategic Awareness, Personal Commitment and the Process of Planning in the Small Business", Journal of Management Studies, Vol 22(6) November 1985

Malone SC "Computerizing Small Business Information Systems", Journal of Small Business Management, April 1985

Martin CJ "Information Technology and the Smaller Firm: The Role of the Chief Executive", a paper presented at the Eighth National Small Firms Policy and Research Conference, N.Ireland Nov. 1985d

Nie NH, Hull CH et al, "Statistical Package for the Social Sciences", McGraw Hill, New York 1981

Siegel S, "Nonparametric Statistics for the Behavioural Sciences", McGraw Hill, New York 1956

Chapter 9

Quantitative Analysis of Selected Hypotheses

Abstract

Much of the analysis of field research results so far has been qualitative; this chapter examines data from the interviews quantitatively. The main purpose of the analysis is to explore relationships between computer adoption decisions, and certain measured background and personal variables using appropriate statistical techniques. Hypotheses about relationships between variables are tested using non-parametric statistics. With one or two key exceptions, the sample does not show characteristics of clear relationships among the measured variables and management predispositions in the adoption cycle. These findings, which are regarded as being primarily of exploratory and advisory value, are taken as generally supportive of the qualitative evidence regarding the managerial behaviour which is presented in earlier chapters.

Introduction

The research materials presented so far have been represented largely by the qualitative analyses of case and associated-group materials. These materials have been utilised primarily in providing a rich and insightful picture of the complex social issues relating to the circumstances of senior managerial direct computer use. However, as well as the insights gained from content analysis of open-ended questions, the research effort gathered data from a number of specific short-answer questions put to each of the respondents. In considering the meaning of these interview responses, a number of tables of data were generated for each organizational case or group of respondents and initially these were helpful in guiding analysis, clarifying thought and correcting some initial wrong impressions. These tables have not be reproduced here, because although they provide interesting background material they do not add materially to the lines of argument discussed in the text (see Martin 1985 for some examples of case by case comparisons).

Our purpose in performing quantitative analysis, apart from complementing the qualitative analysis already discussed, is that it is possible that there are trends in the sample arising from the personal or situational characteristics of the respondents which of themselves shed light on the respondents' positions or choices in the adoption cycle. For example, a respondent's age may be a prime factor in disposing him to use a computer or not, or the amount of computer-specific training he has received may be the main factor in disposing him to continue with use. In fact, of course, it is believed that the factors

involved include complex situational issues arising from various contingencies operating in the respondents' environment, as has already been discussed in the qualitative analyses of the cases in chapters 7,8 and 9. Nevertheless, in the interests of theoretical parsimony it is necessary to test the sample rigorously in order to establish the presence or absence of more simple relationships.

Describing the sample

In addition to the respondents already described qualitatively in the case materials, other respondents were interviewed. As has been previously described, these respondents were individuals (eight in all) from organizations where further investigation was not possible for one reason or another. Although it would add little to the qualitative arguments expressed in the thesis to discuss these respondents in detail, the personal and situational data gathered can be used en masse with that of the other respondents in the quantitative testing of hypotheses.

The source organizations for this new group of respondents are as follows:

Table 9.1 Organizational background for the miscellaneous group

	Respondent	Organization
S91	General Manager	Medium sized private company
S92	Managing Director	Medium sized private company
S93	Financial Controller	Medium sized private company
S94	Director of Personnel	Multinational
S95	Director of Purchasing	Multinational
S96	Head of Planning	Building society
S97	Director of IT	Public utility
S98	Councillor	County council

The complete dataset, tabulated to show the numbers of respondents at various points in the adoption cycle, can now be shown in table 9.2 below.

Table 9.2 Frequencies of all respondents by group and usage

category	Group 1 Private sector	Group 2 Public sector	Group 3 Small firms	Group 4 Misc. group	Totals
Adoption cycle category					
0 Pre-adoption decision		4	10	1	15
1 Adopted: pre-trial		2		1	3
2 Rejected: pre-trial	1	4		1	6
3 Discontinued users	9	1	4		14
4 Slight users	2	2		1	5
5 Moderate users	2	2		1	5
6 Heavy users	2	1	2	3	8
	--	--	--	--	--
Totals:	16	16	16	8	56

The intention is to test hypotheses concerning the relationships among certain background and personal variables such as age, previous career and education and so on with respect to the decisions made by the respondents regarding computer use. From the adoption model developed in the qualitative analysis (see figure 10.1) there are two distinct decision points during the adoption cycle. These are:

Decision A: Adoption or rejection of direct computing prior to trial (or attempted use) of the system, and

Decision B: Continuance or discontinuance of direct use following trial (or attempted use)

Of course in practice, these categories were not always quite so clear cut. For example, the "continuing" group included respondents whose slight use bordered on discontinuance; under certain circumstances it may appear better to regard these categories as being distributed on a continuum which can be represented by an ordinal scale. (Some of the hypothesis testing was repeated on this basis using Kendal's tau, but in practice there was no difference in the acceptance or rejection of the hypothesis proposed from the position arrived at from the dichotomised data). In most instances it was possible to dichotomise the respondents into these groups without much difficulty.

The small firm group has been excluded from the following discussions because either the context of their adoption and use was different from that of the large firm respondents, or because they had not commenced an adoption cycle. Also excluded are

respondents in categories 0 and 1 (ie the pre-adoption decision category and the adopted/pre-trial category), the former because they also have not yet entered an adoption cycle, and the latter because although they have expressed an intention, they have not yet acted in respect of their adoption decision.

The data from the remaining respondents in table 9. 2 have been combined into the four adoption decision categories as follows:

Table 9.3 Respondent frequencies by adoption cycle categories

Category	No.
Adopted	26
Rejected (no trial)	6
Use continued	16
Use discontinued	10

In other words out of the 32 senior managerial respondents considered here, 26 have adopted direct computing to the extent of giving it a personal trial in a work context and 6 have specifically rejected computing (although their colleagues have adopted). Then, out of 26 respondents who adopted computing 16 have continued their use to some extent or another and 10 have discontinued their use altogether.

Statistical background

As discussed, the intention is to examine the possibility that

certain personal or situational characteristics of the respondents in the sample are associated with choices at the two decision points in the adoption cycle. In order to do this, statements about variables will be cast in the hypothesis / null-hypothesis form and tested rigorously using appropriate statistical techniques.

The statistical tests used here have been chosen to suit the modest amount of respondent data and in the absence of knowledge about underlying distributions. Non-parametric tests are used because the data is on an ordinal or nominal rather than interval scale and no assumptions can be made about normality. The choice of non-parametric test with nominal data is dependent upon the type of data available. Where it is desirable to establish a significant difference between one distribution and another, the chi-square test is suitable where expected values in all cells of the contingency table are greater than 0.5 (Lewontin and Felsenstein, 1965 referred to in Everitt 1977). Values shown include the Yates's correction where appropriate. One example of the calculations for the chi-square test is given, but from then on only the final value and its significance have been shown.

With some of the variables, information in the contingency table is at an ordinal level on one dimension and forms a nominal dichotomy on the other. However the dichotomy itself is a special case and may be treated as at least nominal (Nie, Hull et al 1981), allowing a more sensitive test which makes use of the greater information available in the ordered data. In order to test for association between two sets of independent ordinal

data, several bivariate correlation tests are available; the choice of non-parametric tests with ordinal data is between Spearman's rho and Kendall's tau. Spearman's rho is suitable where there are few tied ranks in the data and Kendall's tau is suitable where there are many tied ranks (Siegel 1956); our data shows many tied ranks and so Kendall's tau has been employed. (The choice between tau b and tau c is governed by the presence of square or rectangular tables). The calculations for Kendall's tau have been performed using the SPSS-X computer package (Nie, Hull 1981) and detailed workings are not shown.

Where the chi-square test shows a significant relationship it is possible to indicate the strength of the association using either Phi (for the 2X2 contingency table) or Cramer's V (for the larger tables) (Nie, Hull et al 1981), and these statistics have been shown where appropriate. Although inspection of the table usually makes it clear as to the direction of the association, a value of Kendall's tau b (2X2 tables) or tau c (for larger tables) is given where appropriate to indicate the direction of association for the tables with ordinal data.

In deciding on a value for significance, the 5% level has been adopted here as the criterion for rejection of the null hypothesis. This rather broad interpretation is justifiable considering that the intention here is to consider whether there are underlying trends in the data which would provide simpler explanations of behaviour than the qualitative arguments discussed in earlier chapters.

The generation and testing of statistical hypotheses

Background data was gathered from the respondents in predetermined, short-answer questions in the following categories:

Personal factors

1 Career history

2 Education

3 Respondent's age

General computer exposure

4 Formal computer training

5 Past experience

6 Home computer ownership and use

System introduction and development processes

7 Respondent's relationship to design / choice processes

8 Respondent's technical involvement

Personal factors

1. Career history

It is possible that a respondent's previous career orientation may act to predispose him towards or against direct computing. For example, it can be seen from earlier evidence eg Grinyer (1983), and Grinyer and Wooller (1975), that accountants are the most frequent initiators and users of certain model based DSS systems. According to Super and Bohn (1970) career choices are associated with a developmental process concerned with relating the individual's self-concept to the realities of work

experience. According to Schein (1980) people can be classified into 5 career anchor groups according to their self-perception of needs, values and talents.

1 Technical / functional competence

2 Managerial competence

3 Creativity

4 Security or stability

5 Autonomy

Membership of these groupings might be taken as a predictor of an individual's predisposition towards computer-based decision aid adoption where, for example, he wishes to enhance his technical competence and perceives the computer-based decision aid as a useful medium for him to do so. However, a computer-based decision aid may well satisfy the needs of individuals from other groups, for example for somebody wishing to enhance their managerial competence. The main thrust of the theoretical work in career development has been in the motivational issues, and although this these may well be relevant in a general way it may be difficult to separate them from the more direct effects associated with the organizational milieu. In general therefore it does not appear that a clear cut direct theoretical link can be forged between career choices and computer use on this basis. However, there are other aspects to career progression. It may be, for instance, that continual exposure over many years to cultural norms shared by an occupational group would predispose an individual for or against the perceived values associated with technological tool adoption (and perhaps accountants come into this category). More specifically, the history and

development of computing has taken place in an engineering and mathematical environment and still retains the signs of these roots. Although computers are not especially suited for mathematical use more than any other field, nevertheless the culture of computer use shows a distinctly mathematical or technical image. In practice, much of the literature which a would-be user will read has been prepared by people with engineering, mathematical or scientific backgrounds and has traditionally been prepared in a style and format usually associated with technical descriptions of engineering products. Thus, unless the reader has a suitable background he will find an additional barrier to comprehension owing to the cultural norms of the experts.

It makes sense, therefore, to examine the possibility both of career and educational backgrounds as predisposers to direct computer use, on the grounds that certain experiential orientations will have a direct impact on both predisposition and on the learning effort required.

In order to test career background as a potential predisposing variable, the last 20 years of each respondent's career experience were inspected and a main career emphasis selected. Each respondent was placed into one of 6 nominal career categories forming a contingency table with his adoption categories as follows:

Table 9.4 Career background and adoption decisions

Career	Decision A		Decision B	
	Adopt	Reject	Continue	Discontinue
Marketing/Sales	5		3	2
Finance/Accounting	5	1	2	3
Personnel	4		3	1
Production/Engineering	5	2	4	1
General mgt/Admin	4	1	1	3
Other	3	2	3	
	26	6	16	10

Hypothesis 1A. There is an association between career background and adoption decision A.

The null hypothesis (H0) states that there is no association between career background and adoption decision A in the sample. Taking the contingency table for adoption decision A and calculating expected values gives the following:

Expected value E(ij) = n(i).n.(j)

Table 9.5 Career background observed and expected values

Career	Decision A			
	Adopt		Reject	
	O	E	O	E
Marketing/Sales	5	4.063		0.938
Finance/Accounting	5	4.875	1	1.125
Personnel	4	3.250		0.750
Production/Engineering	5	5.688	2	1.313
General mgt/Admin	4	4.063	1	0.938
Other	3	4.063	2	0.938
	26	26.002	6	6.002

O - observed values
E - expected values

Inspection of the expected values shows that the smallest value is 0.75; this is within the guidelines described by Everitt (1977), and so the test is technically valid.

A value of X^2 can now be calculated using the following formula (Siegal 1956):

$$X^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} (O(ij) - E(ij))^2 / E(ij)$$

$$X^2 = 4.02$$

The degrees of freedom are given by:

$$Df = (r-1)(c-1) = 5 \qquad \text{(Everitt 1977)}$$

r - no. of rows in contingency table

c - no. of columns in contingency table

Inspection of tables for critical values of the chi-square distribution (Siegal 1956) shows that this result is not significant below the 5% level and therefore the null hypothesis cannot be rejected.

Hypothesis 1B. There is an association between career background and adoption decision B.

H0 There is no association between career background and adoption

decision B.

Calculations were performed in a similar manner on the decision B data in table 9.5 and a chi-square value of 6.131 obtained. Reference to the appropriate tables showed that this value is not significant below the 5% level, and therefore the null hypothesis cannot be rejected.

A summary of the hypotheses, statistical tests and results is shown in table 9.13 at the end of this chapter.

2. Education

As has been argued above, it is possible that orientations acquired as a result of career or educational experiences act to predispose individuals to direct computer use. In order to test for a relationship in the sample relating to education, respondents' main tertiary educational subjects were coded into groups and formed into a contingency table. (Some combining of the original education categories was necessary to eliminate cells where the expected values where less than the prescribed minimum).

Table 9.6 Tertiary education and adoption decisions

Subject	Decision A		Decision B	
	Adopt	Reject	Continue	Discontinue
Science	6	2	3	3
Engineering	9	2	6	3
Finance/economics	4	1	2	2
Arts	3	1	1	2
Other	4		4	
	26	6	16	10

Hypothesis 2A. That there is a relationship between principle tertiary education category and adoption decision A.

H0. That there is no relationship between principle tertiary education category and adoption decision A.

Evaluating the tables using the SPSSX computer package (Nie, Hull et al 1981) gave a chi-square value of 1.24 with 4 degrees of freedom, which was not significant at the 5% level. H0 cannot therefore be rejected.

Hypothesis 2B. That there is a relationship between principle tertiary education category and adoption decision B.

H0. That there is no relationship between principle tertiary education category and adoption decision B.

Evaluation showed a chi-square value of 4.17, which was not significant below the 5% level. H0 cannot therefore be rejected.

These findings indicate that there is no clear relationship in the sample between tertiary education and adoption behaviours either as regards initial adoption or continuing use.

3. Respondent age

It might be considered that age has a bearing on the adoption of new technology - ie the older the respondent the less likely will he be to consider favourably the new challenge of computing, or to be able to adapt to the learning demands of present-day systems. It must be emphasised that no such impression was gained from discussion with the respondents, nevertheless in line with the philosophy of this chapter the possibility of such a relationship existing in the sample data has been explored rigorously.

Table 9.7 Respondent age and adoption decisions

	Decision A		Decision B	
Age group	Adopt	Reject	Continue	Discontinue
1 (31-40)	5	1	3	2
2 (41-50)	10	4	6	4
3 (51 +)*	11	1	7	4
	26	6	16	10

*(Includes 1 respondent in group 61+)

Hypothesis 3A. That there is a relationship between age of respondent and adoption decision A.

H0. That there is no relationship between age of respondent and adoption decision A.

The value of chi was 1.76 which was not significant below the 5% level, so H0 cannot be rejected.

Hypothesis 3B. That there is a relationship between age of respondent and adoption decision B.

H0. That there is no relationship between age of respondent and adoption decision B.

The value of chi was 0.98 which was not significant below the 5% level, so H0 cannot be rejected.

These results indicate that there is no relationship in the sample between age and decisions in the adoption cycle. Interestingly, a test on one set of case data considered in isolation indicated a significant positive association between age and computer use (ie the older the respondent, the more likely he is to use computing!) but this is not of course based on any justifiable theoretical position and the relationship is not pursued here.

General computer exposure

It would be predicted from the qualitative results discussed earlier that the amount of a manager's general experience of direct computing would be a significant factor influencing adoption choices. This could act in two distinct ways. Qualitative evidence suggests that some managers adopted on the assumption that their systems would provide certain personal benefits, and without knowledge of the time and effort costs involved, and were substantially disappointed (ie they might not have adopted in the first place if they had known more about the subject). Conversely, the more experienced managers would be more likely to continue with computing once adopted, because their learning requirements would be less and because their

expectations were more realistic. These ideas were tested by considering three aspects of computer experience and exploring their relationship to the adoption decisions.

Table 9.8 Formal training and adoption decisions

Formal training *	Decision A: Adopt	Decision A: Reject	Decision B: Continue	Decision B: Discontinue
0. None	9	3	7	2
1. Slight (<20 days)	9	1	6	3
2. More than 20 days	8	2	3	5
	26	6	16	10

* As measured by days training or full time equivalent.

Hypothesis 4A. That there is a relationship between the amount of formal computer training and adoption decision A.
H0. That there is no relationship between the amount of formal computer training and adoption decision A.

The chi-square value was found to be 0.82 which was not significant below the 5% level, therefore the null hypothesis cannot be rejected.

Hypothesis 4B. That there is a relationship between the amount of formal computer training and adoption decision B.
H0. That there is no relationship between the amount of formal computer training and adoption decision B.
The chi-square value was found to be 3.1 which was not

significant below the 5% level, therefore the null hypothesis cannot be rejected.

Intriguingly, the more sensitive test using Kendall's tau c shows a significant positive correlation of 0.35 between formal training and discontinuance. This seems to indicate that respondents with more training are more likely to discontinue use! However, there is no theoretical position behind a positive correlation and it is treated here as affirmation of a lack of negative correlation - ie there are no grounds for assuming that increased formal training improves the chances of continuing use.

These results seem to indicate that formal computer training has not positively affected the adoption and continuance behaviours of the managers; in particular, the fact that formal training seems to have had no positive effect on continuance behaviours supports the view that there is a substantial lack of suitable training for senior managers generally. This finding makes an interesting contrast with the next result relating to specifically practical experience of computers.

5. Previous practical experience

As discussed, the amount of previous direct computer experience a manager has had is expected to influence significantly his choices in the adoption cycle. To test this idea, respondents were asked about relevant direct experience which they may have had prior to their present adoption circumstances.

Table 9.9 Prior experience and adoption decisions

Prior experience	Decision A: Adopt	Decision A: Reject	Decision B: Continue	Decision B: Discontinue
0. No experience	14	3	8	6
1. Slight (<50 occasions)	6	1	2	4
2. Considerable (>50 occ's.	6	2	6	0
	26	6	16	10

Hypothesis 5A. That there is a relationship between the amount of past experience of direct computer use and choices in adoption decision A.

H0. That there is no relationship between the amount of past experience of direct computer use and choices in adoption decision A.

The value of chi-square was found to be 0.31 which was not significant below the 5% level and therefore H0 cannot be rejected.

Hypothesis 5B. That there is a relationship between the amount of past experience of direct computer use and choices in adoption decision B.

H0. That there is no relationship between the amount of past experience of direct computer use and choices in adoption decision B.

The value of chi-square was found to be 5.88 which was significant at the 5% level, and therefore H0 can be rejected.

