Managers and Computer-based Information Systems: A Study of Current Uses, Intentions and Their Causes

Volume 1 of 2

Submitted by Randall C. A. Fisher
for the degree of Ph.D.
of the University of Bath
1992

Acknowledgements

The research and findings described in this thesis would not have been possible without the active involvement and support of the policy makers in a number of organizations. With no guarantee of a payback for themselves, they offered the use of many of their key employees to an outsider. The more than sixty managers in those organizations who took an active part in the data gathering (or creation) also deserve my thanks and my respect. Taking part in this project was not simply a matter of filling in a questionnaire. These men and women surrendered from three to ten hours of time that, in most cases, had to be recovered from their jobs or their personal lives. Beyond that, their questions, comments and observations had a strong effect not only on the outcome of this research but on the process as well.

Thanks is also due to my supervisors at the University of Bath. Dr. David Sims' insights, guidance and patience kept me on track (and even on the project during difficult periods). Dr. Rod Green helped me to keep a focus on the managers as they use computer-based tools rather than wandering too far afield but, even more, he emphasized the need for simplicity and clarity.

Graham Guest, Ph.D., reviewed the first draft of my thesis and his observations and advice were particularly helpful since they came from an experienced researcher and consultant who had not been directly involved in the project.

Finally, I want to acknowledge the contribution of my colleagues at Mount Saint Vincent University. Without their advice on content and process; their patience when an obligation was missed due to an interview or a deadline; and their tolerance of my single-minded focus on this thesis for more than five years it is unlikely that I could have finished this work. Particular thanks are due to Dr. Don Shiner and Dr. Malika Das whose practical advice and examples help develop the form and content of the final version.

Abstract

The research reported in this thesis investigated the levels and types of current use of computer-based information systems by middle and senior managers; their intentions concerning new or expanded use of such tools and the sources and relative strengths of the factors behind the reported current use and described intentions.

The research was driven by a contextualist model of the manager functioning within a complex and dynamic environment. The basic data gathering technique used was extensive interviews with more than fifty middle and senior managers in six organizations. The interview process and content were dynamic, particularly during the early stages - resulting in more than two thousand pages of answers to open-ended and quantitative (Likert scale) questions. These were supplemented by a number of data sources, particularly the Myers-Briggs Type Indicator.

The data were analyzed using primarily the Grounded Theory method. Statistical analysis was applied to the data from the structured questions and the MBTI using the SAS package.

The findings demonstrated that the use, attitudes and intentions of managers are affected by factors from a number of sources - the organization, its industry and its environment; the job the manager performs; the characteristics of the individual; and the tools and support provided - but four results stood out.

First, the organization was by far the strongest force acting on the managers. Second, managers were more concerned about the corporate-wide applications planned or now running than about specialized tools in their own areas. Third, most managers considered personal use of a terminal or microcomputer be to an inappropriate use of their time. The final, surprising, finding was that managers did, or would, use the computer directly as a communications tool - particularly if voice mail were available.

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SECTION I - Introduction

This section of the thesis begins with a description of the etiology of this research project and explains how it differs from past research into the use of computer-based information systems (CBIS). It then moves to a discussion of the nature of the problem being investigated and the goals of the research.

The difficulties involved in finding a starting point for theory development research are discussed; the guidelines used to begin the project are explained; the process used to actually gather and analyze data is described briefly; and a number of underlying concepts are explored.

The sources of the data gathered and the reasons for choosing these sources are discussed; the structure of the dissertation is described; and the rules which guided the literature search which both led and supported the data gathering and analysis are explained.

Background to the Research

This chapter begins by explaining the etiology of the research project reported in this dissertation. It outlines the goals of the research and explains the development of the model from which it started. The issues driving the process of the project and a number of topics which underlie the research are discussed and, finally, the sources of the data analyzed, the format of the report itself and the rules which guided the literature search are explained.

1.1 Introduction

It has been almost fifty years since the first computer-based information systems (CBIS)[1] were put in place to help organizations increase their efficiency and their effectiveness. Over that period the tools, like their human users, have become considerably more sophisticated and have risen from the lowest levels of the organization to the highest.

The earliest applications, transaction processing systems or TPS, helped operational level staff processing high volume, well structured data to increase the efficiency of those operations. Management information systems (MIS) gradually evolved from the huge TPS files and the detailed processing to provide lower and middle level managers with information intended to increase the effectiveness of control and planning.

[1]Because of the multiple uses of the term MIS in the computer field the term "computer-based information systems" (CBIS) is used throughout this thesis when the general concept of computer-based tools is referred to. Except in discussions of the literature and in quotations "MIS" is used only to refer to the specific class of tools used by middle managers.

During the past decade a number of classes of more sophisticated applications, including decision support systems (DSS), executive information systems (EIS), and expert systems (ES), have been developed. There are two differences between these newer tools and the well established TPS and MIS. The first is independence. They may use data produced for or by a TPS or an MIS but they are most often used as stand alone applications run by the users themselves and they are, in fact, often developed by those users. The second difference is the lack of understanding of the value of those tools. TPS and MIS arose naturally as obvious, often standard, needs of organizations were met but DSS, ES, EIS and other specialized applications have, in most cases, yet to demonstrate such value.

But it was not only the growing availability of such tools and their lack of definition that led to this research. The gradual movement of both the development and the use of computer-based information systems (CBIS) out into the domains of the users themselves over the past decade or so has meant that the potential use of such tools by middle and senior managers themselves is an issue that must be dealt with as organizations acquire more sophisticated tools and users.

Porter and Millar [1985] have pointed out that the rapid changes in computer technology are forcing organizations to recognize a number of effects on the way they operate including:

1. compute technology can no longer be the exclusive territory of technicians. Both decision making and use will move out to user areas.

2. companies can collect, store and analyze more data more rapidly.

3. new information and new information flows can greatly enhance the firm's ability to exploit linkages between activities both inside and outside the organization.

To what extent will these potential changes affect middle and senior managers as both managers and users of the computer resources? How will the costs relate to the benefits?

Since the early 1970s this researcher has worked in a range of computer related positions with both private companies and various levels of government ranging in size from fifty to five thousand employees. Within all of these contexts it was apparent that a significant proportion of computer applications suffered from some degree of failure or caused some type of organizational dysfunction (e.g., Keen [1985] or Er [1988]). Almost twenty-five years ago Ackoff described what he felt to be "five common and erroneous assumptions underlying the design of most MIS" [1967, pg. B-147]. These were:

1. More information is always better. Ackoff believed that managers often suffered from an overabundance of irrelevant information.

2. The manager needs the information that he[2] wants. Data gathering can be driven by bureaucracy,

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[2]Throughout this thesis all managers are referred to by masculine pronouns. This was done to simplify the writing and reading of the thesis and is not intended to indicate or imply any gender bias in the research. Although over 90% of those who took part were men, participants were chosen entirely on the bases of organization, function and willingness to participate.

incompetence, insecurity or procrastination rather than by the desire for more effective problem solving.

3. Giving a manager the information he needs will improve his decision making. Ackoff felt that developing decision rules of varying degrees of detail and/or performance feedback can often be more productive than simply providing more information.

4. More communication means better performance. Communication can slow down and distort decision making.

5. A manager does not have to understand how an information system works, only how to use it. This leaves managers unable to evaluate the appropriateness of a system and unable to use it creatively.

Since these problems could occur even in the centralized, highly structured applications of twenty-five years ago it should surprise no-one if, as applications and equipment move out into the user areas and up into middle and senior management functions, problems continue to arise. But problems with applications in the user areas and at higher levels of the organization are likely to be more complex, more subtle and potentially more damaging to the organization than those experienced at the operational level.

1.2 Origins of this research

This project had its roots in an earlier attempt to understand how senior managers in a number of organizations used that set of applications known generally as Decision Support Systems (DSS) and what the key factors were in developing and evaluating that use. Soon after that investigation began it became clear that very few managers had any direct relationship with any type of computer tools, let alone those as sophisticated as DSS.

The earlier classes of CBIS (transaction processing systems and management information systems) were able to "assume away" a number of factors, including the context of use and the characteristics of the individual. Because of the lack of definition of DSS and other advanced tools and the "hands on" nature of their use, these factors and others, such as the way in which individual managers work, what they do and even their attitudes toward computers, must be understood before such use can be accurately evaluated.

The research described in this dissertation was, therefore, intended to investigate the much broader issue of the relationships of managers to CBIS in general rather than their use of a specific tool or technique. Before the details of such relationships can be defined or evaluated it is essential to develop a framework into which these relationships can be fitted.

1.3 The research problem

The broadest goal of this project was the reconciliation of the technical approach to the use of computer-based tools by managers represented by most MIS research and the behavioral approach as represented by the findings of Mintzberg [1973] or Kotter [1982].

1.3.1 The MIS research tradition

Research and model development about computing in organizations falls under the umbrella of MIS. Because that research field arose from computer science it has, to a great extent, been performed by academics with backgrounds in natural sciences such as mathematics or engineering. As long as the topic under investigation was based on technology (such as terminal screens or compilers) or functions (such as improving the efficiency of inventory file updating) this was appropriate.

In evaluating use of a CBIS at lower levels in the organization the traditional approach was productive since it was necessary only to consider whether such use would contribute to the efficiency of the organization and increase its effectiveness in terms of corporate goals. These are still important issues in considering the use of CBIS by middle and senior managers but the situation at management levels is more complex for a number of reasons including: the lack of structure in the manager's job; the complex of factors which determine what a manager must do and how it will be done; the apparent ability of senior staff to shape their own jobs; and the lack of a framework for evaluating the interaction of these factors.

But most MIS research has not considered factors such as these. In fact, the individual in context has rarely been a focal consideration. For example, Benbasat and Nault [1988], in a survey of DSS research stretching from 1979 to 1988, identified twenty-four investigations. Of these, nineteen used a laboratory experiment, four used surveys and only one was field based (a case study in

1984). Although this is not an exhaustive survey of research over the decade since the DSS concept was given prominence by Sprague [1980] it does indicate the ongoing focus with either isolating the tool from its "real world" context or relying on structured subjective input through surveys. All of these examine the "effect on", not the "effect of", the individual user.

This is not to imply that the current approach is wrong. It has led to numerous useful insights and developments and has, in effect, given DSS researchers "a place to stand". But because it effectively ignores the actual **people** at the heart of any decision and the processes **they** use it may be based on invalid assumptions.

There are, however, some indications that attitudes in the MIS field are changing. Culnan [1986, 1987] took a bibliometric approach to evaluating major "clusters" of topics being researched in the MIS field - based on the number of articles published the "core" MIS journals. She extracted articles from the on-line Social Sciences Citation Index and classified them according to author and topic. In the 1986 study, based on articles published between 1972 and 1982, the main topics she identified in MIS research were: Foundations/Management Theory; Systems Science; Computing Impacts; MIS/DSS Development [not use!] and Individual Differences.

When the research was repeated in 1987 using articles published between 1980 and 1985 the main topics (again in descending order) were Foundations; Individual Approaches to MIS Design & Use; MIS Management; Organizational Approaches to MIS Design & Use and MIS Curriculum. Based on these studies the concept of investigation the individual had moved from the fifth most investigated topic to the second. The research reported in this thesis is intended to continue this trend.

1.3.2 <u>What managers do</u>

In contrast to the "tool first" approach taken by MIS researchers is the behavioral focus of management researchers, such as Mintzberg [op. cit.], who examined the way in which senior managers spend their time by studying in detail the activities of five chief executives of major Canadian corporations. He found that half the activities they engaged in lasted less than nine minutes and only 10% lasted more than one hour. Among the points from Mintzberg's research which are relevant here are:

1. The chief executives strongly favoured verbal rather than written communication.
2. Analytical inputs such as reports or budgets seemed of little interest to them.
3. The chief executives had a simultaneous, experimental, hectic work pattern.
4. Chief executives preferred to jump straight to the solution, avoiding an explicit decision making stage. In less than one sixth of the choices made by chief executives during the research did they mention using explicit analysis. Intuition and Judgement better describe what they did.

Mintzberg [1976] has also suggested that successful senior managers rely more on intuition and feeling than on systematic reasoning; that they tend to synthesize rather than analyze; that they know more than they can communicate. He also believes that they prefer ambiguity and dislike regularity and that, at that level, planning is a "left brain" activity based on intuition and the creative drive rather than logic and formalism.

Kotter [1982] concluded from his study of successful executives that they spend the great majority of their time (a) figuring out what to do and (b) getting things done through others while Mittman & Moore [1984] found that uses of computers by managers in even high tech firms was both narrow and shallow - involving a brief problem solving phase followed by emphasis on implementation of the chosen alternative.

Concern about the effect of computers on managers is not new - Mintzberg recently reported attending a conference at MIT in the mid-1960s:

> "to which a number of impressive people came to discuss the impact that the computer would have on the manager. They went nowhere; for two days they talked in circles, hardly getting beyond the contention that the manager's use of the computer should have something to do with the fact that their work was 'unprogrammed' (whatever that was supposed to mean)." [1989, pg. 8]

In fact "the nature of the work they do" is a basic issue relating to computer use by middle and senior managers. The rigidity of computer processing is well suited to the type of tasks done at the lower levels of the organization but can such technology be adapted to the less structured work done by managers? Is it really just a question of developing the right tools and techniques or are there aspects of management tasks that make them inappropriate for computerization?

The problem for this research project thus became: how can the beliefs and techniques of MIS researchers concerning the use and value of CBIS for managers be reconciled with what is known about how managers work and what they do with their time. How are managers currently using CBIS? What would they like to do? What are their attitudes toward, and beliefs about, broader or more intensive use of CBIS for their area of responsibility? For their own jobs? And, from the point of view of the organization how <u>should</u> managers being using computer-based tools?

1.4 Goals of this research

Achievement of the broad goal described in the preceding section required the development of a set of specific goals which could be operationalized and accomplished by a single project. For researchers these were:

1. Identifying and describing the current types and levels of use of CBIS by the middle and senior managers who took part in the project.

2. Developing a structured description of managers' intentions concerning CBIS for themselves, their areas of responsibility and their organization in the next few years.

3. Understanding what factors affect current use and intentions. What are the sources of those factors, what are the inter-relationships among them and what are their relative strengths?

4. Using a theoretical analysis of the information derived from the first three goals to develop a framework which could be used by researchers to

describe and evaluate the use of any type of CBIS by specific individuals or groups in specific situations.

From the point of view of policy makers in organizations this project had three goals.

1. Identifying weaknesses in the organization's current "application portfolio" as it relates to the use of computer-based tools by middle and senior managers. This includes all computer-based resources: hardware; software; data files; people and procedures.

2. Moving toward a prescriptive model explaining how an organization can evaluate the potential costs and value of new management level applications. What guidelines can be defined for organizations in terms of measuring the value of a MIS for a specific task or even a type of person?

3. Developing an organization level model of when and how to provide support to specific managers or functions.

The final chapter of this thesis is directed to researchers while Appendix IV contains guidelines for organizations.

1.5 Developing guidelines for the research process

Because this project was intended to develop, rather than to test, hypotheses it was not possible to use traditional techniques such as laboratory experiments - a more "free form" approach (described in detail in Chapter 6) was required. But, however much one might strike out in uncharted directions, it was necessary to develop reference points for both starting and conducting the research if any useful results were to emerge.

The guidelines developed for this research consisted of two components. The broadest was a framework, based on past MIS investigations, which included the factors that have been demonstrated to provide significant levels of effect in the development and use of computer-based tools. The second component was a set of research issues which served to get the interviews started.

1.5.1 A starting framework

As is usually the case in theory development this project had to deal with a conundrum - to develop theory and testable hypotheses one must begin with some guidelines and assumptions (i.e. theory). How can one begin to build a model which will guide this research?

The approach used in this research is contextualist in the sense used by Pettigrew, who defined it as:

> "A set of levels of analysis, clearly delineated but theoretically and empirically connected... A clear description of the process or processes under examination... developing a theory, or theories, to drive process, part of which will require specifying the model of the human being underlying the research... this approach recognized that process both is contained by structures and shapes structures." [1985, pp. 238-239]

Fortunately the idea of investigating a complex of topics is not entirely new in the MIS field. Zmud noted that:

> "Although clearly not exhaustive, the following typifies the variety of issues addressed by both academics and practitioners: organizational characteristics, environmental characteristics, task characteristics, personal characteristics, interpersonal characteristics, MIS staff characteristics, and MIS policies." [1979, pg. 966]

In most past research each of these topics has been dealt with separately but this project includes many of them and goes beyond delineation to indicate relationships among them and, where possible, their relative strengths.

Creation of the framework described below was guided by a set of five criteria for a research framework developed by Bariff and Ginzberg [1982, pg. 22]: These consisted of: completeness (does it capture all of the issues of interest?); consistency (is the framework based on an understandable logic?); mutual exclusivity (is each category distinct, representing a unique aspect of the topic?); concision (is it as simple as is consistent with completeness?); and, finally, will it actually impact on current and future research behaviour?

Gorry and Scott Morton

One of the earliest, and most referenced, frameworks for MIS is that of Gorry and Scott Morton [1978] which combines Robert Anthony's three levels of planning and control systems [1965] with Simon's [1977] three stage model of decision making and range of decision situations. They first demonstrated how a number of key characteristics of information (source, scope, level of aggregation, time horizon, currency, required accuracy and frequency of use) varied among Anthony's three levels. They then added Simon's three types of problems (structured, semistructured and unstructured) at each of Anthony's levels. The result of this was a nine cell matrix into which all organizational decisions could be fitted.

Ives, Hamilton and Davis

A broader framework was laid out by Ives, Hamilton and Davis [1980] who examined a number of earlier research models and frameworks (Mason & Mitroff [1973], Chervany, Dickson & Kozar [1971], Lucas [1973], Mock [1973] and Gorry & Scott Morton [op. cit.]). Each was described and evaluated in terms of strengths and weaknesses and a model was derived based on these. Their model has three aspects:

1. Environmental variables - the external environment, organizational environment, user environment, IS [information systems] development environment and the IS operations environment.

The research reported in this thesis focused first on the users, secondly on the organizational environment and includes the other three as required.

2. Characteristics of the Information System - the content (both data and decision models); presentation form (printed vs. displayed, characters vs. graphics) and the time dimension (online vs. offline, processing delay).

All these aspects were of interest in this research as they affect the organization and the current or potential manager/user.

3. Process Variables - the development process; the operations process and the use process.

This model relates directly to this project because it recognizes the importance of variables from both the environment of the application and, to a lesser extent, variables within the information system itself in defining and evaluating the use process.

Bariff and Ginzberg

Bariff and Ginzberg [1982] developed a framework which focuses on the relationship between behavioral research and MIS which is particularly applicable to this research because it focuses on both the process of MIS (design, use or management) and on the levels, or breadth, of the user (individual, group, organizational or societal). They identified the key issues of MIS use at the various levels as:

the individual: impact on job characteristics & job satisfaction; determination of use of & satisfaction with the MIS; patterns of MIS usage

the group: impact on interaction within work groups; impact on job mix in work groups

the organization: impacts on power, control & coordination structures; criteria for evaluating and selecting MIS applications; factors which foster or inhibit growth of IS.

The research reported in this dissertation was interested in the "use" process and on the individual, group and organizational levels of analysis.

Leitheiser

Leitheiser [1985] reviewed past research into a number of classes of applications which focus on the individual user. Through identification of commonalities he developed a model which identified, as sources of independent variables:

the system ("the tools" in this research) - independent variables (causes) from this source include the number of reports available, presentation format, terminal type, data aggregation, decision aid availability, dialogue type, presentation media, report type, and terminal speed.

the user - the primary variables identified within the individual user in prior research were cognitive style, computer experience, domain knowledge, locus of control, motivation, risk taking propensity and "type of subject".

The second aspect of his framework is the dependent variables (effects). These include performance (quality, time, errors and functionality); learning (learning and memory); subjective evaluation (decision confidence, satisfaction, "enjoyableness" and usefulness of display); and behaviour (use of commands in the tool, information extraction, modelling behaviour and process behaviour).

A number of these topics are clearly based on a more technical approach than has been taken in this project but there is a recognition of the need to consider and understand the individual in relation to the tool. This research uses a number of aspects of both the independent and dependent variables to investigate the more specific topic of managers' use, attitude and intentions.

Lucas

Lucas [1975], discussing the relationship between performance and the use of a CBIS, suggested that use of a computer-based tool was dependent on a set of factors: past performance, the context (local, organizational and societal), personal characteristics, decision style and attitudes and perceptions.

Jenkins

A framework which was strongly relevant to the beginning of this project was that of Jenkins [1983]. His conceptual model of the user-system interface addressed the narrow level at which the individual manager interacts with the CBIS by identifying four inter-related factors: the human decision maker, the information system itself, the task being performed and the quality of the performance. Since this research is strongly interested in all of these the Jenkins model was used to frame questions for the individual manager investigating his perceptions of the strength and direction of relationships among all four factors.

Triandis

One other framework that guided the development of the starting point for this project was that of Triandis [1980]. While investigating the use of PCs he identified three sets of factors that he felt drove that use: the organization (long term consequences, internal factors and facilitating conditions); the individual (complexity of use and attitude toward use); and the job (fit with the tool). Because he was investigating a specific tool Triandis could assume away resources but, when tools are added to the three sources of factors he discussed, a solid starting point for this research emerges.

All these frameworks take a broader point of view than the research reported in this thesis. To compensate the salient points for this project have been extracted - those which take the point of view of users of CBIS - not the technicians, the developers the operators or even the researchers.

Based on these frameworks this project began by investigating five possible sources of factors affecting managers' current and intended use of CBIS.

1. The environment

Because many middle and senior managers act at the interface between the organization and its environment it was felt that this could be one source of the forces operating on them in their relations with CBIS. Are aspects of the environment such as customers, competitors or Government regulators forcing certain types of use on managers? Is the environment particularly dynamic, forcing the managers to use computer-based tools to respond quickly? Is the industry one in which technical standards encourage sophisticated use of CBIS or in which tradition discourages such use?

2. The organization

Although managers would seem to have more control over how they do their jobs than do lower levels of staff,is this necessarily true? Are there aspects of the organization itself which have an impact on the manager's use of, and intentions concerning, CBIS for himself or his area of responsibility?

The specific characteristics with which the investigation began were the most structured: its age; size; organizational structure; type and range of products or services provided; type of market serviced; competition and general environment faced; the organization's position in the industry; profitability; growth rate and composition of the work force.

It was intended that, as interviews proceeded, questions would be developed to investigate the less structured aspects of the organization - particularly its culture.

3. The individual

The focus of the entire project was the individual manager - both as subject and as the primary source of data. To what extent does a manager really control what aspects of CBIS he uses and how he uses them? What aspects of the individual are important in defining his current use and intentions?

A starting point for description of the manager was the checklist developed by Ein-Dor and Segev [1981] which includes such factors as decision requirements, rank (absolute and relative), personality, attitudes (technical and non-technical), experience and education.

4. The manager's job

All use of computer-based tools in organizations relates to some part of the work done by each "employee-user". Which aspects of what a manager does encourage (or should encourage) the use of CBIS by that manager? What aspects discourage (or should discourage) such use? To what level of detail must the job be analyzed to reach the point at which it "intersects" with the computer?

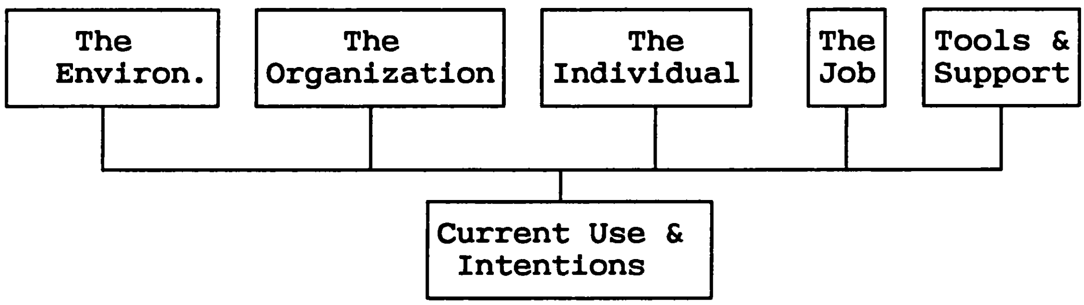
The starting point for this aspect of the project was the function the manager performed for the organization. The data gathered on functions include: title; relationship in the organizational chart to the CEO; position reported to; a general description of the position; number of people below him; number of people reporting directly to him (and their titles); the individuals and groups with which the position must work (both internal and external). Each manager was also asked to describe what he perceived to be the Critical Success factors for his function in that organization.

5. Tools/support available

This topic is actually a subset of the characteristics of the organization but was dealt with separately because it is a primary focus of the research. What is the organization's apparent attitude toward computer-based tools? How large is the computer department? How skilled are the computer staff at dealing with managers and with sophisticated end user applications? To what extent are the day-to-day activities of individual managers reflected in the tools and support available to him (and his people)?

Figure 1-1 summarizes this "beginning framework" for the research.

Figure 1-1: The factors in the starting framework



1.5.2 Topics to be investigated

In addition to deciding which sources of effects to examine it was also necessary to identify a set of topics linking managers to CBIS which would allow the creation of a series of questions and provide structure to the early interviews. The following are among the best known attempts to define the key issues in MIS research[3].

A paper by Ball and Harris [1982] is considered the beginning of the evolution of this type of investigation. Questionnaires were sent to 1400 members of the Society for MIS (417 responses were received). These MIS managers were asked to rate eighteen issues on a six point Likert scale. For each issue both the individuals point of view and his/her belief about the overall importance of the topic were reported. The top ten issues which emerged from the investigation were: MIS planning; measuring productivity; telecommunications technology; data utilization; DSS; office automation; recruiting and training; end user computing and aligning the MIS organization.

In 1984 Dickson, Leitheiser, Nechis and Wetherbe surveyed fifty senior MIS executives and academics to answer three questions: What are the ten most important issues in MIS? What is their order of importance? How much consensus is there on the first two questions?

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[3]Much of the background for this topic comes from a paper presented at the 1988 meeting of the Administrative Sciences Association of Canada by Al Dexter, John Graham and Sid Huff.

Subjects were asked to rate their top ten issues from a list of nineteen. Although no statistics were given to define the strength of the differences between the various issues, the top ten according to this research were: planning of the MIS function; end user computing; software development; measuring productivity; aligning the MIS organization; recruiting and training; data utilization and DSS.

Brancheau and Wetherbe [1987] basically updated the Dickson et. al. survey of 1984 but they added statistical analysis using Kendall's Coefficient of Concordance to demonstrate a valid set of rankings. In this work the top issues identified were: planning the MIS function; strategic systems; educating senior personnel; integrating technologies; end user computing; data utilization and measuring productivity.

Hartog and Herbert [1985a, 1985b] carried out two investigations on the topic of issues "in the coming years" as perceived by IS managers. They interviewed twelve senior members of the IS field in depth and supported this with a questionnaire sent to 107 companies (63 were returned). The main issues as seen by the managers in their first project were: planning the MIS function; aligning the MIS function; software development; data utilization; end user computing; data security; integrating technologies and educating senior personnel.

Their second study, based on the first, consisted of analysis of questionnaires sent to the Fortune 1000 companies (they had a forty percent return rate). The same questionnaire with the same four point rating scale for each issue was used but the results in this second stage were quite different. In this case the top issues were identified as: aligning the MIS organization; data utilization; educating senior personnel; software development; productivity; planning the MIS function and integrating technologies.

Graham, Dexter and Huff [1988] defined importance in terms of the amount of effort a manager expected his area to expend on a topic in the next two to three years. Each manager was asked to give his/her three most important issues. Later a questionnaire containing twenty-nine issues developed from a literature search and the earlier responses from the managers was presented to each manager. He was asked to both rank and rate the issues. The most important were found to be: data management; IS planning; integration of technologies and applications; software application development; data security; competitive advantage; end user computing; educating senior personnel; telecommunications and productivity.

The underlined topics are those which appeared, at the beginning of the project, to be most relevant to the issues of interest. As the project proceeded it became clear that other issues, such as telecommunications, also belonged on the list.

1.6 Process issues

This project went beyond or, perhaps more accurately, outside the traditional approach to MIS research in two ways. First, it took the point of view of the user/managers rather than the developers or suppliers of the computer-based tools at issue. Second. it was oriented toward hypothesis development and the achievement of a series of goals, some of which were not clearly definable at the outset, rather than the testing of a specific aspect of a tool or situation. Because of these factors it was important to consider explicitly the process to be used to gather and analyze data.

A research approach had to be developed that would allow examination of a complex context and series of interactions using the concepts and vocabulary of the "subjects". The issues underlying this consideration were expressed as a series of questions.

1. What are the most appropriate sources of the type and quantity of data required by the research envisioned?
2. How can such data be most effectively collected?
3. What forms of analysis are most appropriate to these types of data?
4. How can the results be most effectively presented?

Development of the methodology, tools and process used are described in Chapter 6 but the basic approach was that of a focus on the words and actions of individuals acting in context. The lack of structure of such an approach was more than compensated for by the flexibility and iteration it allowed as new data required changes in process and even goals.

Data were gathered primarily through face to face interviews in which managers answered open ended questions. This was supported by a number of other techniques including structured question sets, review of documentation and observation of activity. Data from the interviews and observations were organized and evaluated using protocol analysis while the quantified data were analyzed using statistical tests. All data were presented in clusters relating to the five sources of variables described in the preceding section.

Little emphasis was put on the technical aspects of computing in organizations in this research since, as is demonstrated in chapter 5, the permutations and combinations of hardware and software available to organizations is effectively infinite. The only limitations on the organization in terms of acquisition and use of technology are time, money and technical support.

1.7 Underlying concepts

There are a number of general concepts which run throughout this project from the development of a starting point through creation of the process used to the definition of conclusions. Because they could have different meanings to readers with different backgrounds discussing and defining them in terms of this research at this introductory stage may prevent misunderstandings later.

1.7.1 System theory

System theory was used in a number of ways to structure and guide this research. The broadest was the definition of the organization as a system in the sense proposed by Checkland:

> "a system is a model of a whole entity; when applied to human activity the model is characterized fundamentally in terms of hierarchical structure, communication and control, with some properties meaningful only when attributed to the whole entity, not to its parts. (A subsystem is a system operating within a larger system.)" [1981, pg.7]

More specifically, Von Bertalanffy [1968], in a summary work on general system theory, outlined a number of characteristics that all systems have in common. Those which relate most directly to this research include:

1. systems are generally differentiated into subsystems which perform specialized functions.

2. there is an interrelationship and interdependence among the components.

3. all systems perform transformations on inputs to produce outputs.

4. most systems are capable of equifinality; that is, they can achieve a goal in more than one way.

Ackoff [1971], looking at systems in a more operational way, describes three types, or degrees, of systems:

1. a state-maintaining system is intended to maintain a particular state under a range of internal and external conditions;

2. a goal-seeking system can respond differently to internal or external events under either different or unchanged conditions. It has various forms of

behaviour and may achieve the desired end in any of a number of ways.

3. a purposeful system is a goal-seeking system that is able to produce a variety of outcomes under a number of different conditions. This type of system can change its goals as a result of experience or can change its method of obtaining a particular goal.

Throughout this research organizations are considered to be the most sophisticated type of system - purposeful. Management systems are seen as goal seeking systems while computer-based information tools are, for the most part, seen as the simpler state maintaining systems. To what extent can state maintaining systems usefully support the more complex needs of goal seeking and purposeful systems?

1.7.2 Levels of use

In recent years a number of classifications of user/tool interaction have been developed. Among the best known are those of Davis and Olson [1985], J. Davis [1985], Martin [1982] and Rockart and Flannery [1983]. The models use terms such as novice, developer, frequent user, IS amateur, autonomous user and indirect user. Basically there is a range of possible involvement with the CBIS in the organization which extends from non-use through intensive involvement in the creation of complete computer-based tools. The following list defines the main points on such a range.

1. Non-use - the manager has no relationship at all with the processing or output of any application. In the modern organization this relationship is non-existent.

2. Passive use - this level of involvement requires nothing of the manager except that he function in an

organization. Other parts of the organization or even outside groups provide information to him and his people. Examples include a reservation for a trip made by, and in, the airline's computer (which also prints his ticket) or the calculation of his national pension benefits by a government computer.

3. Direct use - this level of relationship, which has a number of degrees, most realistically describes the situation of middle and senior managers today.

 a. Offline - in this case a manager receives printed reports containing data related to his responsibilities. The reports may come from within his area; from any other part of the organization or even from an outside entity. They may be in detailed, summary or exception format and may relate clearly to his problems and decisions or they may require a great amount of manipulation.

 b. Requesting a report - this level of use goes beyond the offline relationship because, although the manager still has no physical relationship with the computer, he must be aware that a specific reporting capacity exists. This type of activity may involve a standard request for a standard report; it may involve a special version of a standard report or it may involve a demand for a new *ad hoc* report. The request may be made to a central computer department or it may be made to a "local" support person.

 c. Online inquiry - this is the simplest type of active relationship a manager can have with the computer. He must be able to access a file and to format an inquiry concerning a specific record or group of records. It is usually done using standardized procedures and commands and requires little technical training.

 d. Creating a report - this is slightly more active than basic inquiry since context (a title, column headings, totals, etc.) must be added. This is the first level of involvement that actually requires programming and can be done using a number of approaches: a report generator on the central computer; a package (e.g., Dbase IV); a procedural language (e.g. COBOL) or a fourth generation language (e.g., FOCUS).

 e. Analyzing computer-based data - this is the most sophisticated level of computer use by most end users and often precedes the report creation just described. Normally it will be done using one of the types of languages described in 3.d.

f. Creating an application - this level of use implies that the manager not only reads files to inquire, to analyze data or to create a report but that he also writes programs to create or modify data files. It is still a rare and potentially dangerous level of use but it is becoming more common. The main ways in which applications can be developed discussed below.

1.7.3 Measuring the value of a computer-based tool

In almost all research into computer-based tools and organizations the ultimate goal has been "determining the value of the tool to the user". This project is no exception. Measuring such value was relatively simple in the older, well structured applications since the user was the organization and the goal of such "transaction processing" systems was efficiency. However, once more subtle applications appeared the ability to directly define the value of the application became weaker for a number of reasons - including the direct involvement of user/managers.

At the level of MIS used by middle managers for planning and controlling operations "usage of the tool" and "reported user satisfaction" have become the traditional measures of the value of a computer-based application to the organization (e.g., Barki & Huff [1985]; F. Davis [1989]).

But this surrogate measure of value has not been universally accepted. For example, Zmud has commented that "While it is easiest to simply examine usage, success ultimately depends on how well the MIS has, in fact, supported decision making." [1979, pg. 969] and as early as 1975 Lucas, in discussing an investigation based on an actual marketing analysis and planning application, asked "Given the weak associations between performance and use of the system, are heavy investments in information systems justified?" [1975, pg. 918].

In discussing the relationship between user involvement in the creation of more structured, systemic MIS and their success, Baroudi, Olson and Ives comment that:

> "User involvement research is typically based on the **assumptions** [emphasis added] that user involvement in the design of an information system leads to increased systems usage, more favourable perceptions of systems quality, or greater user information satisfaction. Generally these constructs are **assumed** [emphasis added] to be indirect indicators of improved decision making performance, which is the ultimate, but usually immeasurable, goal of system implementation." [1976, 233]

Srinivasan [1985] used a questionnaire sent to "real world" users of modelling applications to compare the users' <u>perceived</u> measures of satisfaction (input procedures, system stability, problem solving capabilities, output contents and output form) with their <u>behavioral</u> measures of satisfaction (frequency of use, number of reports produced, time per session and total usage). He found that, unlike most past findings and assumptions, the two types of indicator are not always positively associated. For example time per session and output form were clearly negatively correlated ($p<.05$). Does this mean that heavy users feel that output formats are not useful or does this type of output demand too much of the user? The overall result is that, in my investigation of user attitudes, it was necessary to attempt to look at both behaviour and comments by "looking inside the managers' heads" and, as far as possible, to investigate apparent contradictions.

An alternative approach to defining the value of a computer-based tool has been proposed by Doll and Torkzadeh [1991]. Their "system to value chain" model states that the behaviour aspects of value lie in a chain which begins with causal factors which lead to beliefs which lead to attitudes which affect behaviour which finally has an impact on the context of the user and the tool. This is particularly relevant to this research because it begins with the behaviour and works both forward to the effects and backward toward the beliefs and attitudes and, hopefully, identifies the apparently anonymous "causal factors" that begin the chain of use or non-use.

Managers, information systems, researchers and research techniques have all grown more sophisticated in the last fifteen years but, rather than lead to a resolution, developments seem to have added layers of complexity to the issue of measuring the value of information systems for managers and, ultimately, for their organizations. For example, none of the prior research examined for this project discussed opportunity costs, a topic that was foremost in the minds of many of the managers interviewed.

1.8 The sources of data for the research

Once it had been decided what to look for the next problem became: where to look? Theory bearing on the general use of computer-based tools by managers could not reasonably be developed by talking to only one or two managers or examining only one organization or even one industry - an appropriate research design would require the participation of multiple firms. For example, Pettigrew [op. cit., pg. 6] suggests that, where multiple cases, guided by the contextualist approach, are used to gather data it is more likely that we will be able to "introduce formism and organicist assumptions by dividing the world into analytical categories and deriving generalizable propositions" [ibid, pg. 242].

On the other hand, the depth of involvement by each research site meant that it would be impossible to work with a large number of firms within the time constraints of the project. How best to choose a set of research sites which would be likely to offer a useful range of organizational, manager and computer characteristics?

1.8.1 Choosing research sites

It was decided that firms would be contacted on the basis of six factors:

1. They must be large enough to have specialized senior management.

2. They must have a distinct computer department with professional staff.

3. They must represent more than one industry and more than one region.

4. They must be different sizes - from a "large" small business to a relatively large strongly structured organization.

5. They must be easy to reach since each would be visited up to fifty times.

6. Finally, the researcher must have a contact within the organization to provide an introduction and to give some guidance on who and what to look at.

Based on these guidelines letters were sent to the Presidents or Executive Directors of fourteen organizations. Eight of these showed some interest. Meetings were arranged with the senior executive of each firm and, after the project was described in detail, six organizations (one job shop, one assembly line, one high tech service organization, one university and two hospitals) committed to the project.[4]

Site A - A large, high tech service provider. It has the largest computer facility and the most sophisticated set of applications in eastern Canada.

Site B - A medium size tertiary care hospital in central Canada. Its computer facilities are small, its applications basic and centralized and its management almost completely unfamiliar with computers.

Site C - A medium size tertiary care hospital in eastern Canada. It is current completing the integration of three separate organizations and their computer resources. It is in a state of flux in terms of both equipment and applications. It has a number of senior managers who are users of computers because their previous organizations were so small that they had to activities usually relegated to middle or lower management.

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[4]These organizations are identified throughout this thesis by the capital letters A, B, C, D, E and F. More detailed descriptions of the six sites can be found in Appendix I.

Site D - The largest university in eastern Canada. Senior management on the administrative side (the academic aspects were not examined) ranged from enthusiastic to highly negative toward computing and from experienced to quite ignorant about the capacities of computers. In addition, it is going through severe downsizing of staff due to financial restraints - presenting an opportunity, or a need, for senior managers to use computer applications to replace people.

Site E - This was the most difficult site to investigate for a number of reasons. The first was its mix of businesses which ranged from selling fishing gear in Atlantic Canada and northern England to managing a hotel in Moscow.

A second reason for the difficulty was the intensity of the intervention throughout the organization by the owner and chief executive - formal structures and sometimes obvious actions could be over-ridden at any time. The final cause of problems was the dynamic nature of the organization. Changes happened rapidly, with planning sometimes taking place after the fact. The computing facility was medium sized with a mix of traditional batch applications and advances opportunities such as E-mail and a 4GL. It more than doubled in size during the period of this research.

Because of the complexity of the organization only the management of the Aerospace Division plus a few managers at Head Office whose areas directly supported the operations at Aerospace were examined in detail.

Site F - This continuous manufacturing facility was examined as a contrast to the job shop process used at site E. It was both a stand-alone facility and a branch operation of a national brewery, a situation which led to some interesting conflicts, opportunities and problems for the research. Computing support was supplied by a mainframe at Head Office 1,500 miles away, a minicomputer and small staff on site and a few microcomputers.

It is important to point out that these six organizations were not chosen because they represent the entire spectrum of computer users. But, given the guidelines described above, they represent a selection of organizational structures and management cultures - not a homogeneous group.

For example, Site A is extremely sophisticated in its use of computer technology and provides extensive staff training while site E provides no training to managers or clerical users and has a generally negative view of computer use by managers. Sites A, E and F are private organizations in three different industries while sites B, C and D are government funded and smaller than the private groups. But it must be kept in mind that conclusions drawn from this sample of organizations are limited in their generalizability.

1.8.2 Formal functions

Once the sites themselves had been chosen the next step was to find, within each organization, the managers who could contribute the most to the project. Because no two organizations have identical structures, it was necessary to develop rules to guide the search. First, it was decided to focus only on managers working in relatively standard functional areas to facilitate comparisons within functions across organizations. The four functions used in the beginning were accounting/finance; marketing; personnel and production. As the research progressed a fifth function, planning, emerged as one in which senior managers were highly familiar with computers and in which they were used creatively.

1.8.3 Choosing the participants

A second guideline was that only managers working at a level which gave them some control over how they would perform their organizational function (including using or not using computer-based tools) were asked to take part.

In preparation for meetings with potential participants a memo was sent by the senior executive of each organization to all levels of management explaining who I was, what I was doing and that I had his support.

In the end introductory meetings were held with fifty managers in the six organizations. This meeting was based on a copy of the project proposal which was sent to each manager prior to the meeting. During this meeting it was also explained that the project could require up to five hours of his time but no more than one hour each visit. Amazingly, every manager met with agreed to take part - albeit with different levels of enthusiasm and, as became apparent as the research progressed, a variety of motives including boredom, curiosity and "keeping the boss happy".

Of the fifty people who began the process, forty-three completed all of the protocol. Interviews began in December 1988 and ended in May 1990. In all, almost three hundred one hour meetings were held. Table 1-1 outlines the sources and function of the managers in the research database.

Table 1-1: Sources of data for this project

Organization / Function	A	B	C	D	E	F	TOTAL
Accounting	6	1	1	2	1	1	12
Marketing	7			1		1	9
Personnel	5	1	1	1	1	1	10
Production		2	3	2	7	1	15
Planning	3		1				4
TOTAL	21	4	6	6	9	4	50

Information Systems *	6	1	1	1	2	2	13
Superiors & Support Staff*	8	0	0	3	3	2	16

* managers in these groups were not interviewed using the formal process applied to the "user/managers". Their input and related observations were used to develop the image of the computer support available to managers in each organization. The results of these interviews are reported primarily in chapter 5 and Appendix I.

1.8.4 Management levels

Since this research was intended to investigate the use of CBIS by middle and senior managers an important characteristic of the members of the database was their position within the organization. The organizations in this project used a variety of titles for the managers interviewed and even similar titles did not mean that two managers performed the same tasks or even that they had similar positions on the organizational chart.

Because of these problems a subjective method was used to place each manager in one of two groups. Level 1 managers were those who were seen to have (a) significant input into the policy making of the organization (particularly as it related to computers) and (b) some control over what aspects of the computer resource they used and how they used them. All those who did not fit into this group were level 2 managers. The number of managers in each function at each management level was:

level 1. Accounting 8; Human Resource Management 5; Marketing 4; Production 7; Planning 1 = 25

level 2. Accounting 4; Human Resource Management 5; Marketing 5; Production 8; Planning 3 = 25

1.9 Structure of the report

This research was an attempt to integrate a number of topics which have not usually been studied together. Because of the complexity of this approach a traditional format was chosen for this report, consisting of four distinct sections plus a number of supporting addenda.

Section I - Introduction

Chapter 1 - begins by explaining the etiology of the research project reported in this dissertation. It outlines the goals of the research and explains the development of the questions from which it started. The issues driving the process of the project are discussed as are a number of topics which underlie the research. Finally, the sources of the data analyzed, the format of the report itself and the rules which guided the literature search are explained.

Section II - Underlying Concepts, Theory & Research

Chapter 2 - discusses a set of topics on organizations and management which supported development of the research process and which guided data gathering, analysis and presentation from the point of view of the effects of the organization and its context on managers' current use and intentions.

Chapter 3 - focuses on the individual manager as a cause of his own type and level of use of CBIS and his intentions concerning them. Demographic and psychographic factors are examined as are relevant beliefs and attitudes.

Chapter 4 - discusses four related aspects of the manager's job which may affect his use and attitudes toward CBIS: the formal function he manages, the tasks performed by his function, the activities which comprise his job, and the types of problems faced in that job.

Chapter 5 - describes the computer-based resources available in most organizations today; the evolution and current status of the main classes of applications used by organizations; and the methods of developing computer-based applications available. The possible effect of each topic on the use and intentions of the manager is the primary focus.

Section III - Developing a Methodology & Process

Chapter 6 - discusses the concepts behind the methodology, the tools and the process chosen to gather, analyze and present the data in Section IV and describes the methodology, tools and process themselves.

Section IV - Data, Findings & Conclusions

Chapters 7 to 11 - present and discuss the actual data derived from the research activity. Chapters 7 to 10 each focus on one aspect of the starting framework while Chapter 11 examines the relationships among, and relative strengths of, the answers given by managers to the structured questions.

Chapter 12 - draws conclusions from the data reported and discussed in the preceding five chapters and makes recommendations or raises further questions where appropriate.

In addition to the report itself support for the readers is provided by a series of appendices:

Appendix I consists of summaries of the relevant characteristics of the six organizations which took part in the research.

Appendix II contains examples of the tools (forms) used to gather data during the interview phase: the

Interview Guide; the attitude/use worksheet; the summary of characteristics of the organization; and the computer resources worksheet.

Appendix III contains summaries of the characteristics of the four scales on which personality types are identified by the Myers-Briggs Type Indicator. The four combinations of data gathering & data processing types are also explained.

Appendix IV consists of a series of conclusions and recommendations for policy makers in organizations concerning the use of CBIS by middle and senior managers. It is based on the more conceptual contents of Chapter 12.

1.10 Literature search

Because of the "multi-discipline" nature of this project the literature search has been extensive. Sources of theory, research methodology and past research have been sought out in the following fields: organizational design and organizational behaviour; decision theory; sociology; psychology; and MIS.

At one point the "gross" bibliography included almost eight hundred citations from books, journals, proceedings and miscellaneous sources. Since such a large information base is at best unwieldy and, at worst, dysfunctional it was decided that, for an item to be examined in detail, it must satisfy at least one of five conditions:

1. it is a seminal work in its field [e.g., Cyert & March, 1963]
2. it is referred to frequently in other items in the bibliography [e.g., Simon, 1977] (of course this often overlaps with the first requirement)
3. it is a recent ground breaking item on a topic close to the core of this research [e.g., Todd & Benbasat, 1987]

4. it describes a concept which will guide the research or provide a methodology [e.g. Glaser & Strauss, 1967] and

5. it summarizes some part of the theory behind the research particularly well [e.g., Handy, 1985]

1.11 Summary

This chapter has explained the nature of this research project; discussed the goals of the research; outlined the framework and issues which provided the starting point of the research; reviewed a number of topics which underlie the research; explained the sources of the data in terms of organizations, functions, levels of management and individual; described the layout of the report; explained the rules which guided the literature search.

In their seminal work on systems and teleology, Ackoff and Emery, discussing the difficulty of developing objective definitions of systems observed:

> "A standard can only be idealized in a relative sense - relative to our current state of knowledge. A standard is neither immutable nor absolute. Hence, as our understanding of a concept increases, we change our formulation of how it ought to be observed and measured. This has been the case, for example, with length. Therefore, at this stage in the behavioral sciences, it is not necessary to develop ultimate (or even long term) definitional standards but to provide some standards. We cannot hope to provide generally acceptable operational definitions of behavioral concepts but we do hope to provide definitions that will provide constructive discussion, leading to their rapid improvement" [1972, pg. 7-8]

It is in this sense of pioneering in an area which still needs general explication and the development of descriptive models that the research described in this thesis was undertaken. The observations, generalizations and conclusions from the work will, it is hoped, point to a number of areas of fruitful investigation at more detailed levels - including the relationship between activities and computer tools; management of data for users; training for managers and development of better communications technology for managers.