In other words, there is some form of association between prior experience and continuance behaviours. The value for Kendall's tau is not significant however, which implies that the

relationship is not a straightforward linear one based on a correlation between increasing experience on the one axis and continuing usage on the other. Inspection of table 9.9 shows that the significant chi-square value is probably influenced by the values of the most experienced respondents, who all continued; but there is no clear linear relationship between continuance and experience. In other words, the amount of experience has to be large for the effect to be realised. If the categories 0 and 1 are combined, then the form of the relationship can be seen more clearly.

	Decision B	
	Continue	Discontinue
Prior experience		
0.+ 1. No / slight experience	10	10
2. Considerable (>50 occ's)	6	0
	16	10

These results are most interesting; apparently there is no relationship among the data relating to the initial adoption decision but there is a clear relationship relating to continuance behaviours, albeit not a straightforward one in the present sample. This finding is supportive of the view expressed earlier about the heavy learning costs encountered by inexperienced adopters. Of course, these results could be explained in a number of ways, but there is a clear case for further exploratory work. It is not an unreasonable assumption that the lack of relationship to initial adoption is due to the strength of overriding factors such as role requirements and

advocacy pressures; however, it is always possible that analysis of a more extensive sample would indicate the presence of a weak underlying relationship.

6. Home computer ownership

The third element of computer exposure investigated related to home computer ownership and use. It was suspected that many managers would have home computers (bought for their children if not for themselves) and that this might influence subsequent adoption behaviours at work. (Of course it could also be argued that the reverse were true, and that use at work encouraged use at home; the statistic measures either association).

Table 9.10 Home computers and adoption decisions

	Decision A		Decision B	
Home computer use	Adopt	Reject	Continue	Discontinue
0. Not owned	8	4	5	3
1. Not used by resp.	5	1	2	3
2. Slight use	7	0	3	4
3. Extensive use	6	1	6	0
	26	6	16	10

Hypothesis 6A. That there is a relationship between home computer use and adoption decision A.

H0. That there is no relationship between home computer use and adoption decision A.

The value of chi was 3.34 which was not significant below the 5%

level, so H0 cannot be rejected.

Hypothesis 6B. That there is a relationship between home computer use and adoption decision B.

H0. That there is no relationship between home computer use and adoption decision B.

The value of chi was 5.76 which was not significant below the 5% level, so H0 cannot be rejected.

It is possible to combine categories 0 and 1, and 2 and 3 (ie making new categories no use/ownership and slight/heavy use) and to form a square contingency table; this was also tested using the same hypotheses but again the chi-square values were not significant.

System introduction and development processes

There are a number of reasons for supposing that certain aspects of the way that systems are developed and introduced following adoption will affect the chances that the manager will subsequently continue or discontinue his use. In particular, it might be supposed that where the manager has himself been involved in the choice or design of his own facilities it is far more likely that these will be satisfactory than if he has merely accepted a standard offering which was intended for other purposes.

In order to test these ideas respondents were categorised in terms of their perceptions as regards their involvement in the design or choice of the facilities which they were offered, and in terms of their personal technical involvement (for instance in

programming, designing spreadsheets or developing database language parameters).

Table 9.11 Involvement in design or choice of facilities

Design / choice	Decision B: Continue	Decision B: Discontinue
1. Involved	6	0
2. Not involved	10	10
	--	--
	16	10

As the table shows, the majority of respondents were not involved either in the design or the choice of the their facilities. Interestingly, those that were involved were all continuers.

Hypothesis 7B. There is an association between involvement in the design or choice of computer facilities and adoption decision B.
H0. There is no relationship between involvement in the design or choice of computer facilities and adoption decision B.

The chi-square value was 3.0 with a significance of 8% (after the Yates correction); however, the more sensitive test using Kendall's tau indicated a value of 0.43 which was significant at the 2% level and therefore H0 was rejected

Table 9.12 Technical involvement and continuing use

Technical involvement	Decision B: Continue	Decision B: Discontinue
1. Technically involved	7	0
2. Not technically involved	9	10
	--	--
	16	10

Hypothesis 8B. There is an association between technical involvement in the development of spreadsheets or programs, and adoption decision B.

H0. There is no relationship between technical involvement and adoption decision B.

The chi-square value was 3.0 with a significance of 8% (after the Yates correction); however, Kendall's tau was significant at the 1% level and therefore the null hypothesis was rejected.

In both these last tests a relationship has been shown between the system development processes and the respondents' continuance behaviour; the Phi statistic showing a marginally greater association with respect to technical involvement. Of course, the direction of causality is not clear from the statistic; (ie it could be argued that continuing use encourages increased technical involvement, for instance) and in fact it is entirely possible that both variables are related to a third variable not considered here. For example, it is possible that a predisposition for computer programming is associated with

another variable, which in its turn is also associated with computer use. Thus it would be quite unwarranted to assume that encouraging managers to write their own programs would improve the likelihood of continuance. Similarly, earlier experience and/or knowledge from training may predispose managers to involvement in choice of their computer facilities as well as to continued use, so system choice is not causally linked with continued use on the data examined here. Nevertheless, relationships have been shown and this may warrant further work on larger samples to investigate the phenomena.

Within the limits of the data sample to hand it is possible to examine the possibility of a relationship between the two developmental variables and other variables in order to ascertain the presence of other links; it is possible, for example that there is a certain mix of variables which amounts to a "continuance profile". In order to explore this idea, the last two variables were cross-tabulated against variable 5, prior experience (which was itself correlated with continuance), in order to assess the extent of any relationship.

H9. There is an association between prior experience and involvement in the design or choice of systems.
H0. There is no association between prior experience and involvement in the design or choice of systems.
The chi-square value was 8.8 with a significance of 1%, and therefore the null hypothesis can be rejected. Kendall's tau was also significant at the 3% level and showed the direction of correlation as indicating the expected positive relationship between experience and choice involvement.

H10. There is a relationship between prior experience and technical involvement in systems development.

H0. There is no relationship between prior experience and technical involvement in systems development.

The chi-square value was 2.2, not significant at the 5% level and so H0 cannot be rejected. The result from Kendall's tau was also not significant.

This result is somewhat surprising as it might have been predicted that technical involvement was certainly related to past experience; nevertheless, the relationship has not been shown and this weakens the case for a "continuance profile" based on a group of experiential and implementation involvement features.

Discussion

Of course, there are many other ways of exploring these data statistically. For instance the respondents who have adopted have been categorised in terms of the extent of their usage (slight, medium and heavy use) and this variable may be considered as ordinal; such an extension of the data has been explored in terms of some the other variables already discussed using Kendall's tau, but without substantially affecting the impressions gained from the chi-square tests already discussed. Additionally, it is possible to explore relationships between variables other than those examined here. The main criterion for such exploration is of course the presence of theoretical underpinnings which produce

relevant hypotheses. In general terms, it is felt that the results presented here represent the simplest and perhaps the clearest treatment of the sparse quantitative data available.

Table 9.13 Summary of hypotheses and statistical tests

Hypothesis / Decision		Data Type	Table Size	Chi-square Value	Chi-square Sig-'nce %	Chi-square Out-come	Cramer's V / Phi	Kendall's tau c Value	Kendall's tau c Sig-'nce %	Kendall's tau c Out-come
Personal variables										
H1A	Career A	Nom	6x2	4.0	50	Rej				
H1B	B	Nom	6x2	6.1	20	Rej				
H2A	Education A	Nom	5x2	1.2	87	Rej				
H2B	B	Nom	5x2	4.2	38	Rej				
H3A	Age A	Ord	3x2	1.8	41	Rej		0.11	22	Rej
H3B	B	Ord	3x2	1.0	98	Rej		-0.04	43	Rej
Experiential variables										
H4A	Training A	Ord	3x2	0.8	66	Rej		-0.05	36	Rej
H4B	B	Ord	3x2	3.1	21	Rej		0.35	5	Acc
H5A	Experience A	Ord	3x2	0.3	85	Rej		0.05	37	Rej
H5B	B	Ord	3x2	5.9	5	Acc	0.48	-0.24	12	Rej
H6A	Home C. use A	Ord	4x2	3.3	33	Rej		-0.22	8	Rej
H6B	B	Ord	4x2	5.8	12	Rej		-0.24	13	Rej
Developmental process										
H7B	Des'n/choice B	Nom	2x2	3.0	8	Rej		0.43	2	Acc
H8B	Tech. inv. B	Nom	2x2	4.0	5	Acc	0.48	0.48	1	Acc
Profile variables										
H9	Prior exp. / design-choice involvement	Ord	3x2	8.8	1	Acc	0.58	-0.33	3	Acc
H10	Prior exp. / technical involvement	Ord	3x2	2.2	33	Rej		-0.19	15	Rej

Key: Rej. - reject hypothesis; Acc. - accept hypothesis.

Note: The direction of association indicated by the positive or negative values of Kendall's tau are based on discontinuance as a "higher" value than continuance; thus the relationship in H5B indicates a positive association between experience and continuance.

By and large, (and with the specific exception of the prior experience variable) it seems that the personal and situational background variables discussed here are not statistically associated with the sample individuals' trajectories in the adoption cycle. This is not altogether surprising after the extensive qualitative analysis described earlier has shown considerable evidence for the importance of social and role-related variables in initial adoption and for the importance of interface difficulties and role mismatch in discontinuance behaviours.

In general, the point has been made that the sample does not exhibit characteristics of clear relationships between adoption and continuance with respect to the measured background variables and this serves to reinforce the arguments presented from the qualitative analysis undertaken for each case. The exception is of course the presence of prior experience which, when present in sufficient amount, appears to be associated with continued use. This result is supportive of the qualitative findings which suggested that interface difficulties associated with high learning costs were significant in discontinuance; prior experience acts generally to reduce the learning costs.

The two variables associated with the developmental process showed a clear association with continuance behaviours. Involvement in the choice or design of the managers' systems facilities, and technical involvement in the development of the systems were both associated with continued use. However, some caution is required in interpreting these finding - there is no evidence to suggest, for example, that increasing a manager's

developmental involvement will necessarily increase his chances of continued use (although conventional implementation wisdom would suggest that this would be true). Qualitative evidence would suggest that managers who are involved developmentally have other characteristics (such as strong personal interests in computing for its own sake, and extensive prior experience) which are just as likely to be determinants of any predisposition to continuance; and in fact there is indeed an association in the data which relates prior experience to design involvement (see hypothesis H9). In general then, there were no simple background factors which showed clear relationships to predispositions in the initial adoption cycle and this finding adds support to the discussion of complex organizational and role factors related earlier.

References

Everitt BS, The Analysis of Contingency Tables, Chapman and Hall, London, 1977

Grinyer PH, Financial Modelling for Planning in the UK, Long Range Planning, Vol16 5, 1983

Grinyer PH, Wooller J, Computer Models for Corporate Planning, Long Range Planning, Feb, 1975

Martin CJ, Senior Managers and Computers: A Survey to Identify Key Issues Relating to Senior Managerial Use of Computers, DUBS Working Paper Series, 1985

Nie NH et al, SPSS Statistical Package for the Social Sciences, McGraw Hill 1981

Schein EH, Organizational Psychology, Prentice Hall 1980

Siegel S, Nonparametric Statistics for the Behavioural Sciences, McGraw-Hill Inc 1956

Chapter 10

Results and Conclusions

Abstract

This final chapter reviews the key results from the field research chapters and develops a new theoretical framework. A behavioural model for the computer adoption process is proposed which is grounded in evidence from the study. Finally, there follows an appraisal of the model, and a discussion of the work in a wider context.

Introduction

The primary purpose of this research has been to explore the nature of the computer adoption process and to examine the circumstance and nature of the adoption behaviours. This part of the thesis attempts to create a new theoretical structure which incorporates the main results. The qualitative evidence from the field research sheds a detailed light on the circumstances of the managers' behaviour, considered both as the action of individuals and also (primarily) as part of the complex fabric of organizational life.

> "Rules, motives... situations, social relationships, behaviour are all regarded as analytically separate elements only contingently related to each other. The job of empirical research is to discover... the pattern of these contingent relationships and formulate them as regularities." (Hughes 1980)

It is now possible to synthesize a generalised model of the adoption process which illustrates these patterns, and which combines results from all phases of the research into a single expression of the results. The derivation and presentation of this model involves a number of elements:

1 Summarising and combining the results from the case studies in the light of the behavioural perspectives explored in chapters 3 and 4

2 Elaborating the resulting salient behavioural features within the proposed model framework, and deducing the key variables

3 Reviewing the conclusions from the hypothesis testing on background variables in chapter 9, and from the small firm study of chapter 8

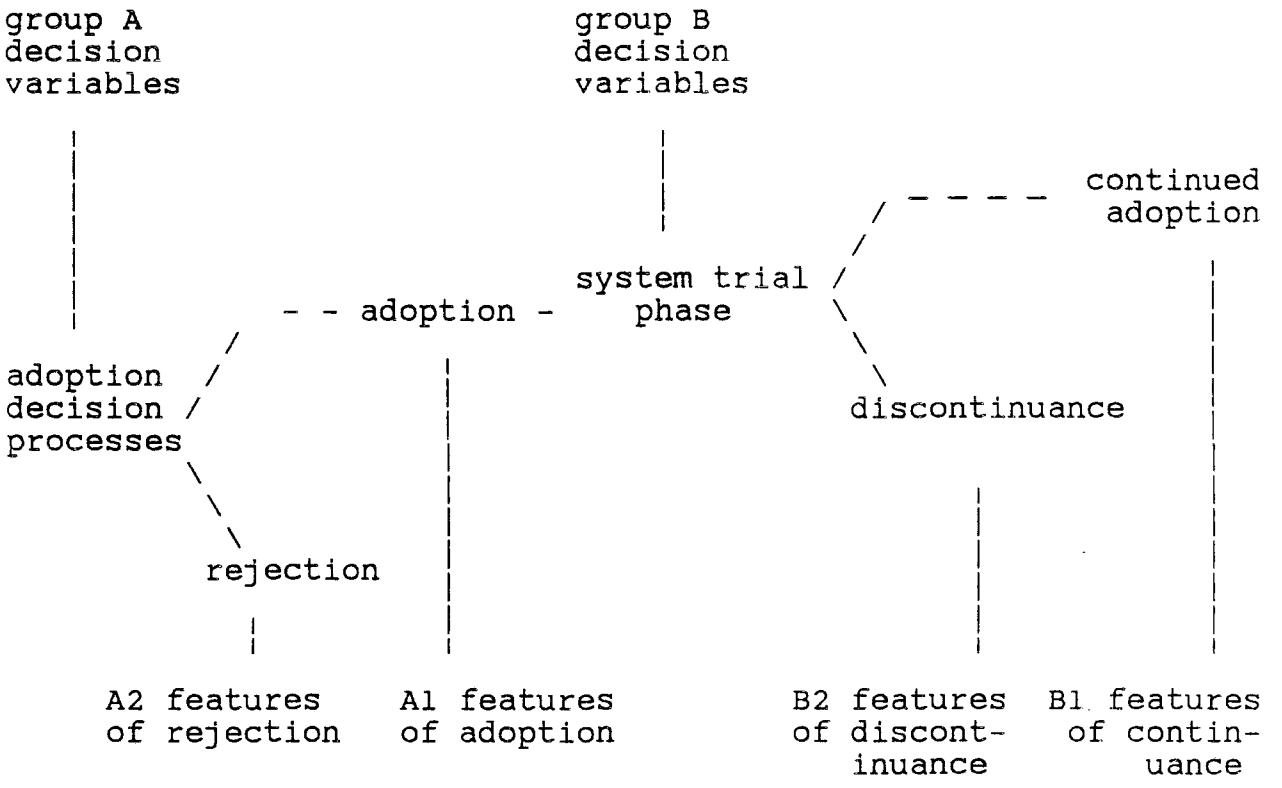
Naturally not every detail of the earlier chapters can be reviewed here; rather the key elements will be highlighted. Following the presentation of the new theoretical model, its value and relationship to earlier work will be assessed.

A behavioural model of the adoption process

A key finding from the case studies described in chapters 6 and 7 was that many of the large organization managers in the sample had been through one (or more) adoption / rejection - continuance / discontinuance cycles. All five case studies showed evidence for the existence of these cycles, although the trajectories and details of the cycles varied from case to case and from individual to individual. In a number of instances, the trajectory through the cycle took the form of an adoption of direct computer systems for reasons associated with leadership role enactment and with high level advocacy; in some instances the system usage was then discontinued - a phenomenon associated by the respondents with man/machine interface difficulties on the one hand, and with a lack of significant advantage arising from system use on the other. There seems to be a crucial point in the adoption cycle of discontinuers where the manager is overwhelmed by negative factors such that he considers the effort required to continue with the adoption outweighs the perceived rewards. It may also be the case at this point that his perceptions of the rewards changes as he experiences the situation directly, rather than relying on external perceptions.

It has been found useful to consider adoption and use behaviours generally as exhibiting a cyclic pattern with two principal stages. In order to describe this pattern accurately it is necessary to extend the dynamic model of chapter 4 in order to incorporate these results. This can be expressed in the form of a pictorial model as shown in figure 10.1 below:

Figure 10.1 Final Model of the Managerial Computer Adoption Process in Large Organizations



This model shows an initial decision process which results either in adoption of a computer system, or in rejection. If the system is adopted, then there is a trial phase followed either by

continuing use, or discontinuance. All the managers in the large organization research sample could be described in terms of their trajectories in these decision paths. The crucial feature of the model is that it postulates two different sets of variables, set A and set B, which come into play at the two key points in the adoption cycle. Hitherto, it has been assumed that there are variables which generally influence computer use; here, it is specifically hypothesised that the set of variables which influences initial adoption is substantially different from the set of variables which influences subsequent continuance. The nature of these variables will be deduced after considering the features of adoption, which will be discussed next.

In terms of our main theme, the key questions about senior managerial computer use revolve around the circumstances under which some managers reject direct computing when others adopt it, and why some managers continue with their system use when others discontinue. Utilising comparative data derived from the case studies, certain features of the managers' circumstances can be associated with their decisions at the two key points in the adoption cycle. This is a key point; it was found in the case studies that the intra-organizational comparisons of managers who described different behaviours (in terms of the categories in the model) were crucial to understanding the nature of those behaviours. These comparisons highlighted the situational factors which were important in prescribing behaviour. On the other hand, inter-organizational comparisons showed remarkable uniformity even though the organizations were functionally very different; in our view this adds weight to the idea that the internal

situational factors identified were in fact the key issues.

Combining the evidence from the case studies provides sets of salient features which were judged to be associated with the behaviours in the adoption cycle. These features can be summarised in the form of a table which shows the cases and numbers of respondents from which evidence of the feature is derived (Table 10.1). It is hypothesised here that these features are not specific only to the cases reviewed in the research, but represent aspects of adoption behaviour which, in the appropriate circumstances, will be found generally in all large organizations. The explanation of these features derives at least in part from the consideration of particular senior managerial behaviours (such as spending time outside the organization) and attributes (such as possessing well-developed personal networks), and also from the requirements of particular aspects of their roles (such as the requirements arising from their leadership position).