SECTION II - Underlying Concepts, Theory & Research

This section of the thesis contains the results of an extensive search of the literature in a number of fields including organizational design; organizational behaviour; decision theory; sociology; psychology and MIS. Each chapter is devoted to the concepts and prior theory and research around one of the topics in the beginning framework described in section 1.5.1.

The focus taken throughout the literature search was the identification of factors which could have an effect on the current use of CBIS by managers and on their intentions concerning them. Prior research or existing theory which would help identify and explain the interrelationships among the factors in the "causal" framework was of particular interest.

Organizations, Managers & Computer-based Information Systems

This chapter discusses a set of topics on organizations and management which supported development of the research process and which also guided data gathering, data analysis and presentation of the findings concerning the effects of organizations on managers' use of, and attitudes toward, CBIS reported in Chapter 7.

2.1 Introduction

The environment of the firm was dealt with in this research at two levels. The broadest was the traditional model consisting of such factors as the social context; the legal and political frameworks within which management must operate; the set of competitors faced; the nature of their suppliers; and their customer base. In this research an aspect of the environment at this general level was investigated only if it appeared to impinge on the firm's use of, or need for, computer-based tools.

The more specific level of the environment examined in this research was the industry of which the firm is a member. It was considered not as a set of competitors but as an entity that could directly affect the firm through such factors as sources of funding, industry-wide technical standards or traditions and the demands these can make on managers in a firm. The industry's use of, and attitudes toward, computer-based information systems was the only aspect examined in detail.

There are many approaches that could be taken when examining the characteristics of organizations but for this project three were of particular interest. The most straightforward were the "demographics" of the firm such as its age, its size or its product mix[1]. The second aspect - structure - was taken as the set of positions in that organization and the relationships among them. The final aspect of the organization, its "culture", is the set of attitudes, beliefs and norms by which individuals and groups operate. As will be seen below it arises, to some extent, from structure.

Finally, this chapter examines a series of specific management topics which were believed to bear on the goals and the process of this research: the sources of changes acting on the organization (and its managers); the ways information can (or should) be used in the organization; and the organization's attitude toward its computer resources.

2.2 Models of structure

Management literature is replete with models of the organization. It was decided to evaluate managers and organizations first in terms of the most traditional model, the bureaucracy, and add others as the need for more explanation arose from the data.

2.2.1 The bureaucracy model

The most common model of any organization is that of the bureaucracy - as described by Weber [1947], among others. The driving force behind this model is an

[1]The "demographics" of each organization which took part in this project are described in Appendix I.

emphasis on the reliability of behaviour of the members of the group through a hierarchical structure, clear sets of responsibilities, well defined relationships and rules to ensure the maintenance of these characteristics.

Merton [1940] expanded on the basic model of bureaucracy with an analysis of its effects on the members. He felt that the development of methods to ensure reliable behaviour led to a number of factors: a reduction of the amount of personalized relationships (the bureaucracy is a set of relationships between titles or roles); internalization of the rules of the organization (rules often assume a value independent of the goals they are intended to achieve) and the increased use of categorization as a decision making technique (this tends to lead to a restriction of search for alternatives in situations). He then outlined a set of individual behaviours caused by this approach to organizing including an increased rigidity of behaviour and extensive use of the trappings of authority.

Where Merton emphasizes rules as a response to the need for control, Selznick [1949] emphasises the effect of delegation of authority, another basic characteristic of bureaucracy. The fundamental effect of the demand for control at the top is the delegation of authority downward along with the development of clear lines of reporting. But, as Selznick points out, there are some secondary aspects of delegation which have a strong effect on the bureaucracy. These include an increased specialization of subunits; the bifurcation of the goals of different units and the decrease in congruence between organizational goals and achievements.

Both Merton's and Selznick's observations were helpful in this research. Factors such as internalization of rules and bifurcation of the goals of different units led to both general and specific questions in interviews. For example, the former could relate to a manager's self-description of attitudes toward CBIS while the latter could affect the value and use of telecommunications.

Modern organizations of any significant size, including all those examined in this research, have developed more sophisticated structures, including line-staff and the matrix. But almost all organizations have, at their core, a bureaucracy and their use of, and attitudes toward, information systems cannot help but reflect this.

2.2.2 Anthony's model

A quarter of a century ago Robert Anthony [1965], outlined a more general model of the structure of organizations. It evolved from the traditional hierarchical, bureaucratic model but has been frequently modified to take into account other structures and more specific aspects of the organization such as technology or functional subsystems (e.g. Lucas [1977]).

Anthony's model points out that most managers work at the lowest (operational) level of the organization performing repetitious, clearly defined functions and that management at that level is mainly concerned with maintaining and improving the efficiency of day to day operations. "Operational control ... is the process of assuring that specific tasks are carried out effectively and efficiently" [Anthony, op. cit., 26].

In the middle levels of the pyramid is a much smaller group of middle managers performing some planning and organizing functions but primarily oriented towards control. As Anthony put it: "Management control ... is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objective" [ibid, 27].

Finally, at the top is a group of a few senior managers and directors involved in long term planning, organizing and control of the firm as a whole. "Strategic planning is the process of deciding on objectives of the organization, on changes in the objectives, on the resources used to obtain these objectives, and on the policies that are to govern the acquisition, use, and disposition of the resources." [ibid, 29].

Chapter 5 describes the relationship between these management levels and the different types of computer tools as understood in current theory. One goal of this research was to examine the validity of that relationship.

2.2.3 Mintzberg's structures

Mintzberg [1979] proposed five possible structures that an organization, or part of it, could take. His models are more operational than Anthony's pyramid but offer more options than the bureaucracy described above.

The "simple structure" is a flat organization with everyone reporting to one person - usually the owner. It is commonly seen in new or very small firms. The "machine bureaucracy" is essentially the Weberian structure discussed above. It is characterized by routine tasks, formal rules, clustering of tasks into functional groups, an elaborate administrative structure and decision making that follows the chain of command. The "professional bureaucracy" is based on the machine model but decentralizes some functions to professional staff. The "divisional structure" is used by the largest organizations since it is, in effect, a set of machine and/or professional bureaucracies coordinated by a central headquarters. Mintzberg's final model is "the ad hocracy" which is characterized by high horizontal differentiation, low vertical differentiation, low formalization, decentralization, flexibility and responsiveness.

It was beyond the scope of this research to examine and describe in detail the structures of each organization examined. However a sense of the basic structure for each was developed based on the manager's descriptions and the researcher's observations. This was necessary for two reasons. The first was to guide the investigation and the second was to evaluate the fit between the structure and the use of the corporate computing resource.

2.3 The corporate culture

More subtle than the way the organization looks is the way it acts - its culture. This is a topic on which much discussion, some theory and little research was found in the literature. Reynolds, after reviewing the literature on the subject, identified:

> "three interrelated concepts in use:" (1) a socio-structural system composed of the perceived functioning of formal structures, strategies, policies and management processes,...; (2) a cultural system that embodies the organization's myths, values, and ideology...; and (3) the individual actors, with their particular endowments, experience and personality." [1986, pg. 334]

This research considered all three of these as they affected the individual manager.

Reynolds [op. cit., pp. 334-336] also identified fifteen "dimensions" of corporate culture discussed in the literature. These are: external vs. internal emphasis; task vs. social focus; safety vs. risk; conformity vs. individuality; individual vs. group rewards; individual vs. collective decision making; centralized vs. decentralized decision making; ad hocery vs. planning; stability vs. innovation; cooperation vs. competition; basis for commitment; simple vs. complex organization; informal vs. formal procedures; high vs. low loyalty; and ignorance vs. knowledge of organizational expectations. Although the managers in the organizations examined had common views on many of these (e.g., high loyalty) this list provided guidance for both gathering and evaluating data on the managers' perceptions of the cultures of their organizations.

There are many models which could have been used to help describe and examine the cultures of the organizations investigated (e.g., Mintzberg [1989], Morgan [1986]) but it was decided to use one which, although it is couched in mythological terms, proved very helpful in developing questions, making observations and structuring and analyzing data.

2.3.1 Handy's model

Charles Handy developed a model of organizations based on four distinct organizational "cultures". The most common in small organizations is the "club culture" which Handy identified with the god Zeus and which he symbolized with a spider web. This culture is excellent for speedy, but not necessarily correct, decisions. The management is performed by a small group of empathetic managers whose approach Handy summarized as "Zeus will not write when he can talk." There appears to be little room for computing in the Zeus management culture. THis culture also relates well to Mintzberg's "simple" organizational structure.

The second culture identified by Handy is the "role culture". This model, related to Apollo and symbolized by pillars, assumes that:

> "man is rational and that everything can be analyzed in a logical fashion. The task of an organization can then be sub-divided box by box until you have an organizational flow chart of work, with a system of prescribed roles (specified in things called 'job descriptions') and held together by a whole set of rules and procedures." [1985, pg. 21]

He points out that this culture, which is essentially the machine bureaucracy of Weber and Mintzberg, is appropriate where it can be assumed that tomorrow will be like yesterday - stability and predictability are assumed and encouraged. It is this culture that is most often envision when one hears the term organization. As mentioned earlier, most of the organizations in this study were, at their core, of this type. The fit of this type of culture with the nature of computer-based processing was an important guideline in understanding problems other cultures had with computer-based tools.

The third organizational culture described by Handy is the "task culture" (Athena).

> "This culture takes a very different approach to management. Management is basically seen as being concerned with the continuous and successful solution of problems." [ibid, pg. 23]

This culture is symbolized by a net and power lies not at the top as in an Apollonian culture or at the centre as in a Zeus culture, but at the interstices which are the points at which the relevant data and expertise lie in relation to a particular problem. This culture talks of teams where the Apollonian culture talks of committees. Decentralization and specialization of computer applications would be most valuable in this culture.

Finally, he describes the "existential culture" (represented by Dionysus) in which, unlike the other three, the individual is not subservient to the organization.

> "Dionysians recognize no 'boss', although they may accept coordination for their own long term convenience...These individuals see themselves as independent professionals who have temporarily loaned their talents to an organization." [ibid, pg. 31]

Universities, research organizations or departments and consultancy are the more common locations of this type of culture (which did not occur to any extent in this study). Decentralized control of the resource; task specific software and, perhaps, hardware; and good documentation would be of paramount importance in such a culture.

2.3.2 Mixing cultures

Handy did not claim that any culture is better than any of the others but he did make two basic points about culture in a specific organization. First, most organizations require a mix of cultures to be successful and, second, it is essential to have each culture in the right place in that organization. Failure in one or both of these will lead to what he calls "cultural confusion".

> "Cultural confusion is one of the primary ills that plague organizations. It shows up in efficiency or, more obviously, in slack, the extra resources, the longer delivery times, the increased overtime, the over staffed head office; slack is the organizational balm used to ease the pain of inefficiency." [ibid, pg. 11]

Slack is described as "fat somewhere in the system" and, although he is concerned with its use, he recognizes that any organization must have some. One type of slack he does not mention, but which became apparent as this research proceeded, is "information". Too many reports, too much detail or redundancy can all force managers to spend valuable time reading and massaging what turns out to be irrelevant, too late or just plain useless. Examining the information patterns at the highest levels of the organizations in this study was another of the goals of this project.

Handy suggests that, in spite of the desirability of a mix of cultures in an organization, most organizations become overwhelmingly Appolonian (bureaucratic). That is, as they become larger they become more and more structured, stressing rationality, consistency and conformity.

On the other hand he feels that another influence on the culture, the rate of change faced by the firm, would or <u>should</u> cause the firm to become more Like Athena - based on flexibility, professionalism and projects.

This conflict between the natural trend toward rigidity and the need for flexibility, especially in large firms facing dynamic environments, means that the continuing growth of large, centralized applications will run up against the need for more creative and more localized uses of CBIS. This, in turn, will affect both use of and attitudes toward computers at all points in the organization in the coming years.

Handy's concern about "cultural confusion" raises two additional points for this research. Do organizations really develop different cultures in different parts of the organization? Is Marketing really different from Accounting? If so, how does this affect their information needs and their attitudes toward technology, particularly computers?

The second issue is that of cross organizational cultures. Are the marketing functions in all the organizations really enough alike that generalities can be derived concerning computer appropriateness, use and attitudes in the Marketing function in general?

2.4 Sources of change

The growing complexity of the environment and the increasing speed and intensity of the changes that must be dealt with by senior managers has become a cliche during the past quarter century (e.g., Toffler [1970]). But how quickly and how well do organizations recognize the changes and their sources? Since the rationalization for CBIS for managers is to help them deal with problems that are often based directly on change this was an important issue in this research.

There are two approaches to change in the organization. The traditional set of concepts on the source of change has become known as the "exogenesis" school of thought which claims that a successful organization is basically an organism which survives and prospers by successfully dealing with the various elements of its environment. The organization evolves into a collection of functional areas - each with its own goals, tasks, activities, tools and rituals.

Sanderlands and Drazin point out that the exogenesis argument:

> "consists of three basic ideas: (1) organization and environment are different and distinct things; (2) they are related by functional imperatives for "fit" or "accommodation"; and (3) their relationship is asymmetrical - the environment affects the organization more than the organization affect the environment (presumably because the environment is bigger)." [1989, pp. 459-460]

The second approach to change in organizations was the "endogenesis" school of thought which attributes organizational change to the actions and choices made by managers in the organization. This is the basic for virtually every major theory of strategic management [e.g., Child (1972) and Lindblom (1959)]. As Sanderlands and Drazin point out, the endogenous approach also:

> "has three parts: (1) managers make decisions about organizational objectives and establish plans for realizing those objectives; (2) these decisions and plans promulgate definite organizational processes such as innovation, growth, divestiture, standardization, downsizing, market or product line expansion, or retrenchment; and (3) these processes leads to changes in organizational form." [op. cit., pp. 464-465]

Investigating the sources of change for each organization had two uses in this research. The first was evaluating what the managers perceived to be the main sources of change for their organization and how much agreement was evident among them. The more direct use was development of an understanding of how computers are now helping the organization to deal with significant change, whatever its sources, and how computer-based tools could be used to improve the organization's ability to identify and deal with such change.

2.5 Organizations and information[2]

The reality of information in organizations is that it is essential for survival. The information used by decision makers in an effective organization performs one of two functions:

1. it points out a problem or an opportunity for some level or subsystem of the organization
2. it helps the organization deal with the apparent problem or opportunity

Radford, describing the reasons for the growing use of information systems in organizations, begins with the assumptions concerning the bureaucratic nature of modern organizations described above and points out that:

> "[in large organizations] Responsibility for routine activities and related decisions is delegated to managers at the middle and lower levels of the organization... A necessary counterpart of delegation of authority is the reporting of the results of the activities that have been assigned. A second effect of the growth of an organization is that the breadth of experience and knowledge of individual members of the organization tends to decrease... For this reason greater attention to communication between individual members is needed... Organizations have met the demand of [their increased internal fragmentation and] the increased complexity of their activities by diverting an increasing proportion of their effort and resources to administrative tasks and information systems." [1978, pp. 5-7]

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[2]Section 4.6 contains a more technical discussion of the relationship between information and decision making in the organization.

Simon [1977] expanded on Anthony's pyramid model by defining the types of information needed at the various levels. He recognized that, at the middle and senior management levels in which this research is interested, the organization and the individual manager deal with current (operational) problems of the organization; with strategic planning to enhance the relationship between the organization and its environment (exogenisis) and with development of new goals (endogenisis). Based on this he identified two types of information needed by middle and senior managers. Intelligence information "is mainly used for attention directing and parameter measuring purposes" [ibid, pg. 128] and can be described as control oriented while strategic information "is more concerned with gaining an understanding of system behaviour" [ibid, pg. 130] and can be classified as planning information.

Mintzberg has developed an interesting concept concerning organizations, managers, information and computers. He distinguishes between "thin" information and "thick " information. The former type - aggregated, analytical, detached - is epitomized by the body counts of the Vietnam war. They are easy to deal with but not necessarily relevant to reality. Thick information:

> "is rich in detail and colour, far beyond what can be quantified and aggregated. it must be dug out on site, by people intimately involved with the phenomenon they wish to influence. In Vietnam it was the look on a peasant's face; in business, the will of a customer, the mood of a factory... Those who practice this kind of management bypass the MIS to be sure they get informed. " [1989, pg. 355]

He then points out that as organizations grow and become more rigid and managers jobs become narrower they are more likely to produce and use the computerized thin information than take (have?) the time to gather thick data themselves. Can a new, or upgraded class of computer-based information systems ever support the acquisition of "thick" information?

Daft and Lengel [1984] also examined the concept of richness of information, but from a more operational point of view - in terms of media. They defined richness as a function of speed of feedback, visual vs. audio channels, the source (personal or impersonal) and the language used (body, natural or numeric). In these terms they found face-to-face conversations provided the richest information while the others they examined, in descending order of richness, were the telephone, written personal communications, written formal communications and computer output. Since one goal of this research is to determine the value to managers of computer output in particular, and its utility in support of communication in general, these concepts were valuable in both framing questions and observing the actions and attitudes of individuals.

2.6 The organization and its computer resource

The computer resources described in Chapter 5 must compete for the limited capital of the organization with many other demands. In traditional organizations large, relatively simple applications such as accounting or inventory management have an obvious and strong claim on such resources but it is narrower, more subtle applications that are of interest in this research and, for them, the case is not nearly so clear cut.

Some of the specific aspects of IS that will have to be managed by successful organizations include: personal computing; distributed computing; departmental and organizational networking; voice and data communications; administrative workflow automation; database management systems; data security; and links with external organizations. Each of these emerged as a topic of interest with one or more managers in this research.

McKenney and McFarlan [1982] have pointed out a number of aspects of computers in the organization that are relevant to this research. The first reiterates the point made above - for purposes of both efficiency and effectiveness IS must add office automation, telecommunications and other advanced technologies to traditional data processing. They go on to point out that new technologies will require new management techniques and skills (one of the main interests of this research) and, finally, they suggest that firms must rethink where in the organization data and hardware resources belong (another important issue in this research).

Leifer [1988] discussed the problem of matching the organization's CBIS to its structure. Although one may not necessarily agree with all of his assumptions or conclusions, it is a useful discussion. He begins by describing four CBIS structures: stand alone PCs; centralized systems; distributed systems and decentralized systems. He then relates each to one or more of Mintzberg's structures (described above). For example he proposes that distributed systems (a central host linked with smart terminals or PCs in a many to one relationship) are most appropriate for professional bureaucracies since they can provide local processing to support individual and functional needs but are also linked to large central databases and software.

In addition to the linkages Leifer raise the issue of levels of analysis in that, since an organization can be a mixture of Mintzberg's structures, it may not be possible to fit one CBIS model to it[3]. At what level should the organization be differentiated when matching structure with tools? Both the problem of defining valid uses of the computer resource based on structure and the question of levels of analysis are key issues in this research. The topic of relating computer-based tools to culture is only implied by Leifer but is investigated in this project.

2.7 Critical Success Factors

One concept that proved useful in recognizing and evaluating the priorities of organizations and individuals in relation to CBIS was Critical Success

[3]Site E, which is, in reality, many sites spread from Halifax to Montreal to Moscow is an excellent example of this issue.

Factors. These were first propounded by Rockart who described them as:

> "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas 'where things must go right' for the business to flourish ... The current status of performance in each area should be continually measured and that information should be made available." [1979, pg. 82]

Being slightly more specific, Bullen and Rockart define CSFs as:

> "the particular areas of major importance to a <u>particular</u> manager, in a <u>particular</u> division at a <u>particular</u> point in time ... no standard organization-wide set of 'key indicators' can provide the necessary operating information." [1981, pg. 14]

Bullen and Rockart also classify CSF's according to three parameters: internal versus external factors involved; oriented toward monitoring (maintaining stability) or toward building (helping the firm grow); and the source of the CSF (the environment; the industry; a temporal issue; their competitive strategy or the manager's own position).

It was the focusing effect of CSF's and the use of common terminology that made them useful in this research because it (a) forced the manager to identify his CSFs at the corporate, function and individual levels and then (b) allowed him to understand how he was and was not using computer-based tools to achieve the goals related to those factors. This was, in fact, a topic which led to many in-depth conversations with managers about the links among the organization, the manager and CBIS.

2.8 Summary

This chapter began by discussing briefly the context in which the organization operates and which provides both the opportunities and the threats to which it must respond. The broadest level of context is the social, legal, political, competitive framework which usually acts only indirectly on a specific firm - but a more focused aspect of the environment, the industry, was also discussed, particularly as it relates to the firm's use of CBIS.

The chapter then reviewed existing theory on organizational structure and culture as they relate to the use of computer-based tools and described a number of models that were particularly useful for developing the research and evaluating the data.

A third aspect of the chapter was the examination of a number of more specific aspect of organizational theory which may affect the individual manager's use of, and attitudes towards, computer-based tools: the sources of change which act on an organization; the use of information in the organization; the relationship of the organization with its computer resources and Critical Success factors as they relate to CBIS support of a manager's activity.

The Manager As Individual

> *This chapter focuses on the individual manager as a cause of his own use of CBIS. More specifically, concepts and pre-existing theory on two sets of factors are examined: the key characteristics (demographics, psychographics and attitudes) of managers in relation to this research are described and evaluated; and the way in which managers work and deal with computers are examined.*

3.1 Introduction

At the heart of this research are the individual managers who work in the organizations described in Chapter 2; who perform the jobs discussed in Chapter 4; and who use (or might use) the tools and support described in Chapter 5.

Almost all of the computer applications implemented in organizations so far have been TPS and MIS embodying the structure, the policies, the processes and the procedures of the organization - the users were fitted to them. But when one begins to deal with the use of computer-based tools by those who have some power over which they will use and how, the relationship between application and user is more complex and, to a great extent, the tools must fit the user - the reverse of the traditional situation.

This chapter examines three classes of the characteristics that the individual brings to his organization, to his job and to the resolution of specific types of problems: demographic factors such as age, gender and education; his personality type; and the set of beliefs and attitudes that shape his relationships, in this case to the use of computer-based tools.

In addition to investigating the "internal" factors which define managers as individuals this chapter reviews prior theory and research on managers and management in general. Because this consists of a huge body of work emphasis was placed on topics deemed most relevant to the use of computer-based tools. Those selected include the different styles of working demonstrated by managers; the difficulties encountered in defining just what it is managers do; their preferred sources of information; how managers deal with increasingly complex environments; the different approaches they may use for solving problems; and their relationships with computer-based tools.

3.2 Characteristics of the decision maker

In order to relate the manager's types and levels of use of CBIS to his individual characteristics it is, of course, necessary to identify the relevant characteristics and to measure them. To simplify this, characteristics have been examined in four groups: demographics, personality types, beliefs and attitudes, and cognitive styles.

3.2.1 Demographic factors

The basic demographic/situational factors recognized by a number of theorists, such as Zmud [1979] and Ein-Dor and Segev [1981], include general intellectual ability, knowledge of the field in question, age, gender, experience, education, professional training, decision requirements, rank (absolute and relative) and attitudes (technical and non-technical).

This research investigated only demographic factors that could be quantified: age, gender, level of education, time with the organization, time in his current position, level of his position in the organization, computer training and experience with computers.

3.2.2 Personality type

One ongoing issue for researchers into the psychology of managers is: how can the "internal" aspects of personality be elicited in an objective way? A number of tools have been developed over the past fifty years which purport to do just this. Some researchers (e.g., Brightman, Elrod & Ramakrishna, [1988]) have proposed that Jung's construct, in which decision makers are classified according to three dimensions of their style (their nature (extroverted/introverted), their method of perception (sensing/intuition) and their method of judgement (thinking/feeling)) is the most appropriate and approachable model for classifying managers. Brightman goes on to point out that Jung's is not only a concise, consistent and comprehensive model but it has been operationalized by the Myers-Briggs Type Indicator (Briggs Myers & McCaulley [1985]). (This and other tools are described and evaluated in Chapter 6.)

Properly developed, such a set of objective measurements of individual characteristics will help a researcher to predict a number of things including: a user's attitude toward CBIS; the most appropriate type of tool for his "attitude"; the most effective way for each manager to use the tools available; and the best approach to managing his use of that tool.

3.2.3 Beliefs and attitudes

Ebert and Mitchell propose that individual managers are driven by three internal forces. Beliefs:

> "reflect an individual's view of the interrelationship of events either past, present or future... there is some object, concept, or thing being related to some other object, concept or thing...we may be imputing causality to events while in other cases we may be stating what we consider to be a factual statement of interrelationship." [op. cit., pg. 51-52]

Values:

> "are normative statements by which human being are influenced in their choice among the alternative courses of action which they perceive .... values are conceptions of desirable states of affairs that are utilized in selective conduct as criteria for preference or choice or as justifications for proposed or actual behaviour." [ibid, pg. 53]

They describe attitudes as a major subset of values which give an individual:

> "a predisposition to respond in a favourable or unfavourable way to objects, persons, concepts, or whatever." [ibid, pg. 58]

Thompson, Higgins and Howell, discussing a model of PC utilization, reported that Triandis [1971]:

> "suggested that attitudes involve cognitive, affective and behavioral components. The cognitive component of attitudes involved beliefs...The affective component of attitudes has a like/dislike connotation. Thus, the statement 'I hate computers' is considered an indication of the affective component of

> attitudes. Behavioral aspects are simply what a person intends to do." [1991, pg. 126]

Beliefs and attitudes affected this research in two ways. The first was their effect on the perceptions reported by managers, as just discussed. The second was more subtle. One goal of this research was understanding the forces behind a manager's use (or non-use) of computer-based information systems. Because managers examined in the research had some control over how they did their jobs, including the type and degree of use of CBIS, their beliefs and attitudes had to be examined as potential factors with the final model.

Did the beliefs and resulting attitudes of an individual manager really determine how he used CBIS? How strong was their effect compared to other factors? Both Ebert & Mitchell and Triandis imply that beliefs and attitudes have both logical (cognitive) and emotional (affective) aspects. Throughout this research attention was paid the effect of beliefs and attitudes on their relationship to the research, on the validity of their perceptions and on their relationship with CBIS.

3.2.4 <u>Cognitive style</u>

Zmud [1979] suggested that cognitive style is composed of three dimensions. The first of these is the simple/complex dimension which relates to structural characteristics of perception and includes differentiation (the number of elements sought and assimilated in cognition), discrimination (the degree of "fineness" of distinctions among available values) and integration (the number and completeness of rules used in cognition.

The field dependent/field independent dimension (low analytic/high analytic) reflects whether a decision maker is bound by external referents or can make use of internal referents in structuring cognition.

The final dimension of cognitive style described by Zmud is that of systemic/heuristic. This approach is based on the distinction between those who use abstract models and systematic processes in cognition and those whose approach is based more on experience, common sense and the practicalities of the situation.

Finally, he proposed a number of reasons why decision aids such as MIS or DSS can be valuable to humans making decisions: humans have been found to be slow in initiating action; to delay too long in making decisions; to be reluctant to change prior decisions;
are unable to make full use of available information (particularly when it is multidimensional); develop and consider too many alternatives; often accept the first alternative that makes sense and are uncomfortable with probabilistic (stochastic) analysis.

In an article linking an individual's cognitive style to "decision aids" Benbasat and Taylor made a number of points which have provided guidance in this research. Their basic distinction between analytic and heuristic decision makers is based on the Embedded Figures Test as described by Witkin et. al. [1971] rather than the MBTI but, as will be shown in Chapter 6, there is an overlap between the classifications developed by the two tools. Benbasat and Taylor made three points concerning different cognitive styles and decision aids:

> "1. Analytic decision-maker types tend to prefer decision aids and reporting systems which are quantitative in nature with results supported by mathematical formulas.
>
> 2. Heuristic decision makers need to have more data search capabilities prior to reaching decisions. Since they rely on feedback and trial and error, an information system capability which can highlight trends and provide period by period comparisons would be suitable for them. the information system should give then the capability to try alternative solutions and analyze the possible outcomes before they decide on their final approach to solving the problem.
>
> 3. Decision-makers differ in their data gathering styles. The perceptives want a system which can organize and aggregate data into categories according to given parameters and exception reporting aids, whereas the receptives or maximal data users prefer an information system which has access to every piece of historical data." [1978, pg. 49]

3.3 How managers work

An important aspect of computer-based tools from a manager's point of view is how they will fit into his work style. Although this will be, to some extent, defined by his individual characteristics there are also some aspects of simply "being a manager" which may be relevant.

3.3.1 Styles of activity

Radford suggests that there are two general styles of managerial activity - incremental and entrepreneurial.

> "The incremental style is oriented toward the maintenance of an equilibrium state both within the organizational and between the organization and its environment. The incrementalist avoids implementing radical change...Movement is achieved by a succession of steps, each succeeding step being undertaken after a review of the effects of the preceding step.
>
> In contrast, the entrepreneurial style seeks change rather than attempting to suppress and minimize it. The entrepreneurial manager anticipates threats and opportunities...Courses of action chosen by an entrepreneurial manager tend to be bold and wide-ranging. His activity places great emphasis on creativity." [1978, pg. 45]

This somewhat simple distinction captures a basic issue relating the use of computer-based tools to managers: to what extent can managerial activities using different approaches be supported, enhanced or even imitated by such tools? More particularly, can they be related to the entrepreneurial style? Is such support more trouble than it is worth?

3.3.2 Sources of information

A key aspect of the way managers work is the sources which they use to acquire information to support their roles. Mintzberg [1975, pg. 52] identified five media available to managers (documents, observational tours, telephone calls and scheduled and unscheduled meetings) but reported that in two British studies managers were found to spend an average of 66% and 80% of their time in verbal (oral) communication while the five Canadian chief executives in his study were found to spend about 78% of their time in verbal mode.

McLeod, Jones and Pontevent [1984], in a related study based on in-depth interviews with five senior executives, asked their subjects to rank the value of ten information sources. the combined rankings were:

1. Memos, letters
2. Scheduled meetings
3. Telephone
4. Unscheduled meetings
5. Non-computer reports
6. Computer reports
7. Office visits
8. Periodicals
9. Conventions
10. Social/civic activity

It is interesting to note that three of the top four are verbal, supporting Mintzberg's contention that senior managers prefer verbal input and output and Daft and Lengel's [op. cit.] concept of the relation between media and information richness. The main findings of this study were:

- The executives relied more heavily on informal than formal sources of information
- Approximately three times as much information came from non-computer as from computer sources.
- Approximately twice as much information came from internal as from external sources.
- Verbal media were the most preferred sources.

McLeod and Jones [1986], in a follow up to this research, examined the information systems (defined in the broadest sense) of five senior executives as they related to their decisional roles. They divided all information sources into either written or oral. Written media included computer reports, letters, memos, periodicals and non-computer reports while oral media included social activity, business meals, tours, telephone calls and scheduled and unscheduled meetings. Unlike Mintzberg's study, this investigation found that only 39% of information sources were oral with only telephone calls, at 21%, having significant impact on decision making. One goal of this research will be to investigate the preferences of the managers interviewed. Do sets of preferences seem to relate to functions (e.g., marketing)? Is the preference set related to personality types?

3.3.3 Dealing with the work environment

Looking at managerial activity in terms of the equivocality and dynamism of the environment, Weick suggested that:

> "the pace of managerial activity implies one or more of the following outcomes:
>
> 1 Managers chronically work amidst enduring puzzles because abbreviated selection leads to minimal removal of equivocality.
>
> 2 Managers do what they are told...and enforce organizational routines because this reduces variety in the environment and also shifts lingering equivocality to someone else (supervisors handle odd cases).
>
> 3 Avoided tests are common because there isn't time to interpret equivocal enactments that would come from attempted test.
>
> 4 Habit and tradition...are invoked as often as possible for as long as possible to accommodate demands for selection with the limited time available for selection.
>
> 5 Because they deal with smaller scraps of data at any one time-each input gets an immediate response-managers may be able to preserve a sense of control." [1979, pp. 203-204]

Handy [1985] suggests that there are a number of standard techniques people use to deal with the increasing demands made on a manager's time:

- polarizing (push problems into black and white - ignore all shades of grey);

- shortening time horizons (deal only with immediate topics and crises);
- searching for a routine ("what did we do last time?" - this approach allows us to avoid a decision);
- taking delight in trivia (turn to, or even create, a trivial problem);
- reacting, not proacting (deal with the in tray - cope with events as they arrive - don't try to influence their occurrence);
- hammering away (do what you do only do even more of it);
- escaping (into non-productive or even destructive behaviour;
- breaking down.

Some of these activities are emotional and no type or amount of technology can help. But in, in general, the use of CBIS by such managers can have three effects. At the organizational level, it can ensure that the manager is actually doing his work - that he has not "escaped" or "collapsed". If he has, the organization will very quickly become aware of this. The other two effects are more positive from the manager's point of view. The computer tools can do some of the manager's work thereby reducing the load and secondly, computer-based tools can support the manager in some of the tasks that must be done by human effort.

3.4 Individual managers and decision making

Simon's [1977] scale of problem "sophistication" - from well structured (programmed) decisions to unstructured (non-programmed) decisions captures many of the issues surrounding managers and their direct use of CBIS. As they rise in the organization managers spend their time dealing with a larger and larger proportion of semistructured or unstructured problems. How can computer-based tools support such managers in such situations?

March and Simon suggested a specific set of consequences of the human's limited information processing skills (discussed in the following chapter) and the resultant development of "action programs" at both individual and organizational levels.

> "Because of the limits of human intellectual capacities in comparison with the complexities of problems that individuals and organizations face, rational behaviour calls for simplified models that capture the main features of a problem with out capturing all its complexities.
>
> The simplifications have a number of characteristic features: (1) Optimising is replaced by satisficing-the requirement that satisfactory levels of the criterion variables be attained. (2) Alternatives of action and consequences of action are discovered sequentially through search processes. (3) repertories of action programs are developed by organizations and by individuals, and these serve as the alternatives of choice in recurring situations. (4) Each specific action program deals with a restricted range of situations and a restricted range of consequences. (5) Each action program is capable of being implemented in semi-independence of the others- they are only loosely coupled together." [1958, pg. 169]

They go on to describe the basic characteristics of these action programs as they relate to organizational and individual problem solving. First they note that, however complex a specific process or program, "they are made up by aggregating very large numbers of elements, each element, taken by itself, being exceedingly simple." [ibid, pg. 178] Second, they observed that a large part of problem solving consists of search processes - either physical or cognitive (relationships, past experience, etc.). Third, screening is another major component of problem solving programs - how appropriate is this alternative? how expensive? how does it fit in our organization? Finally, they noted that the elementary components of any program are characterized by a great deal of randomness. Of course this will relate to the nature and structure of the problems being dealt with but, at senior levels, randomness will be the rule rather than the exception.

Essentially, the abilities of human information processors are too limited - we must simplify, ignore and generalize, usually with the support of heuristics. Rather than optimize by working at all phases of the problem solving process until the "perfect" solution emerges we accept the first solution which meets a minimal set of criteria - we satisfice. In the light of such an extensive description of the weaknesses of human problem solving, the question arises: how can a rigid tool such as a computer-based information system improve the problem solving skills of managers as individuals?

It is important to recognize that not all of the effects of using computers to help solve problems are seen as potentially positive. Weick [1985] pointed out that people use a variety of techniques to help them make sense of what goes on around them. He discussed five of these and described how using a terminal [a computer] could have a negative effect on each.

Effectuating is doing something; learning about an entity by prodding and examining it. Use of a computer could remove the manager from a problem or an event so that it becomes only a model to be manipulated. This situation of detachment, which Weick calls "action deficiencies", can have potentially serious consequences.

Triangulating is confirming one's perceptions of a situation by using a series of alternate measures of that situation. Even when no one measure is complete the series of "images" can provide a strong sense of what is happening. The "illusion of accuracy" created by computer models may cause a manager to fail to triangulate, which Weick calls "comparison deficiencies".

Affiliating is learning about a situation or an entity by comparing what they see with what someone else sees. He defers to Lehmann-Haupt's description of computing as "quantified narcissism disguised as productive activity" to make the point that isolation can lead to serious problems in a manager's understanding of both a problem and possible solutions.

Deliberating is slow and careful reasoning during which ideas are formed and conclusions are reached. Weick points out that in using computers time, so essential to successful deliberation, is the very thing that disappears. Not only the volume but also the velocity of information increases drastically.

Finally, Weick is concerned with our ability to Consolidate the bits and pieces of information we have. Successful consolidation requires that we go beyond the information itself - we must understand relationships and context and be able to add value if we are to get the "whole picture". He recognizes that it is the very self contained nature of computer-based systems that cause them to undermine the consolidation process - enumeration is not enough.

Although none used Weick's terms a number of managers in this research expressed strong reservations about the appropriateness of computer terminals or microcomputers in their offices for similar reasons.

It is instructive to review a list of what one set of senior managers identified as being the key problems they faced in making decisions. Hough and Duffy [1987] asked 1,985 senior managers to rank a set of decision making difficulties. They identified the following as being most significant (in descending order of intensity):

1. deciding under time pressure
2. conflicting objectives/criteria
3. high complexity in decisions
4. estimating impact of decisions
5. insufficient information
6. getting a decision implemented
7. deciding information sufficiency
8. forgetting something
9. communication with people
10. determining information relevance
11. decision effectiveness not known
12. unclear understanding of the problem
13. unclear decision objectives
    and, at the bottom of the list,
14. expected frequency.

The fundamental issue which related this list of problems to this research was how, or whether, managers use (or could use) computers to minimize some, many or all of these problems. These researchers were also interested in the use of computers to deal with these problems and found, among other things, that 55% of the senior managers had not even heard the term "DSS", that only 35% had a computer tool available to them and that only 17% of respondents used the computer directly.

3.5 Managers and computer-based information systems

Who are the current and potential users of CBIS at management levels? What do they want them to do? How do they evaluate their usefulness to themselves? To the organization? What attitudes might they demonstrate toward computer-based tools?

How the potential manager/user sees the tool affecting his position in the organization is an important factor in defining the relationship between users and CBIS. Mason and Mitroff recognized that there can be negative attitudes which will actively mitigate against any use of such tools:

> "In an organization information is power. It affects one's authority, status, visibility and career. Thus one might conclude ... that the dysfunctional reactions to the installation of MIS (that range from failure to use the output to outright sabotage) are based on the individual's defensive responses" [1973, pg. 484].

Although this comment was made concerning MIS which were company-wide and often compulsory, the issue of "unreasonable" attitudes interfering with the use of CBIS by middle and senior managers cannot be dismissed for this research. Does the manager perceive the use of a tool in a particular situation as personally positive, threatening or neutral? Can this be measured? How can the organization deal with it?

In a recent study Nelson [1989] investigated the actual use of personal computers (microcomputers) by the chief executives of America's 500 largest companies. Of the 457 respondents to their questionnaire, only 21.4 % reported that they "compute" at the office or at home. This was the same percentage as was reported in a 1986 version of the research. These users reported that they had been using a computer for an average 3.6 years and spent an average of one hour per day using a computer. The most important overall use was described as "personal productivity" (?) while the most satisfying end result was "access to more information" and the most disappointing aspect of their computing was "difficult to learn". Unfortunately the report does not describe the managers' functions (e.g., production or marketing) so it is not possible to compare results in various functions to their figures.

In an evaluation of interface issues for "advice giving systems" Carroll and McKendree summed up the reality of the limited use of computers by managers, even if they have identified potential uses within their job:

> "People want to use computer equipment because they want to get something accomplished. This is good in that it gives users a focus for their activity with a system and increases the likelihood of receiving concrete reinforcement from their work. But this same pragmatism can also make an individual unwilling to spend any time learning about any system on its own terms. After all, to consult on-line tutorials or programmed self instruction manuals [let alone attend a course of instruction] is for a time to effectively cease working. There is then a conflict between working and learning that inclines new users to try and skip instruction all together, or to skip around

in a training sequence, sometimes with disastrous consequences." [1987, pg. 14]

The issue of training was examined in this research from five points of view: the need for management training; the organization's attitude in terms of rewards (or lack of them) for training; the resources available to managers for training; the costs to the organization of inadequate training of managers in the use of CBIS; and the opportunity costs of both training and use of CBIS by managers.

3.6 Conclusion

When it comes to actually solving problems, whether or not that includes the use of CBIS, organizations are strictly constructs - all aspects of the process are done by individuals. At the broadest level it is groups of individuals who decide what computer resources will be acquired for the organization, how they will be allocated and what policies will be put in place to define the relationships between the resources and the users.

Individual characteristics such as demographics (age, education, experience and so on) and personality (including beliefs, values, attitudes and cognitive styles) will also mediate the relationship of an individual to computer-based tools - as a user or as a manager. This chapter has focused on those characteristics which may affect either the manager's ability to use a computer-based tool or his willingness to employ such tools and to relate them to his responsibilities.

The Individual as a Manager

> *This chapter begins with a discussion of concepts and theory underlying four aspects of the job the individual performs for his organization: the manager's formal function within the organization; the set of tasks which comprise his job; the specific activities required to complete these tasks and the nature of the problems he must deal.*
>
> *But much of the chapter consists of explanations of how these concepts evolved during the research; the relationships believed to exist among them and their apparent effect on the manager's use of, and attitudes toward, computer-based tools.*

4.1 Introduction

The organization and the individual "meet" at the level of the "job" the manager performs for the organization. This chapter examines a number of topics which define that job and the relevance of computer-based tools to it. From the general to the most specific these are: the formal function he (and his people) perform for the organization; the tasks performed as part of that function and the day-to-day activities which must be undertaken to achieve the goals of the job.

A fourth topic, the nature of the problems faced by managers and the problem solving processes used to deal with them, is also included because, at middle and senior levels, this aspect of the job, although less specific than the first three, may have a significant effect on the relevance of computer-based support.

This chapter contains the least "pre-existing" theory of any in this section because this four-pronged model evolved primarily from the researcher's own experience and that of the managers taking part in the project.

Handy, discussing what actually happens in any type of organization, commented that:

> "life is just a set of jobs to be done. Organizations are just larger sets of jobs to be done. These jobs seem to fall into three types:
>
> STEADY STATE describes those jobs which are programmable, because they are predictable. They can be handled by systems and routine, rules and procedures. In a typical organization, they might account for about 80% of the work to be done.
>
> DEVELOPMENT jobs are those which attempt to deal with new situations or problems. In many cases the result might be a new system or routine, which ensures that the next time the situation occurs it will not be a problem, merely an incident in the steady state. These are the jobs which ensure, if they are well done, that the organization adapts.
>
> ASTERISK situations are the exceptions, the occasions where the rule book has failed, the emergencies where instinct, and speed, are likely to be better than logical analysis or creative problem solving." [1985, pp. 34-35]

The work of lower level staff consists primarily of the "steady state" jobs whose activities are highly amenable to computerization. Two issues investigated in this research were (a) the mix of the three types of jobs performed by managers and (b) the relevance of direct use of CBIS to this mix.

4.2 Functions in the organization

As was described in Chapter 1 it was decided that, to provide both structure to the research and comparability among the groups of managers chosen to take part in it, the "formal function" the individual (and his subordinates) performed for the organization would be used as a defining factor. There have been many approaches to the subdivision of labour in the organization (e.g., Fayol [1949] divided the work of an organization into six subdivisions: technical, commercial, financial, security, accounting and managerial) but it was decided to use the terminology with which the managers themselves were comfortable - accounting/finance, marketing, personnel, production and "planning".

But these functions are not all "equal". For example, Accounting has, over centuries, developed a body of theory and practice ranging from clerical procedures to reporting policies which are recognized and accepted internationally. On the other hand, Marketing covers an wide range of activities from product planning to personal selling and, within general models, can differ greatly from one organization to another and even from among individuals. What effect, if any, do these different degrees of development have on current use of, and attitudes toward, computer-based tools by managers in the various functions?

Each function is, ultimately, the responsibility of one manager (usually the one interviewed) but only in the smallest organizations is the work of a function done by that one person. Most of the tasks and activities comprising a function are delegated to subordinates. This made gathering and analyzing data on the individual managers difficult since they often did not distinguish explicitly between the function for which they were responsible and their own tasks and activities.

4.3 Tasks in organizations

Because it soon became evident that a "function" was too large a unit to relate meaningfully to an individual computer user, computer tool or opportunity the complementary concept of "tasks" was added to the analysis of the manager's job. This level of analysis, however, presented two more problems: what is a "task"? and how could data on tasks be elicited from managers? The most obvious approach was to simply ask each manager: what do you do? But this can also lead to problems. The manager may not answer on the same level of generality as was intended - his description will be too detailed or too broad. The answers may deal with irrelevant aspects of his job or even include other jobs, particularly those of his subordinates. So more structure was needed.

4.3.1 Fayol's framework

Traditionally managers' work has been described in terms of Fayol's [op. cit.] framework: planning, organizing, commanding and controlling or some more detailed modification such as that of Gullick and Urwick [1937]. This classification is certainly more specific than an open-ended question and should cover the manager's day but as Mintzberg first pointed out almost twenty years ago "they tell us little about what managers actually do. At best they indicate some vague objectives managers have while they work. " [1989, pg. 3]

4.3.2 Mintzberg's roles

Mintzberg prescribed a more flexible model of managerial "roles": interpersonal (figurehead, leader and liaison); informational (monitor, disseminator or spokesman) and decisional (entrepreneur, disturbance handler, resource allocator and negotiator).

All of these were relevant to this research. The liaison aspect of the interpersonal role was likely to involve computing either through communication technology such as electronic mail or, more commonly, by using organization-wide computer output, such as the annual budget plan, to communicate with other managers.

The informational role had two implications for the use of computer tools. The first was the potential value of the computer in the preparation of information and the second was the use of computers to both receive and send such information. Even more sophisticated is the possible use of a computer-based tool to filter, or even to evaluate, information.

Two aspects of Mintzberg's decisional role appeared to be relevant to this research. The first was the "entrepreneur" in which the manager seeks to improve his unit and keep adapting it to changing conditions. To what extent could, or would, the manager use the computer to enhance this aspect of his job?

The second relevant aspect of the informational role was "disturbance handler" in which the manager involuntarily responds to pressure so that change is beyond his control. The power of computer-based systems to provide early warnings and to analyze potential problems and solutions could be valuable in the handling of organizational "disturbances".

4.3.3 <u>Group tasks</u>

Another aspect of tasks, as they relate to computer-based tools is the degree to which tasks are performed with others. Thompson [1967] has described four types of interaction:

1. Independence - a task is independent if a person [or group] can perform that task without interaction with any other persons [or groups].

2. Pooled interdependence - a task is pooled if two or more people [or groups] are relatively independent but make a discrete contribution to the larger organization.

3. Sequential interdependence - a task is sequentially interdependent if several people [or groups] can only perform their respective tasks in a certain sequence in which the outputs of one task must be used as the inputs to another task.

4. Reciprocal interdependence - this occurs when the outputs of certain departments become inputs to those same departments. A common example of this is the relationship between the operations and maintenance departments of an airline.

How do the different forms of task interaction relate to potential use of computers by the managers involved? Hackathorn and Keen have suggested that there are three levels of support that roughly correspond to Thompson's types of interaction:

"1. Personal Support focuses on a user or class of users in a discrete task or decision (e.g., setting a price for a product) that is relatively independent of other tasks.

2. Group Support focuses on a group of individuals on the same, or different managerial levels,

who are engaged in separate, but highly related, tasks (e.g., office activities).

3. Organizational Support focuses on an organizational task or activity involving a sequence of operations and actors (e.g., developing a marketing plan, capital budgeting." [1981, pg. 24]

Almost all computer-based tools in organizations today are oriented toward organizational support. Some relatively advanced functions have developed personal support systems although these are used more to support tasks than individual managers. Group problem solving is discussed below and the related group decision support systems (GDSS) are examined in Chapter 5.

4.4 Activities

The most specific level of the job evaluated in this research was the activity. Activities were taken to be, basically, whatever an individual spends his time doing. This included "going to meetings", "talking on the telephone", etc.

This is another topic on which little management level research was found and, in the end, it became a matter of working from the general observations of researchers such as Mintzberg [1973] to create a list of activities which could be use to elicit the specific activities of each manager.

But, although how a manager spends his day is the basic activity data, issues based on activities go beyond that. For example, are there significant correlations between specific tasks and sets of activities? Are there significant differences in the "activity mixes" of the five functions examined? Differences between managers in different organizations? Most basically, how does each activity relate to computer-based applications and how do different sets of activities affect the appropriateness of CBIS for that manager?

4.5 Problem solving in organizations

In the normative model of organizations managers exist to define goals, to acquire and allocate resources within the organization to achieve those goals as effectively and efficiently as possible and to ensure that all necessary activities are carried out (e.g., Gibson [1975]). In this research interest was primarily on understanding the nature of a problem and its location within the organization (who is responsible for dealing with it?).

The basic factor in management decision making is the type of problem being dealt with. At the simplest level are operational decisions - those which arise from the day-to-day activity of the organization. The next level is tactical in which some structure, mainly through history, is available. To a great extent these are the types of problems dealt with by managers in this study. The most complex level of problem, strategic, are usually based on long term situations, are large, unique and lacking in structure and history.

Related to this is the idea of the locus of the problem. Three loci were identified based on who is involved in solving the problem. The first was "local", that is, the problem is specialized, and would be dealt with by the manager's area of control with limited input from other areas of the firm. The second locus was "shared" which involved decisions made by more than one function or department so that communication and negotiation are added to data acquisition and analysis. Like local problems these were usually operational or tactical in nature. The third locus was "corporate". It might not involve all aspects of the organization but the decisions affect the entire organization, usually at a tactical or strategic level.

To create a framework within which problems could be defined and related to the use of computer-based information systems, two aspects of problems were examined in detail: the characteristics of problems and the techniques available to solve them.

4.5.1 The characteristics of problems

In order to investigate the difficulties faced by the organizations and managers taking part in this project it was necessary to develop an understanding of problems in general which would allow the creation of questions and data analysis procedures relevant to the research goals. There are many models of problems in general which could be useful but the two which follow demonstrate the extremes of concept and application.

Simon's model

Herbert Simon summarized a model of decision types which he had been developing for twenty years by defining a spectrum of decisions from programmed to non-programmed.

> "Decisions are programmed to the extent that they are repetitive and routine, to the extent that a definite procedure has been worked out for handling them so that they don't have to be treated de novo each time they occur." [1977, pg. 46]

> "Decisions are non-programmed to the extent that they are novel, unstructured and unusually consequential. There is no cut-and-dried method for handling the problem because it hasn't arisen before, or because its precise nature and structure are elusive or complex, or because it is so important that it deserves a custom-tailored treatment." [ibid]

Because of the simplicity of the model it implies that a problem at any point on the continuum is only quantitatively different from one at some other point (e.g., a little more novel or a little less consequential). The qualitative differences among problems are at best implied. If the differences among problems along Simon's spectrum is only quantitative, why has it been so difficult to develop computer-based tools for the more sophisticated problems organizations must deal with?

Gaither's model

How can an organization or a manager operationalize this apparently simple model of decision types? Gaither [1990] defined seven characteristics by which a manager can determine the degree of structure (programming) in a problem situation:

1. degree of complexity - how many input factors must be considered, how many constraints are relevant, how many factors are involved in processing the inputs?

2. degree of uncertainty - How sure are we that all necessary data have been gathered? are the data ambiguous? how many goals are to be achieved? do they conflict? how concrete is the problem?

3. decision time frame - how long do we have to make the decision?

4. expected returns relative to analysis - what can the organization expect to gain from investing time and money in an in-depth analysis of the problem?

5. degree of recurrence - how frequently does this or a similar problem occur within the organization? how programmed is this type of decision situation?

6. intensity of decision impact - how badly will the firm be hurt by a wrong choice in this situation?

7. duration of decision impact - how long will the firm be hurt by a poor decision?

The oldest applications (TPS) deal with well structured, short term, small impact decisions but, since managers are also required to deal with complex, low recurrence, high impact, long term problems, the need for a different approach to computer-based tools becomes apparent from this model.

4.5.2 Problem solving processes

A manager affects, and is affected by, not only the characteristics of a problem but also the process by which a resolution (decision) is reached. To guide and support this research a number of models of decision making were examined.

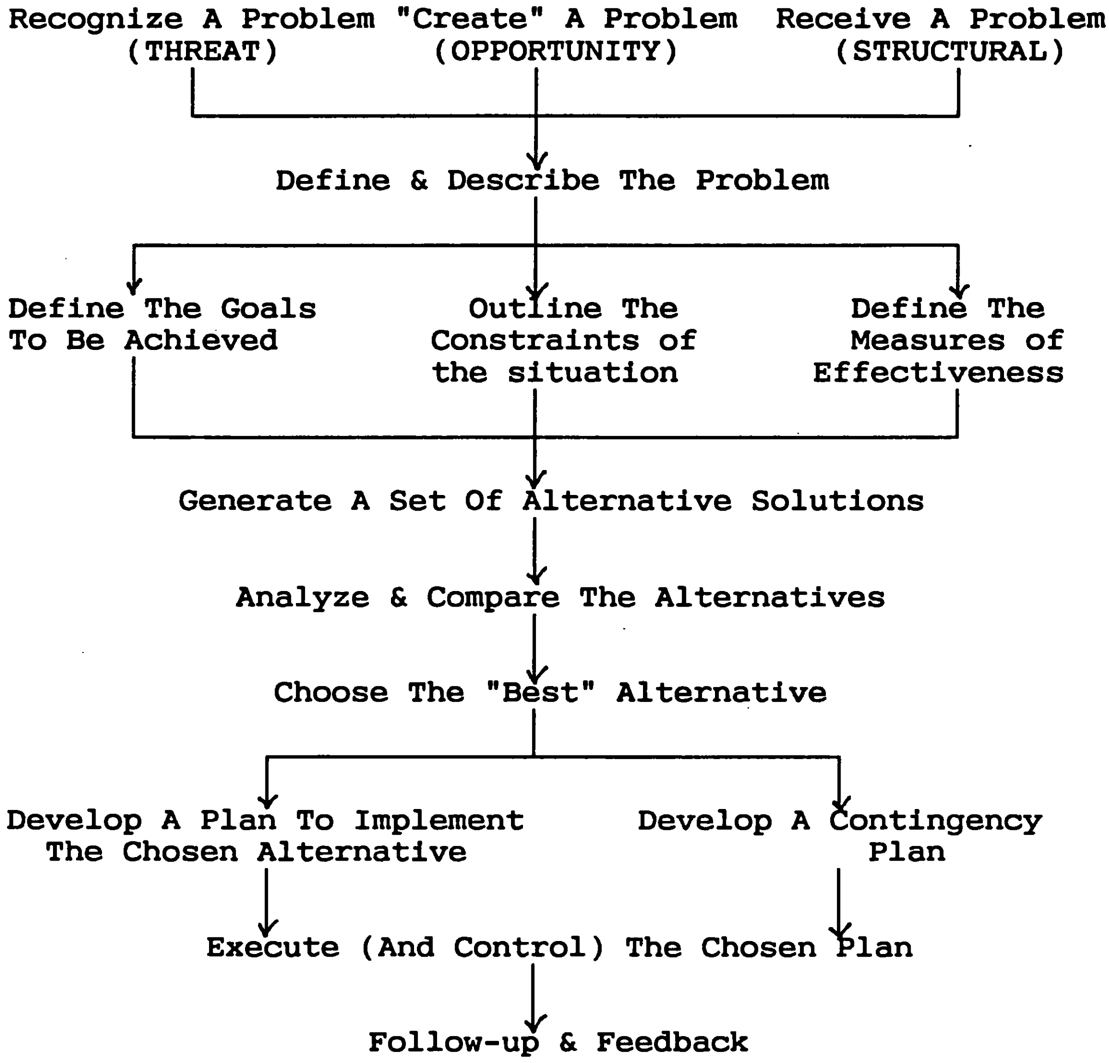
Simon's model

The most basic of these was Simon's [1977] three stage model of problem solving. The first stage, intelligence, is the gathering of information; design is the evaluation of the information based on a model of the problem being dealt with; and choice is the actual decision based on the first two steps. The traditional multistage, iterative model which follows is an operationalized expansion of Simon's approach.

The traditional problem solving model

Figure 4-1 summarizes models of the problem solving process expressed by many theorists including Ansoff & Hayes [1974], Bahl & Hunt [1985], Gaither [1990], Leigh & Doherty [1986] and Simon [op. cit]).

Figure 4-1: The traditional decision making process



A number of points must be made if this model is to conform to the reality of problem solving by managers and address the relevance of computer-based tools.

. as managers rise in the organization the proportion of problems which are "chosen" (that is, the manager is involved in an proactive situation rather than a reactive one) also rises.

. shortcuts are often taken in the process either because a phase can be omitted or because a phase is simplified through the application of an heuristic.

. the process is iterative in that, at any phase, it may become apparent that a previous stage will have to be revised or repeated.

- "define and describe the problem" implies aspects such as source, intensity, complexity and degree of understanding.
- is the set of alternatives continuous or discrete?
- the "best" alternative can be chosen based on numerous parameters (e.g., economic, legal, social, moral, ease of implementation, incrementalism or organizational politics).
- solutions can come in many forms (given, required, custom-made or *ad hoc*).
- as the manager rises in the organization the guidelines for solutions available will diminish and the number of interactions required to reach an acceptable solution will increase.

This model supported this research in three ways. First, it served to subdivide large, sometimes vague and complex processes into more manageable (and discussable) units, or tasks. Its second use was to encourage communication between researcher and subject by providing a set of common terms. Finally, it served to link simple computer-based tools to specific aspects of the process, including the modifications made as problems are actually solved.

There are a number of decision process models which go beyond this normative model by including the individual as a variable. Those most useful in this research are described briefly below.

Economic man (the Rational Actor)

In examining the way in which the American government responded to the Cuban missile crisis, Allison [1971] demonstrated that the decision making process in organizations operates on three levels: the rational level, the organizational process level and the political level. The Rational Actor Model assumes that the organization acts as a directed unit gathering and analyzing data in a logical and complete way ("economic man"). The resulting action is the most probable and reasonable result of such analysis.

The basic concepts behind models of rational action include: translating goals and objectives into rational payoffs; developing a complete set of alternatives; measuring the consequences of each alternative in terms of the payoffs defined earlier; and choosing objectively the alternative that maximizes the pay off for the "unitary" decision maker.

This model is the simplest of the "human oriented" models and most closely approximates the way in which computer-based tools operate. But, unfortunately, it is also the least realistic in terms of the way human problem solvers operate. In fact, this dichotomy underlies much of this research project.

Organizational process

Allison's Organizational Process model recognizes a number of limitations on the preceding model. They all relate to the impossibility and, from the organization's point of view, the undesirability of a complete search either in terms of alternatives or consequences.

Cyert and March [1963] described a similar concept in which problem solving was seen as the outcome of relationships among internal coalitions, each with its own goals and priorities. The resolution of a problem, and even the approach used, result from negotiations among these entities.

Allison describes decisions in this model as "outputs of an organizational process". It more closely reflects the reality in most organizations of the combination of standard operating procedures, traditions, bargaining activity and external forces than does the preceding one. But, conversely, to what extent can computers become part of, and improve, this weakly structured process?

Muddling through

An approach to problem recognition and resolution related to the organizational process model has been offered by a number of writers including Lindblom [1959] and Janis and Mann [1977]. They describe a decision process rooted in the nature of large organizations. "Incrementalism" or "the art of muddling through" implies that, when a situation arises requiring a change in policy, policy makers in governments and large organizations generally consider a very narrow range of policy alternatives that differ to only a small degree from the existing policy. Also "Ends are chosen that are appropriate to available or nearly available means." [Janis & Mann, 1977, pg. 34] Although the term "muddling through" evokes images of confusion, timidity or incompetence, they view it as the method by which societal decision making bodies, acting as coalitions of interest groups, can arrive at compromises. Related issues for this research are: to what extent do middle and senior managers actually use this process? In what aspects of "muddling through" could CBIS be useful? How?

Political process

Allison's Political model is a more subtle model of organizational decision making, difficult to structure and, therefore, to computerize. Managers are seen as players in a game in which negotiation among many groups leads to an outcome. Bargaining takes place along regularized circuits among managers positioned hierarchically within the organization. Differences in roles, responsibilities, perceptions and priorities among players focusing on slightly different facets of a complex issue may permit each player to expect that someone else will do what was required. "Where you stand depends on where you sit."

Based on this political metaphor, Allison suggests an number of sources of power, some of which relate to the use of information systems by managers: control of scarce resources; the use of organizational structure, rules and regulations; control of decision processes; control of knowledge and information; the ability to cope with uncertainty; and the control of technology.

From a research point of view the question is: how can a CBIS be used to improve organizational decision making in each paradigm? Traditionally, developers of CBIS have worked primarily on the basis of the rational model of decision making in organizations. Whether or not this assumption is valid at the lower (and even middle) levels of an organization it is certainly unlikely to be relevant in most situations faced at the levels of management of interest to this research.

O'Brien's model

A final model which supported this investigation and understanding of the actual problem solving processes used by managers was that of O'Brien [1988] who recognized that all data processing, whether by humans or CBIS, performs five basic functions - input, processing, output, storage and control. From the point of view of the researcher this model was applied in two stages. The first was identifying the ways the decision maker performed each of these functions at each step of the decision process and the second stage was defining how a CBIS could support each of these functions at each stage.

4.5.3 Optimising/satisficing & heuristics

The goals of the decision maker in a given situation are important constraints on the model he will adopt and the processes he will use to deal with that situation. March and Simon distinguish between optimal and satisfactory results to a problem situation:

> "An alternative is optimal if: (1) there exists a set of criteria that permits all alternatives to be compared and, and (2) the alternative in question is preferred, by these criteria, to all other alternatives. An alternative is satisfactory if: (1) there exists a set of criteria that describes minimally satisfactory alternatives, and (2) the alternative in question meets or exceeds all these criteria. [1958, pg. 140]

Simon has argued convincingly that the satisficing approach to problem solving fits the limited information processing capabilities of human beings.

> "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behaviour in the real world-or even for a reasonable approximation to such objective rationality." [1957, pg. 198]

That is, decision makers constantly resort to gross simplifications when dealing with complex decision problems. Morgan expanded on this by arguing that

> "people (a) usually have to act on the basis of incomplete information about possible courses of action and their consequences, (b) are able to explore only a limited number of alternatives relating to any given decision, and (c) are unable to attach accurate values to outcomes." [1985, pg. 81]

He goes on to support Simon's contention that organizations can never be perfectly rational because all of their non-programmed problem solving is done by human beings whose problem solving ability is limited.

An important concept related to satisficing and bounded rationality is that of the heuristic. This is simply a guideline, rule-of-thumb. ritual, model or any other device used by a decision maker to avoid a complete enumeration search or the use of a complex optimising mathematical model. In a seminal work on individual decision making, Taylor gave the following definitions of algorithm and heuristic:

> "An algorithm is a process for solving a problem which guarantees a solution to a problem in a finite number of steps if the problem has a solution ... A heuristic is a process for solving

> a problem which may aid in solution, but offers no guarantee of doing so." [1965, pg. 73]

Almost all computer-based information systems in use in organizations today are based on algorithms. If managers are to be supported in solving Simon's ill-structured problems software based on heuristics (and the flexibility and user friendliness that implies) will have to be developed. It remains to be seen, however, whether managers feel that are well served at the simple algorithmic level. If not, then the highest benefit for an investment in CBIS for managers will still be in the traditional data processing methods.

4.6 Information and problem solving

A term that is used frequently throughout this report and which is, in fact, a driving force of this research, is "information". The word itself comes from the Latin "informare" - to give shape to - but what does it mean as it is applied in this research?

Luce and Raiffa [1957], among others, described three level of knowledge. Certainty is the rare situation in which the decision maker knows not only what possible states of nature he is facing but which of them will actually occur. Risk is the situation in which the states of nature are known but only probabilistic data on the relative chance of occurrence is available while uncertainty is the situation in which the decision maker has no reason to believe that any state of nature is more likely than any other and, in fact, may not have a good idea of which states of nature may occur or what alternative strategies are available.

Since, in the normative problem solving situation, it is always best to be in a state of certainty a manager will attempt to move from a state of uncertainty to one of risk and from risk to certainty. In operational terms information is whatever moves one closer to certainty.

Is more information always better? There are three aspects to this which are of interest in this research. The first is the concept of information economics. How much of its resources should a firm be willing to spend to gather more information in relation to a specific problem? For example, McDonough [1963] points out that the Law of Diminishing Returns applies to information just as it does to any other corporate resource.

It is essential to keep in mind that the cost and value of information, unlike those of a specific product or service, is subjective. This means that at some point someone has to decide that enough information has been collected by at least imputing a cost and a benefit to further effort. How this is done in different organizations or different types of organizations is one issue addressed (indirectly) by this research. How well is this done now? How would the use of computers by senior managers affect it?

Related to the question of valuing information is that of valuing effort. For example, in a direct test of the impact of accessability and quality of information on information source use, O'Reilly [1982] found that, although decision makers recognized sources of high quality, they used sources that provided lower quality information but were more accessible. He explains this in terms of the costs involved in obtaining information from the better quality but less accessible sources. Time constraints and organizational rules may also have been factors. Given such explicit recognition of a trade off, can the computer improve quality and accessability at little or no cost?

The second problem in terms of "more information" is that, as one ascends the organizational hierarchy, one is faced by more and more problems for which no amount of search can ever move one to a point of certainty. How successful are managers at recognizing that and dealing with it? Related to this is the question of how useful a computer-based information system can be supporting these less and less clear cut situations.

A third possible problem with information is "information overload". Miller [1960, pg. 697] has suggested that the individual may use one or more of several "adjustment mechanisms" when confronted with an over abundance of information:

(a) omission - temporary non-processing of information;

(b) error - processing incorrect information, which may allow the system to return to normal processing afterwards;

(c) queuing - delaying the response during a period of high overlap of information input in the expectation that he can catch up during a lull;

(d) filtering - neglecting to process certain categories of information;

(e) cutting categories of discrimination - responding in a general way to the input but with less precision than would be done at lower input rates;

(f) employing multiple channels - processing information through two or more parallel channels simultaneously; and

(g) escaping from the task.

Can Miller's "adjustment mechanisms" be computerized or avoided through computerization?

Finally, what does information "look like"? That is, what are its relevant characteristics? Fuglseth and Stabell [1985] summarized the characteristics that normative literature had implied were important: localization (internal or external); institutionalization (formal or informal); periodicity (regular or irregular); accessibility (comes regularly or has to be ordered); frequency of use; scope; level of aggregation; time perspective (historical or toward the future); actuality (current or old) and accuracy. An important issue which emerged as this research proceeded was the effect that managers <u>perceived</u> that the computer had on these characteristics.

4.7 Decision making in groups

Although independent decisions do exist even at relatively high levels of the organization, it is more likely that a decision will be made in an "interdependent" situation (see the section on Group tasks above).

That is, the manager will have to coordinate some or all phases with other parts of the organization.

A general but useful definition of a decision group is that given by DeSanctis and Gallupe:

> "a decision-making group can be defined as two or more people who are jointly responsible for detecting a problem, elaborating on the nature of the problem, generating possible solutions, evaluating potential solutions, or formulating strategies for implementing solutions." [1987, pg. 590]

It is important to recognize that group work (primarily meetings) meets two needs. Task needs are those directly related to getting the job done while social needs deal with process issues such as tension release and solidarity (e.g. Bales [1950]; Blake and Moulton [1964]). Although computer-based tools are likely to be valuable in dealing with the first need the second is more likely to militate against their use.

The group decision has the advantage of being able to bring a collection of specialists' skills to bear on a problem but the disadvantage of requiring a possibly complex process to deal with each aspect of that problem. Eden [1990] describes that as the multiplicative effect of Process times Content. Can computer support reduce the effect of such complexity?

This research was interested in how, how much and why all (or any subset of) managers in each organization used - or did not use - computers to support any aspect of the group decision process.

4.8 Decision making and computer-based tools

What can computers do to actually help managers deal more effectively with the types of problems they face on an individual or group basis? In terms of the relationship between the individual, CBIS and the process of solving problems Zmud pointed out more than a decade ago that:

> "The variations in cognitive behaviours attributable to individual differences as well as the documented limitations inherent to human information processing and decision behaviours provide ample opportunities for designers to provide MIS that extend the decision making capabilities of organizational members. Although some research in this direction has been pursued, much remains unknown about how to best support the individual decision maker throughout the entire decision process: problem finding, problem structuring, solution generation, analysis and choice. Past studies have primarily addressed issues on information presentation. Future studies would benefit from the adoption of a decision support system, rather than an information system, perspective." [1979, pg. 974]

Bahl and Hunt [op. cit.], in an article discussing the problems of designing DSS for a variety of problem solving processes, summarized much of the past discussions of "models of choice" into four classes:

1. Type R Models - These are the basic rational models described by March and Simon [op. cit.] as optimising. This class of models sees a problem situation as having four basic characteristics: (a) "simple" information processing requirements; (b) complete capability to perform the required data processing task; (c) static and determinate conditions of action and (d) the possibility of optimum solutions.

These models see organizational level decision making as either linear aggregates of separate individual decisions or the action of a single "leader" decision maker.

Clearly, these choice models are the most amenable to computer support and, in fact, this is the assumption behind most existing computer systems in organizations.

2. Type B Models - these are "bounded rational" models which are R type models qualified by the assumption of systemic uncertainty, including ambiguity about the problems themselves. They describe two types of B choice models. Sub-type B1 models are the classic Simon models which assume a decision maker who is confronted with complex information and who has limited capacities for processing it. Sub-type B2 models go even further and assume also that the decision maker is systematically biased due to personal characteristics, social context and so on.

This type of choice model implies an orientation to the individual decision maker and requires a different type of computer tool than the data and process oriented R model.

3. Type F Models - These go beyond the type R or type B models in that they consider the context of the decision as an inherent part of the model. Choices are subject to evaluation on pluralistic standards which include explicitly political as well as technical criteria.

Bahl and Hunt point out that this type of choice model is "programmable" only at the very general level of helping a manager or a group gather data - the evaluation remains a human activity.

4. Type N Models - in this class are included all choice models which are "frankly non-rational. They ... conceive of decision making as subject only to post hoc analysis and non-determinative rationalization of prior action." [op. cit, pg. 85]

They suggest that computer support can only provide limited environmental scanning in support of this class of decision making.

Most existing CBIS fall within the R model while the types of processing that this research is most interested in investigating falls under the B1 and B2 classifications. This model was useful in the research because it helped structure data on existing applications, on enhancements desired by managers and on the types of tools that could meet needs that are, as yet, unsupported by computer-based tools. For example, many managers are interested in more or better R type tools and few showed understanding of, or interest in, type F tools.

To help inject more rationality or, at least, more structure, into problem solving there are a number of types of support a CBIS can provide to a decision maker at the process level:

1. it can serve as a supplement to the decision maker. This may consist of helping him get (or stay) organized or helping him remember, organize data or try out alternatives.

2. it can serve as a control on the decision maker, providing feedback (which may lead to further decision making) or it can have, imbedded within it, boundaries and constraints which will guide him.

3. it can prod the decision maker. For instance, Hedberg and Jonsson [1978] recommend the design of "semi-confusing" information systems to help overcome inertia.

4. it can teach the decision maker. Tools such as expert systems can embody decision models and experience from the decision maker's predecessors and other points within or outside the organization.

4.9 Conclusion

This chapter has examined the concepts of the organizational function, the task, the activity and the nature of problems dealt with by managers to develop a coherent description and a better understanding of what managers actually do, what forces act on them and how CBIS might relate to their jobs.

The preceding theory and concepts demonstrate that, unlike clerical level work, management has aspects that will continue to restrict the nature and extent of computer support. The characteristics of the problems faced; the sources and structure of information; the need for multiple types of communication; the "non-rational" aspects of the organizational decision process and the psychological limitations of individual managers will all contribute to this.

Computer-based Information Systems and Individual Managers

This chapter begins with a brief description of the types of computer resources available to organizations today. It goes on to discuss the evolution and current status of the main classes of applications used in modern organizations, stressing their effect on the individual user. Methods of developing computer-based applications, particularly as they relate to managers, are reviewed and the factors behind the relationships between user managers and the central computer resource are discussed briefly.

The goal of this chapter is the evaluation of the relationships between the concepts and practices of the MIS field and the actions and intentions of the manager/users interviewed.

5.1 Introduction

A key factor in analyzing the manager's use of, attitude toward and intentions for computer-based tools must be the tools themselves. During the past twenty years organizations have been bombarded by rapid changes in the computer field. Among those that have had the strongest effect on managers are:

- the rapid drop in the cost of hardware along with concomitant increases in power and accessability;
- the creation and rapid evolution of microcomputers;
- increases in the variety, abilities, "user friendliness", and speed of acquisition of software along with a rapid drop in its cost;
- the development of languages which allow the non-technical user to access or even create data and reports;
- the accessability and flexibility of data files through database management systems; and
- the creation of extensive, inexpensive and accessible telecommunications networks.

This final chapter of the theory section examines the topic which ties together the organization, its environment, individual managers and their jobs in terms of the goals of this research. Because the topic of computer resources is far too extensive to be dealt with completely a set of issues felt to be most relevant to this research are discussed below. These are: the classes of resources available to modern organizations; the types of applications found in most organizations; the methods which can be used to develop or enhance such applications; and the relationships between user/managers and the organization's central computing resource.

5.2 Resources available

Although the computing resources available to managers in organizations vary widely, they must perform the full range of functions described by, among others, O'Brien [1988]: taking data in from the system's environment; storing those data efficiently; processing new or stored data; producing output for managers in a usable format; communicating with users and/or other systems and, finally, providing some level of control over all of these activities. To perform these functions all computer applications use a mix of six types of resources: hardware, software, telecommunications, data, procedures and personnel[1].

5.2.1 Hardware

Traditionally, three classes of computers have been discussed in terms of use by organizations: mainframes, minicomputers and microcomputers. But, from the point of view of users, this can be simplified to two groups.

[1]The resources available to each organization which took part in this research are described in Appendix II.

Central computers, usually mainframes or minicomputers, are those under control of a formal, central group such as "the computer centre". All six organizations examined in this research had such a central facility although the size and quality of the central computing resource varied.

The second hardware resource for user/managers is microcomputers. These were located in the users' area of responsibility or were used by technical specialists in, for example, Finance or Engineering to support other functions. The process for acquiring them varied widely from organization to organization as did the types and intensity of use.

5.2.2 Software

Software is the generic term for all computer programs which are running, in this study, on either the central computing facility or on a "local" computer. It also has two main classes.

system software - includes all the programs which reside in the computer to ensure smooth operation of the system. An example is DOS (the Disk Operating System) in IBM-type microcomputers. Because this is, or should be, transparent to managers it was not discussed explicitly in this research.

application software - includes all the programs which actually "do the work" for the organization. For most managers this is the only type of programming that they are concerned about.

5.2.3 Telecommunications

Telecommunications is a combination of hardware and software which allows one piece of hardware to send data and instructions to another. It may be as simple as a terminal connected to the central computer in one room or as sophisticated as a computer in Nova Scotia transmitting data at high speed over a common carrier network to a computer in Singapore.

5.2.4 Data

This aspect of the organization's computer resources includes all data stored on a computer or in a form that can be readily accessed by a computer (e.g., bar codes). For many years data on specific aspects of the organization were stored in separate files on the central computer. For example, a manufacturing firm might have a payroll file, an inventory file and a customer file, among others. Many organizations, including all of those examined in this research, still store most or all of their data in this type of file. The separate nature of the files contributes to control but makes integration and creativity difficult, particularly for non-technical users.

During the last twenty years a type of system software known as Database Management Systems (DBMS) has been acquired by many larger companies. Ideally, this allows the data from previously separate files to be blended into one large database, eliminating redundant data, increasing data validity and allowing easier access to data by non-technical users. The cost is measured not only in dollars but in administrative overhead and slower processing of data.

5.2.5 Procedures

This refers to all of the practices within the organization which have to do with acquiring or using the computer resource. They range from written policies and procedures concerning acquisition of a microcomputer to a technical description of how to access a specific file. Some organizations have thousands of procedures while others have very few. In some organizations they are clearly codified and written down while in others they have the form and force of folklore.

As the research proceeded it became clear that this aspect of the computing resource is considered important by many managers. The existence (or non-existence), the form and the enforcement of procedures concerning many aspects of CBIS can affect not only current use but also intentions and attitudes.

5.2.6 People

This aspect of the computer resource can also be divided into two groups.

managers - this group was both the most indirect aspect of the computing resource and the primary focus of this research. In fact, this research could be summarized as an investigation of whether these people were really part of the computing resource and, if so, how were they linked to it and how should they have been linked?

support personnel - this class of personnel was, for most of the history of computing, located near the computer, emerging to provide service to users when it became necessary. They include systems analysts, systems designers, application programmers, system programmers and computer operators.

As the users in departments or divisions served by the central facility have become more sophisticated concerning computers a second type of resource person has evolved. These are specialists who work directly with a subset of the organization. These may be employees in a particular function such as Accounting who have taken an interest in computing and have gradually become the recognized "specialist" in that area or they may be computer staff who have moved out into a user area for some reason.

A third type of non-central resource was a group of technical staff who were dedicated to dealing with users in general, particularly for training or to support their use of microcomputers (they are usually located in an Information Centre).

5.3 Classes of applications

Because the users' point of view is based on applications rather than any specific aspect of technology, the development of computer use in organizations through the years will be described in those terms. Different "clusters" of applications have evolved over the years and are described below.

5.3.1 Transaction Processing Systems (TPS)

Looking back over the history of computers in organizations it can be readily seen that they, like their human users, began at the lower levels of the organization and worked their way up. Transaction Processing Systems (TPS), the earliest class of applications, are intended to perform simple "cost reduction" and "clerical replacement" functions. Such applications process high volumes of clearly defined transactions, store data in massive independent files, perform limited processing and produce voluminous lists of activity detail. In such applications the users are basically suppliers of specifications and input documents and consumers of output (of sometimes questionable value). Considering the relatively large investment a firm makes in such systems it was not surprising that efficiency and cost reduction were key criteria in choosing both hardware and applications.

From a management perspective the key issue in the adoption of a transaction processing system is efficiency. Does this tool allow the organization to do more work with the same resources (or the same work with fewer resources)? For a tool aimed at high volume, well structured tasks usually encountered at the lower levels of the organization (such as A/P or customer billing) such evaluation is relatively trivial - and the results are usually positive.

Even at the middle and senior levels of management involved in this project this basic class of applications proved to be a major concern and related more directly to their jobs than had been thought.

5.3.2 Management Information Systems (MIS)

The second class of applications to evolve in organizations was management information systems (MIS) which are intended to help managers at middle levels of organizations control short to medium term responsibilities by producing reports based on the files gathered in related TPS. According to Simon:

> "There is no single, definite description of just what a management information system is. The phrase has to be understood sociologically rather than technically. In the early sixties, as more and more computers were introduced into companies for accounting purposes (i.e., mainly for score-carding and attention directing uses), an interest arose in putting the information produced by these systems to other management uses. The management information

> system, as typically conceived, was a byproduct of the availability of information gathered initially for other purposes. The design of management information systems most often began with asking what could be done with the information that was already there, not with asking what decisions were being made, and what information would be helpful in making them." [1977, pg. 126]

This growing use of the computer by managers was not without its problems, however, as demonstrated by Ackoff's observations on "management misinformation systems" discussed in Chapter 1.

It is important to point out that, although MIS do use the data, the processing techniques and the management concepts of the earlier transaction processing systems (TPS), efficiency, the underlying goal of those early applications, is not the driving force behind MIS. The measurement of MIS success in organizational terms is effectiveness - does use of the MIS actually make it more likely that a manager would be able to achieve the organizational goals for which he is responsible? It was this aspect of MIS that was of primary interest in this research.

5.3.3 Decision Support Systems (DSS)

In organizations today the only classes of applications that have gained wide acceptance and general use are the two just described - TPS and MIS. But a third, decision support systems or DSS, has developed beyond the conceptual stage over the last dozen years. As has been mentioned, the original interest of this project was the use of this class of CBIS by middle and senior managers. Because of lack of a basis for that work, the approach has changed to a broader set of issues but an interest in DSS in the research has been maintained by focusing, as much as possible, on the less structured aspects of managers' tasks and activities.

The function of information within an organization is the reduction of uncertainty and the role of any computer-based information system is to deliver that information. In the most basic sense of the phrase all CBISs and, in fact, all organizational information systems are "decision support systems" in that they are intended to assist one or more people at some point in an organization to make a more informed and, therefore, better decision. The development of DSS has occurred as a result of the recognition that there was an entire class of organizational decisions that were supported weakly, if at all, by TPS and MIS.

Kottemann and Remus, discussing the relationship among managers, problems, processes and DSS, suggested that:

> "One, if not the primary, goal of DSS is to help decision makers bring structure to ill-structured decisions. This structuring applies not only to the decision problem itself , but also, implicitly or explicitly, to the decision making process. A DSS provides normative support to the extent to which it provides predefined structures for decision problems and for the decision making process." [1987, pg. 135]

Scott Morton [1971] first described this class of models. What he called Management Decision Systems were to be interactive, realtime applications used by the managers themselves to solve ill structured problems.

Over the last twenty years a number of conceptual models of DSS have evolved from this.

Keen and Scott Morton developed what has become the basic definition of a DSS. They claim that a DSS implies the use of computers to:

> "1. Assist managers in their decision processes in semistructured tasks.
>
> 2. Support, rather than replace, managerial judgement.
>
> 3. Improve the effectiveness of decision making rather than the efficiency." [1978, pg. 1]

Based on this they compared MIS and DSS. MIS were described as focusing on structured, organization wide tasks, intended to improve efficiency through control and only indirectly supporting managerial decision making. DSS were described as useful in decisions where there is sufficient structure for computer and analytical aids but where the manager's judgement is essential, intended to improve individual effectiveness and operating under the control of the manager. This model, with its operational approach, has been particularly useful in guiding this research. The distinction between efficiency and effectiveness; the focus on support and the individuality of the application were all points raised in the interviews.

Huff has pointed out a fundamental difference between the more sophisticated types of tools implied by the term DSS and earlier applications:

> "DSS are inherently *discretionary* systems - a manager or staff assistant may choose not to use a DSS in solving a problem if the DSS, for

whatever reason, is not perceived to be of value." [1985, pg. 2]

This means that, for CBIS intended for middle and senior managers the decisions concerning appropriateness and effectiveness will depend not only on the problems and specific activities being supported but, to a great extent, on characteristics of the individual such as experience, training and even bias.

The popularity of the DSS concept among theoreticians and academics is based on a number of assumptions:

- There is a class of organizational problems identifiable as "semistructured" or "semiprogrammed".
- That such a class of problems, if it exists, is amenable to computerized solution or support.
- That the types of managers who are faced with these problems have the time and/or the interest to use or even develop a computer based support tool.
- That the technology exists to develop such tools and that it can be applied effectively to the class of problem faced by a manager.
- That such tools would be cost effective in the sense of producing "better" decisions regarding semistructured problems.
- That having managers personally use CBIS to support problem solving is the most appropriate way to use the tools and the manager's time.

Determining the extent to which these factors were reflected in the reality of managers' activity was another goal of this research.

5.3.4 Group Decision Support Systems

A common characteristic of the problem solving done by the managers who took part in this research was that most is actually done in groups. Because of this it is useful to examine briefly the concepts behind group decision support systems (GDSS).

DeSanctis and Gallupe state that GDSS are intended:

"to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing, or content of discussion." [1987, pg. 589]

They go on to describe three levels of GDSS:

"Level 1 GDSSs provide technical features aimed at removing common communication barriers, such as large screens for instantaneous display of ideas, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members [of the group]". [ibid, pg. 593]

Techniques they believe could be appropriate for organizations using a Level 1 GDSS include, networked computer terminals, scheduled electronic meetings and general electronic mail and providing "mock agendas".

"Level 2 GDSSs provide decision modelling and group decision techniques aimed at reducing uncertainty and "noise" that occur in the group's decision process." [ibid, pg. 593]

Techniques propose for this level include planning models such as PERT, utility and probability assessment models and an automated Delphi model.

"Level 3 GDSSs are characterized by machine-induced group communication patterns and can include expert advice in the selecting and arranging of rules to be applied during a meeting." [ibid, pg. 594]

They suggest that tools in such a GDSS should include Automated Roberts Rules of Order, automated facility for rule selection and application and an "automated counsellor".

All of the tools suggested for a Level 1 GDSS are available in the market so the limitation on use of such an aid is administrative. But it is important to point refusing to use GDSS - it remains to be proven that such tools are cost efficient or effective management tools. Level 2 and level 3 GDSS are still concepts since, in addition to the cost and effectiveness issues, the problem of creation and use of some of the tools themselves remains.

DeSanctis and Gallupe also point out a number of other reasons why "we are prohibited from constructing an architecture suitable for all group decision support situations, even within a given GDSS level" [ibid, pg. 595].

> "There is considerable variation in information exchange patterns across groups and generalized stages of decision making cannot be empirically verified... There is little conclusive knowledge regarding how structure can be added to a group's decision process to yield better decision making...[where tools exist] the problem becomes selecting among many models or techniques to build into a system." [ibid, pg. 595]

In a recent collection of theory and research articles on GDSS Eden [1990] concluded that, in successful group decision support systems the key factors were: one or more fulltime facilitators (consultants); the use of traditional media such as flip charts and blackboards (computer-based tools were neither common or sophisticated); and that GDSS are primarily successful in supporting small, specialized groups. Again, not strong support for the development, or acquisition of, complex computer-based tools to support group decision making in the organization.

Since GDSS is the newest and most complex form of DSS it is not surprising that few examples of successful "real world" applications exist. However, the concept was useful in this research for three reasons. First, it forced an evaluation of what technologies were in place in each organization which could be used as part of a GDSS. Second, it focused part of the data analysis on the degree and type of group problem solving activity in each organization and, finally, it forced consideration of the relevance (and the possibility of actually using) of the various levels of GDSS as solutions to problems in each organization.

5.3.5 Expert Systems (ES)

To develop an expert system one or more technical staff members work with one or more "experts" within an organization; extract their knowledge, understanding and reasoning processes concerning their area of expertise; and then build it into a computer model.

> "An expert system makes use of expertise that has been gathered from a human expert about how to solve a specific problem or set of problems. The potential benefits of such systems range from the distribution and omnipresence of expertise to the formalization and preservation of an organization's reasoning knowledge." [Holsapple & Whinston, 1987, pg. 3]

Newquist [1987, pg. 173] suggests five operational reasons why a company would go to the trouble to develop an expert system:

1. To preserve knowledge that might be lost through retirement, resignation or death of the company's acknowledged expert in any field.

2. To "clone" an expert mechanically so that his knowledge can be disseminated.

3. To store information in an active form - a knowledge base - rather than a passive one - a textbook or a manual.

4. To give novices an aid that will help them think the way more experienced professional do.

5. To create a mechanism that is not subject to human failings like fatigue and can hold up in positions where information must flow constantly.

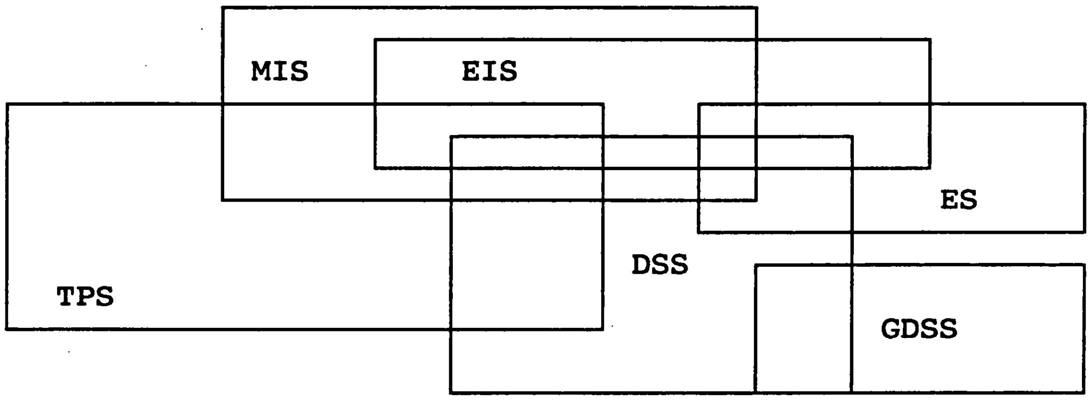
Although none of the organizations which took part in this research have any expert systems in place the concept was useful in the research. The extent of each manager's familiarity with this class of CBIS was examined and observations were made concerning the potential for Expert Systems in a number of areas of each organizations given the types of problems dealt with, the tasks and the activities required and the attitude of the managers.

5.3.6 <u>Executive Information Systems (EIS)</u>

Basically this term seems to be a marketing concept more than a computing tool. It includes any application which is to be used directly by a senior manager to acquire and evaluate information. EIS seem to include telecommunications (electronic mail or voice mail); a local spreadsheet; a word processing function; some way of accessing remote files; a "file conversion" module; and graphics capability. The sources and validity of the data, the specific tools to be used to process it, the telecommunications and hardware involved and even the presentation techniques are still vague.

Although the classes of applications available to organizations and to managers have been discussed separately there is, in fact, significant overlap among them as is shown in Figure 5-1.

Figure 5-1: The classes of applications



5.4 Developing Applications

There are a growing number of methods for creating new or enhanced business applications available to organizations and to individual managers, each having its advantages and disadvantages, but there remain two main sources for most organizations: doing it "in-house" or having it provided by an outside source.

5.4.1 In-house development

The system development life cycle

The SDLC method of developing applications has been used by organizations since the 1950s and consists of a step by step creation of an entire application from system analysis to training the users. It can take years to complete, involve large development teams, cost millions and is the most remote from all levels of users, including managers. It is still in use but, in a rapidly changing world with more and more good packages available, is less and less likely to meet the information or budget needs of managers.

Managers must be familiar with this development approach for two reasons. First, many, if not most, CBIS that affect them and their people were developed in house at some time in the past. The reliability of these systems; their relevance in changing situations and their lack of flexibility are all problems that middle and senior managers may have to deal with. Second, some specialized applications must still be created using the "system development life cycle" in-house. Long waits, "disappearing staff or projects", poor documentation, rigid processing and difficult alterations are examples of the problems that can occur when this technique is used.

Prototyping

Prototyping is an alternative approach to developing applications in-house that does not require the multi-year schedules and multi-million dollar budgets of the "systems development life cycle". A simple, "bare bones" version of an application is developed, used by the relevant people and then modified and/or expanded according to their needs. Rather than laying out the structure and processing of an entire application years before it will be implemented, prototyping deals with the organizational reality of changing goals, constraints and even people. It is an iterative approach which will eventually lead to a complete and up to date model of the application.

End user computing

End user computing is a term that has achieved acceptance both in MIS research and by managers during the past decade and it was one of the "assumptions" on which this research was originally based. It is a catch all term and includes program creation using procedural languages such as COBOL or Basic; general packages such as Lotus 1-2-3; specific packages such as AccPac (accounting); fourth generation languages and report writers.

Fourth generation languages

This term was raised by managers a number of times in discussions of end user computing. 4GLs are intended to be used by non-technical staff to write programs, create reports and access files. Because they require a lot of computing power they are normally installed on the central facility and can be used through terminals. Managers at two of the sites in this research reported having available, but not using, a 4GL.

Report writers

A report writer is a software package which allows users to access files not contained in the package so that records can be queried and reports created. They are particularly useful in situations in which users must access separate files stored on a central computer. They require some technical preparation and training but are easier and faster to use than traditional procedural languages such as COBOL. Again, managers at a number of the sites investigated reported having a report writer available but none was using it.

5.4.2 External sources

Two external sources are available to most organizations.

Outside experts

This can range from advice on a specific problem to creation of one or more computer programs through performing the complete SDLC and turning the finished product over to the organization. Because it fell outside the goals of this research it was pursued only when raised by a manager.

Packages

This is the most common and, generally, the fastest way to create a application for an organization or for any sub-unit. A computer package is a set of "pre-written" programs that an organization buys from an outside source. They are not written for that organization but for the general market. The general nature of a package means that it will contain some modules (functions) that the organization does not want and is missing some that it would like to have. On the other hand it usually implies good testing and adequate documentation. Depending on the size and quality of the package the supplier may provide training and even customize the programs for the purchaser.

Packages actually fall within both the internal and external sources since they are often modified within the organization or used to develop other applications. Managers are usually concerned with not only the abilities of the package but also with the process of acquiring and installing it and, of course, the requirements of using it. This was a topic raised by almost every manager who took part in the project.

5.5 The relationship with the computer centre

A final, but important topic relating to the manager's use of, and attitudes toward, computer-based tools is his relationship with the components of the traditional central resource.

As Nolan [1973] proposed almost twenty years ago the use of CBIS in organizations and sub-units passes through stages. Huff, Munro and Martin [1988] have suggested that there are stages within stages. For example, once an organization or department has reached the stage of end user computing they will pass through stages in that activity ranging from "isolation" to "distributed integration".

Managers at advanced stages of "contagion" are more likely to be able to communicate with the staff in the computer centre but are also likely to make complex demands on them. They would be more aware of what they do not have, be willing to do more themselves and to look to other sources for support. On the other hand, managers in areas still struggling at the simpler stages of computer support are more likely to require hand holding and traditional applications and could resent the areas with more sophisticated resources and support. Not only did the organizations in this project demonstrate range of these stages of sophistication but variations were apparent within organizations as well.

All organizations face restrictions on their assets and, since computing can be capital intensive, it is often a source of friction. The definition of what resources will be allowed, the availability of those resources, their allocation, their methods of use and the training and support that should go with them can all cause problems between users and technical staff. Most large organizations, including three which took part in this research, have attempted to deal with this set of problems through a corporate-wide allocation committee which includes both users and technical management. But, as this research showed, success at smoothing the relationship between users and suppliers of computer support has been limited.

Lederer and Mendelow [1987] investigated this issue from the computer centre manager's point of view and found that they identified a number of communication issues including: management lacks IS understanding; top management fails to communicate its objectives in IS terms; IS and operational managers have different interpretations of objectives; computer staff are viewed as "techies"; line management is intimidated by IS technology; and the request by IS management for the line manager's objectives can apparently be seen as threatening.

Clearly the ongoing problems between users and the computer centre staff are a "two way street".

5.6 **Summary**

The relationship between managers and the computer(s) in their organization has many facets. The simplest is that of resources, which were either available or not and which could be delivered in many different ways.

The second is defined by applications. Two classes of applications (transaction processing systems and management information systems) have been identified which exist in all firms and three (decision support systems, expert systems and executive support systems) which exist in a few firms.

Another relevant aspect of the relationship between user and tool was the way the application is created (traditional use of the system development life cycle, prototyping, end user computing, buying packages or a combination of these).

The final topic evaluated was the ongoing communication problems between user managers and the management and staff of the central computer resource.

SECTION III - Developing a Methodology & Process

This section presents theory and prior research underlying the choice of a research approach, specific research methods and tools and a process which would meet the goals of this project and it explains those chosen.

It begins with a brief overview of the main classes of research methodologies available and discusses their applicability to this project. The set of methods and tools actually used are described and their choice is explained. The process by which they were applied is also outlined.

This section is intended to ensure that the reader understands the methods used to gather the data reported in the following section and that the data analysis, findings and conclusions are grounded in a unified framework of methodology, tools and techniques.

Developing a Methodology, Tools and Process for the Research

This chapter discusses the methodologies available for research in MIS and describes the actual method, tools and research process chosen to achieve the goals described in Chapter 1.

6.1 Introduction

Chapter 1 outlined the descriptive and analytical goals of this research; discussed the need to focus on managers operating in a complex context in order to acquire the data needed to meet those goals; developed a starting point for the research in terms of the environment, organizations, functions, tools and individuals; and examined the main computing issues to be investigated in terms of past research in MIS.

In order for this research to deal successfully with all of these factors it was necessary to develop an approach which included and coordinated them and which allowed the flexibility required by such a complicated research situation. What methodologies, tools and techniques are available and appropriate for a project which begins without testable hypotheses or a firm set of procedures and which must investigate not only individuals but the entire context in which they work and which must rely to a great extent on the perceptions of these individuals rather than "hard data"?

6.2 Research methods

6.2.1 Classification of research methods

A number of researchers (e.g., Diesing [1972], Moore [1983], Udy [1965]) have described sets of methodologies and discussed the appropriateness of their use in a variety of situations.

1. The most specific methodology is the use of Mathematical Models to determine, among other things, whether all components of a situation have been considered, what the most appropriate relationship among them are and what the sensitivities of those relationships are.

2. The next narrowest approach is the Laboratory Experiment, in which a strictly limited subset of the aspects of the system of interest are tested in a carefully defined and controlled situation while the great majority of the aspects of the situation of interest are assumed away or held constant.

3. The Field Experiment is similar to the laboratory experiment in that it focuses on a controlled set of factors but (a) it takes place in the context of the issues being investigated and (b) it takes into consideration some aspects of that context.