It is clear from earlier discussions that the behavioural circumstances which are being described here are particularly complex. In one sense it is less than satisfactory to derive specific "features" or "variables" when this tends to reduce a complex situation to a simple description. But on the other hand, there has to be some way in which the nature of the complexity can be understood, otherwise no progress can be made. The approach adopted here has been one that attempts to isolate important aspects without losing too much of the essential "flavour" of the situation; this is why the resulting conclusions

are described as a model - it is an attempt to provide a useful simplification of a complex reality. A measure of success is the extent to which the model does in fact represent a useful and informative (if simplified) picture of the complex reality.

Table 10.1 Main Features of the Decision Paths in the Adoption Cycle

	Respondents and cases				
Case	1	2	3	4	5
N	6	10	5	4	7
A1. Features of adoption	6	9	3	3	2
1. High level advocacy	H	H	H	H	-
2. Middle-level advocacy	M	M	-	M	M
3. Leadership role enactment	6	9	3	2	2
4. Personal evaluation of systems	2	5	-	3	1
5. Unrealistic expectations as regards rewards and benefits	4	3	-	3	1
A2. Features of non-adoption	-	1	2	1	5
1. Resistance to advocacy pressures	-	-	1	1	1
2. Adverse perceptions about the value of computer systems	-	1	2	1	1
B1. Features of continuance	1	5	3	-	2
1. Polarised system usage patterns	1	5	2	-	1
2. Successful interweaving of system use into manager's role set	1	4	2	-	1
3. Lack of informational advantage	1	5	3	-	1
4. Expression of values	1	5	3	-	1
5. Rejection of the financial DSS	-	5	-	-	-
6. Atypical senior managerial behaviour	-	1	2	-	1
7. Technology fascination	1	1	1	-	-
B2. Features of discontinuance	5	4	-	1	-
1. Difficulties with m/m interface	4	4	-	1	-
2. High cost (to the individual) of information relative to its value	5	3	-	1	-
3. Inappropriate orientation	3	2	-	1	-
4. Mismatch between system intentions and real role requirements	5	2	-	1	-
5. Continuing positive views about organizational computing	5	4	-	1	-

Key: H and M indicates that high- or middle-level advocates respectively were present in the cases indicated. The quantities shown for feature A1.3 and onwards indicate the number of respondents in each case with whom the feature was associated.

Note: Two respondents from case 4 had indicated their adoption decision and are placed in category A1, but neither had yet begun their trial phase and therefore do not appear in either of the B categories.

A description of the main features of the adoption process

Although the circumstances of individuals have been discussed in some detail in the case study reviews, it is necessary here to summarise the principal aspects together with the main arguments for their inclusion in the final behavioural model.

A1. Features of adoption

1. High and middle-level advocacy

Managers were influenced by others within the organization at various levels and rarely was the decision to adopt computing an individual's lone choice. Although it might be supposed that top level managers have complete discretion over these choices, in practice they usually described the ways in which they had been influenced by others, and in one or two instances this amounted to something closer to compliance rather than whole-hearted enthusiasm. All except one case provided evidence for the effects of advocacy, and it is concluded that the influence of intra-organizational pressures is a key variable in the adoption process.

2. Leadership role enactment

Nearly all the managers referred directly to their leadership roles when describing their computer adoption. In some instances this occurred in the context of a requirement to lead their direct subordinates with respect to computer use; in others because they were in charge of a division with responsibility for the computing resource, and hence there was a need to show appropriate usage leadership to other divisions on behalf of the manager's subordinates. Even where there were no direct

functional responsibilities of this kind, senior managers described a perceived requirement for them to reflect certain values (always very positive ones) with regards to computing, to others both inside and outside the organization.

3. Personal systems evaluation

Some managers described their computer adoption in terms of a personal exploration of the capabilities of the system; this deliberate learning experience was described as being undertaken sometimes on their own behalf and sometimes on the behalf of others. In a sense this was part of the leadership role requirement, but involving a somewhat different complex of demands than the straightforward exposition of desirable values to others.

4. Expectations of particular rewards and benefits

Managers had certain expectations with regard to the computer systems which they would receive, in terms of personal informational benefits. These expectations varied, depending partly on the manager's prior experience of direct computing; where the manager had no previous experience the expectations were often unrealistically favourable, leading to subsequent expression of substantial disenchantment and disappointment following system trial. These expectations were described not only in retrospect by discontinuing managers, but also by those who had not yet adopted (and who therefore had no experience to go on).

A2. Features of non-adoption

In most respects the features of non-adoption reflected a

corollary of the features of adoption. In a few instances, managers had specifically rejected direct computing for themselves even though their board colleagues had adopted. Either the internal pressures to adopt had been less acute in their particular circumstances, or they had specifically resisted the pressures. With regard to their leadership requirements, either they perceived there to be no requirement for them to display pro-computing values, or, as in one instance, the manager perceived that computer use would reflect negatively on his position.

B1. Features of continuance

1. Polarised and diversified system usage patterns

Several managers in the study were presently utilising their computer systems to one degree or another. It was noted that a significant characteristic of their use was the tendency for a manager to stick with one particular system or facility, even where a wide range of facilities was available to him. This was taken to be a response to the need to minimise the personal time and effort costs which were associated with learning how to use the systems. These costs arise not only from an initial learning effort but also from the necessity to continually practice specific system-oriented skills in order to maintain effective systems use. The managers could not afford the time to maintain his skills in more than one system. Given a broad choice of facilities, managers settled on one or another facility (in contrast to their colleagues) for no clear informational or task-oriented reason.

2. Successful interweaving of system use into the manager's present role set

A significant feature of the continuing use was the direct utilisation of a system within the manager's present work activities. For example, personnel directors used their terminals to access data on individuals from computerised databases; this activity would have been carried out before computerisation using record cards or other means and the automation represented a straightforward replacement of one access mechanism for another. Other top managers who used their systems regularly had all found some way in which their computer use related to current activities. None of the respondents reported any significant use of generalised decision support systems, even where these systems were very extensive and sophisticated. In general there was little evidence that any manager's work roles had changed significantly as a result of his computer use. All respondents were asked about the way in which direct computer use had altered their personal work activities, and most of them reported that there had been no significant change.

3. Lack of effective informational advantage

What was particularly noticeable was that systems use did not appear to confer any particular informational advantage on the user (and some systems were compared unfavourably by the respondents themselves to alternative access methods). In particular, many of the top managers in the study could command significant human informational resources in terms of staff advisers, financial analysts etc by virtue of their position; and, as has been pointed out, it is a significant part of top

management's work that they create extensive and effective interpersonal information networks. The direct computer facilities were considered to be poor alternatives to such resources except under special circumstances. In many instances, continuing computer use seemed to be related to the achievement of other goals, particularly as regards the influence of others or the expression of values with respect to the man and his organization.

B2. Features of discontinuance

1. Difficulties at the man/machine interface

All the discontinuing managers described difficulties in terms of time and effort costs associated with learning to use computer systems. However, it must be emphasised that many of the respondents had in fact made very determined efforts to utilise their systems, and had achieved substantial operating and conceptual knowledge about the systems before ceasing to use them. This implies that interface difficulties alone were not responsible for the discontinuance, but rather that the managers perceived that they were paying a high relative cost for the system use. For many respondents, the value of the information to be had from the system seemed to represent a poor reward for the considerable efforts required to access it.

2. A mismatch between system intentions and managers' real role requirements

This section explores the reasons why the managers found the informational rewards from the system to be unsatisfactory. The three separate items B2.3-5 of table 10.1 are closely related and

will be more clearly and easily interpreted if discussed together rather than as separate entities.

It has been found most useful to consider the computer system as being aimed at addressing various aspects of the manager's informational and decisional roles; it appeared that the systems failed to do this successfully because the systems were incorrectly oriented as regards the particular nature of senior managerial work in respect of these roles. In particular, where the information was aimed, for example, at monitoring or resource allocation roles it often reflected issues which would be of more interest at lower management levels.

Apart from the orientation failure, it seemed that this computer information just could not compete with the information sources which the managers had developed from their existing personal networks. This is a key point: it is a characteristic of senior managers that they acquire and develop superior information sources through skilful manipulation of interpersonal networks (Kotter 1982). Attempts to create and implement systems which were to compete directly with these sources (even formally based ones) seemed to have been ineffectual. In a similar way, the managers' liaison and dissemination roles were usually not enhanced by computerised messaging systems, partly because the systems did not include important contacts who were part of the manager's interpersonal networks, and partly because they lacked the immediacy of face to face contacts or the efficiency (for the managers) of traditional methods.

In general terms, therefore, it is concluded that the mismatch

between the system outputs and the managers' role requirements - due at least in part to a failure of orientation - resulted in the systems being perceived by the managers to be of poor value relative to their well-developed personal resources, and particularly with regard to the effort costs involved. Practical experience showed the discontinuing managers that their personal efficiency was not addressed by the systems, and they duly abandoned them. There were of course exceptions to this rule, but these have already been adequately discussed in the preceding section.

Derivation of the model variables

Considering the features of the paths in the adoption process leads directly to the deduction of those variables which can be hypothesised as contributing to the direction of the adoption process. In the case of adoption in the first part of the model, it was found that the presence of high and middle level advocacy was a salient feature related to initial adoption. It can therefore be deduced that the strength of the influence on the manager of these intra-organizational pressures (in combination with his response to them) is a key variable in determining the likelihood of his computer adoption. Similarly, in view of the importance of the leadership role it is considered that the nature of the manager's role requirements (and his response to these) is a key variable in his adoption decision. Finally, it was found that the managers' expectations (which were often quite unrealistic) about the systems seemed to be an important consideration both for those who adopted and for those who did

not; therefore the strength and nature of the manager's expectations is hypothesised to be the third main variable affecting his adoption decision.

With respect to the second part of the model, several of the features point to the size of the manager's personal learning effort costs as contributing to his continuance (or discontinuance) behaviours. The difficulties described by the discontinuers, together with the polarised usage patterns of the continuers both support this hypothesis. Similarly, the inappropriate orientation of the systems and the low value ascribed by discontinuers, together with the expressed lack of informational advantage described by the continuers allow the derivation of a variable which expresses the perceived relevance of the system to the managers work. This can best be expressed in terms of the closeness of the system functions to the manager's present role requirements. Finally, certain features (including the lack of informational advantage, and expression of values by the continuers) point to the achievement of non-functional rewards (non-functional in the sense that the rewards were not designed into the system as an inherent part of the system's intended functionality).

The variables which are hypothesised to be the key variables in the adoption process can now be summarised as follows (see table 10.2) below:

Table 10.2 Variables in the Model of the Adoption Process

	Related features from Table 10.1
A. Variables in the adoption/rejection decision	
1. Influence on the adopter of intra-organizational pressures	A1.1,A1.2,A1.4,A1.5 A2.1
2. Role requirements (particularly in respect of leadership)	A1.1,A1.3,A1.4 A2.2,B2.5
3. Expectations of future functional benefits and rewards	A1.2,A1.5 A2.2
B. Variables in the continuance/discontinuance decision	
1. Personal learning effort costs	B1.1 B2.1,B2.2,B2.5
2. Closeness of system functions to present role requirements	B1.2,B1.6 B2.2,B2.5
3. Achievement of non-functional rewards	B1.3,B1.4,B1.7

These are considered to be the main variables which are relevant in the adoption cycle. There are of course others, but it is the contention of this thesis that these are the principle ones. As significant as the items included are those which have been omitted. For example, purely functional system value is not considered to be a key variable in continuance and many of the behaviours described here are inexplicable when considered in these terms. Similarly, attitudinal effects are not considered to be a key variable because even managers who had discontinued still expressed positive attitudes about computing in their

organizations. Neither is the quality of the system interface included; only its affect in terms of the manager's personal learning costs.

In general terms, then the variables shown in table 10.2 are proposed because they are derived directly from those features of the case studies which were judged to be salient. There is no doubt that in a situation of this behavioural complexity, not only will other variables play a part, but the ones proposed will interact in subtle and complex ways. Nevertheless, it is considered that the model derived here will serve a purpose in illuminating at least some aspects of the adoption problem.

The evaluation of other variables

Having presented the model derived from qualitative analysis of the research data, it is worthwhile restating the implications of the quantitative work on testing predefined hypotheses. As has been described in detail in chapter 9, provision had been made in the interview format to gather data with which to test specific hypotheses relating to background variables which might be supposed to have influenced adoption processes. These variables related to specific personal factors: age, education and career history; the effects of prior computer exposure gained from education or previous experience; and the consequences of respondents' involvement in developmental processes. Appropriate nonparametric statistical tests were performed in order to establish the presence or absence of significant relationships between these variables and managers' choices at the two key

points (initial adoption/rejection and subsequent continuance/discontinuance) in the adoption cycle. The intention was to verify as far as possible the assumption that there were not more straightforward relationships among these variables in the sample that would obviate the need for the evolution of more complex social explanations of the managers' behaviours involving role requirements, advocacy pressures and so on.

In the event, out of fourteen specific hypotheses only three were found to be significant. None of the variables was significantly related to initial adoption. The personal variables were not associated with either decision outcome. Of the experiential variables, prior direct experience (if in sufficient amount) was shown to be associated with continuance; this was taken as supportive of the qualitative findings which suggest that discontinuance behaviours were associated with high learning costs and man/machine interface difficulties generally. Both the developmental variables (design/choice involvement and technical involvement) were shown to be associated with continuance behaviour; however, it has been stressed that it would be quite unwarranted to assume simple causality (ie that encouraging managers to write their own programs, for example, would improve the likelihood of continuance) as there were alternative likely explanations for this relationship.

Naturally, having regard for the sparse data available considerable caution must be exercised with regard to the implications of these statistical findings, which are regarded as being primarily of exploratory and advisory value. Nevertheless, it is judged that the results are supportive of certain aspects

of the proposed adoption model, and can be regarded as obviating to some extent any criticism that simple relationships among background variables exist in the sample which have not been properly explored.

The small firm - a different context

The materials from the five case studies (and the statistical analysis) represent findings relevant to large organizations under certain specific organizational circumstances. These circumstances included the presence of established internal specialist computing departments which represented a fund of technical expertise and which acted as providers of a computing service to the senior managers. By way of contrast to these studies, interviews were conducted with the chief executives of the small firms in order to establish comparisons. A review of the established literature encouraged the view that in the small firms, the lack of internal specialists (and indeed the lack of other resources) would result in a different, proactive approach to computing in contrast to the generally rather reactive styles found in the large organizations.

This was indeed found to be the case, although there were several different patterns found in the sample, ranging from close involvement in direct operations of routine systems through to a remote stance similar to that found in the large organizations. The presence of these different styles led to a proposal for a typology of behaviour patterns which showed the relationship of the chief executive to the computer resource.

The typology was arranged to show ordinal categories of increasing personal involvement, which implies increasingly large investments of time and effort. The main factor associated with this range of behavioural patterns seemed to be the requirements dictated by organizational resource constraints, which require that the chief executive take on roles which would be associated with lower management levels in larger organizations. This being the case, one would expect to find a relationship between firm size and the behavioural pattern adopted. This hypothesis was tested using a non-parametric test which indeed indicated a significant association between the two variables. In addition to the behavioural typology, there was evidence in some cases for the existence of distinct involvement/disengagement cycles by the chief executives; this took the form of close involvement (in a technical sense) followed by the delegation of the activity after a period of time. This cycle of development, implementation and delegation was of course undertaken in a rather different context from that of the managers in the large organizations, to whom the direct use of computers was intended to be related to their own personal efficiency.

In general terms then, it was found that where the small firm chief executive interacted directly with a computer system it was undertaken in a different context from that of the senior manager in the larger firm. Generally, the involvement was linked to the implementation of systems intended specifically for organizational (and not personal) efficiency; this different context is understood to reflect the difference in the internal resources which are required to handle the implementation of

operational systems.

Having identified the different contexts in small and large organizations arising primarily from size and resource constraints, what can be said about the large body of organizations which lie between these size extremes? It might be supposed that most organizations can be categorized either as DSS possessing entities with sufficient resources and management slack to invest in personal managerial efficiency, or as small, operationally-oriented entities. However, it can be hypothesised that there will be a cross-over point where firms are big enough to possess specialist expertise and other resources sufficient to enable decision-suppport intended systems to be developed, and at the same time small enough so that the chief executive will still take a personally active part in the development and implementation of these and other systems. Such a possibility merely emphasises the point that size is an important factor - not an absolute dictate of context.

But the general point still stands - most of the literature concerned with this topic makes little reference to the effect of organizational size; this research shows that organizational size (and hence organizational resource) is a key variable in prescribing the nature of senior managerial computer involvement and use.

The model in a wider context

The present work has produced a dynamic, process model specific to senior managerial computing adoption and use, and has shown

how organizational size and resource availability affect the context of that process; the comparative nature of the research has shown that the model is relevant in both private and public organizations. The question now arises as to the extent to which the model can be generalised outside the limitations of the research materials studied; particularly, say to other managerial strata or to quasi-managerial occupations such as the professions.

In some respects it might now seem appropriate to derive a general model of managerial computer adoption and use which incorporates the findings from the field work together with the literature-derived model from chapter 4, and the organizational size/resource relationship from chapter 8. But this is not felt to be a suitable point to attempt such a synthesis. Firstly, the general model from chapter 4 represents a melange of ideas from a review which covered many different perspectives and viewpoints. There appears to be little justification for combining this "theory" with the empirically derived results from the present research. Rather, it is felt to be more appropriate to regard the model of chapter 4 as an initial general framework, a convenient point of departure for specific research into specific contexts.

To have illuminated parts of the whole picture is felt to be perhaps as much as is warranted by the nature and extent of the present research effort. The derivation of a more general theory which encompasses a wider approach to computer adoption and implementation processes will require a better understanding, which will in turn come from future research efforts and from the

synthesis of materials at a broader theoretical level.

An appraisal of the theoretical model

The derivation of the model has attempted two different things. One objective was to create a straightforward conceptual model of a complex behavioural process, one which could be used by practitioners, for example, to guide system design and implementation efforts at top management levels, or in an educational context to emphasise key aspects of the special implementation problems associated with managerial computing. The model is intended to possess predictive and explanatory power, as well as alerting practitioners to important (but often ignored) elements of the managerial world. It is felt that something useful has been achieved here, and some direct implications of the model and associated research findings for managers and practitioners are discussed in appendix 9.

The other aim involved the derivation of a scientifically valid theory which could be verified empirically or utilised as a springboard for further research, either in the context of verification studies or as a framework for examining related topics.

> "... theory in sociology is a strategy for handling data in research, providing models of conceptualisation for describing and explaining. The theory should provide clear enough categories and hypotheses so that crucial ones can be verified in present and future research; they must be clear enough to be readily operationalised in quantitative studies when these are appropriate." (Glaser and Strauss 1968)

It is felt that the model framework and ideas outlined here do

indeed provide such a suitable basis. The model and its elements have been clearly evaluated and presented, and the variables and linkages made explicit. This leaves the way open for the proposals to be tested and refuted (or confirmed!) by others.

In conclusion, it is felt that a new outline of the research phenomena has been achieved, one which is grounded in empirical evidence, and one which will have some use for researchers and practitioners alike. Moreover, the methodology employed involving intra-organizational and inter-organizational comparisons among computer-exposed managers has been both novel and useful, and the study has added materially to our understanding of the issues involved. In particular, it has been shown that role concepts are very useful indeed for investigating aspects of managerial computer use - both in the context of current practice and for future potential. In general, it has been shown that social and organizational issues are particularly significant in prescribing the nature of computer adoption and use processes, an issue that has been given insufficient attention by decision support practitioners and academics.