4. The Survey method allows the researcher to examine more complex situations than those which can be dealt with in an experiment. Many more subjects can be questioned, it can cover more material than most experiments, it is simple to replicate and the data can be evaluated using standard statistical models. But it is inflexible and does not usually "dig behind" the answers given.

5. The Field Study is the least specifically defined but includes most forms of fieldwork such as observation, comparative analysis and case development. This type of research allows the scientist to follow the development of a situation minute by minute and deal directly with unexpected developments. Since the observer is part of the situation his/her observations and insights become part of the data.

The current level of understanding of the relationships of senior managers with computers, and the causes of these, precludes the use of such narrow and specific approaches as the first three. As yet, we have only a limited understanding of the factors at work and their relative strengths and interactions.

Diesing [op. cit.] observed that, for the social scientist, the survey method holds a number of advantages over the experimental method, including the ability to deal with complex subject matter, the substitution of statistical controls for experimental ones, the ability to combine with other methods and the growing formality within the survey field. But the survey is still a superficial approach to a set of issues for which aspects as basic as a common vocabulary are not established. Our lack of understanding of fundamentals would make it difficult to know if we are asking the right questions.

Scott [1965] points out two factors that must be considered when undertaking research in organizations. The first is that subjects functioning in organizations are bound together in a common network of relations. Second, members of organizations share a common set of values and norms. These points are important to this research because they can affect the role the manager plays, the relationships he develops and the type of data to which he is given access. Any narrow method of study will distort or assume away at least part of this context so that only some type of field work will deal with all the factors of interest.

6.2.2 The ethnographic methodology

Wilson, discussing the ethnographic methodology applied to research into education, makes a number of points relevant to the behaviour of managers in context at the heart of this research.

> "Ethnographic techniques are part of a research tradition that has been developed by anthropologists and community study sociologists. These methods have been found to be useful for gathering certain important kinds of data; in fact, some researchers claim that these anthropological techniques may gather information about human behaviour that is impossible to obtain by the more quantitative methods." [1977, pg. 246]

He suggests that this is caused by two factors. The first is the ecological perspective:

> "Many social scientists believe that human behaviour is significantly influenced by the settings in which it occurs. They, therefore, believe that it is essential to study psychological events in natural settings, and they claim that settings generate regularities in behaviour that often transcend differences among individuals...How does the setting influence people in it? [ibid, pg. 247]

The second factor which Wilson feels supports the ethnographic point of view is phenomenology:

> "Those who work within this tradition assert that social scientists cannot understand human behaviour without understanding the framework within which the subjects interpret their thoughts, feelings and actions. They point out that the natural science approach to objectivity requires the researcher to impose *a priori* limitations on the data, an act which makes it difficult to discover the perspectives of the subjects." [ibid, pg. 249]

6.2.3 The participant/observer method

The most common method for applying the ethnographic methodology is the participant/observer method, which was also developed by anthropologists and whose primary subject matter is a single, self-maintained system. Diesing sees this data gathering method as intended:

> "to describe the organization in its individuality, as a system of rules, goals, values, techniques, defense of boundary-maintaining mechanisms, exchange of boundary-crossing mechanisms, socialization procedures and decision procedures." [op. cit., pp. 5-6]

The participant/observer method requires that the researcher spend most of the data gather phase working at the managers' sites but, since that is where the data for this research are to be found, that can be a benefit rather than a difficulty of this method.

6.2.4 <u>The case study & comparative analysis</u>

Moore [op. cit.] subdivides research approaches used by investigators into more specific classifications than those of Diesing but adds one that is complementary to Diesing's "participant/observer" method - the comparative case study. The case study helps focus the participant/observer method by looking at a specific real world situation, identifying the problems faced by the group or individual, the situational factors which relate to those problems, the alternative solutions available and the solution which best solves the problems in that context.

This case method can be taken a step further by using comparative analysis of organizations in which the same (or similar) problems are examined in a variety of situations. The goal of a comparative, case-based approach is to develop a model of commonalities and differences in the solutions and to define the causes of those commonalities and differences. Udy, discussing this technique, captures succinctly an approach which appeared to be relevant to this project:

> "On any given level it is possible to distinguish a case study, which describes something in detail by analyzing the configuration of its parts, and a comparative analysis properly so called, which seeks generalizations about something by studying several instances of it... The writer thus conceives a 'comparative analysis of organizations' to be any attempt to establish general principles about organizations from the study of more than one organization at once." [1965, pg. 679]

6.2.5 The approach chosen

More than thirty years ago Dean, Eichorn and Dean [1955] suggested fifteen advantages of qualitative research in general. Those most relevant to this research situation are:

1. observation and interviewing are appropriate for non standardized data whereas more structured methods have problems with this.

2. the problem can be structured as the researcher proceeds.

3. the researcher can modify his categories almost continuously to make them fit better.

4. the researcher can select informants who can provide better data as the research progresses.

5. the researcher absorbs valuable information as the research progresses and so can modify his approach.

6. the researcher can move between data gathering and analysis.

Based on these points and the preceding discussion, the ethnographic methodology was chosen to deal with this relatively unexplored aspect of MIS research. Its lack of structure and formality is more than offset by the flexibility and open-ended relationship to those being investigated. More specifically the participant-observer approach was used to do a comparative case analysis of a body of middle and senior managers working in five functions in six unrelated organizations to develop an framework (model) of their use of CBIS, their intentions concerning them and the causes of both.

6.2.6 Research methods in CBIS

Traditionally, research into the use of CBIS in organizations has used narrow methods such as laboratory studies and surveys so, as a last step before actually applying this methodology, it was necessary to ensure that these participant/observer and comparative case study methods could prove acceptable to other researchers in the MIS field.

Van Horne [1973] developed a taxonomy of research methods used in the MIS field - case studies, field studies, field experiments and laboratory tests while Keen [1974] and Gibson [1975] have proposed that the participant-observer method is also appropriate for MIS research. Benbasat [1983] feels that useful research into computer-based support tools falls into three classes: setting independent studies (surveys); studies in natural behavioral settings (case studies, comparative analysis, field studies, field experiments) and studies in contrived settings (lab experiments).

Based on a taxonomy of research methods developed by Hamilton and Ives [1982] which consists of case studies, surveys, field tests, experiments and non-empirical methodologies, Farhoomand [1986] reviewed MIS research articles in six leading journals publishing MIS research. He divided the articles into three periods: 1977-79; 1980-82 and 1983-85 and found that field experiments consistently represented about 3% of research; lab experiments varied between three and five%; surveys were relatively stable over the period at about 22%; case studies grew from about 22 to 25% and non-empirical methods fell from 55 to 35% of reported research.

Benbasat, Goldstein and Mead report a growing dissatisfaction with the types of research information provided by quantitative techniques for a number of reasons including the complexity of multivariate research methods, the large sample sizes these methods dictate and the difficulty in interpreting the results of such studies. Benbasat et. al. looked at the use of case studies in MIS research. They began by defining a case study as:

> "[a methodology which] examines a phenomenon in its natural setting, employing multiple methods of data collection from one or a few entities (people, groups or organizations). The boundaries of the phenomenon are not evident at the outset of the research and no experimental control or manipulation is used." [1987, pg. 370]

They suggest three advantages of the case study method: the researcher can study information systems in a natural setting, learn about the state of the art and generate theories from practice; the case method allows the researcher to answer "how and "why" questions, that is, to understand the nature and complexity of the process taking place; and a case study is an appropriate technique to study an area in which few previous studies have been carried out.

On the other hand Lee [1989] has suggested a number of potential problems that a researcher must guard against with this method. These are: the ability to make controlled observations without being overwhelmed by "confounding influences"; the difficulty of making controlled deductions from the data provided; allowing for replicability; and allowing for generalizability. One of the main goals of the research methodology used in this research is to bring enough structure to the case methodology to avoid, or minimize, these problems.

Finally, Bariff and Ginzberg specifically addressed the participant observer approach from the point of view of MIS research:

> "Both participant observation and the use of selected informants represent potentially useful IS research methods. The typical in-depth, longitudinal study is a productive strategy for an MIS researcher to adopt for collecting rich, process-type data during descriptive studies." [1982, pg. 21]

Clearly acceptance of the empirical approach, particularly case studies and field work, is growing in the MIS field as the increasing complexity of research issues is recognized and there was no convincing argument against using the methods chosen above.

6.3 Gathering the data - tools & techniques

Once the methodology had been chosen the issue became: what tools and techniques are most appropriate for gathering data in a participant/observer situation developing a set of comparative case studies? Three rules were used to choose the data gathering tools and techniques for this research. The most obvious is that they had to actually cover all aspects of the research: a focus on the individual; consideration of the context, including <u>at least</u> the five possible sources of effect described in Chapter 1; considering all of the MIS issues also described in Chapter 1 and useful in achieving the goals of the research. The second rule was based on the need for flexibility in the research. Any tools or techniques chosen must allow for changes in "direction" and for iteration. The final rule was the requirement for "triangulation". Tools and techniques must not only complement each other but must allow for the findings based on one tool to be tested by one or more others. Based on these guidelines the following set of tools and techniques were chosen and applied through the data gathering phase of the project.

6.3.1 <u>The Interview Guide</u>

Although a strongly structured questionnaire would not have been appropriate as the only data gathering tool in an ethnographic project, there was enough definition of the situation (based on the beginning framework and issues defined in Chapter 1) to use a set of questions as an introduction and "path finding device". Because of this a core tool in the data gathering phase was the Interview Guide administered in a series of one hour interviews with the managers taking part in the research.

This instrument began as a brief questionnaire consisting of a few structured and a few open ended questions but grew iteratively in response to feedback from managers and the researcher's observations. This "evolution" has had three effects on the data gathered by this tool.

The first is that they are not, in some cases, "well organized" in the sense that questions relating to the same topic appear in different parts of the Guide. This is because, as a question or question set arose, it was added to the end of the Interview Guide as it then existed.

Second, not all data gathered were used. As the project developed, it became clear that it was necessary to focus on certain aspects of the managers' situations and ignore others if an in depth analysis was to be achieved. Many of the data not used in this thesis will be used in other projects or will lead to further research in other directions.

The third effect was that not all managers interviewed answered exactly the same set of questions, particularly in the early stages of the interview process. The differences were minimal and, where it was possible, Any changes were covered during the next meeting. Although the evolving contents of the interviews led to some complications from the researcher's end it was also one of the most interesting and challenging aspects of this project.

The questions on the Interview Guide covered all five aspects of the beginning framework described in Section 1.5 and were of three types. The first was the traditional short answer question such as "What is the title of your position?" or "How many years have you worked here?". Questions with a limited set of answers which could be coded were also part of this first type. For example, all answers to "Highest level of formal education completed?" fell into one of the following classes:

1 - High school
2 - Technical school
3 - Some university
4 - University degree
5 - Some graduate study
6 - Graduate degree
7 - Other

The other two types of questions emerged as the interview process continued. The second, which constituted the majority by the end of the data gathering process, were open ended questions such as "With what groups, organizations or individuals does your position require that you work or communicate?" or "What significant problems do you foresee in the use of computers in your area of responsibility in the coming two to three years?"

The third type of question, which also emerged as the interviews progressed, was the most structured, requiring answers in either Likert scale[1] or Agree/Disagree form. The questions for each topic came from the researcher's experience as an analyst and consultant, from points raised in the literature or, in most cases, from suggestions from the managers themselves. Space was left at the end of each set of questions for managers to add any topics they felt were missing and relevant. Few did.

The topics for which data were gathered in this way were:

1. Problems related to the use of CBIS in the manager's area of responsibility.
2. Factors affecting the use of computer-based tools in the manager's area.
3. The manager's preferred communication (input & output) methods.
4. The individual's reasons for his limited direct use of CBIS.
5. The proportion of his time spent on specific activities.
6. The impact of characteristics of the organization on the use of CBIS.
7. The impact of characteristics of the manager's area of responsibility (function) on their use of CBIS.
8. The impact of characteristics of a task that make it appropriate for computerization.
9. The manager's preferred characteristics of a computer-based tool.

All of these question sets can be seen in Appendix II and are discussed in Chapters 7 through 11.

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[1]There are two ranges of values in the Likert scales in Appendix II - the researcher used a 1 to 6 range but managers required a 0 on the scales they completed. Before statistical analysis was applied all the answer sets ranging from 1 to 6 were "shifted" to a 0 to 5 range to ensure that all means and ranges were directly comparable.

6.3.2 The Myers-Briggs Type Inventory

Three classes of data concerning individual managers emerged as relevant to this research. The first, demographics, was quite straightforward and the factors of interest (age, education, etc.) were elicited through direct questions and examination of documents. The second, beliefs and attitudes of the individuals, was elicited through both opened ended and structured questions on the Interview Guide as well as a number of the other techniques described below including interviews with other managers and the researcher's observations. The third type of data on the individual was some classification of his personality - as it might affect his use of CBIS.

Rather than attempt to gather this psychographic data "from scratch" most researchers use a standardized set of questions and prepared analysis. A number of these are available including the embedded figures test (EFT), the PF-16 and the Myers-Briggs Type Indicator.

After discussing all of these tools, and others, with experienced researchers in sociology, psychology and education it was decided, for two reasons, to use the MBTI as described in Briggs Myers and McCaulley [1985]. The first reason was that it measures in a relevant form a number of characteristics of the individual which are of interest in this research (such as the preferred method of analyzing data).

The second reason the MBTI was chosen was its history in management research. For example Er, discussing the validity of personality characteristics as they relate to management activity, noted that: "For measuring cognitive style it is generally agreed that the Myers-Briggs Type Indicator (MBTI) satisfies that predictive validity property." [1988, pg. 359]

Mitroff and Kilmann used the MBTI in a content analysis of managers' stories about their ideal organizations and reported:

> "[There is} a remarkable and very strong similarity between the stories of those individuals who have the same personality type (e.g., ST) and there is a remarkable and very strong difference between the stories of the four personality types [ST, SF,NT and NF]." [1976, pg. 193]

Liang, in an award winning investigation of critical success factors of decision support systems, proposed that a key independent variable in the "success" of a DSS is the cognitive style of the user. He used the MBTI as the instrument to classify a manager's cognitive style because "Although there are some other instruments available the MBTI has been extensively used and has been recommended as the best one available for measuring cognitive types in MIS research." [1986, pg. 7]

The MBTI uses a set of "either/or" questions to place each person on four scales: the E/I (extraversion/introversion) scale describes the person's preferred way of dealing with the external world (people, things and events); the S/N (sensing/intuition) scale captures the person's process of perception - how they prefer to gather data; the T/F (thinking/feeling) scale describes their process of judgement - how they prefer to process data and, finally, the J/P (judging/perceiving) scale captures their overall style of dealing with the outside world - whether they generally prefer structure or flexibility in life.

In the MBTI each person is described in terms of where they fall on all four scales. Since he will be on one side or another of each of the four scales there are sixteen (2^4) possible combinations (or personality types) such as ESTJ or INTP.[2]

This research focused on three aspects of the individual personality as reported by the MBTI: Does the manager report a preference for judging (J) or for perceiving (P)? Is the manager an extraverted (E) type or an introverted (I) type? Finally, this research looked at each manager's preferred manner of gathering data (Sensation vs. Intuition) and of processing data (Thinking vs. Feeling). The main interest was in the existence, the strength and the direction of cause and effect relationships between these personality factors and a manager's current and intended use of CBIS. Not only can the managers' personality types be related to their use and intentions concerning CBIS but they can be included in multivariate analysis with the organization,

[2]See Appendix III for a description of the characteristics of the four scales defined by the MBTI and the four approaches to data gathering and analysis (ST, SF, NT and NF)

their function and other possible causes of observed and reported types of use.

6.3.3 Interviews with other employees

In addition to the fifty "core" managers three other types of employees were interviewed. Whenever possible, at least one hour was spent with the superior of each manager taking part in the project. This was intended to provide a sense of the corporate view of each manager's formal position; the tasks he was expected to perform and the problems and issues considered to be part of his "domain of responsibility".

The second type of employee interviewed in this aspect of the research was "local support staff". In a number of cases managers made comments such as "well, Jim (or Jane) looks after creating [computer] reports in this department. You'd have to talk to him (or her)." In some cases these interviews went well beyond technical topics because it became clear how little a specific manager actually understood about the uses and limits of computing for his domain of responsibility - and how much power this could give the "specialist".

The third type of employee which provided support to the "core interviews" were the computer people in each organization who had any responsibility for the computing support of a manager's area. In some cases this was general (e.g., maintenance) while in others the support was very specific (e.g., a Systems Analyst who had been working for eighteen months on a new application for a personnel group).

Although the goals in interviewing all these "ancillary" groups were well defined, the interviews themselves were unstructured and each took on a life of its own. Their value ranged from insightful to useless, depending on the interviewee's relevance and attitude. The data gathered from these sources are recorded in Appendix I.

6.3.4 Other question sets

In addition to the Interview Guide two other sets of structured questions were administered within each organization. The first concerned the organization itself and investigated such factors as its relationship to its environment; the nature of the industry; the firm's position; the age, size and style of the firm; its internal structure; the evolution and its use of computers; its driving force and culture; and the locus of decision making.

The second set of questions addressed directly the specifics of computing within each organization and was used to structure interviews with computer staff (and, in some cases, technical people within user areas). It focused on technical specifics such as types and location of hardware, packages available and training provided to the managers in the firm. Examples of both sets can be found in Appendix II.

6.3.5 The use/attitude worksheet

An important set of data were those concerning the relationship between the manager's beliefs and attitudes concerning CBIS and his current use of CBIS and his intentions concerning them over the next two or three years. Some questions in the interviews dealt directly with these but to get a better sense of differences between his organizational function and himself and to identify contradictions a more complex method was used.

After the interviews with a manager were completed the entire Interview Guide was reviewed and a brief "worksheet" was completed for that manager. On this worksheet current use of computer-based tools, attitude toward them and intentions concerning them were ranked on a scale of 0 to 5 for both the function he performed and for his personal use, resulting in six scales. (An example of this tool can also be found in Appendix II.)

6.3.6 The researcher's observations

Another aspect of the data gathering (perhaps most closely related to the participant factor) was the researcher's own observations. These were used to guide the development of the research but they also became part of the data analyzed. Observations on a number of topics including the technology in the manager's office; his apparent comfort with technology; his relationships with peers and subordinates; his use of reference material (hard copy, human or online); his propensity to "multi track" and his apparent attitude toward the project and toward computers were recorded on an open-ended worksheet.

Some observations, however, were more subtle. For example, a number of managers expressed a desire to do more data analysis but they also explained that they had some degree of unhappiness with the data currently available. Put together, these two comments show a gap between the reality of data available and the managers' wish to be more active.

6.3.7 Review of documentation

Examination of internal and external documentation (e.g., organization charts and annual reports), although limited, in some cases provided a understanding of the context in which the manager operated, the constraints on activity and the results expected by the organization. This not only provided support for interviews and observation but some guidance in the preparation of questions.

6.4 Analyzing the data - tools & techniques

Because the thrust of this research was theory development (or theory integration) rather than the testing of existing theory much of the data collected was qualitative and unstructured in nature. The major issues faced in the analysis were the volume of these non-numeric data and the concomitant complexity of the analysis required.

A qualitative approach, in a project of this size, produces thousands of answers, questions and observations. The advantage to such voluminous data is more distinct clustering of characteristics leading to hypotheses and even theories. The disadvantage is the time and care required to organize and evaluate all those data.

The qualitative analysis was, as much as possible supported by the application of statistical tools to the numeric data available but the primary data analysis technique used was protocol analysis. Overall the data analysis phase of the project consisted of three aspects: dealing with the qualitative, non-numeric data; choosing and performing relevant statistical tests on the quantitative data and integrating the data which emerged from these techniques.

6.4.1 Protocol analysis & Grounded Theory

Protocol analysis, discussed by, among others, Todd and Benbasat [1987], Bouwman [1983] and Ericcson and Simon [1984], is the most common technique for gathering verbal data and observations and classifying these data into clusters of topics, hypotheses and even theories.

As useful as it can be, protocol analysis has been criticized. For example, Ungson, Braunstein and Hall [1981] have pointed out that problems can arise through self censorship of the reporting subject; the questionable relationship between the actual process or issue and the protocol description; the instability of protocols over time; their lack of generalizability; and the lack of reliability of the interpretations made by judges. Rather than negate the value of the technique such criticism reminds the researcher to look for missing, ambiguous or conflicting data and to use complementary techniques wherever possible.

Glaser and Strauss [1967] and Glaser [1978] developed an approach to protocol analysis in social science research which they called Grounded Theory. Their technique is based on accumulation of empirical data from observations. The data are coded and analyzed through various stages of generality (property, category, hypothesis) into a social theory. As Glaser put it:

> "Grounded Theory is based on the systematic generating of theory from data, that itself is systematically obtained from social research ... How the analyst enters the field to collect the data, his method of collection and codification of the data, his integration of the categories, generating memos, and constructing theory - the full continuum of both the processes of generating theory and of social research - are *all* guided and integrated by the *emerging* theory." [1978, pg. 2]

Lyles and Mitroff, working in the management area, outlined the actual process of using Grounded Theory.

> "Grounded theory is a process for conducting research that attempts to start with an initial guide to collecting and verifying data but allows the researcher to be aware of other contingencies that will affect the original hypotheses. Hence the theory is grounded on the data but not rigidly bound to it and the researcher can go beyond the original research plan and original theory." [1980, pg. 104]

The comparative analysis described earlier in this chapter is also an important factor in Grounded Theory. Glaser and Strauss [op. cit., pg. 23] suggest that comparative analysis performs at least one of four functions: replicating earlier evidence to check out whether it was correct; to establish the generality of a fact; verifying existing theory and generating new theory. It is the last that is the focus of this research although the other three functions are subsumed in that main goal.

Glaser [1978] points out that, in the development of Grounded Theory, the theory does not "appear" - it "emerges". This means that the researcher has to be, at all times, prepared to recognize and develop a new classification or, more commonly, to revise an existing classification as relevant data emerge. This requires great care, creativity and flexibility on the part of the researcher. The application of Grounded Theory was much more complicated and time consuming than was envisioned at the outset of this project but was invaluable in shaping what would have been an unmanageable mass of non-numeric data.

6.4.2 Statistical analysis

The second aspect of the data analysis was the statistical evaluation of the managers' responses to the sets of structured questions listed in 6.3.1. The topics (such as "reasons for limited use of CBIS") were not investigated for their own sake - the point is their possible effect on a manager's current use, attitudes or intentions.

Since both the use of structured question sets and the contents of each set grew empirically out of the interview process no formal tests (e.g., pre-test, pilot study, content validity, construct[3] validity, factorial validity, convergent validity, discriminant validity or internal validity) were applied. However, Straub [1989] surveyed 117 MIS research papers in three leading journals and found that, in these articles the number of researchers who had applied the various types of instrumentation categories were: pretest -13%; pilot study - 6%; previously utilized instrument - 17%; content validity tests - 4%; construct validity tests - 14% and tests of instrument reliability - 17%. So the approach used in this project, although, not technically rigorous, reflects the level of rigour common in MIS research.

The second issue of validity is that of the statistical conclusions drawn from the results. Do the variables demonstrate relationships not explainable by chance or by some other standard of comparison. This, in turn, depends on the types of tests applied to those data and the evaluation of the test results. Siegel and Castellan, in a basic work on statistics for the behavioral sciences, suggest that nonparametric models are more appropriate than parametric analysis for most social science applications for a number of reasons:

> "they do not assume that the scores under analysis were drawn from a population distributed in a certain way, e.g., from a normally distributed population... nonparametric techniques may be

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[3]A simple definition of construct comes from Cronbach and Meehl: "A construct is some postulated attribute of people, assumed to be reflected in test performance." [1955, pg. 283]

> used with scores which are not exact in any numerical sense, but which in effect are simply ranks ... A third advantage of these techniques is their computational simplicity ... A final advantage of the nonparametric test is their usefulness with small samples, a feature which should be useful to the researcher collecting pilot study data and to the researcher whose samples must be small because of their very nature." [1988, pg. xv]

Because the responses to the question sets administered to the managers meet all of these characteristics three nonparametric tests were used to analyze the quantifiable data. The lack of testing of the question sets led to the use of the Kruskal-Wallis test rather than the more powerful F test version of ANOVA to compare specific groups to the sample as a whole. When interest was on the relationship between two factors (for example between personality type and function) the Chi Square test was used while Fisher's exact probability test was used for questions whose answers were binary and in which many samples were small.

In addition, simple correlation and multiple linear regression were used where appropriate, particularly when correlation among managers' answers and the relationships among possible causes of those answers were of interest.

6.4.3 <u>Integrating the data</u>

The final phase of the data analysis stage was the integration and organization of the qualitative data developed using Grounded Theory and the numerical data derived from the use of the statistical test described.

The grounded theory data were used to evaluate the framework laid out in Chapter 1 and, where relevant, to modify it. The statistical data were used to further evaluate the points of the framework and relevance of the characteristics of each but were also used, when possible, to investigate the relationships among the points in the framework - particularly the relative strengths of any links.

6.5 The process

The final aspect of preparing to undertake the project was the development of a process which would allow the ethnographic methodology, the partici-pant/observer and comparative case analysis approaches and the specific data gathering and data analysis tools and techniques described above to work together to achieve the goals of the project.

6.5.1 Data gathering

The core of the process chosen was the face-to-face interview. Each consisted of the researcher and one of the managers taking part in the research, lasted approximately one hour and took place at the manager's work site. The interviews were driven by the Interview Guide which served to structure the interview, coordinate questions among interviews and record all responses, comments and observations.

Early interviews focused on gathering traditional, well structured data on the organization, the individual, the job and the tools available and but also served two other purposes. They allowed the manager to become comfortable with the researcher and the interview content and style and they provided insights which allowed the addition of more subtle questions.

This multiple interview approach was particularly valuable in light of Wilson's observation on research subjects:

> "the role of being a research subject in social science research often includes the following influences on behaviour: a suspiciousness of the intent of the research, a sense of the behaviour that is either appropriate or expected, a special interpersonal relationship with the researcher, and a desire to be evaluated positively." [1977, pg.248]

By the second or third interview most managers spoke to the researcher as though he were a member of the team or a confidant.

Data gathering had two broad characteristics. First, it was open-ended, flexible and iterative. Answers, comments and observations that did not bear on the current topic but appeared relevant were added to the Guide in some form and applied to all other managers. For example, the entire issue of data in the organization was added to the project in this way. The second characteristic was the use of the multiple data sources described in 6.3.

The process began by focusing on the five possible sources of influence on managers' use and intentions concerning CBIS described in Chapter 1.

The environment

Only when managers indicated that an organization could be strongly and actively affected by its context was the environment or the industry discussed. (The telephone industry, in which member firms, in Canada at least, are tightly linked both technically and administratively, was an example of this.) These data are described and discussed in Chapter 7.

The organization

The data collected on this aspect of the framework was of two types. The most obvious was objective data (such as size) described in chapter 1. The second type, consisted of less well defined factors such as "attitude toward technology" and "driving force", were categorized as "corporate culture".

The data on the organization gathered from the "core" interviews were supplemented by a series of meetings with senior executives and key employees; by the researcher's observations; and by perusal of internal and public documents provided the data needed to classify each firm on the dimensions of interest.

In addition to the factors outlined in Chapter 1 information on a number of topics emerged as the interviews proceeded. These included: the level of technology (current and trends); corporate training practices; the driving force (personality, profit, politics, bureaucratic process, etc.) and the locus of decision making (centralized/decentralized). The data on each organization are reported in Appendix II and discussed and analyzed in Chapter 7.

The individual manager

Because understanding which characteristics of the manager affected his use of CBIS was essential this data set was key to the project. Demographic factors such as those outlined in Chapter 1 were the starting point in understanding the individual but it soon expanded into open ended topics such as their experience with technology in their job, their beliefs and attitudes concerning computing and many other such issues which were relevant to the goals of this research.

The MBTI questionnaire was explained to each manager at the end of the second interview and it and a self addressed envelope were left with him. After it was received from the manager his responses were evaluated and the results were discussed with him in the next interview.

In addition to the data gathered directly through interviews, observations were an important source of data on the managers. Topics such as internal contradictions, the manager's work style and the equipment in his office contributed to an understanding of the attitudes and practices of the individual. All data on the individual are presented and discussed in Chapter 8.

The job

Investigation of this aspect of the framework began simply by examining the characteristics of the function the manager was responsible for in the organization. Information on these was derived from organizational charts, interviews with senior executives, interviews with incumbents and with other employees.

Although these functions are, to a great extent, dependent on the structure and nature of the organization it was believed that commonalities (in terms of computer use and attitudes) among functions such as Accounting would be found across organizations.

But it soon became clear that a more specific description of the manager's job would be necessary to successfully link it to CBIS. The first level of subdivision was "tasks"[4]. To structure and stimulate discussion, each job was described in terms of six classes of tasks: planning, controlling, coordinating, decision making, advising and miscellaneous. In addition, managers brought up tasks which they considered important but which did not fall into any of these classes and so were recorded as comments.

This was the most dynamic of the "classifying" stages since the same function often consisted of different sets of tasks in different organizations and a task could be described in a number of different ways. In fact, the class of tasks called "advising" was not in the original set while "communicating", which was, disappeared.

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[4]This actually began as Mintzberg's roles (4.3.2) but, because many managers had difficulty with that concept, a modification of Fayol's functions (4.3.1) was used instead. This development process is discussed in Chapter 4.

But even at this level the links between the job and computer-based tools was obscure. A third, very narrow description of the job was developed - a structured list of the activities which could occupy his time. The manager was asked to describe what proportion of his time during an "average" month was spent on each of approximately fifteen activities including; attending group meetings, planning, working with a computer and attending training sessions. The research interest was on the relationship between the preponderant activities and computer use (and intentions). Separate questions investigated which of these activities were supported at the manager's level by computer tools, how such support worked and where it came from ("my assistant", "the finance guys", "I do it myself").

Finally, because managers have some control over both what they do and how they do it the managers' perceptions of the procedures used to define and to solve problems related to their jobs was of interest. Goals, constraints, activities and requirements of their problem solving (decision making) were all included in these data. All data bearing on these aspects of the manager's job are discussed in Chapter 9.

Tools & support available to the manager

What hardware, software, telecommunications, data files and human support are available in the organization? What rules apply to use of this support by individuals or functions? How does this relate to the "tool set" actually used by each manager? How does it affect users' attitudes toward CBIS? The data for this topic came from almost every source described in the previous section. It was the most voluminous and the most complex - but it also became the core of the findings and conclusions. These data are reported and analyzed in Chapter 10.

6.5.2 Data analysis

The second stage of this process was analysis of the data gathered on the organizations, the job, computer support and the individual managers (which totalled more than 2,100 pages - not including supporting documentation such as job descriptions and annual reports). Because of the shifting nature of the process not all of this was, in the end, relevant but the majority had to be organized, examined and evaluated.

The main technique used was Grounded Theory. All Interview Guides were reread and answers, comments and observations deemed relevant were written on file cards. This process yielded almost 1,800 file cards. These were separated according to topics, resorted and then sorted again. After eight "passes" through the cards about 80 "clusters" of comments had evolved - each representing a topic related to the research. Those considered to be most relevant are reported in Chapters 7 through 10.

The structured questions produced ten sets of data on topics bearing on the managers' actual use and on relevant beliefs and attitudes. How could this much data possibly be analyzed to produce meaning observations, conclusions and directions for more detailed study? The answers from all managers for each structured question were analyzed using the computer-based statistical package SAS. A confidence level of .95 was used to define significance of the results of all statistical analysis.

The types and amounts of data used for each of the factors depended to some extent on what was available. But since, in almost all cases, much more was available than could be used it was driven more by the value of each to the goals of this research.

6.6 Summary

This chapter has examined the limitations of exploratory research and evaluated a set of research methodologies and tools, ranging from laboratory experiments to observation on site in order to choose and validate those most appropriate for this research project.

As a result, the ethnographic methodology using participant/observer activity and comparative case analysis was chosen. The tools and techniques used to gather data were semi-structured interviews, questionnaires, observation, and examination of corporate documentation. Data analysis consisted primarily of Grounded Theory analysis of qualitative data supported by statistical analysis of a set of data based on structured question sets which evolved as the process proceeded.

The actual process by which these tools and techniques were applied was dynamic in two ways. First, it actually changed as suggestions or problems emerged from interviews and early data analysis. Second, both the data gathering and data analysis phases were iterative and inter-related.

The data acquired using this methodology, these tools and process are presented and discussed in Chapter 7 through 11 and the conclusions drawn from them are described in Chapter 12.

Section IV - Data, Analysis and Conclusions

This final section of the thesis presents and discusses data from interviews with the fifty managers who took part in this project plus supporting information acquired from the other sources described in Chapter 6.

The main type of data found throughout this section is the quotation or paraphrase of answers, comments or questions which came from the managers themselves during interviews. These are presented in a standardized format which includes the words and the manager's identification code. In most cases the manager's function and, where it seemed appropriate for analysis, his MBTI personality preference code have been included. For a few managers the notation CB is added. This means that this manager has a significant background in computing through work experience, education or both. It was felt that this was relevant because such a background gives a manager a better (or at least different) point of view than managers without such training or experience.

. We never use the computer around here. [A-44] [prod.] [INTJ] [CB]

is a comment from manager 44 at site A. He works in production and is an introvert/intuitive/thinking/judging type who worked in the computer department for some years.

Although grounded theory analysis has been the primary technique used to develop clusters of ideas from the data available, quantitative data are used where available and meaningful. In some cases these data are merely discussed as presented but in others they been formally analyzed using a limited set of models: Kruskal-Wallis; the Chi Square or Fisher's exact probability test; simple correlation or multiple linear regression. The confidence level chosen for all tests was .95 so when a result is described as significant it is with $p<.05$. When a result demonstrates an even stronger statistical significance the probability (e.g., $p<.01$) is given.

Tables containing summaries of the raw data analyzed in Chapters 7 through 10 are placed in the chapter following the discussion of their contents. In Chapter 11 tables showing the results of correlation and MLR analysis are placed after the analysis of their contents.

In the final chapter of this section conclusions are drawn from the data and analysis presented in Chapters 7 through 11, limitations of the project are identified and recommendations are made for future research or for application of findings.

The Effects of the Environment & the Organization

This chapter presents and discusses qualitative (interview-based) and quantitative data linking the organization's environment, the industry to which it belongs and the organization itself to the individual manager's current use of CBIS and to his intentions - for both himself and his area of responsibility.

7.1 Introduction

Based on the starting framework and issues described in Chapter 1 a series of questions was administered to all fifty managers who took part in the project. The answers to these were used to develop descriptions of the firm's environment and industry, the basic characteristics of the organization and aspects of the "corporate culture" which managers felt affected their current use of CBIS or their intentions concerning them.

The findings discussed below are based on a number of sources: the managers' responses to a series of open-ended questions and to a number of sets of structured questions; points raised by the managers themselves; and the researcher's observations.

7.2 The environment & the industry

The intensifying rate of change in our society has become a cliche but for the managers who took part in this research it is an everyday reality. A number of points were raised by managers which indicated their beliefs that some aspects of the environment of their organization can, do or should affect their relationships with computers. A corollary of this belief was that so far CBIS have done little to directly support managers dealing with the dynamics of their environment.

7.2.1 <u>Changes in corporate context and computing</u>

A number of examples of how the context of an organization changes through a mixture of external and internal factors were demonstrated in this research. In all cases it was apparent that the management information systems in place were inadequate to support the type, breadth and speed of response needed to deal with such evolution.

Some changes at site A have been initiated by the telephone company itself. These include deciding to sell as well as rent equipment; dealing with new products such as pagers, facsimile machines and cellular telephones and providing more complex services to business customers. But they have also been affected by the decisions of regulators to open up a number of existing fields to competition and to allow full competition in new fields such as cellular telephones.

Managers at site A were finding that both the internal and external changes were highlighting the weaknesses in their management information system caused by its focus on costs rather than on the environment. They realized that a major change was taking place in their relationships with old and new customers and with previously non-existent competitors. The computer was seen as an essential tool to support the needed changes.

. As our situation [environment] becomes less stable we must do a lot more project type work and a lot more reacting. The computer must be made to help us plan, coordinate, model, etc. in a much looser structure. [A-11] [plan.] [CB]

- We are now under attack out there in our market and we feel that computers can help. For example, analyzing customer and product strengths and weaknesses. [A-23] [mark.]

- We have moved from renting equipment to selling it. This has affected the whole firm... Now we have to respond quickly with planning and control. Only the computer can do it and that's not great now... In the long run how we will manage data will determine how well we will compete. We must get information to the [customer] contact point. [A-25] [mark.]

- As competition heats up we must work smarter. Can the computer help us do that? [A-26] [mark.]

- Competition is changing the way we computerize - volume and detail is not enough any more. We have to analyze and plan better and faster. Also we have to figure some way to support our customers through our computers. [A-30] [mark.]

Despite explicit questions none of these managers was able to separate the need for enhanced operations support from new or improved tactical and strategic planning systems. But all are aware of the need for "better" information and that the computer could provide it but doesn't.

For many years Site E had only one significant client - the Government of Canada. But recently two things have happened to change this. Without warning, the Government's 1990 budget cut a program which represented about 20% of the firm's sales. Not only had their intelligence system failed to foresee this, but the massive adjustments that had to be made very quickly were poorly supported by planning or analysis on computers. The perception was that a much improved ability to both scan the environment and plan for change must be developed quickly and only some sort of computer system will do that.

Even before the loss of that large contract Site E had made a commitment to cutting down the proportion of Government business (to about sixty percent from ninety). Senior management were finding that this strategic decision was pointing out significant weaknesses in their information systems - particularly the ability to calculate costs and define schedules. Although these were pretty much irrelevant to the "cost plus" approach preferred by the Government they had become essential to deal successfully with the fixed cost contracts of private aircraft and parts companies.

. When we had one large, patient customer [the Government] our customer record keeping was O.K. But as we get more sophisticated we must move to "information management" and "dynamic planning". With the limited [computer] resources we have here I don't know how it will happen. [E-20] [prod.]

Managers at site F (a brewery) recognized that, although their industry is currently stable, there is the potential for changes in the environment which would demonstrate their serious lack of externally oriented information.

. Right now our customer structure is very simple - the N.S.L.C. [the Government liquor store monopoly] and taverns and restaurants. If that changes (e.g., if stores start selling beer) we will be in real trouble vis-a-vis marketing "intelligence". [F-13] [mark.]

This V.P. of Marketing was concerned that the firm had no existing capability to either model current sales or to estimate the effects of changes such as direct sales to the public or sales to private beer retailers (should they be permitted). But he was also concerned with their apparent inability to develop such models.

In addition to the regulation of Site A the government is also affecting all six organizations through changes in laws. The most obvious example of this is the recently imposed Equal Opportunity laws.

- Our Employee Equity Program was triggered by the Nova Scotia Human Rights Commission. We signed an agreement that our employees should reflect the population as a whole. We have used this to push the organization to finally allow us to acquire a full-blown human resources package (CHRIS)! [A-20] [pers.]

- We have been trying to get personnel computerized since 1974. Finally new government laws forced the company to get CHRIS. [A-22] [pers.]

- We are well up on the employment equity laws - necessary because we depend on the government so much. Right now we are loading their [the Government's] job codes on a micro in Personnel so we can evaluate everyone. I don't know if we will move it to the central computer. [E-15] [pers.]

7.2.2 Outside data sources

A more specific effect of the environment on some managers was the need for, and the value of, data from sources outside the organization.

- Our company is "plugged into" Bell Canada and Telecom Canada for a number of functions - settlements, network management and tactical coordination. [A-10] [plan.] [CB]

- In terms of data the computer helps us connect to outside sources [of data] we need including the Dow Jones database, our pension managers and stock markets. [A-12] [acct.]

- We [the Medical Director's office] use a number of government files for statistics on health and on hazardous materials. [A-18] [pers.]

- We are connected to the inventory files of our largest customer for ordering parts we use in repairs and for general communication. [E-20] [prod.]
- Our marketing people get data from the Government's inventory system for scheduling but I'm not sure if it's online. [F-11] [acct.]

Because senior managers must often operate at the interface between the organization and its environment the ability to link with outside sources is important. It is also important to note that the managers get this information <u>through</u> their staff. No manager reported direct personal contact with outside data files via computer.

7.3 The organization

A number of characteristics of organizations were discussed by managers, either in response to open ended questions or because of a concern raised by a manager. In addition, managers answered eight sets of structured questions the answers to which are compared below among the organizations.

7.3.1 <u>Characteristics of the organization</u>

As described in Chapter 1 the framework began by defining a set of characteristics of the organizations taking part in the research and then attempting to link them to the use and intentions of managers in each organization. The characteristics examined were: size; age; location; physical structure; management structure; financial situation; products/services produced; markets;

competition; nature of the industry; form of ownership; driving force and computer tools and support available[1].

Because of the small sample size it was not possible to determine which characteristics of the organization affected the managers' attitudes toward, and use of, CBIS but it was clear that there were differences among organizations. For example managers at site A were the most sophisticated about the current value and potential of CBIS for managers but it was not clear whether this was because they were the largest organization examined, in the most technical industry, had the largest computer staff, had an information centre (none of the others do) or some combination of these.

Table 7-6 outlines the perceptions of managers in each organization about the strength of the effect of a set of organizational characteristics on their use of CBIS. The differences among the six sites is discussed below but another datum emerged from the table. For the managers as a whole, the three highest rated characteristics were: size; products/services offered; and degree of evolution (sophistication) while the lowest were management structure and physical structure.

7.3.2 Corporate culture

Many of the managers' comments and answers to questions about the organization raised points linking the organization to their current and intended use of

[1]Because it is a key to this research the topic of computer tools and support available is presented as a separate set of findings in Chapter 10.

CBIS. Some links were direct (e.g. the computing budget or the training provided) while others demonstrated a more indirect effect, through their beliefs and attitudes about the organization's values and priorities and, therefore, about the value of current and intended use.

The managers in the six sites investigated did not represent a single model of corporate culture - even within organizations managers expressed a range of perceptions. However there was a consistent sense that the corporate culture has a strong effect on both use of computers by managers and their attitudes toward them.

Driving forces

One topic related to the corporate culture was that of the driving forces behind activity in the organization in general.

- Technology is the driving force in our industry [telephones] but we don't seem to apply it much in marketing - even in highly competitive areas. [A-26] [mark.]

- We have almost no cost accounting in hospitals because of the source of our money [the Government]. We would have a lot more control if we had some sort of system. [B-14] [acct.]

- Competition is not a driving force in the hospital industry. Providing service and keeping costs low are. We must shift from financial information to information that supports these goals. [C-14] [acct.]

- Cost is the driving force in this university in terms of computing like everything else. This is wrong. [D-15] [prod.]

- The personality of our President and his intense focus on the bottom line is the driving force behind everything that happens in this organization. I know he doesn't understand how computing can eat up "all that money" but it will get worse before it gets better. [E-17] [prod.]

Corporate attitude toward management computing

A number of managers expressed concerns about another specific aspect of their corporate culture - the attitude of the organization toward computing for managers.

- The organization does seem to encourage the use of computers but I guess its not our [materials management] turn yet. [B-16] [prod.]

- Our system definitely does not provide adequate reports to management. This is partly a function of our strained computer resources and partly of our management history. [C-14] [acct.]

- This firm does not encourage the creative use of computers or provide us [senior management] with adequate training. [E-12] [prod.]

- This company does not encourage the creative use of computers. The employees drive it. [E-17] [prod.]

- The company must encourage use of terminals by all managers (E-mail, etc.) or it doesn't mean anything. [E-20] [prod.]

- The firm does not seem to encourage the creative use of computers - especially by senior managers. Not only are there no rewards (except words) but little allowance is given for learning time even if I could get the equipment. [F-11] [acct.] [CB]

Only managers at site A consistently felt that the culture was supportive of computing for managers.

Management computer training

Another aspect of the corporate culture that is related to this research is the attitude of the organization toward training and education; specifically for senior managers. Did managers perceive a relationship between the attitude of their organization toward training and education and the level of their own computer use?

Most organizations offer some level of training. However, even at site A, which had the most active and extensive training program (an annual budget of more than $3,000,000), senior managers rarely took part in the training available. When asked about this directly managers gave a number of reasons.

. The computer department does give a bit of training (particularly on PCs) but it is optional and I, like many people at my level, don't have time to attend. [A-16] [acct.]

. We need more training for managers - most came up before computers were spread out in departments. Time is needed for both training and practice. But where will it come from? [A-17] [acct.]

. We need more information and training about computers. But also more time just to learn and try things out. [A-18] [pers.]

. More time and more training is needed for managers especially if we are expected (or allowed) to do things ourselves. [B-15] [pers.]

. Training for both staff and managers is weak around here. We still produce too much paper and go to too many meetings. Maybe the computer could help. [C-13] [pers.]

. We need more training for senior managers - applications and computing in general. Some are resisting change. Maybe that would help. [C-15] [prod.]

. We need good training programs for staff and <u>managers</u>. [D-15] [prod.]

. We need more computer training for all staff but mainly for senior management. But most of all we need time and encouragement to learn. [E-16] [acct.]

. More training is needed for senior managers but right now I'm not sure the attitude is there for some of them. [F-11] [acct.] [CB]

Almost all managers believed that focused, perhaps extensive, training would be necessary if they were to use the computer directly and seriously. It was also made clear that such training was not available to them and that, even if it were, their organization did not provide incentives for them to get involved in it (in most cases there was a perception of implied discouragement of such involvement). It is also important to note that many managers were not convinced that the type of direct use implied by serious training was appropriate.

Corporate contradictions

Going beyond lack of training some managers expressed concern about contradictions in the attitude of their organization.

- The firm encourages the creative use of computers but makes it hard to get PCs, training and time to use and learn. [A-30] [mark.]

- On the one hand the organization encourages the creative use of computers but on the other hand resources are not made available. [B-14] [acct.]

Information for senior managers

The most important function of a computer application for a manager is the production of information that allows him to make a "better" (faster, more focused, etc.) decision. The lack of "management information", that is, information which will actually support management decision making, was seen as a serious problem in all organizations.

- The lower levels of our organization get good information but it is not so good at higher levels. Lack of structure makes it unreliable. [A-12] [plan.]

- We get too little management information in some areas (e.g. labour costs and sales data) and too much in others (e.g. financial accounting). This can distort decision making. [A-19] [mark.] [CB]

- I get a lot of batch reports (e.g. budgets, employee list) but I would like to get more analysis, modelling, forecasts. [A-21] [pers.]

- We lack both appropriate information and timely information. In marketing this is a very serious problem. Our [corporate] information gathering is oriented toward accounting - we have to do a lot to it to make it useful for us. [A-23] [mark.]

- There is a lot of detail available (especially in accounting/finance) but it is not aimed at managers. There are also very general figures available for the Board - but no middle range of data. [A-30] [mark.]

- The computer has given us a lot more flexibility at the lower levels (multiple pay scales, a menu of benefits, etc.) but not at higher levels. [B-15] [prod.]

- Most of the output I get is batch, monthly. Not much flexibility. [C-13] [pers.]

- I get too much information - especially on paper. Too much duplication of effort and not enough "insight". Would a computer system help me with this? [C-16] [prod.]

- I have never before worked in a place where no management reports are produced - especially in accounting. [D-12] [acct.] [CB]

- Timeliness of information is still a problem here. Most reports still come on a monthly schedule. This is not adequate for the type of problems I face at this level. [D-13] [prod.]

- I'm afraid we will continue to fail to get out of the computer what we really need. There is a lack of current management reports (we get lots of history). Reports tend to be in dollars rather than hours or percentages. I have to do a lot of translation. [E-12] [prod.]

- We aren't well served in management information - lots of detail but not much extraction. It is very difficult to manipulate as an end user. [E-20] [prod.]

- We get too much awkward information at senior levels. [F-11] [acct.] [CB]

Far from hungering after "hands on" access to the corporate database most of these managers would like to have timely, well organized, helpful versions of the information they now work with or new reports out of upgraded corporate-wide applications.

Defining information needs

One aspect of corporate culture in relation to computing which was discussed by many managers was that of "defining needs". For example:

- We must develop much more understanding in this place of the need for integrated systems. That's where the benefits for senior managers will be found. [A-10] [plan.] [CB]

- We have a lot of problems defining our information needs, especially as the way we do business changes, so we often have to respond to major problems [crises]. This can be a real problem. We need more ability to scan our environment. Even when we have data we don't know if it's complete and accurate. [A-12] [acct.]