Opportunities for further research

During the course of this project, a number of opportunities for further research have been created. These came from ideas generated from the literature review, during the field work and during the writing-up phase. They are a reflection of issues which were deemed to be tangential to the main focus of the project, or arising from ideas or problems which just could not

be resolved within the project time constraints, or from the implications of the research findings. A few of these ideas are discussed in appendix 10 (see page 427).

A final comment

It has long been assumed that a manager-computer symbiosis of some kind will be an inevitable outcome of improved technology or techniques. And in fact most computer development is indeed essentially technique or technology driven; the current Japanese Fifth Generation initiative and the British Alvey programme are prime examples of the technological approach and ethos. Where this approach has not been successful in managerial computing (and the occurrence of failure may be far greater than is indicated by present research activity) it has been assumed, tacitly or otherwise, to be due to some "problem"; the problem being either on the part of the manager, ie lack of awareness, or lack of training, or attitudes and predispositions or perhaps, more recently, to be a consequence of inadequate human / computer interfaces.

However, this research has shown that managerial behaviours in respect of computing are generally linked to personally rational and compelling reasons for the personal decisions which are made; these decisions often involving the rejection of the technology which so far seems to have comparatively little to offer in terms of functionally advantageous personal support for the top level general manager. Computer systems intended for managerial support seem usually to be based, explicitly or implicitly, on certain assumptions about the nature of managerial behaviour.

Unfortunately, these assumptions seem often to be wrong. The idea which emerges is that the way forward requires first an improved understanding of the real nature of managerial work itself, as a prerequisite for the sensible development of the necessary technology which is to support it.

References

Glaser BG, Strauss AL, The Discovery of Grounded Theory, Weidenfeld & Nicolson, London, 1968

Hughes JA, The Philosophy of Social Research, Longman, London, 1980

Kotter JP, What Effective Managers Really Do, Harvard Business Review, Nov/Dec, 1982

References

The items shown here have been referred to in the main text, and are an aggregation of the individual reference sections at the end of each chapter.

Ackoff RL, Management MIS Information Systems, Management Science, 4, 1967

Aguilar FJ, Scanning the Business Environment, Macmillan, 1967

Akoka J, A Framework for Decision System Evaluation, Information and Management, Vol 4, 1981

Alter SL, A Study of Computer Aided Decision Making in Organizations, Unpublished PhD Dissertation, Sloan School of Management, MIT, Mass. 1975

Alter SL, A Taxonomy of Decision Support Systems, Sloan Management Review, Vol 19, 1977

Alter SL, Why Is Man-Computer Interaction Important for Decision Support Systems?, Interfaces, Vol 7 2 Feb, 1977b

Alter SL, Development Patterns for Decision Support Systems, MIS Quarterly, Sept, 1978

Anthony RN, Planning and Control Systems: A Framework for Analysis, Harvard Busines School Boston, Mass. USA, 1965

Argyris C, Management Information Systems: The Challenge to Rationality and Emotionality, Management Science, Vol 17 6, 1971

Bean AS et al, Structural and Behavioral Correlates of Implementation in US Business Organizations, in Schultz RL, Slevin DP eds, Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Benbassat I, Dexter AS, Value and Events Approaches to Accounting: An Experimental Evaluation, Accounting Review, Vol LIV 4, 1979

Benbasat IB, Taylor RN, The Impact of Cognitive Styles on Information System Design, MIS Quarterly, Vol 2 2 June, 1978

Bennis WG, Benne KD, Chin R (Eds), The Planning of Change, Holt, Rinehart and Winston Inc 1961

Bonczek RH, et al, Foundations of Decision Support Systems, Academic Press Inc 1981

Bosman A, Decision Support Systems, Problem Solving and Co-ordination, in Sol HG, (Ed) Processes and Tools for Decision Support,Proc. of Joint IFIP WG 8.3/IASA Conf., North Holland, Austria 1983

Botkin JW, An Intuitive Computer System: A Cognitive Approach to the Management Learning Process, PhD Thesis, Harvard Business School, Boston, Mass 1973

Boulden JB, Buffa ES, Corporate Models: On-Line, Real-Time Systems, Harvard Business Review, July-Aug, 1970

Brady RH, Computers in Top-Level Decision Making, Harvard Business Review, July/August, 1967

Brightman H, Noble C, On the Ineffective Education of Decision Scientists, Decision Sciences, Vol 10 1, 1979

Carlson ED, An Approach for Designing Decision Support Systems, Procedings: 11th Hawaii International Conference, California USA, 1978

Carlson S, Executive Behaviour: a Study of the Workload and Working Methods of Managing Directors, Strombergs, Stockholm 1951

Carroll DC, Implications of On-Line, Real-Time Systems for Managerial Decision-Making, MIT Working Paper 165-166, MIT Mass., USA, 1966

Carrol JM, Mack RL, Learning to Use a Word Processor: By Doing, By Thinking and By Knowing, in Thomas JC, Schneider ML, (Eds) Human Factors in Computer Systems, Ablex Pub Co Norwood, New Jersey 1984

Corbin CEH, Creating an End-User CAFS Service, ICL Technical Journal, Vol 4 4, 1985

Churchman CW, Theories of Implementation, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Churchman CW, Ackoff RL, Arnoff EL, Introduction to Operations Research, John Wiley New York 1957

Churchman CW, Schainblatt AH, The Researcher and the Manager: A Dialectic of Implementation, Management Science, Vol 11 4, 1965

Culnan MJ, Environmental Scanning: The Effects of Task Complexity and Source Complexity on Information Gathering Behaviour, Decision Sciences, Vol 14, 1983

Culnan MJ, Chauffeured Versus End User Access to Commercial Databases : The Effects of Task and Individual Differences, MIS Quarterly, March, 1983

Cyert RM, March JC, A Behavioural Theory of the Firm, Prentice Hall, New Jersey, USA 1963

Dainty P, Meaningful Management Research, Graduate Management Research, Vol 1 1 1983

Davis D, SMR Forum: Computers and Top Management, Sloan Management Review, Spring, 1984

Davis L, Learning to Walk With a New Computer System : Computers in the Executive Suite, International Management, July, 1983

De Bettignies HC, Evans PL, The Cultural Dimension of Top Executive Careers; A Comparative Analysis, in Weinshall TD, Culture and Management, Penguin Books, Harmondsworth, 1977

De Waele, Managerial Style and the Design of Decision Aids, Omega, Vol 6 1, 1978

Delone WH, "Firm Size and Characteristics of Computer Use", MIS Quarterly, Dec 1981

Denzin NK, The Research Act, McGraw Hill, New York 1978

Dermier JD, Cognitive Characteristics and the Perceived Importance of Information, Accounting Review, July, 1973

Docherty PHG, Some Mismatches Constraining User Choice in Systems Development, in Moshowitz A (Ed), Human Choice and Computers, Proc. 2cnd Int. Conf. on Human Choice and Computers, Baden, Austria, 1979, North Holland 1980

Doktor R, Cognitive Style and the Use of Computers and Management Information Systems, Management Datamatics, Vol 5 2, 1976

Eason KD, Computer Information Systems and Managerial Tasks, in Bjorn-Anderson N (Ed), The Human Side of Information Processing, North Holland, Amsterdam, 1980

Easterby-Smith M, The Design, Analysis and Interpretation of Repertory Grids, International Journal of Man-Machine Studies, Vol 13 1, 1980

Easterby-Smith M, The Use of Repertory Grid Methods, in Taylor & Lippit, Management Development Handbook, McGraw Hill, London 1975

Easton G et al, "Small Computers in Small Companies", Dept of Marketing, University of Lancaster, 1983

Ein-Dor P and Segev E, "Organizational Context and MIS Structure: Some Empirical Evidence", MIS Quarterly, Sept 1982

Everitt BS, The Analysis of Contingency Tables, Chapman and Hall, London, 1977

Faulkner TM, "Information Technology and the Small Firm: the Future Role of Non-Technical Higher Education", Small Business Research Conference, Glasgow, Sept 1982

Financial Times, Different Systems Begin to Emerge, p.iii 30th Sept. 1985

Fishbein M, Attitudes and the Prediction of Behaviour, in Thomas K, (ed) Attitudes and Behaviour, Penguin Books 1971

Fishbein M, The Search for Attitudinal-Behavioural Consistency, in Cohen JB, (ed) Behavioural Science Foundations of Consumer Behaviour, The Free Press New York 1972

Fromm G et al, Federally Supported Mathematical Models: Survey and Analysis, Report for the National Science, Foundation USA 1974

Gibb AA, "The Small Business Challenge to Management Education", Journal of European Industrial Training, Vol 7(5) 1983

Gibb AA and Scott M, "Strategic Awareness, Personal Committment and the Process of Planning in the Small Business", Journal of Management Studies, Vol 22(6) November 1985

Gibson CF, A Methodology for Implementation Research, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Giddens A, Elites in the British Class Structure, in Stanworth P and Giddens A, Elites and Power in British Society, Cambridge University Press, 1974

Ginzberg MJ, Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions, Management Science, Vol 27 4, 1981

Ginzberg MJ, Key Recurrent Issues in the MIS Implementation Process, MIS Quarterly, June, 1981

Glaser BG, Strauss AL, The Discovery of Grounded Theory, Weidenfeld & Nicolson, London, 1968

Gorden RL, Interviewing: Strategy, Techniques and Tactics, Irwin-Dorsey, Ontario 1969

Gorry GA, Scott Morton MS, A Framework for Management Information Systems, Sloan Management Review, Vol 13 1, 1971

Grinyer PH, Financial Modelling for Planning in the UK, Long Range Planning, Vol 16 5, 1983

Grinyer PH, Wooller J, Computer Models for Corporate Planning, Long Range Planning, Feb, 1975

Hackathorn RD, Keen PGW, Organizational Categories for Personal Computing, MIS Quarterly, Sept, 1981

Hall WK, Strategic Planning, Product Innovation, and the Theory of the Firm, Jnl. of Business Policy, Vol 3 3, 1973

Hambrick DC, Mason DC, Upper Echelons: The Organization as a Reflection of Its Top Managers, Acad. of Management Review, Vol 9 2, 1984

Hammond JS, The Roles of the Manager and Management Scientist in Successful Implementation, Sloan Management Review, Vol 15 2 Winter, 1974

Hofstede G, Culture's Consequences: International Differences in Work-Related Values, Sage Publications, London 1980

Hughes J, The Philosophy of Social Research, Longman, London 1980

Ives B, Olson MH, Manager or Technician? The Nature of the Information Systems Manager's Job, MIS Quarterly, Dec, 1981

Jacques E, A General Theory of Bureaucracy, Heineman London 1976

Janis IL, Mann L, Decision Making, The Free Press 1977

Kaiser KM, King WR, The Manager-Analyst Relationship in System Development, MIS Quarterly, Vol 6 1, 1982

Keen PGW, Interactive Computer Systems for Managers: A Modest Proposal, Sloan Management Review, Vol 18 1, 1976

Keen PGW, DSS: A Research Perspective, C.I.S.R. Working Paper No 54, MIT Mass. USA, 1980

Keen PGW, Value Analysis: Justifying Decision Support Systems, MIS Quarterly, March, 1981

Keen PGW, Hackathorn RD, DSS and Personal Computing, C.I.S.R. Working Paper No 47, MIT Mass. USA, 1979

Keen PGW, Scott Morton MS, Decision Support Systems: An Organizational Perspective, Addison-Wesley 1978

Kilmann RH, The Cost of Organization Structure: Dispelling the Myths of Independent Divisions and Organization-Wide Decision Making, Accounting, Organization and Society Vol 8 4, 1983

King WR, Strategic Planning Decision Support Systems: Planning, Development and Evaluation, Working Paper WP-440 Grad. School of Bus, Univ. of Pittsburgh, Penns. 1981

Kelly J, Organizational Behaviour, RD Irwin 1969

Kiechel W, To Compute or Not to Compute: Why Executives Don't, Cornell Hotel & Rest Admin Quart, Vol 24 4 Feb, 1984

Kling R, Gerson EM, The Social Dynamics of Technical Innovation in the Computing World, Symbolic Interaction, Vol 1 1, 1977

Kling R, Gerson EM, Patterns of Segmentation and Intersection in the Computing World, Symbolic Interaction, Vol 1 2 1978

Kling R, Scacchi W, Computing as Social Action: The Social Dynamics of Computing in Complex Organizations, in Yovits M (Ed), Advances in Computers Vol 19, Academic Press, New York 1980

Kolb DA, Frohman AL, An Organization Development Approach to Consulting, Sloan Management Review, Fall, 1970

Kotter JP, What Effective Managers Really Do, Harvard Business Review, Nov/Dec, 1982

Kotter JP, The General Managers, The Free Press New York 1982

Kroeber DW, Watson JH, Sprague RH, An Empirical Investigation and Analysis of the Current State of the Art of Information Systems Evolution, Information and Management, Vol 3, 1980

Laffin M, Young K, The Changing Roles and Responsibilities of Local Authority Chief Officers, Public Administration, Vol 63, Spring 1985

Lawless MW et al, Enhancing the Chances of Successful OR/MS Implementation: the Role of the Advocate, Omega, V10 2, 1982

Levinson D, Role, Personality and Social Structure in the Organizational Setting, in Salaman G and Thompson K (Eds), People and Organizations, Longman, London 1973

Lieberson S, O'Conner JF, Leadership and Organizational Performance: a Study of Large Corporations, American Sociological Review, Vol 37 1971

Lindblom CE, The Science of Muddling Through, Public Administration Review, Vol 19, 1959

Lucas HC, User Reactions and the Management of Information Services, Management Informatics, V2 4, 1973

Lucas HC, Performance and the Use of an Information System, Management Sci, Vol 21 8, 1975

Lucas HC, Why Information Systems Fail, Columbia Free Press 1975

Lucas HC, Behavioural Factors in System Implementation, in Schultz RL, Slevin DP (eds), Implementing Operations Research/ Management Science, American Elsevier Pub Co New York 1975

Lucas HC, Empirical Evidence for a Descriptive Model of Implementation, MIS Quarterly, Vol 2 2, 1978

Lucas RW, A Study of Patients' Attitudes to Computer Interrogation, Int Jnl of Man-Machine Studies, Vol 9, 1977

Lusk ED, Kersnick M, The Effect of Cognitive Style and Report Format on Task Performance: The MIS Design Consequences, Management Sci, Vol 25 8, 1979

Luthans F, Rosencrantz SA, Hennessey HW, What Do Successful Managers Really Do? An Observational Study of Managerial Activities, Journal of Applied Behavioural Science, Vol 21 3, 1985

MacLagan PW, Knowledge Utilisation and Organizational Intervention: A Case Study, Working Paper No3, Dept of OR, Hull University, England 1983

Maish AM, A User's Behaviour Towards His MIS, MIS Quarterly, March, 1979

Malone SC "Computerizing Small Business Information Systems", Journal of Small Business Management, April 1985

Malone TW, Heuristics for Designing Enjoyable User Interfaces: Lessons from Computer Games, in Thomas JC, Schneider ML, (Eds) Human Factors in Computer Systems, Ablex Pub Co Norwood, New Jersey 1984

Management Today, Data Management Supplement, The Birth of a New Machine, p.iv. Sept. 1984

Manley JH, Implementation Attitudes: A Model and a Measurement Methodology, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Management Today, March 1986, pii

Markus ML, Power, Politics and MIS Implementation, CISR Working Paper No 59, MIT, Mass 1980

Markus ML, Robey D, The Organizational Validity of Management Information Systems, CISR Working Paper No 68, MIT, Mass 1981

Martin CJ, Decision Making and the Computer: A Study of Systems Development, Unpublished MSc dissertation, Durham University Business School, Durham University UK, 1982

Martin CJ, The Personal Computer and Research Administration, Graduate Management Research, Vol 2 1, 1984

Martin CJ, Financial Modelling DSS Applications: Identifying the User, DUBS Working Paper, 1984b

Martin CJ, Senior Managers and Computers: A Survey to Identify Key Issues Relating to Senior Managerial Use of Computers, DUBS Working Paper Series, 1985

Martin CJ, Expert Systems in a Managerial Context, Industrial Management and Data Systems, Nov/Dec, 1985b

Martin CJ, Accessing and Interviewing Senior Managers, Graduate Management Research, Vol 3 4, 1985c

Martin CJ "Information Technology and the Smaller Firm: The Role of the Chief Executive", a paper presented at the Eighth National Small Firms Policy and Research Conference, N.Ireland Nov. 1985d

Martin CJ, Winch GW, Senior Managers and Computers, Management Decision, Vol 22 2, 1984

Martin NH, Differential Decisions in the Management of an Industrial Plant, Journal of Business, Vol 29, 1956

Mason RO, Mitroff II, A Program for Research on Management Information Systems, Management Sc
ience, Vol 19 5, 1973

McCall MW, Morrison AM, Hannan RL, Studies of Managerial Work: Results and Methods, Technical Report No9 May 1978, Centre for Creative Leadership Greensborough, North Carolina, USA 1978

McKeen JD, Successful Development Strategies for Business Application Systems, MIS Quarterly, Sept, 1983

McKenney JL, Keen PGW, How Managers' Minds Work, HBR, May/June, 1974

Methlie LB, Organizational Variables Influencing DSS Implementation, in Sol HG, (Ed) Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Michaelis PR, et al, Artificial Intelligence and Human Factors Engineering: A Necessary Synergism in the Interface of the Future, in Badre A, Schneiderman B, Directions in Human / Computer Interaction, Ablex Publishing Co 1982

Miles MB, Hubermann AM, Qualitative Data Analysis, Sage Publications, London 1984

Mintzberg H, Structured Observation as a Method to Study Managerial Work, Journal of Management Studies, Vol 7 Feb, 1970

Mintzberg H, Managerial Work: Analysis from Observation, Management Science, Vol 18 2 Oct, 1971

Mintzberg H, The Nature of Managerial Work, Harper & Row 1973

Mintzberg H, Impediments to the Use of Management Information, Society of Management Accountants of Canada & NAA, Canada, 1975

Mintzberg H, The Manager's Job: Folklore and Fact, Harvard Business Review, July/Aug, 1975

Mohan L, Bean AS, Introducing OR/MS into Organizations: Normative Implications of Indian Experience, Decision Sciences, Vol 10, 1979

Mouzelis NP, Organization and Bureacracy: an Analysis of Modern Theories, Routledge and Keegan Paul, London 1967

Mumford E, Ward T, Computer Technologists: Dilemmas of a New Role, Jnl of Management Studies, Vol 3 3, 1966

Myers IB, Introduction to Type, Consulting Psychologists Press Inc, Palo Alto Cal USA 1980

Nie NH, Hull CH et al, "Statistical Package for the Social Sciences", McGraw Hill, New York 1981

O'Reilly CA, Variations in Decision Makers' Use of Information Sources: The Impact of Quality and Accessibility of Information, Academy of Management Journal, Vol 25 4, 1982

Open University Course T341^, Systems Performance and Human Failures, Open University Press, Milton Keynes, 1977

Pahl RE, Winkler JT, The Economic Elite: Theory and Practice, in Stanworth P and Giddens A, Elites and Power in British Society, Cambridge University Press, 1974

Pettigrew A, The Politics of Organizational Decision Making, Tavistock 1973

Pettigrew A, The Influence Process Between Specialists and Executives, Personnel Review, Vol 3 1, 1974

Pettigrew AM, The Awakening Giant: Continuity and Change in ICI, Basil Blackwell, Oxford, 1985

Powell GN, Implementation of OR/MS in Government and Industry: A Behavioural Science Perspective, Interfaces, Vol 6 4 Aug, 1976

Reisman A, Kluyver CA, Strategies for Implementing Systems Studies, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Reisner P, Human Factors Studies of Database Query Languages: A Survey Assessment, Computing Surveys, Vol 13 1 March, 1981

Reitz HJ, Behaviour in Organizations, RD Irwin Inc Ontario, Canada 1977

Robey D, User Attitudes and Management Information System Use, Acad of Management Jnl, Vol 22 3, 1979

Robey D, Taggart W, Minds and Managers: On the Dual Nature of Human Information Processing and Management, Acad of Management Review, Vol 6 2, 1981

Rockart JF, Treacy ME, Executive Information Support Systems, CISR WP No 65, MIT, Sloan School of Management, Massachusetts, USA 1980

Rockart JF, Treacy ME, The CEO Goes On-Line, HBR, Jan/Feb, 1982

Rogers EM, Shoemaker FF, Communication of Innovations, The Free Press New York 1971

Rubinstein R, Hersh HM, The Human Factor, Digital Equipment Corporation USA 1984

Sagasti FR, Management Sciences in an Underdeveloped Country: The Case of Operational Research in Peru, Management Sci, V19 2, 1972

Sayles L, Managerial Behaviour, McGraw Hill, New York, 1964

Schein EH, The Mechanism of Change, in Bennis, Schein, Steele et al (Eds) Interpersonal Dynamics, Dorsey Press, Illinois, USA 1964

Schein EH, Organizational Psychology, Prentice Hall 1980

Schepanski A, Tests of Theories of Information Processing Behaviour in Credit Judgement, The Accounting Review, Vol 58 3 July, 1983

Schewe CD, The Management Information System User: An Exploratory Behavioural Analysis, Acad of Management Jnl, V19 4, 1976

Schultz RL, Slevin DP (eds), Implementing Operations Research / Management Science, American Elsevier Pub Co New York 1975

Scott Morton MS, Management Decision Systems, Graduate School of Business Administration, Harvard University, Boston, USA 1971

Scott Morton MS, Rockart JF, Implications of Changes in Information Technology for Corporate Strategy, C.I.S.R. Working Paper No 98, M.I.T. Mass., USA, 1983

Seldon A, The Peculiar Problems of Elite Interviewing, unpublished talk delivered at a public seminar on research fieldwork methodology in the social sciences, Research Centre for Social Sciences, University of Edinburgh, 1984.