- We don't seem to have a good perception of where we are going so we don't give a lot of useful information to managers. I think that we should start with small [management] systems and see what happens. [A-23] [mark.]

- We are having a lot of trouble defining what information we need. Especially in our new [amalgamated] situation. Things keep changing and our current system is too rigid. [C-16] [prod.]

- We are still trying to define our financial information needs for the University. The new software [financial management package], micros, online access will all have an effect. We don't always do a good job of planning this from the top. [D-12] [acct.] [CB]

- We have a major problem defining our information needs. Not least of these is simple communication. [E-17] [prod.]

- We are still struggling to find our true information needs. Competition means we have to focus even more on quality <u>and</u> cost control. Can the computer help us tighten this up? [F-12] [prod.]

The comments and answers from most managers made it clear that all of these organizations had problems in defining what type of information, and what sources, were relevant to better management of current activity - let alone future situations. Sites A and E are headed into unknown territory with new products or services while the government funded sites (B, C and D) are facing severe problems in "downsizing" operations. None has developed more than the most basic spreadsheet models from which to forecast future needs and resources.

Opportunities

Managers identified a number of what they felt were important opportunities for computing in the organization - both general and directly related to them.

. As things get more complex we need more timely and valid data to endure security of assets. We have the data but not the time or technique to analyze it. We must be more proactive in computing in corporate auditing. [A-14] [acct.]

. A "skills inventory" will be a very useful management tool. It started at the V.P. level a few years ago but it seems to be stalled now. At my level we have to forecast 5 years or more into the future. Right now we don't have the data or the analysis to do that. [A-20] [pers.]

. If we were computerized we would collect pretty much the same data (which is now on many pieces of paper) but we could link data from many areas and do a lot more analysis. Conceptually it would give tighter control and faster decisions. [B-17] [prod.]

. On the one hand we have so many "deadline" tasks that computerization would help us get them done faster and better (more analysis). But on the other hand we have no time to develop the support systems that would be needed. [C-14] [acct.]

. We need an inquiry tracking system to avoid missed opportunities. Who inquired? What did we do? Follow up? Control? [D-13] [prod.]

. I manage more than $300 million in endowments and pension funds. We do O.K. but I'm sure we are missing opportunities. No so much in specific investments but in strategic or tactical improvements and in general flexibility. [D-14] [acct.]

- The computer hasn't changed the way we do quality control much but I can see how it could. For example I wonder about the reality [validity] of the data coming from the shops. Could the computer both collect and analyze it automatically? [E-12] [prod.]

- We still lack good systems in some manufacturing areas: job costing is weak and inventory control and analysis (turnover, etc, is non-existent. We aren't a good example of management computing. [E-14] [prod.]

Comments such as these indicate that managers are interested, even concerned, with the future of computing in the organization and in their own functions. But few expressed concerns about their personal relationship with computers.

Cost/benefit aspects of computing in the organization

In spite of the many complaints outlined above all managers realized that there is a cost/benefit aspect to enhancing computing. Although few addressed the issues of computer use at senior levels directly many (mainly accountants) commented on cost and benefits more generally.

- We must understand and maximize what we have before we start dealing with anything else. The essential focus is cost/benefit. [A-12] [acct.]

- Cost/benefit is the key to acquisition and development. But as we get into "new" areas like DSS they are harder to define and to defend. [A-13] [acct.]

- Any new tool must allow us to do something we can't already do. It is a cost/benefit issue - but what costs? which benefits? [A-14] [acct.]

- What is the cost of producing information in a specific medium or form? How much will it help? How can we measure this? [B-14] [acct.]

- We must look not only at benefits but also at costs. No matter how good a tool is we have our financial limits. And what about the costs of "getting managers up to speed and things like that" [C-17] [prod.]

. When we look at new tools costs and benefits is the point. But what are the relevant costs and benefits? [D-14] [acct.]

. What is the cost of producing information for a specific situation? How much will it help? How long will it take? How can we measure this? [E-17] [prod.]

But some managers felt that costs and benefits sometimes had to take a back seat to other considerations.

. Cost isn't the first question we ask. We are too busy playing catch up. [A-18] [pers.]

. Cost/benefit analysis for applications is important, especially as money gets tighter. But there are other considerations: services, marketing, competition. Sometimes we take too narrow a focus around here. [D-13] [prod.]

7.4 Quantitative data

In addition to data derived from the answers, comments and observations of the managers interviewed the relationships between membership in an organization and a manager's responses to the structured question sets in the Interview Guide was examined using ANOVA (Kruskal-Wallis), Chi Square or Fisher's exact probability tests[2]. A description of the statistically significant findings for each question set follows along with a discussion of the meanings of the findings for this research.

[2]All statistical tests described in Chapters 7 through 11 were applied to the raw data - not to the summarized versions contained in most tables.

7.4.1 Problems related to the use of CBIS in the manager's area

Table 7-1 summarizes the number of managers in the six organizations who agreed with six possible answers ranging from "no problem" (0) to "a severe problem" (5) in terms of their sense of specific limitations or problems caused by the organization (see page 6 of Appendix II).

When the Kruskal-Wallis test was applied to these data only two areas of significance were found. Site B expressed a much higher level of concern about staffing than the other sites, which helps explain the generally reserved attitude at that site toward increased use of computers - they are simply too overworked. Related, perhaps, to the lack of staff in user areas was the high level of concern expressed at site B about the lack of advice on technology at that site.

7.4.2 Organizational factors relating to computer use in the manager's area of responsibility

Another set of questions put to all managers concerned their sense of the use and value of computing resources provided by the organization (see page 8 of Appendix II). Table 7-2 summarizes the proportion of managers in each organization who answered True for each question in this set. Because the responses to these questions were binary and because many of the response groups (n) were small the Fisher exact probability test was used to evaluate these data.

Some significant results were observed. Managers at site A felt strongly that the organization did encourage the creative use of computers while the perceptions of managers at other sites were mixed to moderately negative ($p<.001$). There were also strong differences among organizations concerning computer training provided ($p<.005$). Site A was quite positive while all other sites were strongly negative.

7.4.3 <u>Preferred input/output (communication) methods</u>

One of the most interesting results of the research was the strong feeling among some managers for different communication techniques (page 7 of Appendix II). Table 7-3 summarized the values placed on the various techniques by managers in each organization.

For managers as a whole the top five communication methods were: the telephone; Voice-mail (Site A only); meetings with subordinates; individual meetings and written memos and letters. The lowest five were E-mail; general readings; professional groups; informal meetings; ad hoc computer reports. Standard computer reports ranked sixth. This demonstrates the continuing orientation toward traditional meetings and reports with some use of the types of computer reports that have been produced for many years.

There were significant differences among organizations in terms of "meetings with outsiders" ($p<.01$). Site A reported considerably more such meetings while sites D and E reported almost none at all. There were also differences among the organizations in terms of informal or "hallway" meetings as a common communication device. The differences to a great extent reflected the physical locations of the managers but also speak to the value of a computer-mediated communication technique such as E-mail or V-mail.

Table 7-2: Organizational factors relating to computer usagein the manager's area (summarized by organization)*

ORGANIZATION / ISSUE	A	B	C	D	E	F	ALL	**
creative use is encouraged here	1.0	0.8	0.5	1.0	0.6	0.5	0.8	6
my staff has adequate train.	0.7	0.0	0.0	0.3	0.3	0.3	0.5	10
I encourage my staff to use them	1.0	1.0	0.8	1.0	0.9	0.8	0.9	2
my staff has a + attitude to comp.	1.0	1.0	1.0	1.0	0.9	0.8	1.0	1
we need more train to use them well	0.7	1.0	1.0	0.8	1.0	0.8	0.9	5
some people spend much time	0.3	0.3	0.2	0.0	0.4	0.3	0.3	13
they have changed way we work	1.0	1.0	0.8	1.0	0.7	0.5	0.9	3
the org. makes it too hard to get	0.3	0.5	0.3	0.3	0.8	0.5	0.5	11
I find it too hard keep up	0.6	0.5	0.6	0.2	0.6	1.0	0.5	9
lack of hardware for communication	0.7	0.8	0.5	0.8	0.6	0.7	0.7	8
I don't know where to look for info.	0.1	1.0	1.0	0.0	0.1	0.5	0.3	12
we found problems we didn't know	0.9	0.7	0.8	0.7	0.8	0.5	0.8	7
we can do things we couldn't	0.9	1.0	0.7	0.8	1.0	0.8	0.9	4
n =	21	4	6	6	9	4	50	

* The numbers in the table are the means of the percentage of managers in that organization who agreed with that statement.

** This column contains the relative ranking of the managers' feelings about the thirteen issues.

7.4.4 Reasons for limited direct use of CBIS

Table 7-4 summarizes responses to another question of interest. Did managers in different organizations express significantly different reasons for limited personal use of the computer (see pages 19 and 20 of Appendix II)? When the Kruskal-Wallis test was applied to this set of reasons no significant differences were found among managers in the six organizations.

7.4.5 Characteristics of computer-based tools

Another topic that was compared statistically among the organizations was the extent to which managers in different organizations expressed preferences for different characteristics of tools (see pages 22 and 23 of Appendix II).

The Kruskal-Wallis test was applied to the managers' ratings of almost thirty functions and characteristics (as summarized in Table 7-5) and some differences were found to be significant. The differences between site C and site D were significant as were the differences between sites B and F, B and D, C and F and A and F. These differences were not evaluated by topic - the interest was in whether such difference did exist. Clearly, in the question of managers and computer-based tools the organizational culture has some effect.

7.4.6 Characteristics of the organization

The next set of questions on the Interview Guide investigated the manager's beliefs (and the related attitudes) about the relationship between some

Table 7-3: Ratings of input/output (communication) methods (summarized by organization)

ORGANIZATION / COMMUNICATION TECHNIQUE	A	B	C	D	E	F	ALL	**
the telephone	4.6	5.0	5.0	4.8	4.9	5.0	4.8	1
written memos, letters, etc.	3.5	3.3	4.2	3.7	4.1	3.7	3.6	5
Electronic mail	1.9	2.0	0.0	3.5	0.4	1.7	1.9	16
Voice mail	4.4	na	na	na	na	na	4.4	2
one-on-one meetings	3.8	3.8	3.7	3.7	3.0	4.5	3.7	4
group meetings	3.3	3.5	3.8	3.3	2.0	3.8	3.2	8
meetings with subordinates	4.4	4.3	4.2	4.5	3.9	4.7	4.3	3
standard, org.-wide computer reports	3.3	3.5	3.7	3.7	2.8	3.7	3.4	6
meetings with outsiders	3.0	4.3	3.8	3.5	3.6	2.3	3.3	7
ad hoc computer reports	2.3	4.3	2.8	3.9	3.4	2.7	2.9	12
general reading	2.3	3.2	3.0	2.5	0.9	1.3	2.2	15
professional groups	2.2	2.0	3.6	3.3	1.1	1.2	2.3	14
formal reports within the org.	3.2	2.0	4.0	1.7	1.8	4.3	2.9	10
meetings with my boss	3.4	3.0	1.7	3.0	3.1	3.5	3.0	9
facsimile machines	2.8	3.3	3.4	2.5	2.4	0.0	2.9	11
informal meetings	2.5	3.5	2.5	2.3	3.1	0.0	2.8	13
n =	21	4	6	6	7	3	47	

** This column indicates the managers' ranking of communication techniques according to the means of their overall Likert scale scoring.

characteristics of the organization and the use of technology in that organization (see page 24 of Appendix II). The responses from managers in the six organizations are summarized in Table 7-6.

The Kruskal-Wallis test demonstrated a number of difference among organizations. Managers at the two hospitals felt that "The level of technology in the industry" was not relevant to their current or intended use while all other managers felt it did affect computer use ($p<.01$). This may be because the technology in the hospital is medical and extremely expensive - detracting from the funds available for "administrative technology".

"Level of competition" was also valued differently with managers at site A feeling it was very important, those at site E somewhat important and the other managers rating it as not important. Since site A is moving into more and more competitive fields and site E is in a very competitive industry they probably focus more on this aspect of the environment. It should also make them more aware of the competitive uses of computers. "Advice available" was another factor with a divergence of opinions among organizations. Site A was very enthusiastic about the support received while managers at all other organizations were slightly to strongly negative.

Table 7-4: The individual's reasons for limited direct use of CBIS (summarized by organization)

ORGANIZATION / REASON	A	B	C	D	E	F	ALL	**
I don't have time to learn computers	2.3	3.5	1.8	3.2	3.7	3.0	2.6	2
I have competent staff to do this work	4.1	3.5	2.5	3.4	3.5	1.5	3.6	1
the org discourages use of comps. by managers	0.7	1.5	1.8	0.2	0.7	0.5	0.8	10
for me the benefits don't match the costs	2.7	2.0	1.5	1.6	2.2	0.0	2.2	4
the hardware needed is not available	0.8	0.5	2.3	0.6	1.0	0.0	1.0	9
there is too much delay getting printouts	0.6	1.0	0.7	0.6	1.0	1.0	0.7	12
computer programs are not flexible enough	1.4	1.0	1.2	1.6	2.2	2.0	1.5	6
too much effort to get the resources needed	1.0	1.5	2.5	1.2	1.3	1.5	1.3	8
my peers won't understand the output	0.2	0.5	1.8	0.4	1.2	0.0	0.6	13
I don't have enough education to use them	0.1	0.5	0.8	0.8	0.5	0.0	0.4	14
there is no room in my office	0.1	0.5	0.8	0.5	0.8	0.0	0.3	15
an inefficient use of my time & know-how	2.1	2.0	1.3	1.6	1.2	0.0	1.7	5
few other managers use computers	0.5	0.5	1.5	0.4	1.6	0.5	0.8	11
the training I need is not available	0.5	2.5	3.3	1.0	2.4	2.0	1.4	7
my time is too "broken up"	2.1	4.5	1.7	2.0	2.8	2.0	2.2	3
n =	21	2	6	5	6	2	42	

** This column is the ranking of the causes based on the mean of the Likert scores given to each reason by the managers who completed this set of questions.

Table 7-5: Ratings of the characteristics of computer-based tools (summarized by organization)

ORGANIZATION / TOOL CHARACTERISTIC	A	B	C	D	E	F	ALL
easy to use myself	2.0	3.0	3.8	3.0	2.6	1.0	2.1
access to multiple databases	2.2	3.0	2.8	1.0	2.0	1.3	2.1
a variety of reports/formats	3.2	3.3	3.3	2.5	2.9	2.5	3.0
runs on a microcomputer	0.5	0.8	1.2	0.3	1.6	0.8	0.8
developed in-house	0.3	0.8	1.2	0.8	0.6	0.3	0.5
lots of flexibility	3.0	2.8	3.3	3.6	3.4	3.9	3.2
finds a "reasonable" answer	2.7	1.0	2.2	2.6	1.8	2.8	2.4
statistical analysis	2.5	2.3	4.0	2.0	3.0	2.0	2.7
cost of acquiring/maintaining	3.1	3.5	2.3	3.4	3.1	3.8	3.2
communication linkages	2.1	4.5	3.3	3.0	2.7	1.9	2.9
fits with current activities	2.0	3.5	2.0	0.8	1.5	2.0	2.0
long term value	2.5	2.5	2.9	2.4	2.9	1.7	2.5
fits with our "politics"	2.3	2.5	2.3	2.0	0.9	1.8	2.0
good forecasting models	2.1	2.3	2.8	1.9	2.9	2.5	2.4
finds the "right" answer	2.1	3.8	1.0	1.0	2.0	1.7	2.0
fits with our other applics.	2.9	3.3	2.8	3.8	2.0	2.5	2.8
easy to use right away	3.3	2.8	3.2	4.2	4.1	2.8	3.4
graphics capability	2.8	1.9	2.3	1.6	3.0	4.0	2.7
able to be modified easily	2.0	1.8	2.3	2.0	1.8	0.8	1.9
maintainable in-house	3.2	3.8	4.0	3.6	2.6	0.8	3.2
good report writer capability	3.7	7.3	3.2	3.2	3.4	2.8	3.3
buying/producing too early?	1.2	2.3	1.7	1.4	1.6	2.3	1.5
good documentation	3.9	4.3	2.5	3.9	3.7	1.8	3.6
supplier provides training	3.2	3.5	3.8	3.4	2.9	2.8	3.3
no extra hardware/software	1.4	2.3	2.7	1.0	1.8	3.4	1.7
no major staff/supply needs	2.9	2.5	3.2	1.5	2.3	2.0	2.6
good front end (menus, etc.)	3.5	4.5	2.8	3.7	3.3	3.0	3.6
n =	21	4	6	5	7	4	47

Table 7-6: Impact of characteristics of the manager's organization on his use of technology (summarized by organization)

ORGANIZATION / CHARACTERISTIC	A	B	C	D	E	F	ALL	**
size	3.0	2.8	3.5	3.3	2.9	4.3	3.2	1
degree of evolution	2.8	3.5	2.4	3.0	3.0	1.8	2.8	3
level of technology in the industry	3.6	2.5	1.7	1.5	1.7	2.3	2.6	5
intensity of competition	2.3	1.8	0.8	1.3	1.7	4.0	2.0	8
management structure	1.6	2.3	2.0	1.3	1.7	2.3	1.7	11
products and/or services provided	3.0	4.0	3.7	1.8	2.9	3.5	3.0	2
financial situation	3.0	3.3	2.3	3.2	1.7	2.5	2.7	4
advice available	3.1	3.5	1.8	1.0	2.1	2.0	2.5	6
physical structure	1.7	2.5	0.8	1.6	2.0	3.0	1.8	10
locus of decision making	1.8	2.3	2.3	2.0	2.7	0.3	1.9	9
nature of the computer dept.	2.6	3.3	1.8	2.3	1.9	2.5	2.4	7
n =	21	4	6	6	7	4	48	

** This column is the relative ranking of the managers' perceptions of the effects of the eleven organizational characteristics on the use of computers (based on mean Likert scale values).

7.4.7 Proportion of time spent on activities

Table 7-7 summarizes the percentage of time managers spend at each of eleven basic activities. The Kruskal-Wallis test was applied to each activity across the six organizations. Based on these data only one significant difference among managers in the organizations was apparent. Managers at sites B, C and D (all government supported) reported much more time spent on both preparing and reading reports than did managers in the private organizations ($p<.02$).

7.4.8 Managers' attitudes, current use & intentions concerning CBIS

A basic issue in this research was the managers' use of, attitude toward and intentions concerning CBIS for their functions and for themselves. These topics were not examined directly in the Interview Guide but, as was explained in Chapter 6, a rating was developed for each manager for each of these topics. The means of these ratings are shown by organization in Table 7-8.

The only factor in which significant differences were found among organizations was Current Use both for Function and for Self. Considering the range of organizations, functions and personality characteristics this is a reasonable result. On the other hand, all managers expressed moderate to strongly positive attitudes toward computers and an interest in expanding future use.

Table 7-7: Proportion of time spent on activities (summarized by organization)

ORGANIZATION / ACTIVITY	A	B	C	D	E	F	ALL	**
group meetings	19.2	10.0	22.0	21.0	19.0	16.0	19.3	1
one-on-one meetings	17.3	22.5	13.7	13.6	15.6	10.7	16.2	2
using the telephone	9.3	10.0	19.2	10.2	14.4	15.0	11.7	3
non-computer documents	9.1	7.5	6.0	7.8	11.0	12.0	9.1	6
drafting reports	6.6	15.0	8.3	14.6	19.0	7.3	9.7	4
working at a computer	0.4	2.5	0.8	3.6	4.0	1.0	1.4	11
travelling	7.5	3.5	2.3	3.2	4.4	6.0	5.4	8
studying/training	2.6	3.5	3.5	3.4	0.8	1.0	2.5	10
analyzing computer rpts.	5.1	6.5	4.5	2.4	3.4	6.3	4.6	9
informal meetings	9.0	9.0	9.7	10.6	4.6	11.7	8.9	7
thinking/planning	12.6	10.0	8.3	7.6	3.8	7.3	9.6	5
Totals (rounded)	98.7	100.0	101.1	98.0	100.0	102.3	98.4	
(All types of meetings)	45.0	27.3	45.3	45.2	39.2	38.3	44.3	
n =	20	3	4	5	7	3	42	

** This column is the relative ranking of the managers' perceptions of the proportions of their time spent at each activity.

Table 7-8: The managers' attitudes, current use and intentions (summarized by organization)

ORGANIZATION / FACTOR	A	B	C	D	E	F	ALL
Attitude:							
Function	3.5	3.0	3.3	3.3	3.3	2.5	3.7
Self	1.5	1.0	2.3	2.3	1.5	1.3	1.8
Current Use:							
Function	3.0	2.5	2.3	3.0	3.0	2.0	3.3
Self	1.0	0.3	1.3	1.8	1.5	1.0	1.3
Intentions:							
Function	3.3	2.8	3.3	3.0	3.1	2.3	3.4
Self	1.1	0.3	2.0	1.8	1.1	1.3	1.3
Current Use + Intentions:*							
Function	6.3	5.3	5.6	6.0	6.1	4.3	6.7
Self	2.1	0.6	3.3	3.6	2.6	2.3	2.6
n =	21	4	6	6	8	4	49

* The maximum value for current use, attitude and intentions was 5 and the maximum score for current use plus intentions was 10.

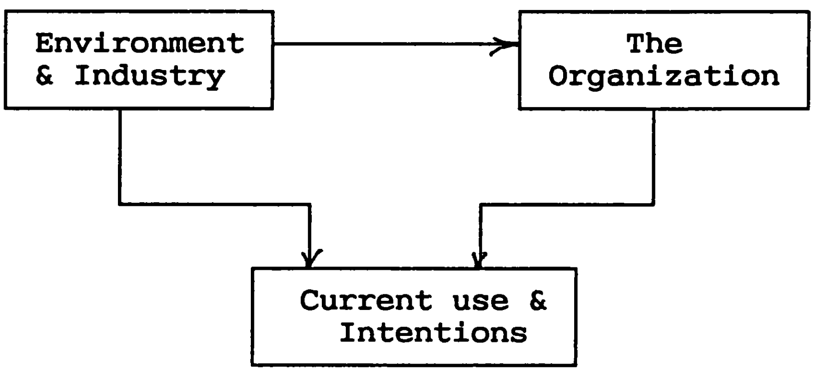
7.5 **Summary**

This chapter has discussed the relationships between the environment (e.g., the need to react faster to threats and opportunities) , the industry (e.g., the driving forces which arise from that industry) and the organization (e.g., the attitude toward training) and the current and intended use of CBIS by middle and senior managers.

The effect of the organization in particular was not positive - managers in all six organizations felt that the corporate culture held back development management use of CBIS at all levels.

Based on the preceding analysis the two factors from the beginning framework are both significant in the managers' current use and intentions concerning CBIS but the relationship is slightly more complex than outlined in Chapter 1 since the environment and the industry affect managers' use of CBIS indirectly as well, through their impact on the organization as a whole. Figure 7-1 summarizes the revised relationships.

Figure 7-1: The environment and organization factors in the emergent framework



The Effects of Characteristics of the Individual Manager

This chapter describes and discusses the data gathered during this research concerning the effects of the characteristics of individual managers on their use of, and intentions concerning, CBIS for their jobs. The effects of these characteristics on the managers' beliefs and attitudes concerning computers in general and on a number of factors which appeared to relate to computer use are also examined.

8.1 Introduction

There are many ways in which the manager as a "bundle of characteristics" can be described and, more specifically, related to his use of computers in the organization[1]. The data on individual managers presented and evaluated below are of three types. The most straightforward is demographic data which describe objective aspects of each manager such as age, education and management level. This type of data was gathered at an early stage of the interview process. In some cases the answers were classified and coded (e.g., level of education).

Psychographic data attempt to describe and classify aspects of the personality of each manager and were gathered using the Myers-Briggs Type Indicator discussed in Chapter 6.

In addition to examining the demographic and psychographic characteristics themselves, their possible effect on five topics which were believed to relate to a

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[1]Ackoff [1979] reported that Allport and Odbert [1936] identified 17,953 traits mentioned in the literature up to that time.

manager's computer use and intentions was also examined. The topics were:

. the manager's preferred communication techniques;
. his reasons for limited personal use;
. the proportion of time spent on a set of activities;
. the perceived relationship between characteristics of a task and the value of computers for that task;
. the manager's preferred characteristics of computer-based tools.

The third type of data reported below emerged from managers' answers to open-ended questions as well as comments and observations made during interviews. It reflects attitudes and beliefs of the individual rather than those of the organization (Chapter 7) or the function (Chapter 9) and so has been treated as a further aspect of the individual's effect on his own current and intended use.

8.2 **Demographic data**

The demographic factors investigated in this research were: gender: age; length of service; experience with that company; experience in his position; computer background; computer training; management level and level of education.

8.2.1 Gender

Because only five of the managers (10%) who took part in this project were female it is not possible to draw broad conclusions concerning gender and other characteristics. However, the comments of the women who did take part did not indicate any significant difference from men in use of, or attitude toward, computers. It is interesting to note that all five women are employed by "pseudo" government organizations (the two hospitals and the University). None of the three private organizations had women employed at the management levels examined in this project.

8.2.2 <u>Age</u>

The majority of the managers at all three levels examined in this project were in the 40-49 age group (58%) while 20% were in the 30-39 range and 18% were 50 and over. There were some significant differences among organizations: at site A 67% of the managers were in the 40-49 age range and only 13% are in the 50+ age range. On the other hand at site E 67% of the senior managers are over fifty and one was over 65. This is partially explained by their practice of hiring retired military officers to deal with the largest customer (the Department of Defence). At site F three of the four senior managers interviewed were under forty. This is because, as a relatively small subsidiary of one of the largest companies in Canada, it is used, in part, as a training ground for up and coming managers (the Director of Human Resources was promoted to a larger subsidiary 3500 miles away before completing this project). The other three organizations showed a spread of ages from 28 to 64.

. The average age of managers in this firm is quite high. So we probably use the computer less. Maybe a good thing? [D-20] [prod.]

. We have a lot of older [managers] and facilities. This, I think, makes it hard to get computers rooted in the firm, no matter how useful. [E-19] [prod.]

There was a sense, from comments such as those above and from observations, that the oldest managers were the most reluctant to become involved with computers but they were generally the least educated and had the longest experience in their position so the data are not conclusive.

8.2.3 Length of service

The average length of service of the twenty-one managers at site A was 21.8 years. Omitting the new company doctor who was hired two years prior to this interviews, the range of service was from 14 to 35 years. Considering that 18 of the 21 senior managers interviewed were under fifty this represents remarkable stability. This organization promotes from within and seems to attract very stable employees (for better or for worse). Contrary to an original assumption that long service would imply rigidity and conservatism, managers at site A were at least as open to new applications of computing as managers with much less service in other organizations. Active encouragement of computing by the organization as a whole, tools and support available and the history of use in his function seem to offset any negative aspects of long service - the managers, whatever their function, appeared to have adopted the high tech attitudes of the industry.

On the other hand, the average length of service for senior managers at site E was only 8.8 years, explained partly by the practice of hiring retired military officers who are sometimes near retirement age. This was reflected in the lack of computer training and experience at higher levels and a broad range of attitudes toward computing support for senior management.

8.2.4 Experience in the position

No structured data were gathered on the relationships between these factors and the manager's use of computers, his attitude or his intentions. But, when each manager's experience was compared to his comments and answers and the researcher's observations, experience in his organization and experience in his current position had no discernable effect on his attitude toward, or use of, computer tools. As with length of service other factors such as the corporate culture, tools available and the history of computing in a function were stronger.

8.2.5 Computer experience

The one type of experience that did seem to have an effect on both use and, more intensely, attitude was past experience with computers. Managers who had worked in a computer facility or who had used computer applications intensely were aware not only of the potential of the computer to support managers but also of the limitations.

. Are supervisors sure what people are doing [with computers]? IS may have problems due to data validity; backup procedures; how many people are trying to solve the same problem? [A-10] [plan.] [CB]

. We are in the position of having to put in place a lot of non-financial databases quickly. These must be aimed at senior management and done manager by managers. What guidelines do we need - there are none now. [A-11] [plan.] [CB]

- Without better data collection (transaction terminals), better use of staff and better planning MIS hasn't got much future here. [F-11] [acct.] [CB]

But, again, the managers use and intentions were driven more by the corporate culture (and budget), tools available and his organizational function than by his understanding of computers.

8.2.6 Management level

This was a factor of particular interest in this project. As a manager rises in the organization does his new position or, more accurately, his increased power in the organization affect his use of, and attitudes about, computers? If so, how? As described in chapter 1 each manager who took part in this project was classified as level 1 or level 2 in terms of his apparent "power" in the organization and his degree of control in his function. This was, for the most part (but not always), directly related to the manager's position on the organizational chart. Tables 8-1 through 8-5 summarize the effects of management level on a number of issues relevant to this research.

8.2.7 Computer training

This was another factor which was of interest in this research because it reflects not only the current levels of knowledge of managers but also the corporate attitude toward training and toward direct use by managers.

Each manager was asked which of five terms best described his current situation regarding computer training:

0 - I have had no training about computers
1 - I have had in-house courses on computing
2 - I have had courses provided by an outside organization such as IBM
3 - I have had some formal education in computing
4 - I have a diploma or degree in computing.

8.2.8 Education

A third demographic factor that was classified during the interviews was the level of education of each manager. These were coded as follows:

1 - high school or less
2 - a technical diploma
3 - some university
4 - an undergraduate degree
5 - some graduate study
6 - a graduate degree.

Tables 8-1 through 8-5 summarize the effects of "level of education" on five topics of interest in this research.

8.3 Effect of three demographic characteristics on managers' perceptions

A number of topics which were believed to affect the managers' current activity and intentions relating to CBIS were investigated in terms of the possible effect on them of management level, level of computer training received and the education of the managers.

8.3.1 Preferred input/output (communication) methods

This was investigated because of the managers' obvious interest in computers as communications tools. Did the demographic characteristics of the managers affect their ratings of each of a set of techniques used for communicating with individuals and both inside and outside the organization? They were asked to rate each of seventeen communications techniques on a 6-point Likert scale (see page 7 of Appendix II). When an ANOVA (the Kruskal-Wallis) test was applied to the data summarized in Table 8-1 no significant effects of management level were apparent.

Computer training, however, did cause some differences. For managers with formal training the value of *ad hoc* reports and of professional groups were significantly higher than for managers with little or no computer training.

The data in Table 8-1 show that level of education caused only one statistically significant difference in the values managers put on communications techniques. Managers with the lowest level of education ranked the value of "standard, organization-wide reports" higher than any other education group. This preference for well structured, traditional computer "print outs" by such managers is not surprising since they are likely to feel threatened by the knowledge and creativity required by packages or end user computing.

8.3.2 The individual manager's reasons for limited direct use of CBIS

A second set of data acquired from most managers was their reasons for not using computer-based information systems personally (see pages 19 and 20 of Appendix II). Table 8-2 summarizes the managers' ratings of the reasons broken down by demographic factors.

The management level of the individual had a significant effect on only reason for not using CBIS directly. Level 1 managers felt strongly that "benefits don't match the cost for me". The managers at level 2 felt this as well but not to the same degree.

The level of computer training received had no apparent effect on the managers' reasons for limited personal use of CBIS.

Level of education led to only one significant difference in the set of reasons for limited use of CBIS. Managers with the two highest levels of education felt more strongly that "there is too much delay in getting output". The most likely cause for this is the higher level of activity and creativity engendered by their education.

8.3.3 Proportion of time spent on activities

This research took a simple approach to the topic of specific activities undertaken as part of the manager's job (see pages 14 & 15 of Appendix II). Is there a discernable relationship between individual characteristics and the type of activities undertaken to complete tasks? Table 8-3 summarizes the time spent on activities from the point of view of management levels, computer training and level of education.

The Kruskal-Wallis test showed no significant effects of management level, level of computer training or level of education on the sets of activities performed as part of the manager's job.

Table 8-1: Ratings of input/output (communication) methods
(summarized by demographic factors)

DEMOGRAPHIC FACTOR / COMMUNICATION TECHNIQUE	MANAGEMENT LEVEL 1	2	LEVEL OF COMPUTER TRAINING 0	1	2	3	LEVEL OF EDUCATION 1	2	3	4	5	6	ALL
the telephone	5.0	4.6	4.9	4.8	4.7	4.7	4.9	2.0	4.9	4.8	5.0	4.8	4.8
written memos & letters	3.7	3.5	3.3	3.7	3.9	3.8	3.9	3.0	2.6	3.8	4.3	3.8	3.6
Electronic mail	2.3	1.5	2.2	1.4	1.9	1.6	1.6	0.0	2.3	1.9	1.7	2.0	1.9
Voice mail	4.8	4.3	4.9	4.3	4.4	4.1	3.8	3.0	4.9	4.6	4.3	5.0	4.4
individual meetings with people outside your area	3.9	3.5	3.7	3.9	3.5	3.8	3.4	2.0	3.3	4.4	3.0	3.7	3.7
group meetings with people from outside your area	3.3	3.1	3.3	3.4	3.1	3.1	2.2	3.5	3.0	3.8	3.0	3.4	3.2
meetings with your subordinates	4.4	4.2	4.5	4.2	4.0	4.5	4.6	4.0	3.8	4.4	4.3	4.3	4.3
standard, org.-wide computer reports	3.6	3.2	3.1	3.7	3.6	3.3	2.7	5.0	3.4	4.0	2.7	3.3	3.4
meetings with outsiders	3.9	2.8	3.2	3.3	3.2	3.7	2.9	1.0	2.6	3.4	4.0	4.0	3.3
ad hoc computer reports	3.4	2.5	3.0	2.5	2.7	3.5	2.2	3.0	1.8	3.3	2.3	2.8	2.9
general reading	2.4	2.0	2.4	2.3	2.3	1.7	2.2	1.0	1.5	2.6	2.7	2.3	2.2
professional/trade groups	2.3	2.3	2.4	2.7	2.5	1.3	1.8	1.0	2.6	2.4	2.3	2.4	2.3
formal reports within the organization	3.0	2.7	2.5	2.9	3.3	2.8	2.8	1.0	2.4	3.6	3.3	2.4	2.9
meetings with your boss	3.3	2.8	3.1	2.8	3.0	3.3	2.8	2.0	2.6	3.4	3.3	3.0	3.0
facsimile machines	3.2	2.7	3.1	3.5	2.8	2.2	2.6	3.0	2.0	3.1	2.7	3.0	2.9
informal ("hallway") meets	2.7	2.8	3.1	2.4	2.5	3.0	2.5	2.0	2.5	3.2	1.7	2.9	2.8
n =	22	25	15	10	12	10	9	1	8	14	3	12	47

Table 8-2: The individual's reasons for limited direct use of CBIS
(summarized by demographic factors)

DEMOGRAPHIC FACTOR	MANAGEMENT LEVEL		LEVEL OF COMPUTER TRAINING				LEVEL OF EDUCATION						
REASON	1	2	0	1	2	3	1	2	3	4	5	6	ALL
I don't have time to learn	3.0	2.4	2.5	2.1	3.0	2.9	2.1	4.0	2.1	3.0	1.7	3.1	2.6
I have competent staff to do this sort of work	3.1	3.9	3.6	4.1	3.7	2.6	3.6	5.0	3.7	3.1	3.0	4.1	3.6
the org. discourages use of computers by managers	1.0	0.7	1.8	0.4	0.4	0.5	0.7	0.0	0.0	1.2	1.0	1.0	0.8
for me the benefits don't match the costs	1.4	2.8	2.2	1.6	2.8	2.0	2.1	5.0	1.1	2.3	2.7	2.3	2.2
needed hardware not avail.	0.7	1.2	1.2	0.7	1.1	0.8	1.0	0.0	0.7	1.2	1.3	0.8	1.0
output is too late for me	0.7	0.7	0.7	0.3	1.0	0.8	0.9	3.0	0.1	1.1	0.3	0.2	0.7
computer programs are not flexible enough	1.4	1.7	1.4	1.6	1.4	1.8	1.8	1.0	0.9	1.2	2.0	2.2	1.5
too much effort to get the resources we need	1.3	1.4	1.8	1.0	1.2	1.3	1.1	0.0	0.7	1.7	1.7	1.4	1.3
my peers wouldn't under-stand the output	0.7	0.5	0.8	0.4	0.5	0.9	0.7	0.0	0.1	0.9	0.7	0.6	0.6
I don't have enough education to use them	0.5	0.2	0.4	0.2	0.4	0.4	0.4	0.0	0.0	0.7	0.0	0.2	0.4
no room in my office	0.4	0.3	0.4	0.1	0.5	0.4	0.4	0.0	0.0	0.7	0.0	0.1	0.3
it is an inefficient use of my time & know-how	1.5	1.9	1.6	1.7	2.0	1.4	1.9	5.0	1.6	1.1	1.3	2.3	1.7
few others here use them	0.9	0.7	1.1	0.3	1.0	0.6	0.7	0.0	0.4	0.7	1.7	1.1	0.8
the training I need is not provided	1.6	1.2	2.0	1.4	0.8	1.3	0.8	4.0	0.1	2.2	0.7	2.1	1.4
my time is too "broken up"	2.5	2.0	2.2	1.9	2.4	2.4	2.0	0.0	1.4	2.1	2.7	3.0	2.2
n =	19	23	12	10	12	8	9	1	7	13	3	9	42

Table 8-3: Proportion of time spent on activities
(summarized by demographic factors)

DEMOGRAPHIC FACTOR	MANAGEMENT LEVEL		LEVEL OF COMPUTER TRAINING				LEVEL OF EDUCATION						ALL
ACTIVITY	1	2	0	1	2	3	1	2	3	4	5	6	
group meetings	17.6	20.9	15.7	16.9	23.3	21.9	13.0	55.0	17.1	19.1	20.0	22.2	19.3
one-on-one meetings	15.1	17.3	17.4	15.0	14.8	17.3	14.1	15.0	15.7	14.6	15.0	20.7	16.2
using the telephone	13.5	9.9	12.4	13.9	11.5	8.8	12.3	0.0	15.0	13.1	8.3	9.5	11.7
reading non-computer documents	9.0	9.2	10.1	9.1	8.4	8.3	9.3	0.0	7.9	8.3	10.7	11.3	9.1
drafting reports	10.2	9.1	10.2	6.4	12.3	8.0	14.5	5.0	7.1	9.4	8.0	9.0	9.7
working at a computer	1.8	1.0	1.1	0.0	2.3	2.0	2.5	0.0	2.1	1.4	1.0	0.3	1.4
travelling	5.9	5.0	3.7	7.9	5.2	6.4	6.4	0.0	6.7	4.7	7.7	4.6	5.4
studying/training	3.1	1.9	2.3	2.0	3.3	2.1	2.8	0.0	2.9	2.9	4.3	1.1	2.5
analyzing computer reports	5.2	4.1	3.7	6.3	5.4	3.5	5.3	5.0	5.3	5.3	3.3	3.2	4.6
informal meetings	8.2	9.5	11.1	9.4	5.6	8.8	7.5	5.0	10.1	10.0	6.7	8.7	8.9
thinking/planning	8.0	11.1	11.6	8.8	8.2	9.0	12.5	15.0	7.9	10.8	10.0	6.5	9.6
total(rounded)	97.6	99.1	99.3	95.6	100	96.0	100	100	97.9	99.5	95.0	97.0	98.4
(all types of meetings)	40.1	47.8	44.3	41.3	43.7	47.9	34.6	75.0	43.0	43.7	41.7	51.6	44.3
n =	21	21	14	8	12	8	8	1	7	13	3	10	42

8.3.4 Characteristics of a task

The next factor examined in relation to management level, computer training and level of education was the effects of the characteristics of a task on the manager's perception of its "computerizability" (see page 25 of Appendix II). Table 8-4 contains summaries of the data used in this analysis.

The Kruskal-Wallis test showed no significant differences concerning the perceived relationships between task characteristics and the appropriateness of CBIS based on management level, computer training or level of education among the managers in this project.

8.3.5 Characteristics of computer-based tools

Of the twenty-seven functions and characteristics rated by the managers (Table 8-5) only one showed significant difference between level 1 managers and level 2 managers. Level 1 managers were more insistent that the CBIS be developed in house.

The level of computer training received by managers affected their responses on two characteristics of tools at the .05 level. Managers with no computer training were much stronger supporters of the ability of a computer-based tool to communicate with others while managers with some in house training rated this factor low. Computer training had only one significant affect on responses: managers with no computer training rated "must have a good front end (menus, etc.)" much higher than others.

Table 8-4: Impact of the characteristics of a task on the relevance of computer support (summarized by demographic factors)

DEMOGRAPHIC FACTOR	MANAGEMENT LEVEL		LEVEL OF COMPUTER TRAINING				LEVEL OF EDUCATION						
TASK CHARACTERISTIC	1	2	0	1	2	3	1	2	3	4	5	6	ALL
task size	3.0	3.1	3.0	2.8	3.6	2.9	3.2	3.0	3.2	3.2	1.7	3.1	3.1
frequency of performance	3.3	3.4	3.5	3.1	3.5	3.2	3.1	4.0	3.0	3.8	3.0	3.2	3.3
financial components	1.7	1.7	2.3	1.1	1.2	1.9	1.3	5.0	1.0	2.1	2.0	1.5	1.7
task complexity	2.6	2.6	2.5	2.5	2.5	2.8	3.1	4.0	1.4	2.5	2.3	3.0	2.6
internal vs. external	1.5	1.5	1.7	1.6	1.0	1.4	0.9	1.0	2.3	1.6	0.7	1.5	1.5
task structure	2.2	2.0	1.7	2.6	2.5	1.9	2.3	4.0	1.8	2.0	2.3	2.2	2.1
his own skills/experience	1.8	1.4	1.9	1.1	1.9	1.2	1.4	3.0	1.5	1.5	1.7	1.7	1.6
tradition	0.3	0.4	0.5	0.3	0.3	0.2	0.1	0.0	1.0	0.2	0.0	0.3	0.3
time available (deadlines)	2.7	2.8	3.4	2.4	2.6	2.3	2.9	4.0	3.1	2.8	2.0	2.3	2.7
n =	22	25	15	11	11	10	9	1	8	15	3	11	47

Table 8-5: Ratings of the characteristics of computer-based tools
(summarized by demographic factors)

DEMOGRAPHIC FACTOR	MANAGEMENT LEVEL		LEVEL OF COMPUTER TRAINING				LEVEL OF EDUCATION						ALL
TOOL CHARACTERISTIC	1	2	0	1	2	3	1	2	3	4	5	6	
easy to use myself	2.2	2.6	3.5	1.9	2.1	1.9	2.4	0.0	2.3	2.1	1.0	3.4	2.4
access to multiple databases	1.9	2.3	2.3	1.8	2.3	1.8	2.1	2.0	2.4	2.4	2.2	1.6	2.1
a variety of reports/formats	3.2	2.9	3.3	2.9	3.5	2.3	3.4	3.0	2.9	2.9	2.3	3.2	3.0
runs on a microcomputer	1.1	0.5	0.9	0.4	0.4	1.4	0.4	1.0	0.4	0.9	0.5	1.1	0.8
developed in-house	0.9	0.3	0.8	0.6	0.0	0.8	0.2	0.0	1.0	0.2	0.7	0.9	0.5
lots of flexibility	3.6	2.9	2.6	3.4	3.5	3.5	3.6	4.0	2.6	3.4	2.7	3.3	3.2
finds a "reasonable" answer	2.3	2.4	2.1	2.9	2.0	2.5	2.8	0.0	2.4	2.5	2.0	2.1	2.4
statistical analysis	2.6	2.7	2.6	3.1	2.6	2.1	2.8	1.0	2.3	2.6	2.7	3.0	2.7
costs to acquire & maintain	3.6	3.0	3.9	3.5	2.9	2.4	3.7	4.0	3.0	2.8	3.0	3.6	3.2
communication linkages	2.7	3.1	3.6	2.0	2.9	3.0	2.9	3.0	3.5	2.8	2.7	2.7	2.9
fits with current activities	2.0	1.9	2.4	2.0	1.7	1.6	2.2	3.0	2.3	1.6	2.7	1.6	2.0
long term value	2.3	2.8	2.4	2.8	3.0	2.1	3.2	4.0	2.4	1.9	3.7	2.5	2.5
fits with our "politics"	1.9	2.1	2.0	1.8	2.3	1.9	2.3	2.0	2.8	1.5	3.7	1.5	2.0
good forecasting models	2.8	2.1	2.1	2.4	3.2	2.1	2.4	1.0	2.2	2.6	2.3	2.5	2.4
finds the "right" answer	1.9	2.0	2.3	1.5	2.1	1.8	2.4	4.0	2.4	1.3	2.7	1.7	2.0
fits with our other applics.	2.9	2.8	2.9	2.8	3.3	2.3	3.0	3.0	3.4	2.6	3.7	2.4	2.8
easy to use right away	3.4	3.4	3.8	2.9	3.5	3.5	2.9	1.0	4.1	3.2	3.3	3.9	3.4
graphics capability	3.0	2.4	2.3	3.1	2.8	2.7	2.6	3.0	2.4	2.7	2.3	2.9	2.7
easy to modify/enhance	2.0	1.8	1.2	2.5	2.0	1.9	2.4	4.0	1.6	1.1	3.0	2.1	1.9
in-house maintenance	3.4	3.1	3.5	3.4	3.6	2.3	3.6	4.0	4.1	2.4	3.7	3.3	3.2
a good report writer	3.2	3.3	2.8	3.2	4.0	3.2	3.8	5.0	2.9	3.1	3.3	3.3	3.3
buying/producing too early?	1.7	1.2	1.4	1.4	1.5	1.6	0.9	0.0	1.3	1.5	1.7	2.1	1.5
good documentation	3.6	3.6	4.0	3.1	3.9	3.3	3.9	4.5	4.1	3.3	3.7	3.4	3.6
supplier-provided training	3.3	3.2	3.4	3.5	3.6	2.5	2.7	4.0	4.4	3.2	3.0	3.2	3.3
no extra hardware/software	1.9	1.6	1.8	1.8	1.8	1.3	2.0	1.0	1.1	2.1	1.7	1.5	1.7
no major staff/supply change	2.5	2.6	2.4	2.9	2.5	2.4	3.4	3.0	1.8	2.6	3.7	2.1	2.6
good front end (menus, etc.)	3.5	3.6	4.2	3.1	3.2	3.6	3.3	2.0	3.7	3.6	3.0	3.8	3.6
n =	22	25	14	11	12	10	9	1	8	14	3	12	47

There were no significant difference in the ratings of the characteristics of tools based on the managers' levels of education.

8.4 Psychographic (personality) data

In addition to the relatively objective demographic aspects of the managers their psychological characteristics were important because of the need, in this research, to understand all the "internal" forces operating on the individual. To bring some structure and comparability to the evaluation of personality the four scales from the Myers-Briggs Type Indicator (discussed in Chapter 6) were used.[2]

The Extraverted/Introverted (EI) scale measures whether an individual prefers to direct perception and judgement on the outer world (E type) or mainly on the world of ideas (I type). Isabel Myers estimated in 1962 that 75% of the population of the United States prefer E. Of the forty-seven managers in this research who completed the MBTI 25 (53%) indicated a preference for Extraversion (E). Apparently this group has a slightly lower proportion of E types than the population as a whole.

The Sensing/Intuitive (SN) scale measures whether one prefers to deal with stimuli (data) observable by way of the senses or with possibilities, meanings and relationships. Myers estimated that 75% of the population

[2]See Appendix III for descriptions of the four scales as well as various combinations of the S/N and T/F scales.

of the United States prefer S. The number in this sample who indicated a preference for gathering data through sensing (S) was 27 (57%) - a slightly lower proportion of S types than the population as a whole.

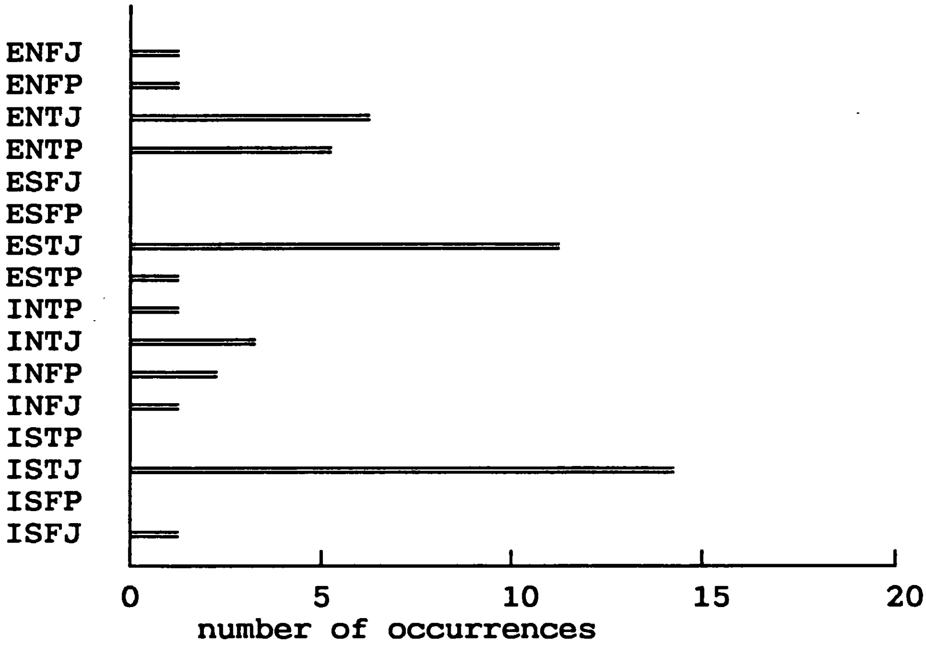
The Thinking/Feeling (TF) scale describes whether an individual prefers to make logical connections among data gathered by S or N or if one prefers to apply feelings and values to data. Myers estimated that about 60% of American males prefer T. Forty-one of the managers (87%) who completed the MBTI indicated a preference for analyzing data through logical analysis (T).

The number of managers in each of the four combinations of data gathering and data processing types were: ST - twenty-six managers (55%); SF - one manager (2%); NT - fifteen managers (32%); and NF - five managers (11%).

Finally, the Judging/Perceiving (JP) scale defines whether a person is most concerned with making decisions, seeking closure, planning operations or organizing activities (J) or one is most attuned to gathering information (P). Myers estimated that 55 to 60% of the population of the United States prefer J. Thirty-seven managers (79%) in this study indicated a preference for the Judging (J) approach to their environment.

Figure 8-1 outlines the number of managers in each of the sixteen MBTI personality types.

Figure 8-1: Dispersion of MBTI personality types among the managers in this research



But what do these number mean in terms of the use and attitudes of managers toward computers? Briggs-Myers and McCaulley [ibid] have done a detailed survey, based on tens of thousands of applications of the MBTI, of the attitudes and preferences of all of the combinations of characteristics in the four scales and have derived a number of guidelines which can be applied to the following data.

Thinking (T) types "link ideas together by making logical conclusions. Thinking relies on cause and effect and tends to be impersonal." This means that almost 90% of the managers interviewed take an approach to analysis which closely resembles the techniques of computers. This is borne out by the breadth of support for computer use.

They have described the type typified by the combination of _S_J as "the realistic decision makers."

Since 25 of the 47 managers who completed the MBTI are _STJ types they would be even more logical and result directed than the basic _S_J type. It is not surprising that the computer was seem by most managers in this sample as very valuable and not yet coming near to fulfilling its potential for them.

The other significant number in the above data is the 87% of managers who prefer a Judging approach to a Perceiving approach to their environment. Basically, "in the Judging (J) attitude, a person is concerned with making a decision, seeking closure, planning operations or organizing activities... for all person who characteristically live in the judging attitude, perception tends to be shut off as soon as they have observed enough to make a decision." [ibid] Judging types are concerned with specific, unambiguous and limited information.

More specifically, the MBTI draws a distinction between TJ and FJ types. "For thinking-judging (TJ) types the decisions and plans are more likely to be based on logical analysis; for feeling-judging (FJ) types the decision are more likely to be based on human factors." Since 34 of the 37 of the managers who completed the MBTI are TJs the logical approach was certainly dominant.

8.5 Effect of these psychographic characteristics on managers' perceptions

Were there any significant effects of personality types on the five topics examined above in relation to demographic factors?

8.5.1 Preferred input/output (communication) methods

Applying the Kruskal-Wallis test to the raw data summarized in Table 8-6 yielded only two significant results. Extraverted managers rated both the telephone and written memos and letters significantly higher than did Introverts while Introverts rated the more technical Voice-mail significantly higher than did Extraverts. Considering the preference of E types for personal interaction this result is quite straightforward but it also means that E types are less likely to be convertible to the impersonal technology of computers. It is interesting to note that, in interviews, Marketing managers (all E types) were among the strongest supporters of the use of computers for communicating internally and with clients. Apparently they were thinking in terms of their function rather than themselves when expressing that need. No other differences among types were found.

8.5.2 The individual's reasons for limited direct use of a CBIS

Based on the data in Table 8-7 only one significant ($p<.01$) difference concerning reasons for not using computers more was caused by personality type. NF types are more likely to say that their "lack of education" was a cause of limited use. Considering Briggs-Myers model of NF types as person, value and situation oriented, it is not surprising that they felt unprepared to use a highly structured and possibly complex tool.

8.5.3 Proportion of time spent on activities

The data summarized in Table 8-8 show a number of significant effects of personality types on the activities undertaken to complete the tasks comprising a manager's job. Extraverts ranked travelling considerably higher than did Introverts, perhaps reflecting a relationship among Extraversion, marketing and travel. Can computer mediated communication cut down on such travel? NF types ranked "studying & training" higher than did any other data gathering/analysis type reflecting the nature of intuition and feeling. No significant effects of J versus P were evident.

8.5.4 Characteristics of a task

Did different personality types consider different characteristics of their assigned tasks as more appropriate for computerization? Table 8-9 summarizes the Likert scale ratings of managers in the three groupings of interest. When the Kruskal-Wallis test was applied to the raw data only two significant differences were found among the personality types. Extraverts were more likely to see "complexity" as a reason to computerize a task while Introverts were more likely to computerize tasks which matched their own skills and experience. Since Extraverts are more comfortable with ambiguity they are also more willing to study and model it while Introverts prefer to computerize something they can understand and structure more easily.

8.5.5 Characteristics of computer-based tools

A computer-based tool can perform many functions and tools performing the same function can have a range of characteristics. Do different personality types prefer different functions and characteristics? When the Kruskal-Wallis test was applied to the data in Table 8-10 some significant differences were apparent. Introverts were much more concerned with the cost of the tool and with the availability of communications technology than were Extraverts. They were also more concerned that a new tool fit with existing hardware and software, possibly because of their penchant for organization and communication.

Sensing types were more concerned with the quality of the documentation than were Intuitive types, supporting Briggs-Myers' description of their need for organization.

Table 8-6: Ratings of input/output (communication) methods (summarized by MBTI personality type)

PERSONALITY TYPE / COMMUNICATION TECHNIQUE	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PERCEP	ALL
telephone	4.8	4.8	4.8	5.0	4.7	5.0	4.8	4.7	4.8
written memos, letters, etc.	3.9	3.4	3.6	4.0	3.3	4.8	3.8	3.1	3.6
Electronic mail	1.7	2.0	1.6	2.0	2.2	2.4	1.8	2.2	1.9
Voice mail	4.1	4.6	4.3	5.0	4.4	5.0	4.3	4.8	4.4
one-on-one meetings	3.5	3.8	3.6	3.0	3.8	3.8	3.6	4.1	3.7
group meetings	3.0	3.4	3.0	3.0	3.4	3.8	3.1	3.6	3.2
meetings with subordinates	4.2	4.4	4.2	5.0	4.6	4.0	4.2	4.6	4.3
standard, org.-wide reports	3.4	3.3	3.5	4.0	3.0	3.8	3.5	2.9	3.4
meetings with outsiders	3.0	3.5	2.8	1.0	3.9	4.4	3.2	3.8	3.3
ad hoc computer reports	2.7	3.1	2.7	3.0	3.1	3.4	2.9	2.8	2.9
general reading	2.6	1.9	1.8	2.0	2.3	4.0	1.9	3.2	2.2
professional or trade groups	2.5	2.0	2.0	3.0	2.2	3.6	2.2	2.4	2.3
formal reports in the org.	2.5	3.2	2.3	4.0	3.5	3.6	2.6	3.8	2.9
meetings with my boss	2.5	3.5	2.8	5.0	3.2	3.3	3.0	3.2	3.0
facsimile machine	2.8	3.0	3.1	2.0	2.6	3.0	3.0	2.6	2.9
informal meetings	2.7	2.8	2.7	3.0	3.1	2.2	2.8	2.8	2.8
n =	22	25	26	1	15	5	37	10	47

Table 8-7: The individual's reasons for limited direct use of CBIS (summarized by MBTI personality type)

PERSONALITY TYPE / REASON	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PERCEP	ALL
I don't have time to learn computers	2.7	2.6	2.3	4.0	2.9	3.0	2.5	2.9	2.6
I have competent staff to do it	3.2	3.9	3.5	5.0	3.8	2.8	3.6	3.6	3.6
the org. discourages comp. use by mgrs.	0.9	0.7	0.7	0.0	0.9	1.4	0.6	1.4	0.8
the benefits don't match the cost	2.2	2.1	1.9	3.0	2.8	1.8	2.2	2.1	2.2
the needed hardware is not available	1.4	0.6	0.9	1.0	0.8	1.6	1.0	0.9	1.0
too much delay getting printouts	1.0	0.5	0.8	0.0	0.3	1.4	0.6	0.9	0.7
comp. programs are not flex. enough	1.3	1.7	1.6	0.0	1.8	0.8	1.6	1.3	1.5
too hard to get the needed resources	1.5	1.1	1.2	1.0	1.3	2.2	1.3	1.3	1.3
my peers won't understand the output	0.8	0.5	0.5	0.0	0.8	1.0	0.5	1.0	0.6
I don't have enough educ. to use them	0.6	0.2	0.3	0.0	0.2	1.4	0.3	0.6	0.4
there is no room in my office	0.5	0.2	0.3	0.0	0.2	1.0	0.3	0.6	0.3
an inefficient use of my time/know how	1.7	1.7	1.4	4.0	2.3	1.2	1.6	2.2	1.7
few other managers here use computers	0.7	0.8	0.6	1.0	0.8	1.6	0.7	1.2	0.8
the training I need is not provided	1.4	1.4	1.0	0.0	1.6	2.6	1.2	2.0	1.4
my time is too "broken up"	2.1	2.3	1.9	4.0	2.4	2.8	2.1	2.7	2.2
n =	20	22	24	1	12	5	33	9	42

Table 8-8: Proportion of time spent on activities
(summarized by MBTI personality type)

PERSONALITY TYPE / ACTIVITY	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PRCEP	ALL
group meetings	21.0	17.7	16.8	40.0	22.1	18.0	20.6	15.0	19.3
one-on-one meetings	16.2	16.2	16.0	10.0	18.1	12.6	16.4	15.4	16.2
using the telephone	10.1	13.2	2.9	10.0	10.1	11.2	11.5	12.5	11.7
reading non-computer documents	9.5	8.7	9.4	10.0	8.9	8.2	9.8	7.0	9.1
drafting reports	11.9	7.7	10.3	10.0	6.6	15.6	10.0	8.7	9.7
working at a computer	1.9	1.0	1.7	0.0	0.8	2.0	1.7	0.6	1.4
travelling	3.4	7.3	5.3	2.0	6.5	3.8	4.9	7.0	5.4
studying/training	2.5	2.5	2.2	0.0	1.8	6.0	2.0	3.9	2.5
analyzing computer produced reports	4.1	5.1	5.7	2.0	3.0	5.0	4.9	3.9	4.6
informal meetings	9.0	8.7	8.9	1.0	10.1	7.0	8.0	12.0	8.9
thinking/planning	9.0	10.2	9.7	11.0	9.4	8.6	8.7	13.0	9.6
total (rounded)	98.4	98.4	99.0	100	97.5	98.0	98.4	99.0	98.4
(all types of meetings)	46.2	42.6	41.8	51.0	50.3	37.6	45.0	42.4	44.3
n =	20	22	22	1	14	5	32	10	42

Table 8-9: Impact of the characteristics of a task on the relevance of computer support (summarized by MBTI personality type)

PERSONALITY TYPE / TASK CHARACTERISTICS	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PRCEP	ALL
task size	3.0	3.1	2.9	5.0	3.1	3.2	3.0	3.3	3.1
frequency of performance	2.9	3.6	3.3	5.0	3.2	2.9	3.2	3.8	3.3
financial components	1.7	1.7	1.8	0.0	1.5	2.0	1.6	2.1	1.7
task complexity	2.0	3.0	2.3	3.0	3.2	2.0	2.4	3.0	2.6
internal vs. external	1.4	1.6	1.6	0.0	1.4	1.8	1.5	1.4	1.5
task structure	1.9	2.2	2.0	3.0	2.0	2.6	2.1	1.9	2.1
his own skills/experience	2.1	1.1	1.8	0.0	1.1	1.8	1.5	1.5	1.6
tradition	0.5	0.2	0.4	2.0	0.1	0.2	0.4	0.1	0.3
time available (deadlines)	2.8	2.7	2.8	4.0	2.6	2.8	2.6	3.3	2.7
n =	21	25	26	1	14	5	36	10	46

Table 8-10: Ratings of the characteristics of computer-based tools (summarized by MBTI personality type)

PERSONALITY TYPE / TOOL CHARACTERISTIC	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PRCEP	ALL
easy to use myself	2.5	2.4	2.5	1.0	2.7	1.3	2.4	2.3	2.4
multiple databases	2.1	2.1	2.1	4.5	1.8	2.8	2.2	1.6	2.1
variety of reports	3.1	3.1	3.1	4.0	2.9	3.3	3.1	3.2	3.0
runs on a micro	0.9	0.7	0.7	2.0	1.0	0.3	0.8	0.7	0.8
developed in-house	0.5	0.6	0.4	0.0	0.8	0.0	0.5	0.6	0.5
lots of flexibility	2.9	3.4	3.0	5.0	3.5	3.3	3.1	3.8	3.2
finds a "reasonable" ans.	2.3	2.5	2.4	3.0	2.4	2.0	2.3	2.8	2.4
does statistical analysis	2.6	2.7	2.6	2.0	3.0	2.0	2.7	2.8	2.7
acquire/maintain costs	3.7	2.8	3.5	4.0	2.9	2.3	3.2	3.2	3.2
telecommunciations	3.4	2.7	2.9	3.0	2.7	3.5	2.9	2.6	2.9
fits with our activities	1.9	1.9	1.9	4.0	1.7	1.8	1.7	2.5	2.0
long term value	2.5	2.5	2.5	1.0	2.8	2.0	2.6	2.3	2.5
fits with org. "politics"	2.3	1.8	2.1	1.5	1.9	1.8	2.1	1.4	2.0
forecasting models	2.3	2.6	2.0	5.0	2.9	3.0	2.3	3.2	2.4
finds the "right" answer	2.0	1.9	2.3	2.0	1.5	1.3	2.1	1.3	1.9
fits with our other applics.	3.6	3.5	3.5	4.0	3.5	2.8	3.4	3.2	2.8
easy to use quickly	3.4	3.0	3.5	4.0	3.5	2.8	3.4	3.2	3.4
graphics capability	2.5	2.9	2.4	3.0	3.1	2.5	2.5	3.8	2.7
easy to modify	2.0	1.7	1.9	3.0	1.8	1.5	1.9	1.5	1.9
maintainable in-house	3.3	3.2	3.3	4.0	3.3	2.8	3.2	3.3	3.2
good report writer	3.3	3.3	3.0	5.0	3.5	3.5	3.2	3.4	3.3
acquiring/buying too early?	1.4	1.4	1.3	0.0	1.7	1.3	1.4	1.2	1.5
good documentation	3.8	3.5	4.0	4.0	3.1	3.8	3.8	3.3	3.6
training supplied	3.2	3.3	3.2	4.0	3.1	4.0	3.2	3.5	3.3
no extra HW or SW	1.7	1.7	1.7	3.0	1.3	3.3	1.6	2.3	1.7
no major changes	2.5	2.5	2.3	3.0	2.7	3.1	2.4	3.0	2.6
good menus, etc.	3.7	3.4	3.5	2.0	3.8	3.5	3.5	3.6	3.6
n =	22	24	26	1	15	4	36	10	46

8.6 Attitudes, current use & intentions

The goal of this chapter is to evaluate, directly or indirectly, the effect of individual characteristics on these three factors. In addition to the preceding structured evaluation of demographic and psychographic factors the relationship between characteristics of managers and measures (or indications) of current use, attitudes and intentions were quantified and evaluated in terms of both the individual ("I") and the function ("we"). The concepts behind this approach were explained in Chapter 6 and the data on which the analysis is based are summarized in Tables 8-11 (demographic factors) and 8-12 (MBTI personality types).

When the Kruskal-Wallis test was applied significant differences in use, attitudes or intentions were found based on the manager's level of computer training. The more training a manager had, the higher the level of current use reported for both themselves and their functions. The result was the same for attitude toward computer tools for both himself and his function and for future intentions. Clearly, training is an essential factor in the relationship between managers and CBIS!

The only significant difference based on personality factors was that Judging types indicated a much higher level of intentions for increased personal use compared to Perceiving types.

Table 8-11: Managers' attitudes, current use and intentions (summarized by demographic factors)

DEMOGRAPHIC FACTOR	MANAGEMENT LEVEL		LEVEL OF COMPUTER TRAINING				LEVEL OF EDUCATION						
FACTOR	1	2	0	1	2	3	1	2	3	4	5	6	ALL
Attitude:													
Function	3.3	3.4	3.1	2.7	3.7	3.8	3.2	4.0	3.2	3.2	4.0	3.4	3.7
Self	1.8	1.6	1.1	1.0	2.2	2.6	1.7	2.0	1.0	1.7	2.0	1.9	1.8
Current use:													
Function	2.6	3.0	2.5	2.1	3.3	3.5	2.3	4.0	3.1	2.8	3.3	2.7	3.3
Self	1.3	1.0	0.6	0.7	1.6	2.0	1.2	1.0	1.0	1.3	1.7	1.0	1.3
Intentions:													
Function	3.0	3.2	2.7	3.3	3.2	3.5	2.9	3.0	3.0	2.9	4.0	3.3	3.4
Self	1.2	1.3	0.8	1.4	1.3	1.9	1.1	1.0	0.7	1.5	1.3	1.6	1.3
Current use + Intentions:													
Function	5.6	6.2	5.2	5.4	6.5	7.0	5.2	7.0	6.1	5.7	7.3	6.0	6.7
Self	2.5	2.3	1.4	2.1	2.9	3.9	2.3	2.0	1.7	2.8	3.0	2.6	2.6
n =	24	25	14	11	12	12	9	1	9	15	3	12	49

Table 8-12: Managers' attitudes, current use and intentions (summarized by MBTI personality type)

PERSONALITY TYPE / FACTOR	INTRO	EXTRA	ST	SF	NT	NF	JUDGE	PRCEP	ALL
Attitude:									
Function	3.3	3.3	3.2	4.0	3.7	2.8	3.4	3.2	3.7
Self	1.9	1.6	1.7	1.0	1.9	1.6	1.8	1.3	1.8
Current use									
Function	3.0	2.7	2.9	4.0	2.7	2.2	2.9	2.3	3.3
Self	1.3	1.0	1.2	1.0	1.2	1.2	1.3	0.7	1.3
Intentions:									
Function	3.2	3.0	3.1	4.0	3.1	2.8	3.2	2.5	3.4
Self	1.5	1.1	1.2	1.0	1.5	1.2	1.4	0.9	1.3
Curr. use + intent.									
Function	6.2	5.7	6.0	8.0	5.8	5.0	6.1	4.8	6.7
Self	2.8	2.1	2.4	2.0	2.7	2.4	2.7	1.6	2.6
n =	22	24	26	1	15	4	36	10	46

8.7 Managers' beliefs & attitudes

In addition to these numeric data, managers' responses to open ended questions; questions and comments from managers; and the researcher's observations raised a number of other points bearing on the managers' beliefs and attitudes about management and computer-based tools.

8.7.1 Incumbents, functions, tasks and tools

One aspect of the actual use of computer-based tools by managers in this study which was raised by a number of managers was that of the "non-computer generation". Basically the argument put forward was that "when you ask middle and senior managers like me about using computers you are dealing with the last generation of managers who came through without getting computer training. Our younger managers all use computers in their jobs. When they move up the computer will move up with them." [A-14 [acct.], A-23 [mark.], A-30 [mark.] and F-12 [prod.]

Although this is an attractive and apparently logical analysis it contains a basic flaw - it confuses the incumbent in the position, the tasks and activities which comprise a position and the tools being used. Will the younger managers bring the computer with them to senior positions or will they gradually change to non-computer oriented activities? If they do bring the computer with them will that be good or bad for the organization? Will tools be developed in the next few years that will make their use by senior managers more appropriate? Overall, are there aspects of middle and senior management tasks that are not, and will not be, amenable to computer support?

Data presented elsewhere in this dissertation indicate that managers feel that fundamental aspects of their job are not, and never will be, amenable to computerization.

8.7.2 Potential problems with direct use by managers

Few managers felt that direct use of CBIS by middle and senior managers would be without problems - for individuals and for the organization.

- Managers in this company need to understand how computers will help them. They have to make a commitment to computing - take the first step to getting "hands on". Some can't or won't do this without corporate pushing. [A-11] [plan.] [CB]

- We could provide better data to managers if they understood their needs better or could express them better. It's partly attitude and partly training. [A-17] [acct.]

- I'm just starting to understand about micros. Now they say they will soon be connected to the mainframe for "uploads" and "downloads". I can't keep up with all this. [A-22] [pers.]

- I have the feeling that the computer could cause trouble for managers. Will it really save time and effort? [A-24] [mark.]

- Some managers in this organization are "paranoid" about computers. [B-14] [acct.]

- In all my divisions I have some managers who resist even basic changes. What would happen if I went after something fancy? [E-14] [prod.]

- I let my managers run their own business [Division] and I stick to high level decisions - policy, deep discounting, etc. So far there isn't much support for this [from computers]. [E-14] [prod.]

8.7.3 The individual and the computer

Although most managers did not use the computer tool directly (personally) some did reflect on their relationship with computers. Both satisfaction with limited use and problems caused by it were recognized.

. We are one of the most sophisticated user groups in the company or the region but I don't do it myself - I manage. [A-12] [acct.]

. I have a large micro and a printer outside my office but I don't use it. I like hard copy because I can mark it up. I think my secretary is the main user. [A-14] [acct.]

. The nature of my job doesn't lend itself much to computing. I guess I'm average for people in middle management. I don't try to keep up with computer developments in my field. [A-16] [acct.]

. When it comes to computing I react - not act. My use is almost non-existent. [A-18] [pers.]

. I'd like to get more involved with computers but it would detract from [doing] my job. It's a hard balancing act... I would like a computer-oriented person to support me. I wouldn't fight to use computers but I must learn how they would help me. I need time and training for this. Then I could delegate knowing what I'm doing. [A-23] [mark.]

. The only glitch in computing around here is me. Not that I'm against it but I don't have the time or inclination. [A-27] [plan.]

. In this position I have no use for a computer [personally]. I am interested in ideas. [A-27] [plan.]

. It is important to let all managers know what is available for them, what it will do and how to use it. After that, at our level, it is up to the individual. [A-28] [mark.]

. I don't worry about computer developments in my field - I delegate all of this. It doesn't matter to me as long as I can do my job well. [B-14] [acct.]

. I could make good use of a computer but just have not bothered with it. I do not have a burning desire to use computers and my job gets done. [E-12] [prod.]

- Should I get a terminal or not? A PC? I never have time to use it. I feel like a dinosaur but does it matter? [F-12] [prod.]

- I was shown how to use a terminal a couple of years ago so I could access marketing data but I have never done it. [F-13] [mark.]

8.7.4 Personal use reported

In spite of restrictions ranging from lack of time to corporate attitude a number of managers did report direct use of computers to do their jobs.

- I finally taught myself to use FOCUS [a 4GL] because I wanted to be able to extract data from the mainframe. I had a lot to learn about file access too! [A-13] [acct.] [ISFJ]

- I use all aspects of the [central] computer mainly for analysis. I an learning how to use a PC but its access to central data is limited. [A-17] [acct.] [ESTJ]

- I do a lot of my own work around here: planning collective bargaining; producing special reports (very basic); keeping a log of grievances; advising the President on negotiations (spreadsheet). [D-11] [pers.] [INTJ]

- We manipulate data centrally around here now. I am one of the few senior people who uses spreadsheets, etc. now. I'm not sure if it is good or bad. [D-16] [mark.] [ENFP]

- I produce more than 100 pages of spreadsheets for managers in all of our subsidiaries. I should delegate it but it's just easier to do it myself. [E-16] [acct.]

8.7.5 Support staff

Many managers expressed the attitude which is also expressed in Chapters 9 and 10 - the value of specialist support rather than doing it themselves.

- I am a heavy "second level" user - through my people. We use mostly standard tools and I'm not too involved. [A-10] [plan.] [CB]

(this is a particularly important comment coming from a man who had spent most of his career in the computer department prior to moving to the Planning position. He is speaking from a position of both experience and insight.)

. The Vice-President, the Treasurer and I don't use computers directly. We all rely on one person who does what we need in terms of reporting and modelling. [A-13] [acct.]

. Almost everything I do is related to computers but mostly quite indirect. I have good people supporting me on this. [A-16] [acct.]

. Using computers is, to a great extent, a function which should be done by support specialists within my area. Not by line people - they should be out serving customers. [A-24] [mark.]

. I don't bother trying to keep up with computer developments in accounting. I rely on specialists for this. [C-14] [acct.]

. So far there hasn't been any need for me to use the computer. I guess there are things they could do but I have people who are very knowledgeable already. [D-16] [mark.]

8.7.6 Contradictions

Another interesting outcome of the review of the interview records was the discovery of a number of cases of internal contradictions - either implicit or explicit. For example one manager stated that:

. A micro terminal in every manager's office would create interest and, therefore, applications.

but this same manager also said:

. Working with the computer goes against the nature of my job - I delegate... My job is managing, not processing work." [B-14] [acct.]

In another case a manager made two disparate comments. He was not enthusiastic about computing:

. In this position I have no use for a computer [personally]. I am interested in ideas. Even at the national level there is little use of computer by senior people in my field [Regulatory Affairs].

But he later commented:

- I do plan to become more involved with computers - I need information quick - status reports, schedules, calendars. Our situation is just getting too complex to deal with on paper. [A-27] [plan.]

It is natural that individuals would give conflicting responses from time to time, especially when the research process takes place over a period of more than a year. But such conflicts also indicate that a manager's answers may be driven as much by changing circumstances as by stable factors such as function or personality.

8.7.7 Appropriateness of use

The ultimate issue concerning managers and computers is that of appropriateness. Managers had a range of comments on the appropriateness of CBIS for them, for their area of the organization or for managers in general:

- Do we really need more tools - like a P.C. on every desk? I think we need to learn to use what we have better...I spend a lot of time "guiding" my people and setting goals. I can't imagine how the computer could [support] this. [A-12] [acct.] [ENTP]

- I have a PC at home. I'd like to use a computer to do more "what if" analysis but what is the opportunity cost to the company? ... Planning the strategic direction of my department is a valuable long term part of my job. Not much computer use. Not much potential for computer use. [A-13] [acct.] [ISFJ]

- Computing can be effective at an operational level (e.g., customer records) but not at our level. A lot of what I do is subjective so computing is irrelevant or even misleading. [A-14] [acct.] [ISTJ]

- I have no time to use a PC here. How could I justify it? [A-16] [acct.] [ENTJ]

- Because of the amount of medical and legal work I am involved in a lot of what I do must be in writing. A computer system would be inappropriate. [A-18] [pers.] [ISTJ]

- Real time reporting is the only obvious reason for senior managers to use computers... Should managers at this level be using computers? They don't suit the way many managers work. To use or not is a personal decision. [A-19] [mark.] [ENTJ] [CB]

(This comment comes from a Marketing manager who had spent a dozen years in the computer field. His questions on both appropriateness and choice are basic to this research.)

- The Vice-President of Marketing had an EIS for a while but it didn't suit him. Even E-mail was too much for me and, anyway, it's a secretarial function. [A-25] [mark.] [ESTP]

- One thing I observe is that I have managers doing clerical work because of a keyboard. I don't want this to happen to me. How can we work out what aspects of computer use are appropriate? Is the computer a means to an end or has it become an end in itself? [A-25] [mark.] [ESTP]

- Should we force people [managers] to use a computer system? [A-27] [mark.] [ENTP]

- Dealing with outside correspondence, customers, regulators, other telephone companies, is a big part of my job. I'm not sure the computer could help - it is so non-standard. [A-30] [mark.] [ESTJ]

- I'd like to have the time to play with a computer but there are many who could use it more and better than me. [B-14] [acct.] [INFP]

- A manager should know what has to be done and how to express his needs clearly, but should avoid getting involved in producing information. His job is to use it - it is someone else's job to gather it. But a terminal would put it all at my fingertips. [C-16] [prod.]

- A major part of my job is keeping my managers up to date. All face to face - I like sitting down with my managers. Not much opportunity for computing. [E-14] [prod.] [ESTJ]

- It seems that more and more of my job has to do with people - both employees and outsiders. This restricts the value of computers. [F-11] [acct.] [ISTJ] [CB]

These comments as a whole demonstrate a mixed sense of the appropriateness of CBIS for managers at middle and senior levels. The conclusion drawn is that, although many senior level tasks are amenable to indirect support by computer-based tools, direct use by managers is rarely appropriate. There is some evidence from the comments above that Extraverted (E type) managers are even less likely to see direct use of a computer as an appropriate way to spend their time.

8.7.8 Looking to the future

In spite of the many reservations outlined above some managers did feel the need to attain at least a basic level of understanding of computing in the organization - no matter what one's individual attitude. This is a sample of a long list of such comments.

Managers at site A expressed almost universal interest in using the computer more actively, although with some limitations.

. I do hope to get more involved in computing. I am getting some online access to the mainframe. I mostly want to see current data but also to do some manipulation. This is long term. [A-15] [acct.] [ISTJ]

. I do want to get more personally involved in computing. I bought a PC for home - the only place I have any time. Data analysis, communicating with others, word processing. I may not build spreadsheets but would like to "play with" them. [A-16] [acct.] [ENTJ]

. I think that in this company there is no way around using a computer. We will have to do "what if" analysis, look at historical data, understand contract and do communications. [A-22] [pers.] [ISTJ]

. I do want to use the computer more to access information about my customers or my market. But not too often. I don't want to do the "nuts and bolts" of someone else's job. [A-24] [mark.] [ENTJ]

(he was not sure where the data could be found or what had to be done to "access" them if they did appear.)

. I plan to get a little bit more involved with the computer - but not too much. [A-28] [pers.] [ISTJ]

Enthusiasm at other sites was more limited but some managers do see a computer in their future.

. I would like to get more involved with computing but I"m not sure how valuable it would be. I would want to access [personnel] data, GRASP data and plan resource allocation. [B-17] [prod.]

. I produce some spreadsheets, graphs and reports but I'm still a novice. I will be getting a laptop and a terminal for data analysis. I'm getting training soon on DBase and Wordperfect. [C-14] [acct.] [INTJ]

. I definitely plan to get more involved in computing. I've already signed up for some internal training on PCs and terminals - if I can find the time. I want to be able to do online access, analysis and report generation. [C-15] [plan.] [ENTJ]

. I do want to get a little more involved with computers - but not too much. I don't intend to do a lot of reporting (I have people to do that) more analysis I think. [D-12] [acct.] [INFP] [CB]

. I do want to get more involved in computing. I want to take a course in computer use and become more involved in what we do. [D-16] [mark.] [ENFP]

. I plan to become more involved in computing but only in a limited way [he is already a heavy user of Lotus]. I want the computer to provide a lot more MIS for all managers not just accounting. [E-16] [acct.] [ESTJ]

. I plan to get a terminal and/or a micro but I have some doubt whether it is appropriate at my level. [E-17] [prod.] [ENTJ]

. I should know more about computers but I don't have the time to learn. [F-12] [prod.] [ENTP]

These comments indicate that most managers were interested in using the computer more directly but it was also clear that many of them did not understand the ramifications of such use and some had no clear idea of what they would actually use the tool for. All organizations examined face both policy and operational decisions concerning levels and types of use of CBIS my managers and related issues of evaluation, training and encouragement.

8.8 Summary

This chapter has examined the effects of the characteristics of the fifty individuals who took part in this research on their current use of CBIS and on their intentions concerning future use for themselves and for the areas they supervise.

Some limited effects of the demographic factors examined (particularly computer training) were demonstrated.

In terms of personality Introverts were found to be more oriented toward both the type of activities supported by computers and the use of computers themselves. Sensing-Thinking types were also more amenable to the use of computers as were Judging types. Since most managers interviewed had some or all of these characteristics personality type is generally supportive of computerization in general - but not at the level of the individual manager.

The managers made numerous comments on the their current and intended use of CBIS, on how they felt they could best relate to computers for their organization and on their sense of possible problems arising from computer use by managers. Some points indicating beliefs and attitudes raised were:

> Managers still confuse the incumbent, the job and the tools used to support that job. Research will needed to determine which activities are appropriate for

computing and which are not after separating these factors. Should the incumbent's experience with and attitude toward computers affect the use of tools or should it be defined by the function?

A number of potential problems for the organization and the individual manager that could be caused by direct use of computers were recognized by some managers.

Managers discussed their personal relationships with computer and, in many cases, explain why they do not use them directly. Although a few described some direct use of microcomputers most explained their relationship with specialist support staff.

Managers also discussed the appropriateness of direct use by managers at their levels and their own intentions for the future which sometimes contradicted comments on appropriateness.

Finally, comments on the future of computing indicated that almost all managers would like to achieve at least a low level of direct use. But linked with this was a concern that such use could be distracting or even counter productive in terms of the job they do for that organization.

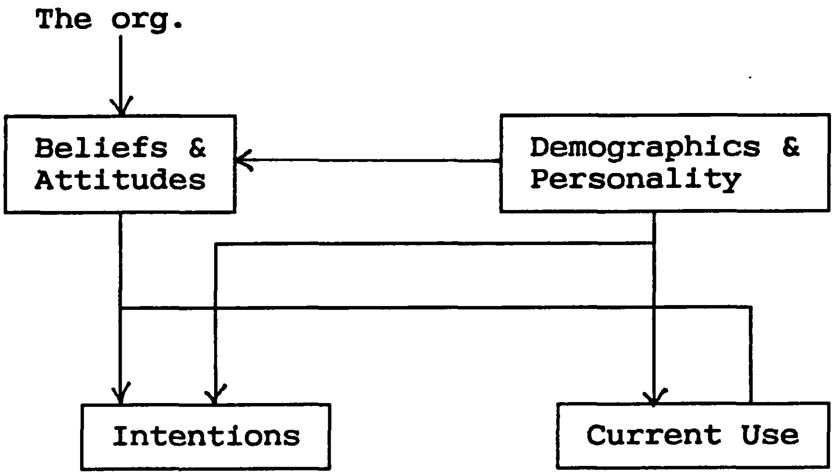
Overall, the single factor (the individual) in the beginning framework in Chapter 1 appears to be two clusters of factors relating to current and intended use of CBIS:

1. Demographic and psychographic factors are relatively fixed, have limited effect on use and are not strongly linked to outside factors.

2. Beliefs and attitudes are affected by the person's characteristics but also by outside factors, primarily the organization.

Furthermore current use and intentions must be dealt with separately since, although they are driven to a great extent by the same forces, intentions are also affected by current use and the beliefs and attitudes which develop from that use. Figure 8-2 summarizes the expanded "individual" aspect of the emergent framework.

Figure 8-2: Aspects of the individual in the emergent framework



Managers and Computer-based Information Systems:
A Study of Current Uses, Intentions and Their Causes

Volume 2 of 2

Submitted by Randall C. A. Fisher
for the degree of Ph.D.
of the University of Bath
1992

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The Effects of the Individual as a Manager

This chapter presents data on the effect of the job the individual manager performs on his current use of, and intentions concerning, CBIS for himself and the area he supervises. Comments and observations as well as statistical analysis of a series of structured questions are used to define issues common to some or all functions as well as differences among functions.

This chapter also presents and discusses data relating the tasks and activities performed by individual managers and the types of problems dealt with in a job which could affect either current use or intentions concerning the use of CBIS to support that job.

9.1 Introduction

In Chapter 1 it was explained that five functions (accounting/finance; marketing; personnel; production and planning representing the basic activities in most organizations would be examined. The data which follow on the relationship between functions and the use of CBIS came from three sources: comments from managers on issues related to their function; the researcher's observations; and analysis of the relationship between functions and the answers given to some of the structured question sets in the Interview Guide.

As was explained in section 6.5, it became clear that "function" was too broad a concept to capture all of the aspects of a job which relate it to computer-based tools. As a result three more specific levels of analysis of the job were developed: tasks; activities; and problem types and problem solving processes. Gathering data on these three topics was one of the most difficult aspects of this research because, as soon became obvious, the terms mean different things to different individuals.

The data below on tasks came from four sources. The main source was the semi-structured set of questions in the Interview Guide (see pages 4 and 5 of Appendix II) which simply asked each manager to list all the tasks he performed in terms of planning, controlling, coordinating, decision making, advising and "other". A second source was a question set (see page 25 in Appendix II) which asked managers to rate a series of task characteristics on a 6-point Likert scale in terms of their effect on computerization of that task. A third source was the descriptions given by some managers of general tasks such as budgeting or specialized tasks which were a part of their organizational function. The fourth source was the researcher's observations of what a manager did for the organization - beyond what he had reported.

The data on activities was gathered by presenting each manager with a list of common activities and asking what proportion of his time was spent on each (allowance was made for the addition of other tasks but few were added). Comments by the managers and the researcher's observations also contributed to understanding the activities that filled the managers' days.

Data specifically concerning the nature of problems and problem solving was the most limited of all aspects of the model developed. Although, with the original focus on DSS this was a fundamental topic, it became a background factor as the focus of the research turned to the individual and the organization and the lack of computer support at the level of complex problems became clear.

9.2 The functions

9.2.1 Functions and familiarity with computing concepts

Although the managers' technical knowledge of computing was not examined explicitly all managers were asked if they could define the terms used to describe the more advanced applications. "End user computing" was by far the best known concept. Ten out of twelve (83%) of the Accountants who answered this question demonstrated an understanding of the concept. Three out of four of the managers in Planning understood the concept but, since most of them come from a computer background, this was to be expected. Five out of nine (56%) of the Marketing managers understood end user computing as did four out of ten of the Personnel managers. Only three out of fifteen of the Production managers were familiar with it.

From the point of view of the organization as a whole time must be spent with the Production and Personnel managers if end user computing is to be spread into those areas. It should be made clear that no significant link was apparent between understanding of the concept and its use - in a function or in an organization.

The other terms investigated were far less broadly understood by managers in all functions. Five out of twelve (42%) of the Accountants demonstrated an understanding of the concept of decision support systems (DSS) while two out of four of the Planning managers understood it. No managers in Personnel, Production or Marketing were familiar with the DSS concept.

Four out of twelve Accounting managers understood artificial intelligence as well as two out of four Planning managers; three out of fifteen Production managers; two out of ten Personnel managers and one of the nine Marketing managers.

Three of twelve Accounting managers understood expert systems (ES); two of four Planning managers; three of fifteen Production managers; two of ten Personnel managers and one Marketing manager.

Six of twelve Accounting managers understood the concept of executive information systems (EIS). However, five of these were from site A where at least one Vice-President has had an EIS in operation. Two of four Planning managers; three of ten Personnel managers; one Marketing manager and no Production managers were familiar with the concept. (All of those who understood the concept came from Site A).

Considering that the computer began, and is still intensively used, in Accounting it is not surprising that the understanding of computing concepts in most advanced in that function. Other than end user computing, none of the concepts examined (including the original research topic of DSS) was well understood by managers in other areas. This is not to say that these managers were not enthusiastic about the potential, or need, for computer support of their function.

9.2.2 Functions and Personality Types

Is there a correlation between function and personality type? Do certain types "cluster" in specific functions? Is it redundant to examine both in terms of their effect on a manager's current use of CBIS, his attitudes and his intentions?

Table 9-1 summarizes the relationship between the personality types as identified by the MBTI and organizational functions. The Chi Square or Fisher's exact probability test was used to investigate the relationship between the two factors and a number of statistically significant results were found. Personnel had a preponderance of I type managers while all Marketing managers were Extraverts (perhaps not surprising logically but significant at a level of $p<.001$).

No significant differences were apparent among the functions in terms of how data are gathered - Sensing (S) and Intuition (N). But concerning how data are analyzed - Thinking (T) or Feeling (F) - Personnel managers tended to be significantly more value oriented (F) than the norm of the sample. Finally, the five functions were compared in terms of their overall "approach to life" - Judging (J) versus Perceiving (P) - no statistically significant differences were found.

What does this mean in terms of individual managers? Personnel managers are more Introverted than managers as a whole and also are more oriented toward Feelings. This is a complicated result because, according to Briggs-Myers Introverts should be more oriented toward analysis and detailed information while Feeling types are not as interested in logical analysis as in the values and emotions of a situation. In terms of computer use these have opposite effects - the first toward use, the second against use.

The results concerning Marketing are more straightforward. Extraverts are strongly oriented toward personal interaction and overview data rather than detail. This was borne out to a great extent in Marketing managers comments as described in Chapter 15 - they prefer to have others provide enough information for them to do their work but they are not interested in personal use of CBIS.

Table 9-2 outlines the relationship between the preferred method for capturing data (sensing (S) or intuition (N)) and the preferred method of data processing (thinking (T) or feeling (F)) as they relate to the five functions evaluated. But what do these number mean in terms of the use and attitudes of managers toward computers?

When the Chi-square test was applied to these data only one significant result emerged - Planning managers preferred the NT combination significantly more than other managers. This implies that, as described in

Table 9-1: MBTI types by function

	I	S	T	J
Accounting (12)	8	7	9	10
Marketing (7)	0	5	8	6
Personnel (12)	6	5	6	7
Production (12)	6	9	14	12
Planning (4)	2	1	4	2
Total (47)	22 (.47)	27 (.57)	41 (.87)	37 (.79)

Table 9-2: Data capture/processing preference (summarized by function)

	ST	SF	NT	NF
Accounting (12)	6	1	3	2
Marketing (7)	5	0	1	1
Personnel (12)	5	0	5	2
Production (12)	9	0	3	0
Planning (4)	1	0	3	0
Total (47)	26 (.55)	1 (.02)	15 (.32)	5 (.11)

Appendix III, they would emphasize a technical approach to problem solving and prefer situations which lack structure and require abstract skills. This fits well with the preceding comments about the use of computers in Planning along with the managers' distance from the actual processing.

The limited number of significant differences indicates that function and personality type were not redundant in this research.

9.2.3 The functions and CBIS

To what extent does a manager's function affect his current use of, attitudes toward and intentions concerning CBIS? The following comments capture the main points made by managers from each function.

Accounting

- In finance [accounting] we tend to have very precise problems so tools are readily available. I don't know how it would work in more "touchy feely" areas. [A-12]

- At my senior accounting level we are really short of useful modelling data. It must cross department lines and we aren't very good at that yet. [A-13]

(an interesting contradiction between accountants. The former is a financial accountant focused on monthly control reports while the latter is involved in the new cost reporting system.)

- Other areas are learning more about both computing and accounting. This puts more pressure on us in accounting because we have been used to being away ahead. [B-14]

- I look after not only accounting but also finance and computing here. I am stretched pretty thin - I wonder if the computer could help lighten my load but right now I have no time to look at it. [B-14]

- In finance at [this company] we have to do four things: gather financial data and report it; control financial reporting; working capital management; internal audit. The computer does well on the first, a little of the second and third but almost nothing on the last topic. [E-16]

Marketing

- I have my doubts whether there really is an ideal answer in marketing analysis - even with computers. It's not like accounting where everything balances. Because of our special needs we don't use the mainframe except for corporate record keeping. Our two local applications are packages on micros. [A-19] [CB]

- Now that we understand better how to gather and process data we are starting to build a client information system to support marketing from top to bottom. Yes, That's right, we don't have one now! Everything is analyzed by product because that is how the accounting system works. [A-23]

- We rely on information systems designed for fully regulated residential customers. We must develop systems to deal with complex customers in a complex environment. We must learn to provide both service and response to problems. Soon this type of systems will be a matter of survival! [A-24]

- Sales people and sales managers have very different needs for computing. They want support so they an sell more - we need control and planning. [A-26]

- We in marketing are externally oriented while our [corporate] information systems are mostly internal. [A-26]

- Sales analysis and customer analysis by computer is just starting. When the company sees the value I think it will take off. [A-28]

- The rapid growth of competition [in what was a monopoly] has given us a lot more political clout in many aspects of business. [A-29] [mark.]

- We need more data and especially more up to date data on donors! We also need better access to it. In general we need more technology and more training (mandatory even for me). [D-16]

- We in marketing need more than monthly reports. Brewing is a very competitive industry. We need online, dynamic data - we don't have it now. The lack of timeliness is a severe restriction in terms of my managing. [F-13]

In one marketing area at site A the management is attempting to overcome the traditional reluctance of marketing people to use computers.

- We have about six technical people in marketing. One guy is a genius at extracting and analyzing data. Rate cases, for example, require huge quantities of data. We couldn't do it without the computer. But as senior manager I just ask questions and see the output. [A-25]

- "Laurie" developed and uses a database but I'm not sure what's in it or what he does. He amalgamates incoming data (especially financial) so that we [managers] in marketing can use it. He also uses graphics to prepare a lot of reports. [A-26]

A telling comment about computing in Marketing came from an accountant.

- We are a marketing company. We must push computing more into that area. But I'm not sure how well it will suit them. [F-11] [CB]

A number of the preceding comments from marketing managers expressed an ambivalence between what they see as their jobs (selling and service) and the use of computers. All see a large and growing need for computers but the potential for direct use by most managers in this function is very limited. The lack of use by Marketing managers is also caused by the (perceived) lack of useful data in the organizations' current databases.

<u>Personnel</u>

- Because of the amount of medical and legal work I do [for this company] a lot of what I do must be in writing. A computer system would be inappropriate. [A-18]

- We have been putting together bits and pieces of personnel over the past few years because we couldn't get a package. We have a basic personnel file, an applicant "filter", a seniority system and a pension fund [record keeping] system - all on separate micros. [A-20]

- We are trying to do a lot of catching up in basic computing in a hurry. We have good people but there will be a learning curve. [A-22]

- In labour relations the value of the computer is marginal but in productivity and quality control management it will become essential. Setting and tracking standards, seeing problems, seeing future trends. [A-28]

- We have no computer people in my department. I think that this hurts us since we don't always understand what we could do. In this we are away behind accounting and purchasing. [B-15]

- We have some small personnel files on the PC but we aren't very sophisticated. We need more computing and less hard copy but in our situation can it be done? [C-13]

- Our personnel system is on a stand alone (orphan) minicomputer. Our lack of access to adequate computing is severe! People in this organization don't see the long term benefits of a CHRIS. But senior support is getting better... Personnel tends to be quite organization specific so there haven't been a lot [of packages] on the market. But from what I have seen this is starting to break now. [D-11]

- The computer has helped us recognize some problems we didn't even know we had. For example, long term problems with insurance. [E-15]

- We use the computer mainly for record keeping - things like payroll and keeping track of absentees. I hope we get more sophisticated and do things like plan negotiations but none of this is happening now. [F-14]

The sense that Personnel was well behind other areas in terms of computer use was expressed by a number of managers in this area. Although their problems had a number of causes it was apparent from interviews and observations that the lack of specialized packages and, to a lesser extent, the very limited experience with computers in the Personnel function that were the main sources.

Production

- We have to soon start computerizing nursing. There is now no fixed schedule for doing this but financial and staffing pressures are building. We must manage both better. [B-17]

- We need better links between nursing, pharmacy, physiotherapy and so on. It seems that the computer should be a lot of help here but we have only isolated systems - not connected at all. [C-16]

- We have one of the most comprehensive purchasing programs in Nova Scotia. But it is not really well supported by computers! Over the last few years we have stabilized the inventory system [at the operational level] but we have to move on to management type data - mainly planning and scheduling. [C-17]

- Prior to three years ago quality [control] here was based on an inspection system - expensive and inefficient. We now focus on quality on the line. Our computer system must support this approach and it isn't even close now. And I think we can forget about management support! [E-12]

- What we really need here is good, up to date, relevant data files and simpler extractions. Can't we put all finance and production data online? Could we trust the data? Could we [senior managers] learn to do ad hoc reports? Also online calendars would help us organize better. [E-17]

- Now that we are switching from almost exclusive government work to private customers life [in the Production area] will be very interesting. We have time to get ready but will we get the resources needed? [E-18] [prod.] [CB]

- We need more sophisticated computing in production here: terminals on the [factory] floor; bar coding for automatic job tracking; realtime data capture and analysis; automatic reports - not manually generated; and a user friendly, flexible scheduling system. The effect on my managers would be great! [E-19]

- We believe that scheduling on the computer saves about $250,000 per year. Because we are the core function these savings ripple out from us. (The computer deals well and quickly with volatility - particularly inputs that don't arrive, etc.). But it happens mainly because I pursue things. [F-12]

The Production managers, overall, felt that it would be inappropriate to get involved in computing at their level. They were, however, eager to apply computer much more at the operational level. Most of the Production managers had come up from "the floor" and so may have been aware of the ongoing problems at that basic level. It was also clear from the Production managers' comments that they felt there was still an opportunity for large cost savings (site E) or significant increases in service (sites B and C) at the operational level.