Senn JA, Essential Principals of Information Systems Development, MIS Quarterly, V2 2 June, 1978

Shaw ME, Wright JM, Scales for the Measurement of Attitudes, McGraw-Hill 1967

Shrivastava P, Grant JH, Empirically Derived Models of Strategic Decision Making Processes, Working Paper Series WP-506, Univ of Pittsburgh USA 1982

Siegel S, "Nonparametric Statistics for the Behavioural Sciences", McGraw Hill, New York 1956

Simon HA, Administrative Behaviour, Macmillan, 1945

Simon HA, Administrative Behaviour: A Study of Decision Making Processes in Administrative Organizations, MacMillan 1957

Simon HA, The New Science of Management Decision, Prentice-Hall New Jersy 1960

Smith HR, Kozar KA, Underutilization of Computing Technology in University Education: The Problem and Proposed Solution, Proc. 11th Hawaii Int Conf on Systems, Sciences, Western Periodicals Co Cal USA 1978

Smith HT, Human-Computer Communication, in Smith HT and Green TRG (Eds) Human Interaction with Computers, Academic Press 1980

Sol HG, Processes and Tools for Decision Support: Inferences for Future Developments, in Sol HG, (Ed) Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., North Holland, Austria 1983

Sorensen RE, Zand DE, Improving the Implementation of OR/MS Models by Applying the Lewis-Schein Theory of Change, in Schultz RL, Slevin DP (eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Sprague RH, A Framework for the Development of Decision Support Systems, MIS Quarterly, Vol 4 4, 1980

Stabell CB, Individual Differences in Managerial Decision-Making Processes: A Study of Conversational Computer System Usage, PhD Thesis, Sloan School of Management, MIT, Mass 1974

Stewart R, Managers and Their Jobs, Macmillan, London 1967

Swanson EB, Management Information Systems: Appreciation and Involvement, Management Science, Vol 21 2, 1975

Swanson EB, Measuring User Attitudes in MIS Research: A Review, Omega, Vol 10 2, 1982

Systems Programming Ltd, An Introduction to the `SAGE' Expert System, Systems Programming Ltd SPL Research Centre, Abingdon, Oxon, UK 1982a

Systems Programming Ltd, SAGE Expert System: Language Specification, Systems Programming Ltd, SPL Research Centre, Abingdon, Oxon, UK 1982b

Thomas K (Ed), Attitudes and Behaviour, Penguin Books 1971

Thomason GF, Managerial Work Roles and Relationships (Part 1), The Journal of Management Studies, 3 1966

Tisdall P, What Managers Really Do All Day, International Management, Oct, 1982

Tymshare Ltd, REVEAL: Reference Manual, ICL Knowledge Engineering Centre, West Gorton, Manchester, UK 1983

Urban GL, Building Models for Decision Makers, Interfaces, Vol 4 3, 1974

Vertinsky I, OR/MS Implementation in Valle, Columbia, SA: A Profile of a Developing Region, Management Science, Vol 18 6 Feb, 1972

Warren N, Jahoda M (Eds), Attitudes, Penguin Books 1973

Weaver D, Brickman P, Expectancy, Feedback and Disconfirmation as Independent Factors in Outcome Satisfaction, Jnl of Personality and Social Psychology, Vol 30 4, 1974

Weiss M, The Human Side of Systems: An Experiential Approach, Information and Management, Vol 6, 1983

Winkler RL, Research Directions in Decision Making Under Uncertainty, Decision Sciences, Vol 13 4 Oct, 1982

Wolek FW, Implementation and the Process of Adopting Managerial Technology, Interfaces, Vol 5 5, 1975

Wright PC, Computers, Change and Fear: An Unholy Trinity, Management Decision, Vol 22 2, 1984

Wright WF, Cognitive Information Processing Biases: Implications for Producers and Users of Financial Information, Decision Sciences, Vol 11, 1980

Wroe B, Towards the Successful Design and Implementation of Computer Based Management Information Systems in Small Companies, Unpublished PhD Thesis, Leicester Polytechnic, England 1986

Young LF, Computer Support for Creative Decision Making: Right-Brained DSS, in Sol HG (Ed), Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Zadeh LA et al, (eds) Fuzzy Sets and Their Applications to Cognitive and Decision Processes, Academic Press, New York, 1975

Zmud RW, Individual Differences and MIS Success: A Review of the Empirical Literature, Management Science, Vol 25 10, 1979

Zmud RW, Cox JF, The Implementation Process: A Change Approach, MIS Quarterly, June, 1979

Bibliography

The following items have not been referred to directly in the body of the thesis, but represent a sample of the literature which was consulted during the project. They are included here as a record and for future research efforts.

Ackoff RL, The Design of Social Research, Univ. Of Chicago Press 1967

Ackoff RL, The Art and Science of Mess Management, Interfaces, Feb, 1981

Adams CR, How Management Users View Information Systems, Decision Sciences, Vol 6 2, 1975

Addis TR, Machine Understanding of Natural Language, Int Jnl of Man-Machine Studies, Vol 9, 1977

Ahituv N, Munro MC, Wand Y, The Value of Information in Information Analysis, Information and Management, Vol 4, 1981

Alavi M, An Assessment of the Concept of DSS's as Viewed by Senior-Level Executives, MIS Quarterly, Vol 6 4 Dec, 1982

Allen DE, Bureaucratic Politics: Decision-Making in Organizations, Personnel Review, Vol 8 4, 1979

Allen GR, The Graduate Student's Guide to Theses and Dissertations: A Practical Manual for Writing and Research, Jossey-Bass 1974

Allen RB, Cognitive Factors in Human Interaction With Computers, in Badre A, Schneiderman B, Directions in Human / Computer Interaction, Ablex Publishing Co 1982

Alty JL, Coombs MJ, Expert Systems: Concepts and Examples,, NCC Publications Manchester 1984

Badre A, Schneiderman B, Directions in Human/Computer Interaction, Ablex Publishing Co 1982

Bainbridge HC, Ironies of Automation, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Baker HC, The Design of Systems - The Human Dimension, Omega, Vol 10 2, 1982

Bariff ML, Lusk EJ, Cognitive and Personality Tests for the Design of Management Information Systems, Management Science, Vol 23 8, 1977

Beer S, Platform for Change, J.Wiley and Sons 1975
Bell C, Newby H (Eds), Doing Sociological Research, Allen & Unwin 1977

Benjamin RI, Information Technology in the 1980's: A Long Range Planning Scenario, Mis Quarterly, June, 1982

Bjorn - Anderson N, Rasmussen LB, Sociological Implications of Computer Systems, in Smith HT and Green TRG (Eds) Human Interaction with Computers, Academic Press 1980

Bobbit H, Ford JD, Decision Maker Choice as a Determinant of Organizational Structure, Acadamy of Management Review, Vol 5 1, 1980

Bracker J, The Historical Development of the Strategic Management Concept, Acadamy of Management Review, Vol 5 2, 1980

Bruwer PJS, A Descriptive Model of Success for Computer-Based Information Systems, Information and Management, Vol 7 2, 1984

Buchanan DA, Boddy D, Organizations in the Computer Age, Gower Pub. Ltd Hants. England 1983

Bullen CV, Bennett JL, Office Workstation Use by Administrative Managers and Professionals, CISR MIT 1981

Campbell JP, Daft JR, Hulin CL, What to Study : Generating and Developing Research Questions, Sage Publications Beverly Hills, Cal., USA 1982

Card SK, Moran TP, Newell A, The Psychology of Human - Computer Interaction, L. Erlbaum Associates London 1983

Carlson ED, Developing the User Interface for DSS, Unpublished working paper, IBM Research Laboratroy RJ 3112 1981

Carper WB, Snizek WE, The Nature and Types of Organizational Taxonomies: An Overview, Academy of Mgt Review, Vol 5 1, 1980

Carter EE, The Behavioural Theory of the Firm and Top Level Corporate Decisions, Administrative Science Quarterly, Vol 16 3, 1971

Cecez-Kecmanovic D, The Value of Information in Decision Making, in Sol HG (Ed), Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Cohen J, Behaviour in Uncertainty, Allen and Unwin London 1964

Collins F, Managerial Accounting Systems in Organizational Control: A Role Perspective, Accounting, Organization and Society, Vol 7 2, 1982

Comshare, The Acquisition and Use of DSS Software, Research and Planning Inc 1983

Conrath DW, Prescriptive Vesus Descriptive Decision Theory: Where Might the Twain Meet?, in White DJ, Bowen KC (Eds), The Role and Effectiveness of Theories of Decision in Practice, Hodder and Stoughton 1975

Cook TD, Campbell DT, Quasi-Experimentation, Rand McNally Chicago, USA 1979

Coombs MJ, Alty JL, Computing Skills and the User Interface, Academic Press, London 1981

Cooper RB, Swanson EB, Management Information Requirements Assessment, Database, fall, 1979
Cozby PC, Models in Behavioural Research, Mayfield Publishing Co 1977

Curran J, Stanworth J, Small Firms, Large Firms: Theoretical Strategies for the Comparative Analysis of Small and Large Firms in the Wider Environment, Procedings of the 6th Nat. Small Firms, Conference Durham 1983 1983

Danziger JN, Computers and the Frustrated Chief Executive, MIS Quarterly, Vol 1 2 June, 1977

Davies J, Easterby-Smith, Organizational Myths from the Perspective of Evaluation, in Hammond V (Ed), Current Research in Management, Frances Pinter London 1985

Davis GB, Management Information Systems, McGraw Hill London 1974

Davis GB, Comments on the Critical Success Factors Method, MIS Quarterly, Sept, 1979

Dewhirst HD, Influence of Perceived Information Sharing Norms on Communication Channel Utilization, Academy of Management Jnl, Vol 14 Sept, 1971

Dickson GW et al, Research in MIS : The Minnesota Experiments, Management Sci., Vol 23 9 May, 1977

Dickson GW, Requisite Functions for a Management Support Facility, in Sol HG (Ed), Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Donovan JJ, Madnick SE, Institutional and Ad Hoc DSSs and Their Effective Use, Database, Vol8 3, 1977

Dreyfus Hl, Expert Systems Versus Intuitive Expertise , Unpublished working paper, Univ. of California USA 1983

Drury DH, An Empirical Assessment of the Stages of DP Growth, MIS Quarterly, June, 1983

Dubin R, Theory Building, The Free Press New York 1969

Dumais ST, Landauer TK, Psychological Investigations of Natural

Terminology for Command and Query Languages, in Badre A, Schneiderman B, Directions in Human / Computer Interaction, Ablex Publishing Co 1982

Duncan RB, Zaltman G, Ethical Value Dilemmas in Implementation, in Schultz RL, Slevin DP eds, Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Eden C, Sims D, Computerized Vicarious Experience: The Future for Managerial Induction?, Personnel Review, Vol10 1, 1981

Edstrom A, User Influence and the Success of MIS Projects: A Contingency Approach, Human Relations, Vol 30 7, 1977

Einhorn HJ, Hogarth RM, Behavioural Decision Theory: Processes of Judgement and Choice, Annual Review of Psychology, Vol 32, 1981

Elam JJ, Henderson JC, Knowledge Engineering Concepts for Decision Support System Design and Implementation, Information and Management, Vol 6, 1983

Else L, The Dangers of Reliance on Artificial Expertise, Computing 13/10/83, 1983

Epstein BJ, King WR, An Experimental Study of the Value of Information, Omega, Vol 10 3, 1982

Everett JE, Stenning BW, Japanese and British Managerial Colleagues - How They View Each Other, Jnl. of Management Studies , Vol 20 4, 1983

Feigenbaum EA, McCorduck P, The Fifth Generation: AI and Japan's Computer Challenge to the World, Michael Joseph London 1984

Ference TP, Organizational Communications Systems and the Decision Process, Mgt Sci, Vol17 2, 1970

Fersko-Weiss H, Personal Computing at the Top, Personal Computing, Vol9 March, 1985

Fick G, Sprague RH (Eds), Decision Support Systems: Issues and Challenges, Pergamon Press 1980

Fischer G, Symbiotic, Knowledge-Based Computer Support Systems, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Fitzgerald TH, Why Motivation Theory Doesn't Work, Harvard Business Review, July/August, 1977

Foley J, Teaching the Design and Evaluation of User-Computer Interfaces, SIGCSE Bulletin (ACM), Vol 14 3, 1982

Ford J, Paradigms and Fairy Tales (Vols 1 and 2), Routledge and Keegan Paul London 1975

Fox MS, The Intelligent Management System: An Overview, in Sol HG (Ed), Processes and Tools for Decision Support, Proc. of Joint IFIP WG 8.3/IASA Conf., Austria, North Holland 1983

Gallagher C, Metcalfe A, How Managers Use Numerate Techniques, Management Today, Dec, 1982

Gallagher CA, Percpetions of the Value of a Management Information System, Academy of Management Jnl., Vol 17 1, 1974

Gerrity TP, Design of Man-Machine Decision Systems: An Application to Portfolio Management, Sloan Management Review, Vol 12 2, 1971

Gershefski GW, Harvey A, Corporate Models - the State of the Art, Management Science, Vol 16 6 Feb, 1970

Getzels JW, Problem Finding: A Theoretical Note, Cognitive Science, Vol 3, 1979

Ghymn K, King WR, Design of a Strategic Planning Management System, Omega, Vol 4 5, 1976

Gibson CF, A Methodology for Implementation Research, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co, New York 1975

Ginter PM, Rucks AC, Duncan WJ, Planners' Perceptions of the Strategic Management Process, Jnl of Management Studies, Vol 22 6 Nov, 1985

Goeffrion AM, Can MS/OR Evolve Fast Enough?, Interfaces, Vol 13 1 Feb, 1983

Gorry GA, The Development of Managerial Models, Sloan Management Review, Vol 12 2, 1971

Green TRG et al, (Eds) The Psychology of Computer Use, Academic Press 1983

Greiner LE et al, Putting Judgement Back Into Decision, Harvard Business Review, Mar/April, 1970

Gremillion LL, Managing the Implementation of Standardised Computer Based Systems, MIS Quarterly, Vol 4 4, 1980

Guido G, Tasso C, On-Line Information Retrieval Through Natural Language, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Gul FA, The Joint and Moderating Role of Personality and Cognitive Style on Decision Making, The Accounting Review, Vol

LIX2, 1984

Hambrick DC, Operationalising the Concept of Business-Level Strategy in Research, Academy of Management Review, Vol 5 4, 1980

Hambrick DC, Some Tests of the Effectiviness and Functional Attributes of Miles and Snows' Strategic Types, Academy of Management Jnl., Vol 26 1, 1983

Hamilton S, Chervany NL, Evaluating Information System Effectiveness - Part 1: Company Evaluation Approaches, MIS Quarterly, Sept, 1981

Harris SA, A Method of Measurement of Behavioural Factors Affecting Information Systems, PhD Thesis Ann Arbor Univ, Mi USA 1983

Hatvany J, Guedj RA, Man-Machine Interaction in Computer-Aided Design Systems, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Hawgood J, Information and Decision Effectiveness in Bureaucratic Subsystems, Unpublished working paper, Durham University, England 1983

Hayes RH, Nolan RL, What Kind of Corporate Modelling Functions Best?, Harvard Business Review, May-June, 1974

Hayes-Roth B, Hayes-Roth F, A Cognitive Model of Planning, Cognitive Science, Vol 3, 1979

Hayes-Roth B, Walker C, Configural Effects in Human Memory: The Superiority of Memory Over External Information Sources as a Basis for InferenceVerification, Cognitive Science, Vol 3, 1979

Higgins JC, Finn R, The Chief Executive and His Information System, Omega, Vol 5 5, 1977

Higgins JC, Opdebeeck EJ, Computers in Decision Making: Some Survey Results, Computer Bulletin, Sept, 1983

Hilton RW, The Determinants of Information Value: Synthesizing Some General Results, Management Science, Vol 27 1, 1981

Hogue JT, Watson HJ, Management's Role in the Approval and Administration of Decision Support Systems, MIS Quarterly, June, 1983

Holt RN et al, Towards Understanding the Contents of the "Black Box" for Predicting Complex Decision-Making Outcomes, Decision Sciences, Vol 14, 1983

Howard K, Sharp JA, The Management of a Student Research Project, Gower Press London 1983

Huber GP, The Nature of Organizational Decision Making and the Design of Decision Support Systems, MIS Quarterly, June, 1981

Hunt EB, Artificial Intelligence, Academic Press London 1975

Huysman JH, Operations Research Implementation and the Practice of Management, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Jago AG, Scamell RW, Decision-Making Styles of MIS Managers: A Comparative Evaluation, Information and Management, Vol 5, 1982