Particularly at sites B and C (hospitals) and E (manufacturing) there was a strong sense that alterations as straightforward as changing units (to bed days or labour hours, for example) on standard reports would be a big step forward.

Planning

- We (six people) are now working on 150 separate projects. We couldn't have done this five years ago before we got terminals, micros, etc. Computing is very effective for us - scenarios, what if, etc... I don't use the computer myself but I have people who use both PCs and FOCUS [a 4GL] on the mainframe. We also use WordPerfect, Lotus, Symphony, FreeLance and Dbase. [A-27]

- "Impact analysis" is the new buzzword in strategy around here but it's not clear what it means, how it will impact on us [program planning & evaluation] or to what extent computer models will help. [C-15]

Planning is a "catch all" term describing a corporate-wide support function working on a project basis. In Planning computers are used in sophisticated ways by subordinates who often have strong backgrounds in computing or operations research. Not even those Planning managers who come from a computing background use the computer directly. They expressed frustration at this but also understanding that their jobs were people and meeting oriented.

Although these comments on the five functions are not comprehensive some points are evident. Accounting is the most computerized function - which is not surprising since it has been using computers for almost forty years and, more fundamentally, the type of data gathered, stored and processed is "naturally" structured and coded in formats that are amenable to computer processing.

Personnel and Marketing are well behind in terms of computerization at all levels (not just senior managers) while Production has islands of computerization such as materials management while other areas such as job shop scheduling use the computer very little.

Many managers see corporate-wide functions as better supported by computers than functions that are localized in their own area and they also see structured functions as better supported than unstructured ones. For example, planning based on accounting data was more computerized than planning based on customer or even employee data.

9.2.4 Functions and quantitative data

In the preceding chapters the responses to the structured questions sets in the Interview Guide were analyzed by organization, demographics and personality types. This section examines the strength and means of responses in terms of the function which a manager performs for the organization.

Problems related to the use of CBIS in the manager's area

One set of structured questions on the Interview Guide concerned managers perceptions of problems relating to computer use created at the level of the organization (see page 6 of Appendix II). Were there any significant difference in such perceptions among managers in the five functions? Table 9-3 contains the responses for each possible problem summarized by function.

Applying the Kruskal-Wallis test to these data produced a number of significant results. Personnel managers felt strongly that they lacked technical support staff while both Marketing and Production managers felt strongly that their computing budgets were too restricted. Accounting managers were particularly sensitive to the lack of computing resources. Since they have the greatest access in all organizations examined to such resources this is apparently caused by a better understanding of what could be done with more and better computing resources.

Organizational factors relating to computer use in the manager's area of responsibility

Another set of questions (see page 8 of Appendix II) concerned the managers' sense of the quality and value of the resources and support provided by the organization for their particular function. Table 9-4 contains the proportion of managers in each function who agree with each statement in this set.

Because the responses to this question fall into two discrete classes and also because the sizes of many response groups were small the Fisher exact probability test was applied to these data. Accounting, Marketing and Personnel managers all felt strongly that creative use of computers by managers was not encouraged ($p<.02$). Secondly, Production managers felt that their staffs lacked adequate training ($p<.0001$).

Preferred input/output (communication) methods

Another structured set of questions concerned the methods preferred by the individual for communicating with others both inside and outside the organization (see page 7 of Appendix II). The mean responses for each function for each communication technique are shown in Table 9-5.

The Kruskal-Wallis test showed that Planning managers were less interested in written memos and letters than the norm while Personnel managers were more involved with these media. The latter is probably a result of the limited access to more advanced media, the need to keep accurate employee records and the amount of tradition communication required by the function. Marketers reported significant more use of voice mail than managers in other areas while Marketing and Personnel managers were less involved with ad hoc reports than managers in other functions.

The differences in manager's preferred ways of communicating raises a number of questions such as (a) should computers be used to strengthen current communication patterns and processes? (b) if so, how can computers make the managers' current communication more effective? (c) can computer-based tools change the way managers communicate to make them more effective for the organization as a whole? (d) would such enhancements maintain the mix of cultures between, say, Marketing and Accounting?

Table 9-3: Problems related to the use of CBIS in the manager's area (summarized by function)*

FUNCTION / PROBLEM	ACCT	MARK	PERS	PROD	PLAN	ALL
limited budget	1.8	1.6	2.1	1.1	2.0	1.6
not enough staff	2.3	0.7	1.7	1.2	2.0	1.5
not enough info.	1.2	2.3	1.3	1.8	1.0	1.6
timeliness of the info. we receive	1.1	2.0	1.2	2.4	0.5	1.6
too much info.	1.3	1.7	0.9	0.7	0.0	1.0
coordinating with other groups	2.2	1.0	1.3	1.6	2.3	1.6
too many people to manage	0.2	0.2	0.1	0.6	0.0	0.3
lack of technology	1.0	0.4	0.9	1.3	0.0	0.9
limited staff training/educ.	1.5	0.8	1.2	2.3	0.0	1.4
limited access to computers	0.3	1.4	1.8	2.0	0.0	1.3
lack of advice on technology	0.5	0.8	0.7	0.9	0.5	0.7
problems defining our info. needs	1.9	2.0	1.4	2.1	1.5	1.9
n =	12	9	10	15	4	50

* The contents of this table are based on discrete data rather than on continuous Likert scales. For each possible problem created for a manager by the organization a mean was calculated based on the following values: "this is not a problem" = 0, "it is rare" = 1; "it has happened" = 2; "it is occasionally a problem" = 3; "it is often a problem" = 4; "it is a severe problem" = 5.

Table 9-4: Organizational factors relating to computer usage in the manager's area (summarized by function)*

FUNCTION / ISSUE	ACCT	MARK	PERS	PROD	PLAN	ALL
creative use is encouraged by the org.	1.0	0.9	0.9	0.5	0.8	0.8
my staff has adequate training with computers	0.7	0.6	0.4	0.1	0.8	0.5
I encourage my staff to use computers	1.0	0.9	0.9	0.9	1.0	0.9
my staff has a positive attitude toward computers	1.0	0.9	1.0	0.9	1.0	1.0
we need more training to use them well here	0.8	0.6	1.0	0.9	0.8	0.9
some of my people spend too much time with comps.	0.1	0.2	0.3	0.3	1.0	0.3
they have changed the way we do our work	1.0	0.9	0.7	0.8	1.0	0.9
the org. makes it too hard to get computer resources	0.4	0.3	0.4	0.5	0.5	0.5
I find it too hard to keep up with what they can do	0.3	0.6	0.8	0.5	0.7	0.5
lack of communic. hardware causes us problems	0.8	0.8	0.6	0.7	0.7	0.7
I don't know where to look for info. on computers	0.5	0.1	0.2	0.4	0.3	0.3
we have identified problems we didn't know about	0.8	0.9	0.8	0.7	0.8	0.8
we can do things we couldn't do before	0.9	0.1	0.7	0.9	0.8	0.9
n =	12	9	10	15	4	50

* The numbers in the table are the means of the percentage of managers in that function who agreed with that statement.

Table 9-5: Ratings of input/output (communication) methods (summarized by function)

FUNCTION / COMMUNICATION TECHNIQUE	ACCT	MARK	PERS	PROD	PLAN	ALL
the telephone	4.7	4.8	4.8	5.0	4.5	4.8
written memos & letters	4.1	3.6	4.3	3.3	2.3	3.6
Electronic mail	1.9	1.9	1.6	1.9	2.3	1.9
Voice mail	4.0	4.9	4.2	na	4.5	4.4
one-on-one meetings	3.9	4.1	3.6	3.2	4.0	3.7
group meetings	3.5	3.7	3.3	2.8	2.8	3.2
meetings with subordinates	4.7	4.4	3.9	4.1	4.3	4.3
standard, org.-wide reports	4.4	4.6	2.4	2.9	1.5	3.4
meetings with outsiders	2.8	3.6	3.3	3.4	3.9	3.3
ad hoc computer reports	3.2	3.2	2.1	3.2	2.0	2.9
general reading	2.1	2.2	3.1	1.6	2.8	2.2
professional groups	2.0	2.3	3.0	2.2	1.0	2.3
formal organizational reports	3.0	3.1	2.9	2.3	4.0	2.9
meetings with my superior	3.2	4.2	2.6	2.7	2.0	3.0
facsimile machines	2.9	3.0	3.1	3.1	1.6	2.9
informal (hallway) meetings	2.8	2.3	1.7	3.4	3.5	2.8
n =	12	9	8	14	4	47

Impact of characteristics of the manager's function on the use of CBIS

The next structured question set concerned some characteristics of the manager's area of responsibility itself - in terms of perceived impact on their use of computers (see page 25 of Appendix II). Table 9-6 contains the mean value for each function for each characteristic examined. The Kruskal-Wallis test demonstrated no significant differences among functions. Perceptions of which aspects of their area were relevant to computer use were quite similar for all managers.

The individual's reasons for limited direct use of CBIS

The same question arose concerning the managers' reasons for limited computer use (pages 19 & 20 of Appendix II) and the same test was used. Table 9-7 contains the mean Likert ratings of a set of fifteen possible reasons why a manager's use of CBIS in his job is limited (summarized by function). Again, the Kruskal-Wallis Test revealed no significant differences among the sets of reasons given by managers in different functions for their limited personal use of computers.

Characteristics of computer-based tools

Another set of questions investigated whether there significant differences among managers in different functions in terms of what they saw as the most valuable characteristics of computer-based tools (see pages 22 & 23 of Appendix II). The results of this question are summarized in Table 9-8. The results of the Kruskal-

Table 9-6: The impact of the characteristics of his function on the use of CBIS (summarized by function)

FUNCTION / CHARACTERISTIC	ACCT	MARK	PERS	PROD	PLAN	ALL	**
the tasks they perform	4.2	3.6	3.1	3.4	3.8	3.6	1
the size of my area	1.0	1.6	1.9	1.9	1.5	1.6	8
the attitudes of my people toward computers	3.1	1.4	2.3	2.7	3.1	2.5	3
support from the computer department	2.1	1.6	2.0	2.1	3.0	2.1	4
my attitude toward computers	2.9	2.9	2.6	2.9	2.5	2.8	2
my "political clout"	2.1	1.1	2.0	2.3	2.9	2.0	5
the existence of appropriate packages	2.4	1.7	1.3	1.4	2.3	1.8	6
the budget of my area	1.2	1.8	1.4	1.5	1.8	1.5	9
the education level of my staff	1.9	1.2	1.6	1.6	2.1	1.7	7
n =	12	9	9	14	4	48	

** This column is the relative ranking of the managers' perceptions of the effect of the nine characteristics of their area of responsibility on their use of computers (based on the mean Likert scale values).

Table 9-7: The individual's reasons for limited direct use of CBIS (summarized by function)

FUNCTION / REASON	ACCT	MARK	PERS	PROK	PLAN	ALL
I don't have time to learn about computers	2.9	2.3	2.5	2.6	2.8	2.6
I have competent staff to do the computer work	3.1	4.3	3.9	3.1	3.5	3.6
the org. discourages comp. use by managers	0.9	0.6	0.9	1.1	0.3	0.8
for me the benefits don't match the costs	2.5	2.1	2.6	1.5	2.3	2.2
the hardware we need is not available	0.6	0.7	1.4	1.2	1.0	1.0
there is too much delay getting printouts	1.1	0.7	0.4	0.7	0.3	0.7
computer programs are not flexible enough for us	0.8	2.0	1.4	2.0	1.5	1.5
too much effort is needed to get resources	1.1	1.3	1.1	1.8	1.0	1.3
my peers won't understand the output I produce	0.4	0.4	0.5	1.3	0.3	0.6
I don't have enough educ. to use computers	0.5	0.2	0.5	0.4	0.0	0.4
there is no room in my office	0.3	0.2	0.4	0.6	0.0	0.3
they are an inefficient use of my time/know-how	1.6	1.9	2.1	1.0	2.3	1.7
few other managers here use computers	0.3	0.7	1.1	1.5	0.0	0.8
the training I need is not available here	1.0	1.3	0.9	2.2	1.5	1.4
my time is too "broken up"	1.7	1.9	2.8	2.3	3.0	2.2
n =	11	9	8	10	4	42

Table 9-8: Ratings of the characteristics of computer-based tools (summarized by function)

FUNCTION / TOOL CHARACTERISTIC	ACCT	MARK	PERS	PROD	PLAN	ALL
easy to use myself	2.5	2.0	2.2	2.9	1.6	2.4
access to multiple databases	2.4	1.9	2.3	2.0	1.8	2.1
a variety of reports/formats	3.5	3.1	3.0	2.7	2.5	3.0
runs on a microcomputer	0.9	0.1	0.3	1.4	0.4	0.8
developed in-house	0.2	0.6	0.4	0.9	0.5	0.5
lots of flexibility	3.2	3.2	3.1	3.3	3.3	3.2
finds a reasonable answer	2.2	2.4	2.4	2.1	3.3	2.4
statistical analysis	2.0	2.3	3.0	3.2	2.8	2.7
acquiring/maintenance costs	3.3	3.6	3.3	3.1	2.5	3.2
communication linkages	3.3	2.4	2.2	3.3	3.0	2.9
fits with current activities	1.8	1.8	1.8	1.9	3.0	2.0
long term value	2.1	2.6	3.3	2.5	2.1	2.5
fits with our "politics"	1.6	2.2	2.8	1.9	1.8	2.0
good forecasting models	2.4	1.9	2.4	2.1	3.0	2.4
finds the "right" answer	1.9	2.4	2.1	1.8	1.5	2.0
fits with our other applics.	3.1	2.9	3.2	2.5	2.3	2.8
easy to use right away	2.8	3.3	3.6	4.2	2.5	3.4
graphics capability	2.4	3.4	2.4	2.3	3.8	2.7
easy to modify/enhance	1.8	1.6	2.0	1.7	2.8	1.9
can be maintained in-house	2.5	3.5	3.9	3.3	3.3	3.2
good report writer capability	3.9	2.6	3.4	2.9	3.8	3.3
buying/producing too early?	1.4	0.9	2.0	1.4	2.0	1.5
good documentation	4.0	3.8	3.2	3.8	2.5	3.6
supplier provided training	3.0	3.6	3.2	3.3	3.5	3.3
no extra hardware/software	1.4	1.9	1.6	1.7	2.5	1.7
no major staff/supply changes	2.2	2.6	3.2	2.4	2.3	2.6
good front end (menus, etc.)	3.3	3.4	3.6	3.7	4.0	3.6
n =	12	8	9	14	4	47

Wallis Test on these data also showed no significant differences among the functions.

Proportion of time spent on activities

The Kruskal-Wallis test was applied to a set of activities across the five functions (see Table 9-9) and a significant difference among functions was found for only one activity. Planning and Marketing managers reported spending much less time than other managers reading and writing reports while Accounting managers spent more time than other managers at it.

Attitudes, current use & intentions concerning CBIS

As is explained in Chapter 6 these data are a result of a review of the answers of each manager as they related to these topics. Table 9-10 contains the data summarized by function.

The Kruskal-Wallis test indicated that Accountants reported significantly higher use of computers in their function than other managers while Personnel managers had much lower use ($p<.02$). Given the preceding comments from managers in the two areas these results are not surprising. The other area of significance was in managers' attitudes toward computers. Marketing managers had the lowest mean attitude score while Accountants' attitudes were much higher than other managers. Again, these findings generally support the comment-based data above.

Table 9-9: Proportion of time spent on activities (summarized by function)

FUNCTION / ACTIVITY	ACCT	MARK	PERS	PROD	PLAN	ALL
group meetings	23.1	14.4	16.3	18.6	26.3	19.3
one-on-one meetings	14.4	17.5	16.3	16.1	18.8	16.2
using the telephone	11.5	10.0	11.4	15.5	6.3	11.7
reading non-computer documents	8.1	9.6	11.8	9.2	5.3	9.1
drafting reports	10.7	7.1	9.4	12.5	4.5	9.7
working at a computer	3.0	0.3	0.4	1.4	1.5	1.4
travelling	4.2	8.1	4.6	4.0	9.0	5.4
studying/training	2.3	3.5	3.1	1.5	2.5	2.5
analyzing computer reports	5.9	4.5	6.0	3.4	2.3	4.6
informal meetings	7.1	8.8	8.9	9.6	11.3	8.9
thinking/planning	10.8	11.9	10.6	6.5	8.8	9.6
Totals (rounded)	100.1	99.6	100.0	98.2	96.3	98.4
(All types of meetings)	44.6	40.6	41.4	44.4	56.3	44.3
n =	11	8	8	11	4	42

Table 9-10: Managers' attitudes, current use and intentions(summarized by function).

FUNCTION / FACTOR	ACCT	MARK	PERS	PROD	PLAN	ALL
Attitude:						
Function	3.8	3.2	3.1	3.0	3.8	3.7
Self	2.5	1.1	1.3	1.4	2.0	1.8
Current Use:						
Function	3.6	2.8	2.1	2.6	2.8	3.3
Self	1.8	0.8	0.8	1.1	1.3	1.3
Intentions:						
Function	3.1	2.9	3.5	2.8	3.8	3.4
Self	1.4	0.9	1.3	1.2	1.8	1.3
Current Use + Intentions:						
Function	6.7	5.7	5.6	5.4	6.6	6.7
Self	3.2	1.7	2.1	2.3	3.1	2.6
n =	12	9	10	14	4	49

9.3 Tasks

The first subdivision of the manager's "job" which emerged as the research progressed was that of the "task". As described in Chapter 6 this was an evolving aspect of the research process itself but the end result was two pronged - an evaluation of managers responses and comments to questions in general as they related to tasks and a "semi-structured" list of tasks based on Fayol's model of managerial activity.

9.3.1 Tasks in general

Managers commented on the unstructured nature of their tasks in the organization in relation to the use of computers in a number of ways, including:

- I spend a lot of time "guiding my people" and setting goals. It is a face to face activity - I can't imagine how the computer could do this. [A-12] [acct.]

- We have computerized all of our structured tasks. We are now doing some unstructured - particularly accounting analysis. [A-16] [acct.]

- We are involved in a lot of policy level tasks here concerning costs, prices, etc. But, like in most of the organization, the computer is almost irrelevant at a tactical or strategic level. Quantifying in policy level tasks and issues is a problem now. I'm not sure how deep the computer could go. [A-27] [plan.]

- I have a lot of unstructured tasks at my level. Would the computer really help? Would it be worth the effort. [C-14] [acct.]

(this manager (Dir. of Finance) had acquired a laptop computer but found that he had little time to use it and that it took too long to build up the data in a spreadsheet.)

- I like to computerize more complex tasks. Harder to get started but it has two advantages: (a) it forces us to think things out in detail and (b) if it works the savings tend to be high. [D-13] [prod.]

9.3.2 <u>The classes of tasks on the Interview Guide</u>

A number of points concerning the relationship between the tasks performed by the managers and the use of computers within the organization came out in this research:

<u>Planning tasks</u>

- Project management in planning is done using PCs by whoever is relevant. It is still quite informal. [A-10] [plan.] [CB]

- I'm responsible for all computerized accounting systems in the organization. This gives me a lot of power. But this doesn't extending to developing planning applications. [A-16] [acct.]

- A skills inventory would be a very useful application for our "people planning". [A-20] [pers.]

- I have a costing model now for salary reviews but it is not yet computerized. I want to be able to do "what if" for any salary component. [C-13] [pers.]

- Forecasting supply usage is becoming critical as budgets shrink. New [medical] programs are a particular problem. A good computer system would do most of this automatically. [C-18] [prod.]

- To be effective the computer must provide us with more stats to help us spot trends. [D-12] [acct.] [CB]

- The computer helps in setting our sales and profit objectives by producing budget planning forms (spreadsheets with blanks). But I don't get enough analysis of <u>why</u> current sales, costs, etc. happen. I need more analysis, especially of trends. [E-14]

- Right now our forecasting models are not too good. Because of rapid changes, lack of resources, lack of understanding of what is happening. Of course, these are the reasons we must get good forecasting models. [E-17] [prod.]

- We are weakest on trending. We know about past variances but will be their impact for tomorrow and how can we prevent it? [F-11] [acct.] [CB]

- Forecasting demand is really important to us in production. I'm not satisfied we do it very well now. We meet demand but it can use overtime, small runs, very expensive. What can the computer do? [F-13] [prod.]

Planning tasks were almost always described as a group effort, no matter which organization or function a manager is involved in.

No managers are satisfied with the computer support for their planning tasks but organizations and functions are at varying levels in terms of planning. Accounting at all sites leads the way with Personnel at the "back of the pack".

Controlling tasks

Managers' descriptions of tasks related to control were of two distinct types. The broadest was the organization.

. Our accounting focus has been on efficiency but the new cost focus of the profit centre system should encourage more managerial effectiveness. [A-16] [acct.]

. At [this company] we are moving away from an emphasis on employee productivity to an emphasis on quality of work. This will be harder to control. Can the computer help? What units would we use? [A-28] [pers.]

. The bottom line [in a hospital] is: do the patients perceive that they are getting the care that they need. We have to be more objective but we don't have the data for Q.C. let alone the computing. [B-17] [prod.]

. Our [accounting] system is batch so it has good control. The built-in audit facility helps as well. Online inquiry should help all managers but it doesn't do much now. it is partly the fault of the system and partly the managers. [D-11] [acct.]

. Speed of response and better data give us a lot more control. But (a) we are growing so fast with "amateur" managers that they don't know how to use the data and (b) we need more aggregate data. [E-16] [acct.]

Three points emerged from these comments. The first is the focus on accounting data for control. The second is the need for both better data for controlling the firm and better trained managers to use it. The third is the perception that some aspects of the organization (e.g., product or service quality) are much more difficult to control than Accounting.

Many managers also discussed control tasks at a more specific level.

- There is a central focus on control in this job. All data for the budget goes through here as well as depreciation (>$100 million/year). The computer does a lot of this because it is so standard. [A-10] [plan.] [CB]

- A main use of the computer for us [in Finance] is control - and related warnings. Control is now much tighter, faster and easier. We have to decide what to not control. [A-12] [acct.]

- The computer gives us a lot more control over day to day activity such as sales staff activity, customer contacts and billing. [A-19] [mark.] [CB]

- Our advertising budget is about $5 million/year. We have to track it by product, by activity, region, etc. There are both internal and external people involved so right now control is only done at a gross level. I have proposed using the computer to control it but its use is limited now. [A-23] [mark.]

- As managers we need to be able to get more accurate costs of each product and service we use; also more accurate forecasts. We have none of this now. [B-16] [prod.]

- We don't have a well defined internal audit function so we are still developing a computerized audit program. Basically we rely on the standard computer reports and some Lotus programs. [C-14] [acct.]

- Control of my area is <u>the</u> reason I use computers. Feedback is faster and more sophisticated. [E-14] [prod.]

- We have just started an absentee control system. It is still mainly lists. We need to move to move from details to analysis. [F-12] [pers.]

- In marketing we concentrate on volume and market share. Costs are important but they don't affect us much.

[F-13] [mark.]

In terms of control Accounting managers indicated by far the highest level of comfort concerning the use of computers in the control tasks associated with their jobs. This is not surprising given the structured nature of accounting and the fact that computers have been active in accounting longer than in any other function. The one topic in accounting that raised some concerns was cost control. Both sites A (moving to a profit centre model from traditional financial accounting) and site E (project-based in an environment that is speeding up rapidly) expressed the need to focus on this.

In the other functions many tasks were seen as difficult to quantify and, therefore, to control or they simply were not at a level of sophistication which would allow them to use their data for a high degree of control.

Coordinating tasks

A number of managers reported this as "a major part of the job". It seems to be related to both planning/decision making and to daily operations.

. Coordinating is a major aspect of my job. Little computer support except word processing. [A-22] [acct.]

(he gave 15 examples of his coordinating relationships - both internal and external.)

. My job is Province wide. I have to work with finance, engineering, operations, the computer centre, my own people and customers. Computer support is almost non-existent except for record keeping and voice mail internally. [A-29] [mark.]

. Dealing with outsiders (customers, other telephone companies, regulators, etc.) is a large part of my job.

I'm not sure the computer can help. its so non-standard. [A-30] [mark.]

. A major part of my job is dealing with suppliers. I wish the computer could help but we have little connection to outsiders. [B-18] [prod.]

. I deal with a lot of outside groups (Trust companies, lawyers, etc.) but I can't see the computer as too relevant to this - meetings, meetings, meetings. [D-12] [acct.] [CB]

. One of my main problems is coordination with other people in the company - from project managers to the President. [E-13] [prod.]

(he recently got rid of his terminal which would have allowed him to use E-mail because no-one else uses it.)

. One problem we have here is meetings. People are away or they just hate meetings. I think the computer could help us. I know that we have E-mail capacity on our current system. But it will be hard to get a lot of people to use. [E-16] [acct.]

. I have to coordinate the three plants in this region. Mainly management structure, major controls and capital budgeting. No computer support other than some dollar-oriented capital planning reports. [F-12] [prod.]

(the firm does have E-mail among all three plants but this manager was not interested in computer use "of any type".)

Coordinating was seen as a primary task in all functions but also one that was not nearly well enough supported by computer applications.

Decision making tasks

Decision making, like planning, was usually described, explicitly or implicitly, as a group task. Few managers described corporate wide decisions they, or their people, made. It was seen as a cooperative, incremental process, related to the concept of "muddling through" discussed in Chapter 4. Decision making was felt to be a primary aspect of most jobs yet it was very weakly supported at the level of individual managers and, in most cases, not well supported at the corporate level beyond the traditional activities such as budgeting (described below).

Advising tasks

This was not originally included in the task question but, early in the interview process, a number of managers, when asked about decision making, commented that they didn't make many decisions, rather they claimed to be involved in a number of forms of advising: upwards (e.g., the President), sideways (their peers in other areas) and down (their subordinates).

All fifty managers described some level of advising as part of their organizational function. This is, in fact, one area in which a number of managers suggested opportunities for more computer support including *ad hoc* reports for meetings and preparations of presentations, particularly graphs.

. Advising management and, if necessary, the Executive Committee, on unacceptable levels of risk is a key task in this job. Once I get the data and analyze it I pass it on - it is up to them to solve the problem. [A-14] [acct.]

. In addition to my management chores I am a consultant to the Executive Committee on Human Resources and I do special projects. The computer offers the opportunity for a lot of support to me (e.g., statistical reports, capital budgets). But I get them in printed form now and have to do a lot of "massaging". They could, and should, be online so I could do computer analysis. [A-21] [pers.]

. We always seem to be facing a deficit. I don't make final decisions but I have strong advisory power with the Board. I use spreadsheets to test the effects of various types and levels of change. [C-14] [acct.]

- Advising senior executives is a key task of my job. The computer doesn't help in this except by providing historical raw data. [D-11] [pers.]

- I am called on to advise a lot of people informally. My boss is a concept guy - I advise on how to implement [his concepts]. I'm hoping the computer will at least help simplify this. [E-18] [prod.] [CB]

Miscellaneous tasks

This was included as a catch-all classification to include the "different" but essential tasks managers perform. Tasks described in this group by one or more managers include: meeting with clients, attending conferences, travelling, staffing activities and memberships in professional or charitable groups.

It was interesting to note that most managers don't identify "communicating" as a separate task. It is seen as an integral aspect of those described above. On the other hand, the point will be made in Chapter 14 that many managers interviewed see communications technology as at least important to their work as data processing technology.

9.3.3 Other common tasks

In addition to these six sets of "conceptual" tasks a number of more specific tasks were reported as receiving some level of support from the "computer centre". Among these were analysis (in many forms); annual budget planning; and monthly budget control.

Analysis as a task

Many managers spoke of analysis as an important component of their function; something they spent a lot (but rarely enough) time on and an activity separate from planning. Some representative comments follow.

. We do more than 100 studies a year to evaluate 87 units (O.H. departments., products, regions, large customers). The computer is essential. [A-15] [acct.]

. We need a lot more ad hoc reports to help us improve marketing. Right now we have a few that are useful but most of our reports are pretty structured and not very timely. [A-19] [mark.] [CB]

. Our sheer size (we have more than 4000 employees) requires that we have our records computerized but we aren't into fancy analysis yet although I guess we should be. [A-20] [pers.]

. We are starting to analyze raw data. E.g., what sort of person seems to miss a lot of work? [B-15] [pers.]

. We need the software, the data structure and the training to do more (and better) modelling and ad hoc reports on our data. None of this seems to exist for my area yet. [D-13] [pers.]

. We are working toward analysis of problems (right now we just spot, record and report them). Quality control doesn't have much meaning unless we can lean from our mistakes through analysis. We have to get the computer working in this area. [E-12] [prod.]

. We need a lot more computer support for management analysis and trending. Now we have lots of detail but no analysis except in our heads. [F-11] [acct.] [CB]

. We are doing a little analysis, particularly in scheduling, but we could do a lot more. [F-12] [prod.]

(they have a microcomputer dedicated to scheduling but it depends on the experience of one young employee.)

These comments cover a number of points of view and level of understanding of computers but, overall, it is clear that managers see advising as a task which needs more structure and better computer support. The vague nature of the task, however, makes it difficult to describe specific tools for support.

The budgeting task

The tasks that were reported by far the most frequently as supported by some level of CBIS were "planning our corporate budget" and "controlling my budget". Virtually every manager mentioned these and indicated that he was an active participants in both.

All six sites use the central computer facility to support the annual budgeting process to some degree. One effect of this was that each manager was "forced" to do his part of the process and to respond to the input of others. The budgeting process was also an example of how the computer can reduce the manager's workload. Spreadsheets or other software help the manager and his subordinates determine what they will need and support their requests but it also will allow them to prepare multiple versions of reports (e.g., levels of detail) and to cut down on data entry.

Since this was one of the few tasks in which managers indicated that they did sometimes come directly involved with the software, these factors could be quite important. It is valuable to note that many of the comments are actually "mixed reviews" of this type of computer-based support for managers.

. Our corporate budgeting system is now on the central computer, much faster. Online (restricted) input and batch output. Capital budgeting is also computerized but it is still not used... We are now efficient in budgeting [due to the computerized budget system] - but are we effective? We get lots of reports but it takes three quarters of a meeting to argue about the data. [A-10] [plan.] [CB]

- Budget planning used to be a pain in the neck. Now it is "trivial" with all the accounting reports. The only problem is the excess of detail but we should be able to choose our own level and topics of interest soon. [A-12] [acct.]

- We produce budget planning sheets based on historical data but it is still very crude. [B-14] [acct.]

- The computer does help plan my budget for nursing ... if we had more data the budgeting cycle would be shorter. [C-16] [prod.]

- We use the computer for planning our budgets but mainly for controlling them. [D-12] [acct.] [CB]

- A lot of our managers aren't experienced [at management] and not financially oriented so our budgets aren't very sophisticated. I do a lot of hands on work [on budget planning] using LOTUS. [E-16] [acct.]

The budgeting function represents traditional computer-based support for managers. It describes not only what a tool can do for a manager (and for the organization) but also what it does not do or does badly. In some comments managers have gone further, pointing what they would like to add to the current system at an individual level (e.g., spreadsheets).

9.3.4 Tasks & functions

Some managers reported tasks (often supported by some level of computing) that were specific to one organizational function.

Accounting

- I use a computer more for planning (e.g., debt ratios). Models are created by Accounting Operations and run by my people. We quantify what we can but the final call is still human judgement. [A-12]

- Inter-company [telephone company] long distance settlements couldn't be done without a computer. It is done monthly and there are 30,000+ variables. [A-16]

- I am responsible for staff training for the whole accounting area (more than 350 people). We are looking at CAI but there's not much available right now. This is something we will have to improve. [A-17]

. Controlling [accounting] source documents is a real problems in a company this big. Authorization, verification, timing. Can the computer help at the operational and management levels? [A-17]

. We produce quarterly reports for 500 endowment funds plus activity reports monthly. This would simply not be possible manually. [D-14]

. We have rapid growth in this company but we do very little forecasting. If it continues that could cause a problem for us in accounting. [E-16]

Marketing

. We are computerizing daily tracking of sales staff including calls per period. The sales person fills in a daily report, a clerk collates and enters them so we can see what has happened and where. [A-19] [CB]

(this is still on a microcomputer and is separate from the customer files on the mainframe)

. We use a P.C. with a spreadsheet to plan the budget for each project. It is crude but is as much for coordinating as for planning. [A-23]

. We do all the marketing research and intelligence in my area. The computer isn't doing much for us now except some descriptive statistics. I think we have an opportunity. [A-25]

. We should be able to analyze repair causes and point out needs such as quality control or training. We have the data (all repair reports) but not the processing. [A-26]

. My job involves all tasks related to marketing as well as controlling and coordinating installation and repair of all types business services. It is almost like a small business. Computing support of installation and repair is getting quite good but marketing is weaker. [A-30]

. Fund raising needs a lot more support. Even up to date lists of contributors, mailing lists etc. Who should the executives and Board members be calling on? Who has given? [C-13]

Personnel

. The computer is not used now for disciplinary procedures but we should. If we miss a step or a deadline it is thrown out or grieved automatically. I don't do it but it comes down on me. [A-15]

. We have just developed a succession planning. It is still basic but this will become an important personnel task when we hit our retirement "bump" in a few years. [A-21]

. The computer is used in a very limited way to plan salaries (unionized and management). The president and I try out different allocations. But union rules and secrecy make this a frustrating exercise... We don't use a computer for grievances or arbitration with union members. We plan to start using a spreadsheet on a micro for negotiations but we don't have anything like this now. [F-14]

Planning

. A rate case can come from marketing or from any senior manager. The computer is used to schedule the project, do analysis and prepare reports. [A-27]

Production

. We have computerized our manual inventory records so we have better access to raw data for analysis (not much yet.). On the other hand we still type all of our P.O.s. We are a long way from sophisticated management reports for me - let alone the Executive Director. [B-16]

The difficulty of computerizing tasks which have such narrow focuses is yet to be faced in most of the organizations examined in this research.

In addition to the managers' comments on tasks and functions the number of each type of task performed by the managers in each function was calculated to determine whether there were significant differences in the number of tasks of the various types (planning. etc.) among the functions? Table 9-11 summarizes the relationships between the five functional areas examined in this research and the six classes of tasks described by the managers. It is important to note that, other than the names of the six classifications, this was still a relatively unstructured process. For example, one manager might say "I have to coordinate with my people" while another might describe that as three tasks.

What do these numbers tell us and how do the result relate to the use and appropriateness of computer-based tools? Chi-square analysis demonstrated no significant differences among the mean numbers of different tasks reported by managers in the five functions. Generally planning, coordinating, controlling, advising and decision making was the sequence of tasks in terms of "volume" while, as reported earlier, the sequence in terms of "value" was control, coordination, planning, advising and decision making.

9.3.5 Characteristics of a task

One set of structured questions on the Interview Guide asked the managers for their perceptions of which characteristics of a task made it appropriate for computerization (see page 25 of Appendix II). The meanings of all terms (e.g., complexity) were discussed with the managers before they answered these questions. The mean rankings for the characteristics for each function are given in Table 9-12.

When the Kruskal-Wallis test was applied to the ratings no significant differences about what characteristics made a task most appropriate for computerization were found among the managers in the five functions.

Table 9-11: Types and numbers of tasks performed (summarized by function)

	acct.	mark.	pers.	plan.	prod.	totals
planning	4.3	4.6	4.7	5.0	5.1	4.8
controlling	4.2	4.0	4.8	5.5	3.7	4.2
coordination	4.4	5.3	5.4	4.0	4.1	4.7
decision making	3.9	3.6	3.3	3.5	3.2	3.5
advising	3.3	3.0	4.9	3.0	3.8	3.7
miscell.	4.2	6.0	5.8	4.3	4.6	5.0

Table 9-12: Impact of the characteristics of a task on the relevance of computer support (summarized by function)

FUNCTION / TASK CHARACTERISTIC	ACCT	MARK	PERS	PROD	PLAN	ALL	**
task size	3.5	2.9	2.9	3.1	2.3	3.1	2
frequency of performance	3.3	3.7	3.0	3.4	3.3	3.3	1
financial components	2.3	1.7	1.3	1.5	1.3	1.7	6
task complexity	2.4	2.6	2.4	2.7	2.8	2.6	4
internal vs. external	1.2	1.1	1.3	2.0	1.8	1.5	8
task structure	2.4	2.2	2.1	2.0	1.5	2.1	5
his own skills and experience	1.5	0.7	2.0	2.0	1.5	1.6	7
tradition	0.4	0.1	0.5	0.3	0.3	0.3	9
time available (deadlines)	3.2	2.1	3.0	2.7	2.5	2.7	3
n =	12	9	8	14	4	47	

** Relative rankings of the nine characteristics in terms of their effect on computerization.

9.4 Activities

Due to limitations of both time and technique (unstructured interviews) the data gathered on activities were limited and the method used was basic - presenting a list of common activities to each manager and having him estimate what proportion of his time was spent on each (see pages 14 and 15 of Appendix II).

Three issues concerning the managers' mixes of activities were of interest: (a) to what extent do different corporate cultures affect the way in which a manager spends his time; (b) to what extent does the manager's function affect his activity mix; (c) to what extent do his personal characteristics affect his activities? The results of the analysis of these relationships for the organization, demographics and psychographics are presented and discussed in chapter 7 and 8.

But the goal of this research was not simply to determine how managers spend their time or why. It was intended to help understand how computers can support managers in their activities. An overview of the managers' responses to the questions about the ways they spend their time (see Table 9-13) makes a number of important points in terms of current and potential use of CBIS by these managers.

1. the percent of time spent using the computer directly ranged from 0% to 15% for all managers, with a mean of only 1.4%. In fact, 32 of the 43 managers (74%) who answered this question reported that they spent no time at all working at a computer. In almost all cases

managers spent more time in automobiles or airplanes that in front of computers.

2. The three most common activities were: group meetings (19.3%); one-on-one meetings (16.2%) and using the telephone (11.7%). The proportion of time spent in all meetings ranged from a low of 20% to a high of 75%. (All types of meetings took up an average of 44.3% of their time.) This raises two issues for this research. The first is the propensity of a manager to say something like "I spend so much of my time in meetings that computers couldn't help me much". The second is the opposite; that is, how can computers and related communications cut down on meetings. To what extent are meetings necessary and to what extent are they habit or ritual?

   It is important to note that, although many (most) managers expressed resentment at the number, length and inefficiency of the meetings they have to attend, it was clear that such attendance serves purposes beyond the narrow goals of the gathering. Negotiations on unrelated topics, planning future meetings and general intelligence gathering were mentioned by various managers. It is hard to see how Electronic or Voice Mail can replace these ancillary activities.

3. Overall managers reported spending less than 10% of their time "thinking and planning" and many expressed concern or even resentment at this. Is it possible to computers to provide managers with more time for this essential activity or can they help managers use their thinking and planning time more efficiently?

Table 9-13: Manager's rankings of the proportion of time spent on activities

Activity	n	Range Low	Range High	Mean
group meetings	42	5	55	19.2
one-on-one meetings	42	2	30	16.1
using the telephone	42	0	40	11.7
drafting reports	42	2	45	9.7
thinking/planning	41	0	30	9.6
using non-computer documents	42	0	30	9.1
informal meetings	41	0	30	8.9
travelling	42	0	20	5.4
analyzing standard computer reports	42	0	20	4.6
studying/training	42	0	10	2.5
working at a computer	42	0	15	1.4
				98.2
(all types of meetings)		20	75	44.2

9.5 **Problem solving**

Managers were not directly asked to discuss the nature of the problems they dealt with or the processes they use to solve them. But the issue of "problems" runs through many topics reported in other parts of this section of the report and a number of managers did make comments directly relevant to this aspect of computer use.

9.5.1 The structure of problems & information needs

Although most managers in this research were not familiar with the concepts of satisficing and optimising a few did have observations:

- Satisficing is not good enough in accounting - we need to have precision. In a $500,000,000 firm a one percent error is $5,000,000! [A-15] [acct.]

- Because we are dealing with dollars, and with careers [in Personnel] we must be precise. Can we be sure that a computer will get things right? [A-22] [pers.]

On the other hand, Marketing people had a different point of view:

- In marketing there are really no perfect solutions. We are happy with a reasonable solution. [A-23] [mark.]

- We don't need "ideal" answers very often - reasonable answers suit the nature of marketing. [A-24] [mark.]

One manager looked at optimising from a more conceptual point of view and, in so doing, captures a major aspect of decision support:

- Some aspects of quality control are not really appropriate for computing at all. For example, what is a good paint job? Some things have to be done by people. But we can still gather data for analysis. For example, do all the bad paint jobs come from one person or one piece of equipment? Unfortunately we can't even do this here yet. [E-12] [prod.]

In discussing other topics a number of managers described their attitude or their situation in terms of problem solving and decision making. Often they reflected on the process most relevant to their "way of working".

. I am a strong believer in simplification. If the computer can support that then I am all for it. [D-13] [prod.]

. I know that I could make better decisions through better data, more sensitivity analysis and I want to be able to use computers like spreadsheets to do it. But I don't see it happening soon. [E-14] [prod.]

. I have a lot of unstructured tasks at my level and I spend a lot of time in meetings. Would the computer really help? Would it be worth the effort? [C-14] [acct.]

9.5.2 Group problem solving

The second aspect of managerial problem solving which emerged clearly from interviews was related to these levels of solutions - the strong orientation toward group decision making at both middle and upper levels of management found in all six organizations. This was, in fact, one of the primary findings of this research. Since this has been emphasized a number of times already the data presentation and analysis are not repeated here.

In spite of this emphasis on the group little evidence of Group Decision Support Systems was found - computer support of the group process was restricted to printed reports, E-mail or V-mail.

This is an area of computer support for managerial activity which offers some of the greatest opportunities for organizations facing problems with time (the rapidly diminishing length of decision making cycles) and space (managers spread thinner and thinner and spending larger proportions of their time away from their offices).

9.6 Summary

This chapter has discussed the effects of the job a manager performs in his organization on his current use of computer-based information systems and on his intentions concerning them.

All managers in all functions use computers to some extent but none are content with what they have or what they see happening in the foreseeable future. Accountants are by far the heaviest users of CBIS, both within their own areas and for communicating with others. They are also the most familiar with sophisticated concepts such as DSS.

No function reported a burning need for direct use of computers by managers although Marketing expressed the strongest need for *ad hoc* reporting and for dealing with others (particularly customers) immediately. On the other hand, they had the least positive attitude toward CBIS for themselves and their function.

Although there are some differences among the functions it is more of case of some having slightly less need for specific types of support or suffering less from particular problems. The effect of function is much less strong than is that of the organization as a whole described in Chapter 7.

This chapter has also reviewed the data gathered concerning the tasks managers perform, the activities that fill their days, the nature of the problems they face and, most important, how these can affect their relationship with CBIS.

There were no major differences among the five functions in terms of the types of general tasks performed. All are involved in planning, controlling, coordinating, decision making, advising and miscellaneous tasks. Managers in all functions described planning and decision making as being primarily group activities.

Managers' comments made it clear that they see the computer's use as varying greatly from task to task. Of the "general" tasks control was the most emphasized and the computer was described as very important, even indispensable to this aspect of their jobs. Coordination is also important to them but few saw significant opportunity for computer use. Planning was the area where the most opportunity for expanded use of computers was seen. The potential for support for decision making, advising and miscellaneous tasks was limited and spotty - they were certainly not seen as tasks for which large, corporate-wide tools would be appropriate.

Beyond this framework of general tasks each manager reported tasks that make their version of their function distinctive and which contribute to the difficulty of computerizing their jobs.

On the other hand some tasks were ubiquitous. But even budgeting was felt to be not always well supported by CBIS - particularly at senior levels.

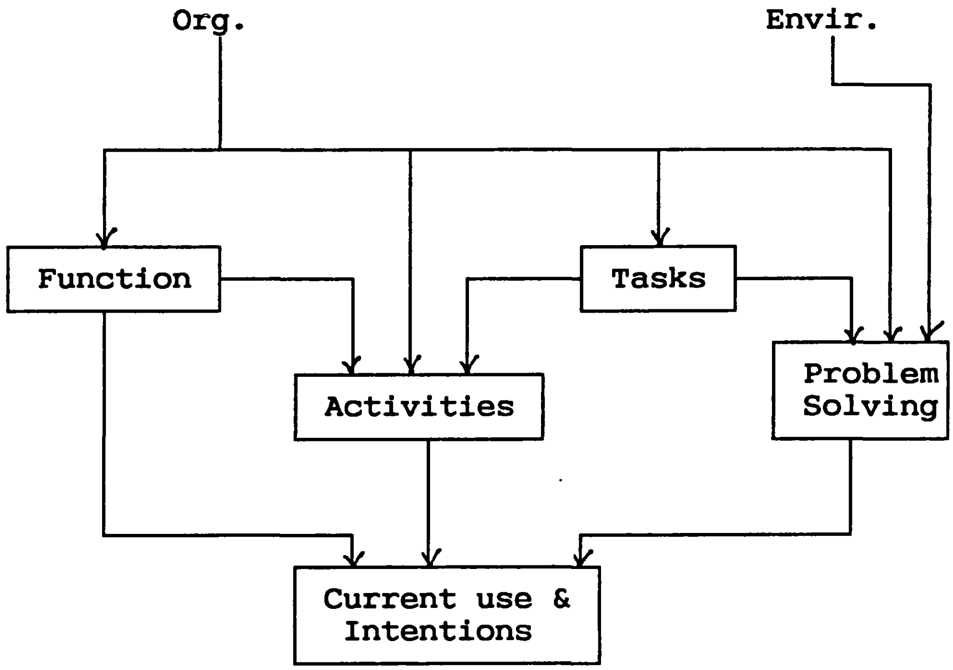
The data on activities were limited and is also evaluated in Chapters 7, 8 and 10 but a number of generalizations could be drawn from the results concerning the need for (and appropriateness of) computer support of the most common.

The least developed aspect of the framework for this research is decision making - data on both problem types and problem solving processes run throughout the data in chapters 7, 8 and 10 as well as this one but few specifics in terms of computer support emerged - other than the accountants' focus on optimising and the marketing manager's belief that computer models for problem solving are inappropriate for them.

The group nature of managerial problem solving also runs throughout the data but, again, few examples of computer support beyond traditional reports and Electronic mail were evident.

Because of the data presented in this chapter the single component "job" of the starting framework is more appropriately subdivided into function, tasks, activities and problem solving processes. Current use and intentions are directly affected by the manager's function; by the types of activities he performs and by the problem solving processes used (which relate more to intentions than current uses). They are affected by the set of tasks a manager must complete only for specific, specialized aspects of the job. Figure 9-1 summarizes the revised components of the manager's "job" and the relationships among them.

Figure 9-1: The components of the Job aspect of the emergent framework



The Effects of The Tools & Support Available

This chapter presents and discusses data acquired during the interview aspect of this project which deals with the computing resources available to managers; the factors they perceive as limiting their use of CBIS; the development techniques they use for new or enhanced applications and their evaluation of computer-based tools in general.

10.1 Introduction

A major source of factors which could affect the manager's use of and intentions concerning computer-based tools is the tools themselves. More subtle but equally relevant aspects of computing in the organization are the types and amount of support available to managers from each organization's computer centre[1]. Appendix I outlines the computer support available within each organization.

This chapter reports managers' comments on the aspects of computer support they felt either encouraged or discouraged their use of computers. It describes how they were actually using the computer and also includes data on their attitudes, intentions and "hopes" concerning computing for them, for their function and for their organization as a whole. To simplify the presentation of data these issues have been subdivided into five topics: resources available; advanced applications; acquiring & using resources; developing applications; and the managers' point of view.