Johnson G, Strategic Management in Action, in Hammond V (Ed), Current Research in Management, Frances Pinter London 1985

Judd P, Paddock C, Wetherbe J, Decision Impelling Differences: An Investigation of Management by Exception Reporting, Information & Management, Vol 4, 1981

Kahneman D, Tversky A, Subjective Probability: A Judgement of Representativeness, Cognitive Psychology, Vol 3, 1972

Kakabadse AK, Margerison C, The Management Development Needs of Chief Executives, in Hammond V (Ed), Current Research in Management, Frances Pinter London 1985

Katz E et al, Traditions of Research on the Diffusion of Innovation, in Cohen JB (Ed), Behavioural Science Foundations of Consumer Behaviour, The Free Press, New York 1972

Kay AC, Microelectronics and the Personal Computer, Proc. Nat. Conf. Advance. of Research, Univ. of Arkansas 1982

Kendall KE, Kendall JE, Observing Organizational Environments: A Systematic Approach for Information Analysts, MIS Quarterly, March, 1981

Kerlinger FN, Foundations of Behavioural Research, Holt, Rinehart & Winston London 1969

Kilmann RH, The Cost of Organization Structure: Dispelling the Myths of Independent Divisions and Organization-Wide Decision Making, A, O and S, Vol 8 4, 1983

King WR, Strategic Planning Decision Support Systems: Planning, Development and Evaluation, Working Paper WP-440 Grad. School of Bus, Univ. of Pittsburgh, Penns. 1981

King WR, Rodriguez JI, Evaluating Management Information Systems, MIS Quarterly, Sept, 1978

Kling R, Social Analyses of Computing: Theoretical Perspectives in Recent Empirical Research, Computing Surveys, Vol 12 1, 1980

Knights D, The Scientific Construction of Reality and the Problem of Research Access, Graduate Management Research, Vol 1 3, 1984

Koontz H, The Management Theory Jungle Revisited, Academy of Management Review, Vol 5 2, 1980

Kosaka T, Hirouchi T, An Effective Architecture for Decision Support Systems, Information and Management, Vol 5, 1982

Kotter JP, Schlesinger LA, Choosing Strategies for Change, Harvard Business Review, March/April, 1979

Laffin M, Young K, The Changing Roles and Responsibilities of Local Authority Chief Officers, Public Administration, Vol 63 Spring, 1985

Larcker DF, Lessig VP, Perceived Usefulness of Information: A Psychometric Examination, Decision Sciences, Vol 11 1, 1980

Levis AH, Boettcher KL, On Modelling Teams of Interacting Decision Makers with Bounded Rationality, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Libby R, Lewis BL, Human Information Processing Research in Accounting: the State of the Art in 1982, Accounting, Organization and Society, Vol 7 3, 1982

Littauer SB et al, A Framework for Optimising Managerial Decisions, Omega, Vol 4 1, 1976

Little JDC, Models and Managers: The Concept of a Decision Calculus, Management Science, Vol 16 8 April, 1970

Lockett AG, Polding E, OR/MS Implementation - A Variety of Processes, Interfaces, Vol 9 1, 1978

Lockett G, Thoughts on Numeracy and Management, Personnel Review, Vol 3 2, 1974

Loebner EE, Basic Factors That Inhibit the Acceptance and Utilization of Computer Technology, Proc. Nat. Conf. Adv. of Re., Univ. of Arkansas 1982

Lorenz C, Shell- A Victim of Corporate Culture, The Times 18/11/83, 1983

Lusk ED, Kersnick M, The Effect of Cognitive Style and Report Format on Task Performance: The MIS Design Consequences, Management Science, Vol 25 8, 1979

MacGregor JM, What Users Think About Computer Models, Long Range Planning, Vol 16 5, 1983

MacLennan D, Wood G, Information Acquisition: Patterns and Strategies, in Clark WAV (Ed), Modelling Housing Market Search, Croom Helm, London 1982

Margulies F, Zemanek H, Man's Role in Man-Machine Systems, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Martin EW, Critical Success Factors of Chief MIS/DP Executives, MIS Quarterly, June, 1982

Martin JC, Pendse SG, Transactional Analysis: Another Way of Approaching OR/MS Implementation, Interfaces, Vol 7 2 Feb, 1977

Matlin G, What Is the Value of Investment in Information Systems?, MIS Quarterly, Sept, 1979

McClean ER, End Users as Application Developers, MIS Quarterly, Dec, 1979

McMillan CJ, Qualitative Models of Organizational Decision Making, Jnl. of General Management, Vol 5 4, 1980

Michie D, Expert Systems in the Micro Electronic Age, Edinburgh Univ Press 1979

Miller WB, Building an Effective Information Systems Function, MIS Quarterly, Vol 4 2 June, 1980

Mitroff II, On Mutual Understanding and the Implementation Problem: A Philosophical Case Study of the Psychology of the Apollo Moon Scientists, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Mitroff II, Nelson J, Mason RO, On Management Myth-Information Systems, Mgt Sci, Vol 21 4, 1974

Monk A, ed Fundamentals of Human-Computer Interaction, Academic Press London 1984

Moore JH, Chang M, An Implementation Paradox of Decision Support Systems, Proc. 11th Hawaii Int Conf on Systems etc., Western Periodicals Co, Cal. USA 1978

Moran TP, An Applied Psychology of the User, Computing Surveys, Vol 13 1, 1981

Morgan G, Paradigms, Metaphors and Puzzle Solving in Organizational Theory, Admin Sci Quart, Vol 25 4 Dec, 1980

Moser C, Kalton G, Survey Methods in Social Investigation, Heinneman 1971

Moshowitz A, ed Human Choice and Computers, North Holland 1980

Moskowitch H, Schaefer CE, Borcherding K, "Irrationality" of Management Judgements: Implications for Information Systems, Omega, Vol 4 2, 1976

Mumford E, Computer Systems and Design Work: Problems of Philosophy and Vision, Personnel review, Vol 3 2, 1974

Mumford E, Values, Technology and Work, Working Paper No 43, Manchester Business School Manchester, England 1979

Mumford E, The Participative Design of Clerical Information Systems: Two Case Studies, MBS Working Paper No 44, Manchester Business School England 1979

Mumford E, Mercer D, Mill S et al, The Human Problems of Computer Introduction, Management Decision, Vol 10 1, 1972

Mumford E, Pettigrew A, Implementing Strategic Decisions, Longman London 1975

Munro MC, Davis GB, Determining Management Information Needs: A Comparison of Methods, MIS Quarterly, Vol 1 2 June, 1977

Munro MC, Wheeler BR, Planning, Critical Success Factors and Management Information Requirements, MIS uarterly, Vol 4 4 Dec, 1980

Murray EA, Strategic Choice as a Negotiated Outcome, Mgt Sci, Vol 24 9, 1978

Nolan RL, Wetherbe JC, Towards a Comprehensive Framework for MIS Research, MIS Quarterly, June, 1980

Nutt PC, Models for Decision-Making in Organizations and Some Contextual Variables Which Stipulate Optimal Use, Academy of Management Review, April, 1976

Oborne DJ, Computers at Work: A Behavioural Approach, J.Wiley Chichester, England 1985

Ohsuga S, Knowledge-Based Man-Machine Systems, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Pal S, Improving the Human Factors Aspects of Software Products, Computer Bulletin, March, 1984

Paskins D, Planning Horizons and Organizational Strata, in Hammond V (Ed), Current Research in Management, Frances Pinter London 1985

Pettigrew AM, Information Control as a Power Resource, Sociology, Vol 6 2, 1972

Pfeffer J et al, The Effect of Uncertainty on the Use of Social Influence in Organizational Decision Making, MIS Quarterly, Vol 21 June, 1976

Radford KJ, Analysis in Support of Strategic Policy Making,

Omega, Vol 4 5, 1976

Radnor M, Neal RD, The Progress of Management Science Activities in Large US Industrial Companies, Op Res, 21, 1973

Rand T, Now Executives Take the Keyboard, The Times 11/10/83, 1983

Raphael B, The Thinking Computer: Mind Inside Matter, WH Freeman & Co 1976

Reitman W, ed Artificial Intelligence Applications for Business, Procedings of NYU Symposium May 1983, Ablex Pub Corp 1983

Rice GH, But How Do Managers Make Decisions?, Mgt Decision, Vol 18 4, 1980

Rockart JF, Chief Executives Define Their Own Data Needs, Harvard Business Review, Mar/April, 1979

Rockart JF, The Role of the Executive in the New Computer Era, C.I.S.R. oorking Paper No 105, MIT, Mass, USA 1983

Rockart JF, Crescenzi AD, Engaging Top Management in Information Technology, Sloan Mgt Review, Summer, 1984

Rogers DL, Molnar J, Organizational Antecedents of Role Conflict and Ambiguity in Top Level Administration, Admin Sci Quart, Vol 21 Dec, 1976

Rouse WB, Models of Human Problem Solving: Detection, Diagnosis and Compensation for Systems Failures, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Saaty TL, Vargas LG et al, High Level Decisions: A Lesson From the Iran Hostage Rescue Operation, Decision Sciences, Vol 13 2 April, 1982

San Miguel JG, Information Prpocessing in Managerial Decision Making: A Preliminary Study, Omega, Vol 4 5, 1976

Schmitt JW, Kozar KA, Management's Role in Information System Development Failures: A Case Study, MIS Quarterly, Vol 2 2 June, 1978

Schultz RL, Slevin DP, Implementation and Organizational Validity: An Empirical Investigation, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Schultz RL, Slevin DP, Implementation and Management Innovation, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Schultz RL, Slevin DP, Implementation Exchange: The Implementation Profile, Interfaces, Vol 13 1, 1983

Schweiger DM, Is The Simultaneous Verbal Protocal A Viable Method for Studying Managerial Problem Solving and Decision Making?, Academy of Management Jnl, Vol 26 1, 1983

Scott Morton MS, Huff S, The Impact of Computers on Planning and Decision Making, in Smith HT and Green TRG (Eds) Human Interaction with Computers, Academic Press 1980

Scott Morton MS, Rockart JF, Implications of Changes in Information Technology for Corporate Strategy, C.I.SR. Working Paper No 98, MIT MASS 1983

Senn JA, A Management View of Systems Analysts: Failures and Shortcomings, MIS Quarterly, Sept, 1978

Shrivastava P, Strategic Planning for MIS, Long Range Planning, Vol 16 5, 1983

Shrivastava P, Grant JH, Empirically Derived Models of Strategic Decision Making Processes, Working Paper Series WP-506, Univ of Pittsburgh USA 1982

Shukla RK, Influence of Power Bases in Organizational Decision Making, Decision Sciences, Vol 13 3, 1982

Simon JL, Basic Research Methods in the Social Sciences, Random House 1969

Smith HT, Green TRG, Human Interaction With Computers, Academic Press 1980

Smith I, Programming a Future Full of DP Friendliness, Computing 12/4/84, 1984

Sprague CR, Barriers to Progress in Information System Design: Technological or Not, Database, Winter, 1973

Sprague RH, Watson HJ, Bit by Bit: Towards Decision Support Systems, California Mgt Review, Vol 22 1, 1979

Srivastava S et al, The Executive Mind, Jossey-Bass London 1983

Swanson EB, Rationality and Politics in Information Design and Implementation: A Juxtaposition of Two Views, Accounting, Organization and Society, Vol 8 23, 1983

Tagg R, Sandford M, Where To Now The Mouse Has Arrived?, Computer Bulletin, Vol II 42, 1984

Taylor B, MacMillan K, (Eds) Top Management, Longman Press London 1973

Tomeski EA, Lazarus H, A Humanized Approach to Computers, Computers and Automation, June, 1973

Vazsonyi A, The Calculus of Information, Interfaces, Vol 6 4, 1976

Vertinsky I, Barth RT, Mitchell VF, A Study of OR/MS Implementation as a Social Change Process, in Schultz RL, Slevin DP (Eds), Implementing Operations Research/Management Science, American Elsevier Pub Co New York 1975

Vierck RK, Decision Support Systems: An MIS Manager's Perspective, MIS Quarterly, Dec, 1981

Watkins PR, Perceived Information Complexity and Cognitive Styles: Implications for Decision Support Systems, Unpublished PhD Dissertation, Arizona State University USA 1980

Watson CJ, Driver RW, The Influence of Computer Graphics on the Recall of Information, MIS Quarterly, March, 1983

Weinshall TD, ed Culture and Management, Penguin Books 1977

Whiteside D, Computers Invade the Executive Suite, International Management, August, 1983

Winograd T, What Does it Mean to Understand Language?, Cognitive Science, Vol 4, 1980

Wuwongse V, Kobayashi S, Ichikawa A, An Interactive System for Supporting Multi-Objective Decision Making, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Young LF, The Golden Scope Syndrome, the Availability Effect, and MIS, MIS Quarterly, Sept, 1981

Zoltan E, Weeks GD, Ford WR, Natural Language Communications with Computers: A Comparison of Voice and Keyboard Inputs, in Johannsen G, Rijnsdorp JE (Eds), Analysis, Design and Evaluation of Man-Machine Systems, Procedings of IFAC/IFIP/IFORS/IEA, Sept 27-29, Conference, Baden-Baden, Germany 1982

Zuboff S, Psychological and Organizational Implications of Computer Mediated Work, C.I.S.R. Working Paper No 71, 1981

Appendices

Contents:

Appendix 1

Details of the computer literature search

An on-line search was performed using the Dialog commercial database search system acting on a chosen database. The "management contents" database was searched using two sets of keywords in a Boolean "AND" relationship. The keywords were senior manager (and various synonyms) and computer (and various synonyms) as follows:

senior manager	AND	computer
OR		OR
senior managerial		management information system
executive		MIS
CEO		Decision Support System
top manager		DSS

The numbers of references produced by these search arguments were as follows:

1974	3
1975	5
1976	5
1977	9
1978	7
1979	18
1980	10
1981	18
1982	18
1983	50
1984	36
1985	13

	192

Appendix 2

Towards An Operational Definition of Senior Management

From the review and summary of the characteristics of senior management, in chapter 2 it is clear that in an important sense the distinction between roles and decision behaviours is a subtle one, and will not be adequately dealt with by a one line definition. However, in order to operationalise the matter for field research purposes it is necessary to be specific about the characteristics which are being examined. In particular, key characteristics of senior management can be seen in several of the roles which have been discussed at length in chapter 3. One key aspect of the senior managerial decisional role is his authoritative prerogative in respect of the allocation of organizational resources. The emphasis on allocative control adopted here has also been noted by Mintzberg (1973) and Pahl and Winkler (1974).

In particular, the essence of one of the senior managerial characteristics in which we are interested is that he is concerned with significant outcomes for his organization. This "significance" is of course relative; it may be represented by decisions relating to hundreds of millions of pounds worth of resources for large organizations, or tens of thousands for small ones; what is important is that the resources represent a large part of the organization's total. In principle, such considerations should lead on their own to discovery of critical members of an organization's decision-making elite. However, in order to reduce a potentially enormous number of candidates, positional criteria have also been adopted.

Therefore, in arriving at an operational definition of managerial seniority two variables have been employed. Firstly positional seniority - only board directors of commercial organizations are included in the sample (managing directors or owner/managers for the smaller firms). It is recognized, of course, that this screening mechanism does not allow for managers who are not on the board but who nevertheless wield considerable power and make substantial decisions in terms of their organizations resources; such respondents have simply been unavoidably excluded from our sample. Neither does it allow for board members who in fact have a small and perhaps specialised brief, or who, perhaps through unsuitability, personal disinclination or political circumstance have no place in the internal strategic decision club. Secondly, two proxy measures of the manager's resource allocation authority have been taken - annual spend budget and the number of employees for whom he is responsible. Although these rather crude measures do not of course in themselves capture the essence of an individual manager's specific decisional roles within his organization, they do represent a flexible and justifiable screening mechanism for improving the likelihood that the sample contains respondents in whom we have an interest.

Appendix 3

Organizations in the survey

1. Large companies

ABC Multinational chemical conglomerate
BCD Multinational computer manufacturer

2. Public organizations

PHA Public Corporation
CCC County Council
NHL Institute of Higher Education

3. Miscellaneous group

S91 Medium sized private company - engineering
S92 Medium sized private company - engineering
S93 Medium sized private company - engineering
S94 Multinational - conglomerate, mainly mining investment
S95 Multinational - chemical processing
S96 Building society
S97 Public utility
S98 County council

4. Small firms group

S61 Manufacturing industrial equipment
S62 Manufacturing industrial equipment
S63 Food processing
S64 Manufacturing industrial materials
S65 Distribution and Marketing of Leisure Products
S66 Interior Furnishing and Decorating
S67 Manufacturing metal forgings
S68 Manufacturing industrial service vehicles
S69 Manufacturing furniture
S70 Manufacturing industrial components (gas industry)
S71 Distribution of Electronic instruments
S72 Manufacturing of engineering sub-assemblies
S73 Hardware retailing
S74 Food processing
S75 Manufacturing and marketing office equipment
S76 Manufacturing industrial components

Summary of small firms group

Manufacturing	9
Services	2
Food processing	2
Distribution	2
Retailing	1

Appendix 4

Interview details

1. Introductory letter *

* Note: In practice many different versions of this letter were sent, each one tailored to the specific circumstances of the target manager or organization; but the gist of each letter was similar.

Dear Mr

Research into Senior Managers and Computers

I wonder if it would be possible for you to help in a research project which we are running here at the Business School? I have recently had a talk with Mr * of * who mentioned that you might be able to help.

Briefly, we are examining the use made by top managers of computers in their work. Specifically, we are interested in the situation where a director uses or has used a desk top computer or terminal himself, or where a trial has been made of such a facility.

I would be most grateful for the opportunity to discuss your own situation for a short time. I am interested in individuals' own personal views and experiences, and any information about themselves or the organization will be treated in strict confidence.

Perhaps if I telephoned over the next few days I could make an appointment to see you?

Many thanks for your help.

Yours sincerely

C.J.Martin

Research Fellow

3. Interview checklists

a) Semi-structured interview schedule for senior managers in large organizations; covering all adoption categories

GENERAL
=======

G1 Date of interview: (Researcher's use)

G2 Organization: (Researcher's use)

G3 Division etc: (Researcher's use)

G4 Name of interviewee: (Researcher's use)

G5 Title: (Confirm)

G6 Can you briefly describe your role ?

G10 Annual budget under your control:

G11 Staff reporting to you (and/or under your control):

G12 Time in organization:

G12.5 Time and roles in other organizations ?

G13 Time in current function:

G14 Time in (and nature of) previous functions:

	function *	time
1-		
2 -		
3 -		
4 -		
5 -		

* Broad description of work discipline, eg personnel, production

G15 Age: 20-30, 30-40, 40-50, 50-60, 60+

G16 Can you tell me about your educational and professional qualifications ?

G17 Highest level of maths or science or quantitative subject

G19 Main education bias:

Arts
science
maths

engineering
languages
law
finance
etc

Previous computer exposure
==========

G23 Computer education: (time in any category)

	Concepts	Techniques	Products
School			
College/University			
Training Agencies			
Manufacturers			
In-house			
Own reading			
Other			

Other computer exposure (prior to present system adoption)
==========

Direct (Own use hands on)

Slight <10 occasions of hands-on use

Moderate 10-50 " "

Extensive > 50 " "

Indirect (But have defined own inputs and/or outputs)

Home computer ?
Do you use it ?

Extent of Indirect/Own Use (cat 2A) Computer use
==========

Do you receive computer printouts yourself ?

(Take this current month as an example)
How many different ones daily
weekly
monthly

Do you ever ask specifically for a computer printout ?

(Take this current month as an example)

CATEGORY OF USER : Current or not current user
==========

G24 Do you use a computer personally, yourself now?

G25 Have you ever ?

****

GOTO
====

Currently direct user: goto (1.a)

Currently non-user : goto (1.x)

See also pre-trial questions (about to undertake trial) : goto (1.z)

1.a START *******

CURRENTLY A DIRECT USER
=======================

D1 What kind of system do you use and what is available to you ?

	Available	Use
Personal (P/C)		
Terminal		
Executel / OPD		
Other		
Connected to m/frame		
Other connections		

Internal data:

File draw		
Data analysis		
Analysis information		
Archiving (assassin)		
Diary management		
Messaging		
Budgetary control		
Other		

External data:

Viewdata		
External database		
Other		

Messaging:

Wordprocessing:	Available	Use

Modelling:

Spreadsheet:

Expert system:

Other:

D1.5 What use do you make of these facilities; what do you use them for ?

D2 Personally, which aspect of the system is of most use to you ? Why ?

D3 Which aspect is of least use, and why ?

D4 How much use do you make of the system :

per day : no. of times - duration
per week:

Slight user

<15 mins per day <1 hour per week <2 occasions per week

Moderate user

<1 hour per day <5 hours per week <10 occasions per week

Heavy user

<5 hours per day <25 hours per week <50 occasions per week

D4.5 If messaging is significant, how many people have screens and can access the same system as you.?

D5 Please rank the facilities according to preference

D5.5 Based on your experience so far, are there any facilities or features you would like to see added ?

D6 Why do you use the system yourself rather than have somebody else do it for you ? (and provide you with printouts, summaries or word of mouth results)

D7 What aspects of your job are facilitated by the system ?

D8 How does this come about ?

D9 Has your view of the system changed at all since you started using it ?

D8x How did the system come to be developed for you ?

D8y Who was involved in the decision/choice as to the nature of

the system ?

D10 How have the facilities been developed, by whom, and to what extent were you involved ?

D11 Whose idea was it to install/develop the system ?

Management services
Computer dept
OR/MS
Other

*** D12 What aspect most influenced you to agree to using it ?

D13 What is your opinion of manuals/written materials

D14 " " training course/facilities

D15 Has the quality of these been a factor in your use of the device ?

D16 How long was spent learning how to use it ?

D17 Was the time spent learning about the system / learning how to use the system justified, in your opinion ?

D18 How do you like using a keyboard ?

D19 Which aspects of the system do you like least ?

D19.5 Is the system reliable; are there any problems of this sort?

D20 Are any aspects difficult/ a nuisance?

D21 Which would you change, given the opportunity ?

D22 Which aspect of the facilities do you like most ?

D23 How does your use of the system relate to strategic decisions that the organization might implement ?

D23.5 What kind of decisions does the system help you with ? How does it help? Can you give an example ?

D24 How does the system help you personally ?

D24.5 Are there any other uses for the system (other than those described so far ?)

D24.7 Is there anything about your use of the system that gives you a kick (personal rewards) - why do carry on using it - what does it do for you ?

D25 Has the nature of your job changed at all (since your system installed) as a result of the system ?

D26 Thinking of the potential rather than what is available now, what, potentially, do you think computers might be able to do for you ?

D27 Can you roughly describe the way in which strategic decisions are made in this organization ? Describe your relation to the strategic decision process ? (Strategic decisions affect the org. as a whole and usually are looking several years ahead).

1.x START *******

CURRENTLY A NON USER
====================

(Rejected with/without trial ?)

Have you been approached with schemes to provide you with computing facilities ?

By whom ?

Internal
External
What kind of facilities ?

What was your response to the approach ?
Did you try the system ?

GOTO
=====

Non-adopted (discontinued) after trial goto 1.b
Rejected without trial goto 1.c/1.d

1.b START *********

Non-adopted after trial
=======================

D1 What kind of system did you use and what is available to you ?

	Available	Use
Personal (P/C)		
Terminal		
Other		
Connected to m/frame		
Other connections		
Internal data:		
File draw		
Data analysis		
Analysis information		
Archiving (assassin)		
Diary management		

Messaging
Budgetary control
Other

External data:

Viewdata
External database
Other

Messaging:

Wordprocessing: Available Use

Modelling:

Spreadsheet:

Expert system:

Other:

D1.5 What use did you make of these facilities; what did you use them for ?

D2 Personally, which aspect of the system was of most use to you? Why ?

D3 Which aspect was of least use, and why ?

D4 How much use did you make of the system :

per day : no. of times - duration
per week:

D5 Please rank the facilities according to preference

D5.5 Based on your experiences so far, were there any facilities or features you would like to see added ?

D6 Why did you use the system yourself rather than have somebody else do it for you ? (and provide you with printouts, summaries or word of mouth results)

D7 What aspects of your job were facilitated by the system ?

D8 How did this come about ?

D9 Has your view of the system changed at all since you started using it ?

D8x How did the system come to be developed for you ?

D8y Who was involved in the decision/choice as to the nature of the system ?

D10 How have the facilities been developed, by whom, and to what

extent were you involved ?

D11 Whose idea was it to install/develop the system ?

Management services
Computer dept
OR/MS
Other

D12 What aspect really most influenced you to agree to using it ?

D13 What was your opinion of manuals/written materials

D14 " " training course/facilities

D15 Has the quality of these been a factor in your use of the device ?

D16 How long was spent learning how to use it ?

D17 Was the time spent learning about the system / learning how to use the system justified, in your opinion ?

D18 How did you like using a keyboard ?

D19 Which aspects of the system did you like least ?

D19.5 Is the system reliable; were there any problems of this sort?

D20 Are any aspects a nuisance?

D20.5 Was your time wasted at all, do you think ?

D21 Which would you change, given the opportunity ?

D22 Which aspect of the facilities did you like most ?

D23 How did your use of the system relate to strategic decisions that the organization might implement ?

D23.5 What kind of decisions did the system help you with ? How did it help? Can you give an example ?

D24 How did the system help you personally ?

D24.5 Are there any other uses for the system (other than those described so far ?)

D24.7 Is there anything about your use of the system that gives you a kick (personal rewards) - why carry on using it - what did it do for you ?

D25 Has the nature of your job changed at all (since your system installed) as a result of the system ?

D26 Thinking of the potential rather than what is available now,

what, potentially, do you think computers might be able to do for you ?

** What caused you to stop using the system ?
==========

Were any aspects of the system particularly difficult ?

Was it relevant to you - did it help you personally ?

What aspects were most instrumental in causing you to give up the system ?

What was the system intended to do (achieve) ?
==========

Before you started with the system, did you think that it might be a significant management tool ?

How was the system supposed to help you ?
==========

In your opinion, what was achieved ?

Did the system do these things in any way at all ?

Were your reasons for giving up the system different from the "official" (or reported) reasons ?

Was there any particular thing about the system or about the circumstances in which it was introduced that acted as a turn-off?

How do you feel now about computers ? How can they can be of use to managers such as yourself ?

1.c 1.d START ********

Non-adopted ; no trial

Are there any plans to provide you with facilities ?

Have you ever thought it might be advantageous to have one yourself?

Do any of your colleagues have one (directors, or chief officers etc)?

(Get names for interview)

Why do they use one and you not?

Do you have any plans to use one?

Can you see any circumstances in which using a computer yourself might be advantageous?

Do you think it would be useful to use one personally?

*** Why good for the company but not for you?

Have you been approached with schemes to provide you with computing facilities ?

By whom ?

Internal
External
What kind of facilities ?

What did you do about the approach ?

Were any schemes attractive to you at all ?

Do any of your colleagues use computers at all ?

Why do you think that they use them ?

Why do you not use one ?

Given a completely free choice, is there any kind of direct computing which you think you might adopt?

Was any computer adoption intended

Factors in the intended adoption

Why do you intend to take up these systems?

*** Any computer facilities that might potentially be of use to you personally ?

Considering the computer information you receive (printouts etc)

What is the most useful to you personally

What are the features that make it useful

Considering strategic planning computer systems

Do you receive info yourself, or are the results reported to you

Would you say that strategic choices are put up to you and your colleagues for decision, or do you find yourselves approving/disapproving individual propositions

Does the information affect strategic decisions ?

Considering computer systems in general in the organization
==========

Are any of relevance to you ?

Do you receive printouts directly?

How do you use the information?

Do you influence the way the computer dept structures these systems?

How are systems chosen?

Are you involved in design matters at all?

**** Start

1.z Pre trial questions
---

p1 Who has initiated the trial
p2 Why have you agreed to take part?
p3 What systems / facilities do you expect to get
p4 What do you think they will do for you
p5 Will they help your job in any way
p6 Will they help with strategic matters
p7 How will they achieve these things
p8 Will there be any difficulties in using it

p9 What kind of learning task do you consider will be involved

1 full day
5 full days
10 full days
20 full days
More?

2. Interview Checklist - Chief Executives of Small Firms

Date :
Name :
Firm:
The company (size and activities):
Title: (NB Owner manager, managing director, shareholder, relative of owner(s)
Responsibilities: (NB partners)
Time in organization:
Age range:

Work experience: (prior to present organization):

G14 Time in (and nature of) previous functions (reverse order):

	function *	time (yrs)
1 -		
2 -		
3 -		
4 -		
5 -		

*** Is there a professional management background (ie a large firm background; and does this have an influence on his approach to computing ?)

Education

Main formal educational bias:

Previous computer exposure

G23 Computer education: (time in any category)

	Concepts	Techniques	Products
College/University			
Training Agencies			
Manufacturers			
In-house			
Own reading			
Other			

Other computer exposure (prior to present system adoption)

Direct (Own use hands on)

Slight	<10	occasions of hands-on use
Moderate	10-50	" "
Extensive	> 50	" "

Indirect

Home computer ? Do you use it ?

Category of user
==========

Computer systems in the organization
==========

Who in the company physically operates it?
==========

Factors in adoption of company systems
==========

Computer System introduction processes
==========

Respondent's Relation to design process

Respondent's relation to implementation processes

What role was played by external consultants or suppliers?
==========

Manuals/written materials - training facilities

Time spent on learning (by the respondent)

Facilities available for the respondent
==========

System use by respondent(or use prior to discontinuance)
==========

(Real use; experimentation, trial - what?)

Nature of use
==========

Precise relationship of respondent to computer use/ relation of his
==========
involvement in comparison with his role.
==========

Reasons given for discontinuance (if any 1A use)
==========

Any computer facilities that might potentially be of use to you personally ?
==========

Which aspect of the system is of most use to you ?
==========

Any facilities or features you would like to see added?
==========

Any aspects of the system particularly difficult ? Or
==========
inconvenient?
==========

Any aspects of your job facilitated ?
==========

Relevance
==========

Has adopting the technology necessitated a role change?
==========

Has your view of the system changed since before you used it ?
==========

Comments
==========

3. Interview checklist - intermediaries and system providers

Date of interview:
Name:
Organization:
Division:
Title:
Responsibilities:

Topics for discussion:

1. What facilities have been made available to directors ?

2. What were the circumstances surrounding the introduction ?

   who initiated the development
   what part did the s-m play in deciding on what would be made available?

3. What benefits accrue to the s-m?

4. What were the objectives for the trial?

5. What training facilities were offered to them?

6. What are the main difficulties / problems with senior managerial computing ?

7. What has been the result of the trial?

   has it been successful?
   in what way?

8. Has there been any evaluation of the effect of the introduction (formal or informal)?

9. Are any more trials or introductions planned?

   what purpose will be served?

4. Interview checklist - second interviews

Name:
Date:
Organization:

1st Int. No.:

1 Any missing data:

2 Category 1st time:

3 What technology do you have now?

4 What systems are available now?

D1 What kind of system do you use and what is available to you ?

	Available	Use
Personal (P/C)		
Terminal		
Executel / OPD		
Other		
Connected to m/frame		
Other connections		

Internal data:

File draw		
Data analysis		
Analysis information		
Archiving (assassin)		
Diary management		
Messaging		
Budgetary control		
Other		

External data:

Viewdata		
External database		
Other		

Messaging:

Wordprocessing:	Available	Use

Modelling:

Spreadsheet:

Expert system:

Other:

D1.5 What use do you make of these facilities; what do you use them for ?

D2 Personally, which aspect of the system is of most use to you ? Why ?

D3 Which aspect is of least use, and why ?

D4 How much use do you make of the system :

per day : no. of times - duration
per week:

Slight user

<15 mins per day <1 hour per week <2 occasions per week

Moderate user

<1 hour per day <5 hours per week <10 occasions per week

Heavy user

<5 hours per day <25 hours per week <50 occasions per week

D4.5 If messaging is significant, how many people have screens and can access the same system as you.?

D5 Please rank the facilities according to preference

D5.5 Based on your experience so far, are there any facilities or features you would like to see added ?

D6 Why do you use the system yourself rather than have somebody else do it for you ? (and provide you with printouts, summaries or word of mouth results)

D7 What aspects of your job are facilitated by the system ?

D8 How does this come about ?

D9 Has your view of the system changed at all since you started using it ?

D8x How did the system come to be developed for you ?

D8y Who was involved in the decision/choice as to the nature of the system ?

D10 How have the facilities been developed, by whom, and to what extent were you involved ?

D11 Whose idea was it to install/develop the system ?

Management services
Computer dept
OR/MS
Other

*** D12 What aspect really most influenced you to agree to using it
==========

D13 What is your opinion of manuals/written materials

D14 " " training course/facilities

D15 Has the quality of these been a factor in your use of the device ?

D16 How long was spent learning how to use it ?

D17 Was the time spent learning about the system / learning how to use the system justified, in your opinion ?

****

(Special this respondent)

You had intended to use the pc for :

access to the personnel databases;
in order to explore data yourself,
to explore the age structure.
messaging
budgeting

What are your views now about computing for yourself?
Have your views changed since last time?

You did consider that computing was increasingly going up the organization - do you think it will now percolate to the rest of the board?

Comments

Appendix 5

List of variables and definitions

Uf Usage factor

a 0 Not available (Av 5 or 6)
n 1 No use (rejected although available in some sense)
d 2 Discontinued after adoption
s 3 Slight use <15 mins/day <1 hr /wk <2 occasions/wk
m 4 Moderate use < 1 hr/day < 5 hrs /wk < 10 occasions /wk
h 5 Heavy use > 1 hr/day > 5 hrs /wk > 10 occasions /wk
l 6 Lapsed leader (small business)

Rf Responsibility

(These represent rankings within one organization. Between organizations there is little basis for comparison).

1 Slight
2 Moderate
3 Heavy

A Age

1 <30
2 31-40
3 41-50
4 51-60
5 61+

Pe Prior experience

1 None
2 Slight < 10 occasions of hands on use
3 Moderate 10 - 50 " "
4 Considerable > 50 " "

Ft Formal training

0 None
1 Slight: (< 20 days,seminars etc)
2 Moderate: 20 - 60 man days
3 Extensive: 3 mnths - 1 year
4 Specialist: 1 year +

Hc Home computer

0 not owned
1 owned, but no use by respondent
2 slight use
3 considerable use

Si system intro processes

a initiated by user
b initiated by others
u initiation uncertian
n not applicable

Df Design of facilities

a user involved in design or choice of his facilities
b user not involved (offered a standard product)
n not applicable

Ti Technical involvement

a user designs own spreadsheets, programs etc
b no active technical work
n not applicable

Eb Formal Education subject bias

s science
e engineering
l law
f finance
a arts

Ca Main Career bias

Marketing / sales
Finance / accounting
Personnel
Production management
Data processing
Education
Mgt Services
Administration
Local govt.

Av Availability

1 Openly available
2 Readily available
3 Reasonably available
4 Available with difficulty
5 Not available
6 Not available - no system

Appendix 6

Examples of summarised interview accounts
---

1. A respondent from ABC

S03

Uf Rf Pe A Ft Hc Si Df Ti Eb Ca

rr3

Name:

Date : 30/8/84

Title: Director of Personnel and Management Services Dept

Responsibilities: Staff: 128 in personnel and 116 in MSD

NB: MSD includes the computer dept, which includes a voluble, and articulate advocate - * a man who seems to aspire to head of MSD and is personally interested in computing being a powerful and important force in the organization. [Was promoted to this position 6 months later]

The broad view of the board of directors' role can be seen as a management team that decided policy matters together; in addition to this general role, each director had one or more "portfolios".

Time in organization: 20

Age: 50-60

Work experience:

G14 Time in (and nature of) previous functions (reverse order):

	function *	time (yrs)
1 -	Personnel	8.5
	Management Services	1.5
2 -	Business Area Manager (Largely planning role)	2
3 -	Personnel	8

Career summary
==========
Mainly personnel with a spell in planning.

Education
=========

BA Degree from Cambridge in English and Law. No science or maths, not even at 'o' level. Harvard Business School for 2 months.

Previous computer exposure
==========
G23 Computer education: (time in any category)

	Concepts	Techniques	Products
School	(none)		
College/University	(none)		
Training Agencies	(none)		
Manufacturers	3/4 days (IBM seminars)**		3/4 days (IBM seminars)
In-house	(none)		
Own reading			
Other			

** "IBM seminars included familiarization with products and possibilities. No programming; no technical stuff."

Other computer exposure (prior to present system adoption)
==========

Direct (Own use hands on) None
Indirect None

Respondent was involved in the computerisation of personnel records, responsible for introduction - "... the first to do so in *."

"I believe in leading in computing."

Home computer ? Yes
Do you use it ? "No. Kids use it. Not me yet. Not games."

Category of user
==========
Discontinued after trial. (At first he claimed that he was a direct user , but after some discussion explained that he made "very little use of it, now.")

Factors in adoption
==========
"Because of MSD hat. I took it and did some experimenting and found out the potential. I will now chuck it. I know the potential. It has served its purpose."

The respondent described at some length the use the salesmen made of computers in their homes (cf *). His reason for trying it was to see what it was like for the others to use.

The respondent was asked to rank his reasons for adopting the system:

1 Curiosity
2 Because I'm MSD director

3 In case it was of use (to me)

"I believe in leading in computing."

[The respondent was a member of the Computer and Systems Steering Panel. Cf *. He is director of MSD]

Facilities available
====================
In common with the other directors, a number of different facilities had been offered based on 1) a vdu terminal linked to mainframe and internal databases and 2) a small screen linked to Prestel and internal and external databases. (This latter arrangement was replaced at some point by one terminal for all purposes). The system facilities available included:

Summaries of internal data (financial and operating data)
Analyses of internal databases (personnel records)
Messaging (to other board members and immediate subordinates)
Diary management

Other facilities are available within * (eg assassin archiving system, plus many others) but it is not clear that any others were attempted by this respondent.

System use prior to discontinuance
==================================
"Fits and starts over maybe 2 weeks. Maybe less than 10 hours altogether."

"Now, I make very little use of the system."

Reasons given for discontinuance
================================
"The limited personnel data was of only marginal use."

"Little data or information requires instant action or response by me. So, most data comes in written form - quite properly."

"I can see the potential of having this kind of data [personnel database] in the system; but as it is at the moment it's no use."

"At the end of the day, decisions are made by debate about judgements."

Any aspects of the system particularly awkward ?
==
"Having to use the keyboard was an irritation - not being able to type fast."

"Getting into the system was a problem - the codes and so on." [Opening incantation].

Any aspects of your job facilitated ?
=====================================
"Very limited ... none."

"Not at all. But potentially possible."

Relevance
=========
"There are insufficient `have to have ' features, rather than `nice to have' features."

"There is a distinction between judgement and calculation."

What sort of information would you like - that would be useful ?
==========
"[When I get my new PC] ... I will use my new PC for access to personnel database, messaging; getting a feel for the age structures of the workforce, because of the need to reduce the workforce - what will happen to the age structure ?"

"I hope to play with the database myself.'

"Maybe use it for budgeting"

System introduction processes
==========
"Management Services did the whole thing. I was not personally involved at all."

Has your view of the system changed since before you used it ?
==========
"Limitations exposed more clearly."

Your views on the role of computers in management
==========
"Essential for the organization ... Increasingly going up the organization. Some of my colleagues have PCs. I will be shortly using one."

[None of his colleagues use a PC except * who is a special case]

"There is a distinction between judgement and calculation."

"There are insufficient `have to have' features, rather than `nice to have' features."

S07

Uf Pe A Ft Hc Si Df Ti Eb

RR07 Interview Summary

Date: 13/11/84

Name :

Organization: *

Title: Group Technical Director

Responsibilities: As a diversified group, * requires group technical coordination. The function employs 250 staff and has a #23m annual spend. Group functions undertaken by the Technical Directorate include quality control, standards and procedures, technical strategy, profitability, external dialogues with EEC [but note *'s function], PR etc. R & D is the main function. In addition, two special projects are handled centrally: * business development and MOD business development. (These are handled centrally until they can be set free to a life of their own; presumably they are in this division as much because of *'s obvious and very considerable talents, as for any technical or administrative reason.)

Time in organization: 2.5 yrs

Age range: 30-40

Work experience: (prior to present organization):

Prior to * had 2 senior roles in a similar technical capacity; previously was involved in computer hardware /software development and before that in process and electronic engineering.

G14 Time in (and nature of) previous functions (reverse order):

	function *	time (yrs)
1 -	Technical Director - *	2.5
2 -	Technical Director -	2
3 -	Tech. Manager(?) Controls - *	2
4 -	" " (Scotland) "	3
5 -	Systems Development mgr (USA) "	4
6 -	Mgr - h'ware/s'ware development	1
7 -	Development engineer (electronics)	1.5
8 -	Process engineer "	1.5

Education

Cambridge double 1st in engineering and electrical sciences. MIEE and AMBIM.

Maths and physics at 'A'level.

Previous computer exposure
==========
G23 Computer education: (time in any category)

	Concepts	Techniques	Products
School	None		
College/University	None (but wrote programs for scientific use)		
Training Agencies	None		
Manufacturers	None		
In-house	? (maybe some)		
Own reading	?		
Other	?		

Other computer exposure (prior to present system adoption)

Direct (Own use hands on)

Indirect : Experience of developing/observing operational systems (nb past role in s'ware development)

Home computer ? Yes
Do you use it ? Yes - games with kids.

Category of user
==========
The respondent claimed to be a current direct user. There was an * pc on the desk. But see comments below. The respondent stated later that his usage was minimal, and in fact he may better be described as a "discontinued user" because he had sufficient extensive knowledge of the systems to suggest to me that his usage must have been much higher at some earlier time. [Categorised as slight user]

Factors in adoption
==========
[Not directly elicited!]

Facilities available
==========
In common with other directors at this location the respondent had a pc linked to a mainframe. No mention of the pc facilities (spreadsheet, wordprocessing and database) was made, however (although he knew of them, see comments at end). The mainframe DSS systems included extensive organizational and divisional databases, financial systems and messaging. The respondent described the following elements:

Cost budgeting
Competition data analysis (market competitors)
Company financial model
Messaging (Exac)
Mailing (?)

Project management (?) [Some PERT-based system.]

He clearly knew enough about some of these systems to imply that he must have used them at some time.

System use (or use prior to discontinuance)
==========
"Minimal"

"1 - 2 hours per week at most."

"I know I should use it but... if the right systems were there...I don't spend much time in the office."

Nature of use
=============
"Messaging is not useful." [To me?] "My secretary uses the messaging extensively - I tend to use it through her."

"The financial system is the most useful. The others aren't used."

[Contrast this with *, where the reverse was true - but see the reasons for * using the messaging!]

Reasons given for discontinuance/or non-use
==========
"I want databases that don't exist."

"I ask my accountant [for financial data] - he's down the corridor."

"I ... get my planner to do planning for me."

"If I was one level down I would use it."

"I would do more if I had the time."

"Interruptions are a real problem.' [And I can personally vouch for the truth of this!]

Which aspect of the system is of most use to you ?
==========
"Financial data" [But this was not all that much use.]

Why do you use the system yourself (rather than have somebody else
==========
use it for you?)
[Not elicited]

Any facilities or features you would like to see added?
==========
"Yes - there are loads of things if I had the time to specify them." "

"I want databases that don't exist."

*** [I would like] ".... graphics and presentation slides etc. This is very important; if I could develope this it would be extremely useful... Bulk communication."

"Communication to others - this will be most important; fundamental!"

"Search in data; search in textual data."

[None of these items is based on realistic appreciation of current difficulties in relation to own personal usage; rather they are partly his own vision - a highly developed and intellectual vision - of what is to come in computing, and partly idealised pictures of forthcoming * products.]

How would you rank the facilities according to preference?
==========
"Financial system is the most used."

Any aspects of the system particularly difficult ? Or
==========
inconvenient?
==========
"Upper case characters" [this presumably refers to the mainframe's sensitivity to upper/lower case, requiring "pernickety" care]

"Bad choice of control commands - characters scattered over the keyboard." [And hence hard to remember]

"Error prone" [Not certain what this refers to, but presumably the system falls over occasionally and has various software wrinkles.]

Any aspects of your job facilitated ?
==========
"Marginal as to whether the system helps me personally at all."

Relevance
==========
[Very marginal]

"The system is not the most valuable thing ... it's strong on financial things only."

[In no respect was anything shown to be directly related to the respondent's job or personal requirements.]

Relation to strategic decisions
==========
Respondent stated that his use of the system did not relate to strategic decision making.

System introduction processes
==========
"GIS put the system up." "I wasn't involved at all in the design or specification - the system is a standard product."

"But I will do in the future [specify his needs]."

Quality of written materials - a factor in usage ?"

"Yes - not good enough."

"Not enough"

How long spent learning the system and was it justified?

"3 to 4 hours - and no; minimal justification."

Has adopting the technology necessitated a role change?
==========
"No."

Has your view of the system changed since before you used it ?
==========
[Not asked]

Your views on the role of computers in management
==========
[Here the respondent gave a brilliant and articulate exposition on the potential of computers in management. I wish I could do as well with advance notice of the question and a set of notes!]

"Managerial activities are divided into two sets:

one - operational jobs, people, budgets ... routine; this can be helped by computers .... PERT, spreadsheet, database etc

two - means deciding what to decide about; it is critical but least developed, tends to be external; the information doesn't exist" ...

[And so on; a superb discussion of the important elements of managerial computing.]

"At the top, one tends to go to staff [for information]; the computer could help, but ... there is a short timescale, urgency the corporate database is the last place to look for the information ..."

"If the organization has a matrix structure [meaning the use of inter-departmental project teams, which presumably * was implying happened in *]... then the organization must have a computer.... Some company structures preclude any but computer control...eg NASA as a structure."

[This represents the classic systems orientation to organizational matters. Of course none of this relates to his own personal use of computing for himself]

Appendix 7

Characteristics of the small firm respondents

Table A.1 Computer training in small firms

	number (n=16)
None	3
Slight (<10 days FTE*)	11
Moderate (10 - 20 days FTE)	2
Extensive (> 20 days FTE)	0

Table A.2 Prior direct (hands-on) involvement

None	12
Slight (<10 occasions)	1
Moderate (10-50 occasions)	1
Considerable (>50 occasions)	2

Table A.3 Prior managerial experience of implementation

Has had prior managerial involvement with computer implementation	5
No prior involvement	11

Note: FTE - Full time equivalent.

Appendix 8

Statistical background for small firm analysis

The statistical test used here has been chosen to suit the modest amount of available data and in the absence of knowledge about underlying distributions. Non-parametric tests are used because the data on the behavioural typology scale is on an ordinal rather than interval scale and no assumptions can be made about normality (on the contrary, it can be assumed that data on the firm size distribution will be skewed in the larger population).

In order to test for association between two sets of independent data, several bivariate non-parametric correlation tests are available; the choice of tests with ordinal data is between Spearman's rho and Kendall's tau. Spearman's rho is suitable where there are few tied ranks in the data and Kendall's tau is suitable where there are many tied ranks (Siegel 1956), which is the case with the data employed here.

The data matrix on which the statistic is based is as follows:

Figure A.1 Matrix showing firm size against behavioural category

(N=14)	Firm Size Category:				
Behavioural Pattern	1	2	3	4	6
1		1	1	2	1
2		1	1		
3		1	1		
4		2	1		
5	1	1			

The calculations for Kendall's tau have been performed using the SPSS-X computer package (Nie, Hull 1981) and detailed workings are not shown here. The appropriate value of Kendall's tau c has been taken, giving a value of -.054847 at a significance level of 0.0049.

Appendix 9

Some Practical Implications of the findings

It is perhaps an unfortunate outcome of this research project that a rather pessimistic view of the potential of present-day direct computing for top level managers has emerged. Nevertheless, it is possible to derive from the findings a number of implications which hopefully can be turned to positive effect. These implications are presented in terms of implications for managers, systems developers and people involved in implementation:

1 Implications for senior managers

It has been an important finding of this research that in many instances senior managers take up direct computing and expend varying degrees of time and effort, only to find that the rewards in an informational sense are not significant. Although managers will still wish to be associated with computing for various leadership-related reasons, it would seem to make sense at present to limit time spent learning detailed operating procedures unless it is quite clear that a sensible advantage will ensue. It must be said that for most senior general managers, the opportunities for such advantage do not seem to be frequent. (Although there will of course be instances of specific specialist systems which replace normal information sources, such as personnel records).

In order to limit wasted effort expenditure it may be advisable for the manager to spend much more time with system-providing teams during system design and choice activities, when the manager's inputs will be most valuable, and correspondingly less time alone learning system details after the choice has been made. In particular, the use of senior management as a test-bed for new systems seems entirely inappropriate when there are far better ways of testing these systems. Finally, it is always possible that some technological breakthrough will occur in the immediate future such that senior managers will find distinct advantage from some form of direct computer use. However, there have been any number of false dawns already and in the light of the special characteristics of senior managerial behaviour and decision making, it seems unlikely that any really profound changes will occur in the short term which would invalidate these comments.

The position in the smaller firm is of course somewhat different; here, the chief executives were involved in a project-management capacity in the implementation of systems intended primarily for organizational efficiency. A number of firms in the sample showed evidence of computer systems which for one reason or another had not entirely fulfilled the expectations of their owners; this is in contrast to the somewhat optimistic views about small-business computing sometimes expounded in the literature. In view of the common role of the chief executive in a project-management capacity it would seem to make sense if there were training

facilities available which were specifically designed to help him undertake this specialised responsibility, in contrast to the technical and software oriented training which appears to be all that there is readily available. Such computer-management training may represent a good investment for the small business manager if it increases the chances of his achieving more successful system implementations and reduces his requirement to learn experientially.

2 Implications for systems developers

This is perhaps the most difficult section of all in which to suggest appropriate directions for development. The research has indicated that managers have discontinued their computer use when, apart from man/machine interface difficulties, they have perceived that system use offers little direct advantage to them. However, it has been shown that where systems are successful, they have been directly interwoven into the manager's current roles; this implies that designing systems which are specific to a manager's specific operational responsibilities (if he has them) is more likely to be successful than providing generalised decision information. (For example, many of the system users in this study rejected their organization's financial decision support system). It seems likely that close study of an individual manager's specific roles and activities is more conducive to useful system design than the provision of "off-the-shelf" systems.

Certainly, attention to man/machine interface issues is necessary but it must be stressed that this in itself does not appear to be a sufficient condition for sustained system use; such use requires ongoing effort and managers are unlikely to undertake this unless (saving perhaps the implications of leadership-role related issues) there is a relevant informational advantage. The problem lies in identifying such an informational requirement bearing in mind the inherent difficulty of competing with the manager's current and probably well-developed network of information sources.

It is possible that developments in Expert systems may in the future be useful to senior managers; the development of these systems to incorporate general managerial expertise may be relevant as a supplement to internal resources. Alternatively, it may be useful to develop systems which reflect the manager's own organization-specific expertise in order to act as a pool of knowledge to be tapped by his colleagues or successors when he leaves the company. Whatever the nature of the information, to be useful it must reflect the real needs of managers in the special context of senior managerial roles and behaviours and must constitute an advantage over other sources. In practice this may be a very tall order in terms of presently available technology and, more especially, in terms of our understanding of management processes.

3 Implications for system implementers and support personnel

A model of the senior managerial adoption process has been put forward which should provide significant insights for system implementers. In particular, attention to the appropriate adoption factors should ease problems of introducing a direct system in the first instance. However, the research evidence shows that once having adopted a computer system there is a very real danger of disenchantment arising from unrealistic expectations, leading to discontinuance. The logical solution to the disenchantment effect is to involve the manager himself to a far greater extent in system design and choice activities, so that he will have made a greater contribution to these activities and will be more familiar with the nature of the systems which he can expect to receive. Such participation in design processes is hardly a new recommendation (see the implementation literature review in chapter 4); nevertheless, the circumstances found in the case studies were far removed indeed from such participation and the necessity apparently needs restating.

Of course, the implementation of computer systems where the operator has complete discretion over his system use (although his adoption choice may be constrained!) represents a special situation for the systems implementor. In the case of the busy senior manager, the initial problem may be to persuade him to expend sufficient time with the development team during the design and choice phases of the project in order to obviate the problems of mismatch between the systems capability and the manager's real roles and activities. Another problem arises with learning processes; the manager will need to acquire sufficient detailed operating knowledge to enable him to make use of the system effectively and in the shortest possible time. This implies the provision of good quality training, helpful and well-ordered documentation and a reliable and discreet back-up, advice and help facility. In the cases reviewed in this research, at least two of these items were nearly always absent; system documentation in particular was almost universally castigated by managers from all cases. It must be pointed out, though, that some managers overcame an apparently conspicuous lack of support in order to utilise their systems; nevertheless, any sensible steps taken to smooth the user's path must pay dividends in terms of an improved likelihood of significant system usage being made.

Appendix 10

Opportunities for further research

During the course of the project a great number of opportunities arose for specifying further research. These came from ideas generated from the literature review, during the field work and during the writing-up phase. They are a reflection of issues which were deemed to be tangential to the main focus of the project, or arising from ideas or problems which just could not be resolved within the project time constraints, or from the implications of the research findings. Out of a large array of possibilities only a small number will be discussed here; two are presented in a little detail with a suggested methodology and the rest are merely sketched out in terms of a few sentences which contain a germ of an idea for development.

1. Information in the strategic decision process

Many organizations have extensive decision-oriented computer systems which provide outputs intended for strategic and policy decision. However, managers use other sources of information (Mintzberg 1975a) so that there is a range of stimuli which may act to influence decision choices. Additionally, the nature of decision processes is such (see for example Pettigrew 1973 and 1974) that it is rarely the case that decisions are made simply on the basis of well-quantified and analysed options.

The research question relates to the routing of computer-based information from the organizational decision support system through to its eventual inclusion and influence in a high-level decision situation. What evidence there is (see for example Grinyer 1983, or Martin and Winch 1984) suggests that the information path is often via specialist staff personnel. However, it is generally an act of faith that DSS and related systems have a specific effect on decision outcomes and there is a clear need to document rigorously the social processes by which these effects occur and also the value of the information in terms of its real influence on the decision outcome.

In order to study the effects of computer information in the decision process, it would be necessary to study the decision-making process itself with some care. This will involve following through decision processes within a target organization using participant observation and interview techniques in conjunction with an investigation of the computer-based information. The general approach therefore would be that of a case-based, qualitative investigation which will analyse the research phenomena in some depth.

2. Towards a managerial support technology

A key implication of the research findings was that the present technology of computer-based tools for senior management was inappropriately oriented with respect to senior managerial real

roles and activities. The question immediately arises, then, as to what kind of computer-based tools would be personally appropriate to senior management; this leads on immediately to the question as to how this issue is to be researched and resolved - apparently a very difficult problem. Most information technology developments in this context seem to be based either on matching existing systems to current problems, or to developing new technologies in the absence of immediate applications. By way of contrast, it might prove fruitful to perform a study of an individual manager's real roles and activities with a view not to matching (or mismatching) present technology to his tasks, but towards specifying those key aspects of his work which might most fruitfully be supported by a future technology. Such a research effort would entail reviewing previous studies of behavioural aspects of managerial work as a potential basis for documenting key managerial activities. This proposal is both speculative and long-term, and represents a significant departure from the current man/machine interface research mainstream.

3. Computing in the small firm

The small business area seems overdue for an empirical research effort which addresses areas of special concern. On the one hand, the issues and context of small-business computing are distinctly different from those of larger organizations; on the other hand there appears to have been very little basic research into the realities in the field (although a very recent British study by Wroe (1986) may have gone some way towards filling the gap). Comparative studies between large and small computing environments, and perhaps across different industrial sectors, which indicate the differences in terms of relative strengths and weaknesses would be very valuable. A key research question relates to the special informational needs of small businesses, and how these might be satisfied in the context of sparse internal resources.

4. Support for computer users: the role of documentation

The present study indicated a distinct deficiency in the support facilities available to (or perhaps utilised by) the managers as they addressed the problems of direct computing. The general topic of support in this context needs some investigation in order to examine in more detail how these facilities were supplied and used, in order to establish how they might best be improved. In particular, the written documentation consisting of so-called "user manuals" and other paperwork supplied by computer hardware and software suppliers was almost universally castigated by the managers. Although there already is a body of work in this general area, there seems to be a real need for an investigation which identifies the current needs of managers for written materials supporting their computer use, and which can suggest a suitable role for these materials in the general context of user support.

5. Personal learning costs for direct computer users

The research showed that managers expended considerable personal effort in their attempts to utilise direct computer systems; discontinuing users complained of the effort costs in acquiring detailed operating skills, and continuing users tended to polarise their use on one system facility presumably in order to minimise ongoing learning costs. However, the precise nature of these "learning costs" is not known, in the sense that neither the psychological nor the technological parameters can be specified, except perhaps in the broadest possible terms. There has been already been some work done on learning protocols, for example in respect of wordprocessing systems see Carroll and Mack (1984). But clearly much remains to be done with regard to the nature of the learning effort involved in different systems and under different circumstances, and particularly with respect to the general problem of reducing those learning costs for the user.