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[1]Because each organization used a different title for its central computing facility the generic term "computer centre" has been used throughout this chapter.

10.2 Resources available

10.2.1 The computer centre

Meeting managers' needs

Many managers had distinct opinions or concerns about the central facility's ability to support them and their function. Some representative comments:

- The resources of [the computer centre] are stretched too thin to support even our standard needs let alone PCs, DSS, etc. [A-17] [acct.]

- An important part of computing for us now is the timing of deliverables. It's not quick enough for marketing needs. [A-26] [mark.]

- The mainframe is still too slow and access is too limited. We fight a lot of fires down here. We need [ad hoc] reports now! [B-15] [pers.]

- Our mainframe is too limited. We need micros connected to it so we can download data to analyze. We also need more online processing instead of batch. [C-17] [prod.]

- This firm has grown and changed rapidly in the past few years. Managers are just able to keep up with our jobs. I'm not sure but it seems to me that the central computer system is not keeping up. They are under a lot of pressure. [E-14] [prod.]

- Our current system is getting better but I am hard pressed to say much good about it. It took incredible effort and is still inadequate for management (late data, etc.) [E-18] [prod.]

- Our current system produces fairly accurate data on a regular basis but it is "out of date" and is very inflexible. You take what you get. I would like to see executive summaries and the option of getting various levels of detail on specific topics. [F-13] [mark.]

Relating resources to users

However, most managers felt that the computer centre was trying harder to meet users' needs in terms of both technology and people.

- The technical and computer skills of our [computer] staff are much improved over the last few years.

[A-10] [plan.] [CB]

. The company has made a commitment to stronger funding of [the computer centre]. This will come through to users like us but it will take some time. [A-19] [mark.] [CB]

. We are feeling our way here so we use only micros right now. But the people from the computer centre help a lot - often informally. [C-15] [plan.]

. We don't use a 4GL but we get good response from Darrell's people [the programmers] who use MAPPER [a crude 4GL] ... We have finally gotten new hardware and more computer staff I think we are headed in the right direction. [E-16] [acct.]

At two sites there were comments on a specific reason for this.

. Martin [the new Director of Systems Development] is really sensitive to our point of view. He can't always help but we get a good hearing. Mike [his predecessor] was basically a technician. [A-11] [plan.] [CB]

. The new Director of Computing is a good listener. The old one was totally insensitive to users. Communication is definitely better than it was a year ago. [D-13] [prod.]

As the computer staff focus more on applications for middle and senior managers instead of well structured clerical systems such interpersonal skills will become even more valuable.

Corporate applications

A number of managers also expressed concerns with the functionality or the reliability of some of the applications run in the central facility for the organization's managers.

. Our capital management system is old and doesn't meet the needs of our new situation. [A-10] [plan.] [CB]

. We have to become more and more responsive to our customers. Some of our older systems [in accounting and marketing] just do not allow for that and a lot of time and money will have to be spent to make them relevant. [A-17] [acct.]

- We have some systems in place which were developed "in-house" years ago. They are costly, confusing and not adding value to my area. [A-28] [pers.]

- Our main [accounting] application is still designed for "production people" so we don't use it directly. Menus, a report writer, etc. would give us (including me) more access and flexibility - and less work for them! [D-12] [acct.] [CB]

- CUFS [the university's central financial system] is not user friendly at all. In my area [purchasing] it is quite rigid. So we probably don't use it to its greatest extent - especially in planning and controlling purchasing. (my staff are terrified of it. Some quit.) [D-15] [prod.]

- Our current cost and schedule systems are just inadequate for our new markets - especially the U.S. We must work on these first or we will be overloaded. [E-18] [prod.] [CB]

A theme which ran through the comments and observations on the computer centre was the need for the organization to focus first on the most basic "infrastructure" applications before attempting to provide sophisticated applications for senior personnel. Most managers felt that the broad applications needed more functions, more reliable data and more user friendly access to that data and to processing.

10.2.2 Microcomputers

The most obvious way most organizations have attempted to overcome problems with the central facility was the use of microcomputers. The managers taking part in the project had a number of comments on them. The situation expressed by this manager was, fortunately, rare.

- One of the reasons we use micros so much here is that we don't even have a link to the mainframe. [A-18] [pers.]

The most common (and practical?) attitude was expressed by this manager.

- We are PC oriented because it is easier to get something that way. [A-23] [mark.]

Related to this attitude was:

- Our needs in marketing don't fit with any existing systems so we focus on PCs. [A-26] [mark.]

Other comments on microcomputers expressed a range of needs, uses and attitudes.

- We intend to increase our investment in data gathering and analysis - this will mostly be done on PCs. [A-27] [plan.]

- We now have a microcomputer in the office. It came from a supplier but we will be able to access other suppliers [using a built in modem] to place orders. It also has a spreadsheet and word processing but we don't know how to use those yet. [B-16] [prod.]

- We have a lot of micros for decentralized decision making. They are not linked - it seems to me this could be a problem in the future. [C-13] [pers.]

- We use micros for word processing and desktop publishing. I try to use it for my budget planning (Lotus) but I'm not too good at it yet. [D-13] [prod.]

- We use a lot of micros around here for specific tasks in quality control, scheduling, etc. But it only affects me indirectly. [E-17] [prod.]

- We now use a [micro] in negotiating annual contract terms with our largest customer. We can do planning of both financial and scheduling aspects then send them the disk. [E-18] [prod.] [CB]

- We use a microcomputer to develop, modify and communicate our marketing plan. Pretty basic (word processing and spreadsheet work) but it really helps. By the time we reach the final version everyone feels they have had their say. [F-13] [mark.]

Not only did managers and functions differ in attitudes toward and use of microcomputers but there were also differences among organizations. The extremes were represented by sites A and B. In order for a manager at site A to get a micro for his department he had to complete a "business plan" form and follow it through the Capital Budgeting Committee and the Computer Steering Committee. It could take up to six months with no guarantee of success. The firm was concerned with both efficient use of resources and standardization of hardware and software. Site B, on the other hand, exerted virtually no control over acquisition of microcomputers. At the first meeting with the Director of Systems he commented that he didn't how many micros were "around", where they were, who was using them or how.

10.2.3 Telecommunications

One of the unexpected findings to emerge from this research was the high value that many managers put on the current or potential uses of computers for communication - as opposed to processing. Virtually every manager expressed some degree of interest in telecommunications.

- Telecommunications will become even more important in marketing than data processing itself: cellular telephone, voice mail, E-mail, direct communications with customers. [A-30] [mark.]

- The computer really cuts down on the time for communicating but, so far, not the volume. [D-16] [mark.]

- We have to get a lot more people computerized and do a lot more networking - both internally and with our customers. [E-17] [prod.]

The main topics discussed were electronic mail (E-mail); voice mail (V-mail) and networked computing.

Electronic mail

Only two sites (the hospitals) of the six investigated did not have electronic or voice mail available.

The general attitude of managers who had started using E-mail was expressed by the following comment:

. I use E-mail on campus almost hourly. It's secure, I can send a message to a lot of people at once. Of course, I always save the original message as proof. [D-15] [prod.]

A number of managers cited specific advantages of E-mail for their function in the organization.

. We use E-mail a lot around here. It is very useful since senior people aren't in very often. We also use it to send [broadcast] job notices, special notices, etc. to all departments. [D-11] [pers.]

. We have E-mail among our three regional plants. Very useful. It actually cuts down on travel and chat! [F-11] [acct.] [CB]

(This same manager expressed frustration that the other managers in head office, where he was located, wouldn't use E-mail)

But support for E-mail was not quite unanimous:

. We have E-mail on the central computer but it seems very unfriendly. [E-18] [prod.] [CB]

. We have E-mail available but I never use it - I prefer the telephone. [F-13] [mark.]

Some managers who do use E-mail expressed frustration with other managers.

. We do have E-mail around here. I am a heavy E-mail user but I don't always get responses - I wish more people used it. It might save some meetings but around here everyone <u>must</u> have their say. [D-13] [prod.]

. We have E-mail on our central computer system but few managers have terminals and those who do won't use them. Very frustrating! [E-19] [prod.]

Some managers didn't even know what was available to them. For example, site E had an E-mail facility on its central system but it was rarely used - perhaps because of comments such as:

- In communication we don't have voice mail or E-mail. Telephone, fax or mail are the ways we communicate. [E-12] [prod.]

- The only communication I have now are mail, telephone and Fax. (Is that computer communication?) [E-13] [prod.]

In addition to the technical aspects of electronic mail these comments capture a significant aspect of corporate culture - the laissez faire attitude toward training or even informing of managers concerning the technology available to them demonstrated by five of the six organizations which took part in this study.

<u>Voice mail</u>

Only one of the six companies uses voice mail actively. Virtually every manager was enthusiastic about it (many claimed that they could never go back to "the old ways".) Following are a few sample comments.

- V-mail is essential for me now. It is a real control tool and helps me with delegation and feedback to avoid too many meetings. [A-11] [plan.] [CB]

- Nothing else in computing and technology has had the impact on me of V-mail and the cellular telephone. [A-13] [acct.]

- I was originally really negative about voice mail but now I am really positive. The benefit of easy communication is better than the frustration of not actually talking to the person. [A-19] [mark.] [CB]

- I combine cellular telephone with V-mail. I figure it gives me up to an extra hour a day - particularly when traffic is bad. [A-21] [pers.]

Clearly this form of computer technology has paid of in this organization.

Linking systems

A more complicated aspect of telecommunication raised by some managers was the linking of multiple computers either within the organization or with other organizations.

. We have a lot of technology [in Finance]. We are connected to our Trust Co., the stock markets, our pension fund managers and the cash management system at our Bank. [A-12] [acct.]

. We still have trouble transferring data up and down between our mainframe and PCs. [A-15] [acct.]

. We still lack a lot of data on hazardous materials. But we can now access government files in Ottawa so our knowledge is growing. [A-18] [pers.]

. I hope that in the near future we will do inter-organizational computing with some of our largest customers. But there are serious management decisions to be made before we do this. [A-24] [mark.]

. We have good E-mail and Voice Mail internally and with our industry but it has not had any effect on our customers <u>yet</u>. [A-26] [mark]

. I would like to be able to connect to government agencies and other sources for research purposes. [B-15] [pers.]

. It will become more and more important that we connect to our suppliers - for prices, availability and ordering. [B-16] [prod.]

. I would like to get a better [electronic] connection with at least our main vendors. Do we really need to print hundreds of P.O.s? [D-15] [prod.]

. We are connected to our main customer's inventory system for information and ordering materials. They also use it to communicate with us. [E-20] [prod.]

. We are linked nationally [within our company] and with other breweries. But there is not enough use in this office. [F-11] [acct.] [CB]

Although managers in all functions saw benefits to linking computers together this was one of the few cases where Marketing managers were as enthusiastic as those in other areas.

One manager showed a level of faith in technology that was reminiscent of the early days of computing:

- I an assuming that all of our equipment will communicate. That is up to the technical people. [E-13] [prod.]

10.2.4 The Information Centre

Some organizations have attempted to overcome the problems in communication and workloads described above through development of an Information Centre. This is basically a specific location (or at least a group of technical staff) to which users can go for advice and instruction on both hardware and software, primarily related to microcomputers. Only one organization (site A) in this research has formally initiated an Information Centre. Managers' comments were universally positive.

- We like to get packages that are well tried out and that have a lot of flexibility. Because of the Information Centre we are now getting informal company-wide standards. [A-11] [plan.] [CB]

- In a dynamic job like mine [internal auditor] the Information Centre has helped a lot in developing small, quick systems. [A-14] [acct.]

- When we get to the stage of doing small things on PCs the Information Centre will be very valuable. Right now we are trying to clean up our mainframe situation. [A-17] [acct.]

- Access to people who know what is going on is a key benefit for us. We aren't too technical. [A-18] [pers.]

- The Information Centre has to expand even more. They are becoming more helpful and would be a key area if we could get some Executive training. [A-21] [pers.]

- We use a range of packages (LOTUS, Harvard Graphics, etc.) for analysis and presentations. Some of my people spend a lot of time in the Information Centre. [A-27] [plan.]

. The Information Centre is superb. They have been a big help to us on special projects. [A-29] [mark.]

Two points about managers, training and the Information Centre must be made. The first is that most managers use the Information Centre indirectly.

. My people use the information centre a lot. I call Dean [the Director of the Centre] occasionally but my use is mostly through my people. [A-16] [acct.]

. I never use the Information Centre directly but my staff does for both advice and for training. [A-18] [mark.]

. My use of the Information Centre is indirect. I don't go there myself. I give one of my people an assignment and they go. [A-20] [pers.]

The second point came from the Director of the Information Centre himself: "We have never had a senior executive attend one of our training courses." If senior managers are to ever use computer-based tools to any significant level this type of flexible, personalized support will have to grow. But even more important the organization will have to make it worth their while to attend such course with time off and "merit points" for such attendance.

10.2.5 <u>Data in the organization</u>

Managers raised five issues concerning data in the organization. The first two were the <u>accuracy</u> and the <u>timeliness</u> of the data available to them or, in most cases, their staff. A number of comments elsewhere in this chapter address these issues.

Access to data

The third concern was access itself. Most central data are supplied to managers on a monthly, predefined, batch basis. In terms of analysis and planning this was often felt to be inadequate.

. We really need to integrate a lot of files into a big "database". My technical people tell me that this will mean separating data from processing. This makes sense. [A-12] [acct.]

. We haven't been very good at getting non-technical people access to corporate databases. If we really are supposed to use the computer ourselves this will have to change. [A-16] [acct.]

Data security

A corollary of this perceived need for access was the frequently expressed concern about the security of data. This was expressed by both technical staff and users - particularly those in Personnel.

. Confidentiality and control of data is really important in this area so security is a growing issue for us. Will we have to move from PCs back to the mainframe? [A-18] [pers.]

. Human Resource Management will get more and more sensitive. I am a little worried about security. We need a good protection system and better training. [A-20] [pers.]

. I am concerned about data security as we get more computerized. And if we have PCs and lots of people using them it will be even worse. [A-22] [pers.]

. Because of fears about confidentiality we don't keep much on the computer - demographics, payroll, education/training data. [C-13] [pers.]

. As telecommunications spreads the users can get access to H.R. files. Good service but poor security. We must give users a stake in both security and integrity of data. [D-11] [pers.]

. As we get fancier and more extended in computing I can see that data security could be a problem. [E-16] [acct.]

Data fragmentation

The fifth concern about data that became apparent as interviews proceeded was its location. None of the organizations had successfully resolved the question of local storage (on a microcomputer) versus central storage. Managers saw the advantage of have all data in one place for common access but their experience told them that such data often were not available to all managers. On the other hand local data might be limited but at least they are known, controlled and easy to use.

. We have kept control of the growth in information needs by using microcomputers. But that means that data that should be corporate is local. [A-10] [plan.] [CB]

. I am concerned with the potential in the future for large numbers of "data islands". We may use old data when newer is around. [A-15] [acct.]

. We store a lot more data than we used to but a lot is separate that could (should?) work together. [A-18] [pers.]

. As long as we don't have any end user computing around here we can control our data pretty well. I hope to keep it this way. [B-14] [acct.]

. Protecting corporate assets is a major part of my job. I know the computer could help more but the data we need are so fragmented! [F-11] [acct.] [CB]

10.3 Advanced applications

The original intention of this research was to investigate the direct use of advanced applications such as DSS by senior managers. Although a broader set of issues are now being examined there were some data concerning the managers' attitudes toward (and use of) such tools.

10.3.1 Decision Support Systems

As discussed in Chapter 9, not all managers were even familiar with this term, let alone the characteristics of the concept, but there are aspects of computing in some of the organizations which reflect the principles of DSS and a number did have relevant comments.

. In [technical] network planning we use a lot of models for flows, costs, etc. We do a lot of adjusting to see which is best. [A-10] [plan.] [CB]

. We have just gotten 1-UP. It is a DSS for financial modelling. We now capture not only dollar-based data but non-dollar data and analytical data (e.g. variances) as well. We store models as well as data. [A-15] [acct.]

. We use TFPA (total factor productivity analysis) which is a DSS which allows us to look at all the costs of providing services. [A-21] pers.]

. A good decision support tool will give managers reports they can use right away; e.g., reports for specific meetings. [A-25] [mark.]

. We use a workload management system (GRASP)for some scheduling (very basic) and for analysis; e.g., sick leave costs by department or by period. It has been a real help to my Directors and me. Patient specific or unit specific. For example, in one department the staffing is 120% in another it is 82%. How did it happen? What do we do about it? [B-17] [prod.]

. One area where decision support will become more important is collective bargaining. We have a number of unions and money is tighter and tighter but our modelling is still crude. [D-11] [pers.]

. We produce standard accounting reports but we also do trend analysis of direct labour inputs and overhead. A useful DSS if used well and not seen as gospel. We keep them simple because a lot of our managers have little management training. [E-16] [acct.]

. The flexibility of our computer system for scheduling and for forecasting (with marketing) are the most important aspects of what we do. [F-12] [prod.]

Again, familiarity with DSS or the description of such a tool did not imply that a manager used it directly. In almost every case the manager was an indirect user of the system.

In spite of the enthusiasm of theorists and researchers for Group Decision Support Systems (GDSS) as described in Chapter 5 and the group nature of much the managers' activity (chapter 9) no individual mentioned such a tool and, when the term was introduced, none was familiar with it. Processing was still done at a general corporate level or at a narrow, individual level. The "group" aspect came in the communication among managers - not among tools.

10.3.2 Expert Systems

Of the managers taking part in this project only six were familiar with the concept of expert systems and four of them come from a computing background.

. Within the business school [at the University where he works] we have developed an "automatic" bursary system. It appears to be an expert system although it still has some bugs. [D-13] [prod.]

. I would like to be able to develop an "admission decision" module on our Student Information system. This would eliminate hours of examining applications. Can we identify key factors? Is this an expert system? [D-14] [acct.]

10.3.3 Executive Information Systems

As was explained in Chapter 6 this type of CBIS is the least developed at this stage of computing in organizations. It is intended to be used by executives to do a more effective job but, beyond that, little has been clarified. Only twelve of the fifty managers asked indicated an understanding of the "apparent" concept of EIS and four of these have a computer background. A number of managers commented on this approach to computing for senior management.

. My boss [the V.P. of Marketing] had an EIS in his office for a few weeks but he got rid of it. He found it was too hard to get anything out of it and anyway he is almost never in his office. [A-23] [mark.]

. A lot of stuff like EIS is a waste of time and money. It is faster and easier to do it directly. It [EIS] is a confusing cliche - basically a marketing term. [B-14] [acct.]

. I don't see us getting into ES, AI or even EIS in the next decade or so. We have to fix up our MIS and evolve into DSS first. [F-11] [acct.] [CB]

One manager took a broader point of view than simple use:

. One of the problems with EIS (or any other upper level system) is: do we have the hardware and, most importantly, the data files to support it? [A-15] [acct.]

10.4 Acquiring/allocating resources

Before the issue of how to use most effectively use a piece of hardware or software can arise it must first be available. The answers and comments collected during interviews made it clear that acquisition of resources, even for traditional applications, let alone direct use by the individual manager, is a topic that has not been successfully dealt with by any of the organizations examined in this project.

10.4.1 <u>General problems</u>

Managers in all organizations expressed some degree of concern or frustration related to getting more support for themselves or their people from the central facility.

. We get a lot of good words from senior management but the resources often seem to go elsewhere. [A-11] [plan.] [CB]

- In my area [Finance] we currently have 67 systems projects running, planned or requested...It can be very frustrating to wait for a necessary system. Some projects with huge paybacks don't get done because of the resource requirements. [A-12] [acct.]

- Even a good business case for a new application isn't always enough. We are still budget driven not need driven. [A-17] [acct.]

- Our system has been approved by the Executive Budget Committee a number of times over the past five years - but then not funded. This does not give managers a good feeling toward corporate [computing] issues. [A-20] [pers.]

- It takes a long time to get anything done in terms of hardware or software. We really don't try much anymore. [B-14] [acct.]

- I have no control over getting hardware or software. This is done by a committee. This is wrong. [C-13] [pers.]

- We have been promised specific tools, such as a link between micros and central files, for a long time but nothing ever seems to happen. We have learned to work around it. [D-11] [acct.]

- I know that we have the potential to make savings if we had a [computerized] system to support quality control. But I haven't been able to sell it yet. [E-12] [prod.]

- Our MIS people aren't great listeners and the process [for getting computer resources] tends to be quite bureaucratic. So users either give up or go their own way - like we have done. [E-18] [[prod.] [CB]

- We are now waiting on a two year backlog of change requests from our central system. We don't even look for more potential improvements. [E-20] [prod.]

10.4.2 The political aspect of resources allocation

Beyond the general problems of limited resources or an excess of process a number of managers identified what they called the "politics" of computer support. All managers understand that there are finite resources in the central facility but some expressed doubts concerning the objectivity of allocation of those resources.

- I like to think that logic not "political clout" drives corporate computing development - but that is not always apparent. Of course, there may be things I don't know about. [A-23] [mark.]

- We recently developed a "steering committee" for computer resources. It appears to have smoothed out a lot of political problems. But it will take time to develop trust around here. [B-14] [acct.]

- We can get small tools and necessary changes but with larger systems we are into the political arena. [D-11] [pers.]

- The computing resources are allocated by a committee (ASAC). It seems to have a political attitude toward allocation. [D-12] [acct.] [CB]

- Getting computer support shouldn't depend on politics and what already exists. But it seems to me that it often does. Because we are a cost centre it is hard to "sell" our computing needs. [E-12] [prod.]

- The degree of [computing] support you get depends on where you are. In Ontario it was fine, it's good here and not so good in Newfoundland. [F-11] [acct.] [CB]

- We are "behind the times" in computing here in marketing. But I don't see that changing soon. Among other things we don't have the political or financial clout. [F-13] [mark.]

This reflection of Allison's political model of decision making doesn't even get to the point of <u>using</u> CBIS. Managers were concerned with whether it was worth the effort to even <u>try for</u> the resources they need. Organizations concerned with effective management must begin to consider this attitude (valid or not) to be a primary factor in the relationship between managers and computing.

10.5 Developing applications

Managers reported being affected by two classes of computer applications: programs written "in house" to meet the special needs of the organization and computer packages. Managers had little interest in the in-house programs (which all ran on their central computers) beyond the problems with using current systems described above. But they had a lot more to say about packages and related topics.

10.5.1 Software packages

Some packages, such as CUFS (Colleges & Universities Financial System) and general use applications such as fourth generation languages (MAPPER at site E; Focus and SAS at site A), run on the central computer. However it was packages running on microcomputers that were on the minds of most managers:

. We use Lotus 1-2-3, WordPerfect, A statistics package to identify and evaluate risks, graphics (through the Information centre) and DBase III+ for audit records. [A-14] [acct.]

. We use Chartmaster on one of our PCs to prepare presentations about sales or production. I don't actually do it - I request (!) it from one of my people who is very good at it. [A-19] [mark.] [CB]

. We use a lot of micro packages in marketing. Lotus 1-2-3, Symphony; Wang WP, WordPerfect, a number of graphics packages and DBase III+. [A-23] [mark.]

(he wasn't sure how they are used but he knows that they are "out there".)

. In staffing we use the computer only to keep track of surplus or deficit staffing. It is on a spreadsheet. [C-14] [acct.]

. We have and use Lotus for planning and analysis. We have DBase III+ on the micros in my department (Accounting) but I don't know what we do with it. [D-12] [acct.] [CB]

. Because of the fragmented nature of our organization packages are very important. Spreadsheets have been very useful for standardizing analysis across plants and, to a lesser extent, across functions. [F-11] [acct.] [CB]

All of these comments indicate indirect use of these programs and tools by the manager speaking. This was by far the most common situation for all managers in my research. "we" or "Jane" or "my people" use the computer - not "I".

More generally, some managers and organizations have a philosophy which leads them toward packages.

. The first thing we look for in a potential new application is an existing package. This is because of the problems with in house development. [A-13] [acct.]

The managers were not always enthusiastic about the proliferation of packages, whether on the central computer or microcomputers.

. We now have a tower of babel in software here - FOCUS, SAS, 1-Up, etc. [A-10] [plan.] [CB]

. I am concerned that with all the packages, end user computing, etc. we are getting too fragmented. New applications should fit with existing applications. [F-11] [plan.] [CB]

In some cases managers felt that there were few or no relevant packages available.

. I'm responsible for screening all potential employees. There are about 10,000 applications a year. Right now this is not supported much by a computer. We do have an applicant file on a PC in the Employment office. [A-16] [acct.]

. We couldn't find a good grievance tracking system so we are building one on our microcomputer. [A-21] [pers.]

. There doesn't seem to be much package support for product tracking and analysis. We will have to create one ourselves. [A-25] [mark.]

. We are the leader in Regulatory Affairs in this region. We can't wait until a package comes along - we have to be leading edge. [A-27] [plan.]

. Most existing accounting packages are irrelevant to hospitals. We had to build our own which means, of course, that it is basic. [B-14] [acct.]

. Packages for Q.C. [quality control] are rare. My people are very creative with general packages. [E-12] [prod.]

. I don't know of any package that will meet all of our (Human Resource) needs. The computing people tell me we would have to do a lot of modifications. [F-14] [pers.]

These managers are caught between the backlog of systems development in their central facility and this lack of relevant packages and present an opportunity for both researchers and organizations to develop models for evaluating the costs and benefits of "niche" tools.

10.5.2 <u>Prototyping</u>

In some organizations there was the beginning of a move away from the traditional system development life cycle toward prototyping. This was particularly obvious at site A.

. A major use of the computer for my area [Planning] is prototyping. It helps us spot problems early and cheaply. We often prototype on a microcomputer then move the product to a mainframe. [A-11] [plan.] [CB]

. We are currently prototyping the new profit centre system on micros before it moves to the mainframe. [A-16] [acct.]

. I use the PC for prototyping. I try out reports for people, if it flies we will put it on MAPPER [their central system]. This approach cuts the "communications cycle" way down. [E-16] [acct.]

. It would be easier to "see" systems if we took more of a prototyping approach. It makes it easier to swallow and to change. [E-19] [prod.]

. We are now prototyping a model of the production process for one major product on a PC. When it is refined it will move to the mainframe. [E-20] [prod.]

. We are now going the prototyping route of development. It seems to help prevent misunderstanding and gets people onside. [F-11] [acct.] [CB]

Although the concept of prototyping has been around for a number of years the impetus for it seems to come from the users rather than the (more traditional?) systems people. Also the main approach seems to be prototyping on a micro then moving the product to a mainframe. This sounds obvious but it can be difficult because of different system software and programming languages. It does have the potential to prevent some of the problems managers have described above concerning the difficulty of getting new systems if administrative problems such as control of documentation and data fragmentation can be overcome.

10.5.3 End user computing

Closely related to prototyping is the concept of end user computing - pushing some data entry, programming or, at least, report production out to the users themselves. But most managers reported a lack of knowledge and experience with it or concerns about its effects.

. I have concerns with end user computing due to data validity; back up procedures; how many people are trying to solve the same problem? Are supervisors sure what their people are doing with it? [A-10] [plan.] [CB]

. I don't think that this company has a grip on end user computing. It is either PCs or help messages on terminals. [A-11] [plan.] [CB]

. I understand the concept of end user computing (those who need the information have the ability to access the data, process it and report it) but it is still pretty fragmented around here. I have never tried it. [A-13] [acct.]

. I have a good group of end user computing tools but I'm not much interested in more than basic online access. There is a lot of cost for end user computing - what are the real benefits? A lot of this comes from childish natures. [B-14] [acct.]

(This Director of Accounting also controls the computer centre in this organization. How accurate was his perception? To what extent is such an attitude a result of limited resources and to what extent is it a cause of such limitations? This is one issue that will need more research in terms of management computer use.)

- Both access to computers and related training are too limited around here to have any end user computing. [C-16] [prod.]

- We are having serious problems with end user computing in this company. MAPPER [their 4GL] is supposed to be user friendly but has turned everybody off. [E-16] [acct.]

On the other hand a number of managers were quite positive about end user computing, particularly those who are already using it.

- End user computing requires people with appropriate skills in the user departments. I have a number of people like this so I don't have to bother. [A-15] [acct.]

- In terms of end user computing we have someone who came here from [the computer centre] so we can look after ourselves. [A-20] [pers.]

- We do a lot of end user computing here. [A-25] [mark.]

(but he doesn't do any personally)

- We need more control of data and reporting. If we do it ourselves we can change as needed. Of course we would have to have the staff and training. [D-11] [pers.]

- I'm not sure I understand end user computing and I don't want to have to be too technical. But access to *ad hoc* reporting would be wonderful. [D-13] [prod.]

- In terms of end user computing we have some critical users who have PCs but we aren't investing much in them. There are opportunities in production; in marketing; in finance. [F-11] [acct] [CB]

These comments make a number of points. First, the managers recognize both the opportunities and the threats of this type of support. Second, many managers are open to, even eager for, end user computing for their area but the final point is that they don't intend to "do it" themselves. End user computing is seen as being "done by" a specialist within each user department.

10.5.4 Ad hoc reports

One of the main reasons manager would like to have computing power in their own area is to produce *ad hoc* reports.

. We need "on request" data at the department and individual levels but little is available now. [A-22] [pers.]

. We don't do a lot of ad hoc reporting (because of limited skills and time) but those we do are customer oriented - they are very important. [A-24] [mark.]

. Ad hoc reports are a big part of my job now but the computer isn't involved much. We will have to get much better as we get more competition. [A-30] [mark.]

. Our ability to produce ad hoc reports from our files is very restricted. It usually has to be formally requested from [the computer dept.]. Response is sometimes quick - sometimes not. [D-13] [prod.]

. I'm one of the few senior people in this firm who work on ad hoc reports. They appreciate their value but don't have time, skill or interest to do it in their area. this is going to be a real problem as things move faster. [E-16] [acct.]

(he has more than 150 pages of spreadsheets he has created himself! What is the opportunity cost to the organization of having the Director of Finance spending so much time at a keyboard?)

10.5.5 Report writers

Closely related to end user computing and ad hoc reports was the topic of packaged report writers. These were discusses in terms of producing reports from each organization's central computer files and particularly emphasized the data problem discussed above.

. Having a report writer capability could be very useful but only after our files are cleaned up. [A-21] [pers.]

- We now have a query language (FLEXGEN). With user training it might be valuable - but so far it has mainly pointed out problems with our files. [B-14] [acct.]

- We completely lack report writer capability now. It must all be done in the computer centre. Sometimes it's not worth the wait. [B-15] [pers.]

- There is a report writer available with our accounting package but no-one can get it to work so far so we transfer data down to micros for reporting. It is very awkward. [D-12] [acct.] [CB]

- We have report writer capability with MAPPER but it is not user friendly. [E-17] [prod.]

The need for good data behind a report writer is one issue that will have to be dealt with eventually in all organizations if they truly want managers to both use report writers and 4GLs and, more importantly, to have faith in them.

10.6 **The managers' point of view**

In addition to answers and comments on the "technical" aspects of the computing resource in the organization, managers raised a number of issues that they felt affected users more than the technical staff. Those bearing on this research are reported below.

10.6.1 Centralized versus decentralized processing

A number of managers, discussing the use of microcomputers, identified a problem that all organizations and managers will have to face in the near future - the potential for conflict between the central facility and micros.

- It's relatively easy to get PCs (just go through the hoops) but access to larger systems is tough. The focus there [the central facility] is still on traditional processing. [A-13] [acct.]

- Our development process is long and bureaucratic. More resources for the Information Centre [which provides support for microcomputers] are essential. [A-14] [acct.]

- We have been using the company-wide (centralized) WANG word processing system but it appears that we will soon be losing it because so many areas now use micros. This seems to me to represent the whole problem we have (and haven't addressed) - centralized versus decentralized processing. [B-15] [pers.]

- We tend to put our simple stuff on the mainframe and the more complex or sophisticated on PCs. What's the long term impact of this going to be? [E-16] [acct.]

- On our central computer we basically computerized the old manual systems. I think we missed an opportunity. PCs are generally much more useful to us. [E-17] [prod.]

10.6.2 Degrees of use

Unlike the popular concept of advanced organizations having a microcomputer or terminal on every desk, this research found very few managers who are in that situation or who want to be. A detailed range of relationships that a manager can have with a computer was described in Chapter 1 but, for the most part, managers reported three basic levels of use.

Organization-wide support

The simplest and most common was the use of reports produced either externally or by other parts of the organization, particularly Accounting and Personnel. Managers in all six organizations received some standard reports such as annual budget planning reports; monthly budget analysis and various reports on employees.

Other "organization level" reports are specific to the type of organization. For instance senior hospital staff receive a standard set of activity reports based on patients while at the manufacturing firms these reports focus on monthly costs and progress related to contracts.

Some managers also receive reports from the central computer specific to their particular area. Examples include "new hires" for Personnel and "customer change reports" for Marketing managers.

Local computing

The second level of support described was "local" and "indirect". Hardware and, in some cases, software are located in the manager's area and are used to support the activities of that function. But the manager doesn't use any of the computer-based tools himself - it is done for him by subordinates. Dozens of quotes in other parts of this thesis have stressed the preference of managers for this type of relationship with computers but one particularly evocative example was:

. Feedback from my people is essential - I don't like getting blind sided. But this feedback is almost always face to face. I don't know where they get it [information]. I guess a computer could be involved. [A-26] [mark.]

Direct use by the manager

The third level of use, actual hands on programming or creation of reports, was rare in the managers examined in this research. Only six (12% of those taking part) were active users of hardware and all of them used microcomputers.

Three were the senior financial officers at sites C, D and E who used LOTUS 1-2-3 to prepare financial analyses, budgets and forecasts. All felt that it was not appropriate for them to be doing this type of work but (a) there was no-one else available and (b) they believed that it would take longer to explain the subtleties in their models to an "assistant" than to do the work themselves. Another manager who used a microcomputer was the Director of Human Resources at site D. He also "realizes that his time is valuable" but his staff had been cut so severely that he had no choice but to do it himself.

The Vice-President of Engineering at site E began using computers as an engineer but explained that he now "wears his management hat" while computing. He prepares schedules for engineering projects, analyzes potential costs of new contracts and plans his budget. Unlike the preceding managers he felt that this was a natural part of his management duties. The other user was the Contracts Manager at site E who used both a microcomputer and the central computer to plan and control contract costs and schedules.

10.6.3 Characteristics of computer tools

It will be essential for firms that intend to provide (or impose) computer access for senior managers to develop a coherent and accurate image of the manager's needs and wishes in terms of characteristics of CBIS. The only structured question in the interview process concerning tools was used to get a sense of what it is that managers expect them to "look like" and what they require from them.

Originally this was two sets of questions - one on characteristics such as "number of databases accessed" and one on functions such as "graphics capability". But a number of managers commented that this was confusing or redundant so the list of factors in Table 10-1 contains both.

The responses to this list made a number of points concerning managers and CBIS:

1. The clear priority is for tools which have good documentation, are easy to use and for which training is available. A number of managers commented on these aspects of computer tools:

. We need more user friendly systems on the mainframe but it doesn't seem to be happening. [A-16] [acct.]

. With our small number of non-technical people [apparently none] it is important that our packages work well together and are easy. [A-18] [pers.]

. I had a terminal but I get rid of it a few weeks ago. I couldn't even turn the damn thing on! I don't think that at my level I should fool with a system that is not user friendly. [E-20] [prod.]

2. Are we getting involved too early? caused many managers to make comments such as "this is never an issue around here. We are not state of the art."

3. The two lowest rated factors ("must run on a microcomputer" and "must be developed in house" indicate that managers have little interest in the source of the tool. They are only interested in what it will do for them.

4. The range of values for almost all factors is from 0 to 5, indicating a lack of consensus or, perhaps, a lack of understanding of some topics by managers.

5. The question about data (file) security was not answered by a number of managers but those who did answer rated this as one of the most important functions of a CBIS.

Table 10-1: Ranking of characteristics of computer-based tools by all managers

Characteristic	n	Range Low	Range High	Mean
good quality documentation	47	0	5	3.61
a good front end (menus)	47	1	5	3.55
easy for non-tech people to use right away	47	0	5	3.43
good training provided	47	1	5	3.29
has a "report writer"	47	0	5	3.28
easy to upgrade	47	0	5	3.24
acquisition/maintenance cost	47	0	5	3.23
flexible processing	47	0	5	3.21
good data security	45	0	5	3.04
variety of reports available	47	0	5	3.03
telecommunications ability	47	0	5	2.90
fits with other applications	47	0	5	2.83
graphics capability	47	0	5	2.67
no major changes required	46	0	5	2.55
long term value	46	0	5	2.54
good forecasting models	47	0	5	2.44
easy to use myself	47	0	5	2.41
finds a "reasonable" answer	44	0	5	2.35
number of databases accessed	47	0	5	2.11
fits with the "politics" of the organization	47	0	5	2.02
finds an "ideal" answer	46	0	5	1.96
fits well with the way we do things	46	0	5	1.95
easy to modify	47	0	5	1.86
no extra hardware/software required	46	0	5	1.70
are we buying too early?	47	0	5	1.47
it must run on a microcomputer	46	0	4	0.75
must be developed in house	46	0	4	0.54

10.7 Summary

The relationship between computer resources and the managers who took part in this research was, for the most part, not positive. They felt that resources were too limited; that corporate applications were not always as useful as they should be; that allocation of computing resources was not always objective; and that the data resources presents a number of current or potential problems for the organization and for them.

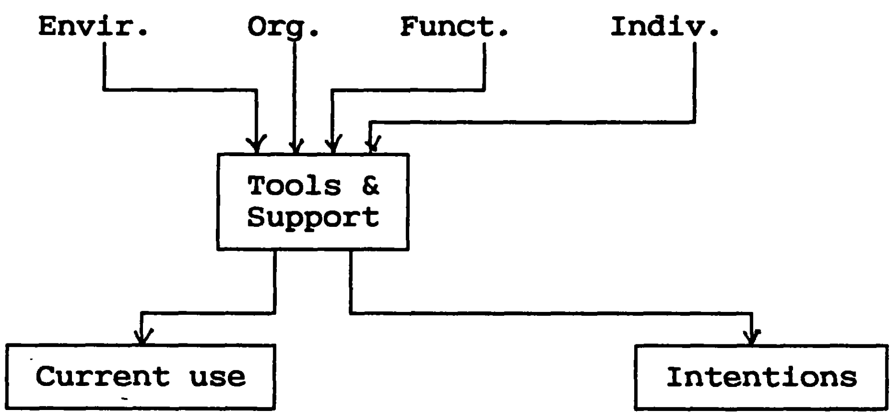
Their understanding, and use of, advanced concepts was very limited but they demonstrated strong interest in report writers on the central computer; development of specific applications on microcomputers using packages and increased support for end user computing. Managers at site A (the only site in this project with a formal Information Centre) were enthusiastic about its potential - for their staff rather than for them personally.

The clearest support was for telecommunications. Managers who use V-mail were unanimous in their enthusiasm but managers were divided on the use of E-mail - some for personal reasons and some for technical reasons.

The most popular characteristics of CBIS were ease of installation and use. Managers cared little whether tools were developed in house or acquired as packages or whether they ran in the central facility or on a local micro - but, in almost all cases, they did not and will not be using them themselves.

In terms of the framework, computer tools and support are affected indirectly by the environment (hardware and software actually available) and the industry (traditions and standards); the manager's function (accountants are the most sophisticated users and appeared to have to broadest set of resources); the personality of the individual (introverts were more comfortable with technology than were extraverts); and primarily by the organization (through many aspects). The tools and support available strongly affect both current use and intentions.

Figure 10-1: Tools and support in the emergent framework



Quantitative Analysis of Managers' Responses to Structured Questions

This chapter presents and discusses data which (a) examine correlations among managers' responses to the structured question sets and (b) compare the relative effects of the sources of managers' use and intentions discussed in the preceding four chapters on their responses to the structured question sets.

11.1 Introduction

The four preceding chapters in this section described and analyzed data on the sources of factors which might significantly affect a manager's use of computer-based tools (CBIS) and his intentions concerning those tools. Described in the "beginning framework" in Chapter 1 these sources were: the organization, its environment, the manager himself, the job he performs for the organization and the tools and support available to him. They were shown to have varying degrees of relevance and a number of factors arose which were not in that original model (e.g. the beliefs and attitudes of the individual).

This final chapter of data presentation and analysis performs two functions for this research. The first is to evaluate the relationships among the answers given to each set of structured questions. Correlation analysis was used to discover any significant links, which are presented and discussed in section 11.2.

The second function is to apply multiple linear regression to the data in the structured question sets in order to evaluate the relative strengths of the factors listed above on managers' responses. Findings on these relationships are presented and discussed in section 11.3.

11.2 Correlation among responses

The responses to the structured questions, as analyzed in the preceding chapters, have provided information on commonalities (and differences) among organizations, functions, tasks, personality types and demographic factors - but what about relationships among the responses themselves? Are there "sets" of responses which could shed light on the beliefs, attitudes or actions of the individual managers?

To investigate this the Pearson Correlation Coefficient (R^2) was calculated for all response sets and the t-test computed for each coefficient in order to test the null hypothesis that that correlation is actually zero. Tables 11-1 to 11-10 contain the correlation coefficients for the pairs of responses whose correlation had a level of significance of at least .05 (the level of significance is included in parentheses).

11.2.1 Limitations imposed on the use of CBIS in the manager's area of responsibility

Most of the correlations shown in Table 11-1 were straightforward (those between "a limited budget" and "lack of staff" or between " a limited budget" and "lack of needed technology", for example). One surprising finding was the inverse relationship between "lack of staff" and "information overload". One would think that as the manager's sense of staff shortages intensified so

Table 11-1: Correlations among limitations imposed on the use of CBIS in the manager's area of responsibility (47<n<50)

	b	d	g	h	i	j	k	o
a	.46(.00)			.28(.05)				
b		-.36(.01)					.35(.01)	
c		.42(.00)	.31(.05)					
d				.29(.05)				.38(.00)
f				.34(.01)				.28(.05)
g					.39(.00)	.48(.00)		
i							.29(.05)	
j							.41(.00)	

a: my budget is too limited
b: not enough staff
c: lack of valuable information
d: too much information to deal with
e: we need more computer training
f: difficult to coordinate with others
g: too many people to manage
h: lack of needed technology
i: lack of training for my staff
j: limited access to computers
k: lack of advice on technology
o: we have problems defining our information needs

would his sense of being overwhelmed by data. It may be that "lack of staff" limits the amount of data provided but, ironically, "too much information" was directly correlated with "lack of valuable information" (perhaps managers are too overwhelmed to sort out which information is valuable).

11.2.2 Factors affecting computer use in the manager's area of responsibility

No unexpected correlations emerged from the data in Table 11-2.

11.2.3 Ratings of input/output (communication) methods

The strong correlation between "the telephone" and "written memos, letters, etc." shown in Table 11-3 had also appeared in interview-based data. Since there does not appear to be a causal relationship between them it is most likely that they arise from a common cause - they have been the traditional means of communication in business during the careers of most of the managers interviewed.

The inverse correlation between written material and "Electronic mail", while expected, represents a clear challenge to organizations if computers are to become more extensively used at middle and senior management levels. Should managers be switched to the electronic medium (E-mail or V-mail) and, if so, how?

The correlation between "one-on-one meetings" and other types of meetings is straightforward (people who like meetings like meetings) but the link between such meetings and "general reading" and "formal reports in the

Table 11-2: Correlations among factors affecting computer use in the manager's area of responsibility (48<n<51)

	a	b	c	e	f	g	l
a	.43(.00)						
c	.35(.01)						
d	.47(.00)		.55(.00)				
e		-.42(.00)					
f	-.39(.05)						
g	.28(.05)	.28(.05)	.63(.00)				
h	-.28(.05)						
i						-.28(.05)	
k	-.29(.05)	-.33(.05)		.31(.05)			
l					-.34(.02)		
m							.34(.02)

a: creative use is encouraged
b: my staff has adequate training
c: I encourage my staff to use computers
d: my staff has a pos. attitude
e: we need more training on them
f: some of my people spend too much time with computers
g: they have changed the way we do our work
h: the org. makes it too hard to get them
i: I find it too hard to keep up with computer developments
j: we lack the hardware for telecomm.
k: I don't know where to look for advice on computers
l: they have helped identify problems we didn't know we had
m: we can do things we couldn't do before

Table 11-3: Correlations among the managers' ratings of input/output (communication) methods (44<n<50)

	a	b	d	e	f	g	h	j	k
b	.42(.00)								
c		-.34(.05)							
e			.46(.05)						
f				.49(.00)					
g				.44(.00)					
h				.35(.05)	.38(.05)				
k		.45(.05)		.31(.05)		.35(.01)			
l		.36(.05)							.59(.00)
m				.34(.02)					.28(.05)
n				.34(.02)			.29(.05)	.30(.05)	
o							.38(.05)		
p								.35(.05)	

a: the telephone
b: written memos, letters, etc.
c: Electronic mail
d: Voice mail
e: one-on-one meetings
f: group meetings
g: meetings with my subordinates
h: standard, org.-wide computer reports
j: ad hoc computer reports
k: general reading
l: profession/trade groups
m: formal reports within the organization
n: meetings with my boss
o: facsimile machines
p: informal ("hallway") meetings

organization" was not so apparent. It may be that these are the communication methods which get one to senior levels or simply that habit has become preference.

11.2.4 Manager's reasons for limited direct use of CBIS

This set of responses (see Table 11-4) produced one of the highest proportion of correlations of all of the issues examined. Most of the relationships were expected but two were surprising.

The first was the numerous relationships between "lack of education" and other responses. For example, it was inversely correlated to the managers' responses concerning the availability of competent staff. The more strongly the manager felt that he lacked education the less he felt that he had adequate support staff. Although it may be that the two sets of perceptions arise from a common source more investigation is needed. Most of the other relationships between lack of education and other factors are just as unclear. For example, does the expressed belief that "it takes too long to get the output" represent a perception of the manager's inability to produce or to use that output?

The second difficulty arose from the number of correlations between "no room in my office" and other reasons given for limited use. Again, it is possible that this is used as an excuse to avoid acquisition and use of computer tools and the skills needed to run them.

There may be other, less apparent reasons for these findings but they represent a possible roadblock on the

Table 11-4: Correlations among managers' reasons for limited direct use of computer-based tools (40<n<43)

	d	f	h	i	j	k	l	m	n	o
a										.56(.00)
b	.63(.00)				-.33(.05)		.51(.00)			.31(.05)
c			.46(.00)	.41(.05)					.44(.05)	
d							.49(.00)			
e		.36(.02)	.72(.00)	.53(.00)	.45(.00)	.65(.00)		.43(.00)	.45(.00)	
f			.36(.02)	.51(.00)	.47(.00)	.67(.00)			.36(.02)	
h				.50(.00)	.34(.05)	.53(.00)		.44(.00)	.56(.00)	
i					.60(.00)	.83(.00)		.68(.00)	.71(.00)	
j						.77(.00)			.51(.00)	
k								.50(.00)	.62(.00)	
l										.58(.00)
m									.55(.00)	
n										.31(.05)

a: I don't have time to learn
b: I have competent staff to use them
c: the org. discourages management use
d: for me the benefits don't match costs
e: The needed hardware is not available
f: too much delay getting the output
h: too much effort to get the resources
i: my peers wouldn't understand the output
j: I don't have enough education to use them
k: there is no room in my office
l: it is an ineficient use of my time and know how
m: few other managers around here use computers
n: the training I need is not available
o: my time is too "broken up"

way to expanded use of computer-based tools by some managers.

11.2.5 Proportions of time spent on activities

Because the data in this set of responses (Table 11-5) concern what the managers do, not what they want to do, correlations describe common activities or the fact that one activity causes another. Basically, as discussed in Chapter 9, the more time managers spend in meetings the less time they have to do anything else.

The one link in this set of responses that did not follow the obvious pattern was the positive correlation between "studying/training" and "analyzing computer reports". Does this represent personality types (individuals either like or dislike doing the two activities?), commonalities within functions (e.g. accountants like to do both but marketers hate them?) or is organization culture behind this link?

11.2.6 The effects of characteristics of the organization on the use of CBIS

No surprises were found in the correlation summarized in Table 11-6.

11.2.7 The effects of characteristics of the manager's function on the use of CBIS

The most obvious point in Table 11-7 is the inverse relationship between "the tasks the manager's area performs for the organization" and "the support received from the computer centre". The more (or less) important the manager saw the tasks as being in defining the use of computers the lower (or higher) the computer support was

Table 11-5: Correlations among proportions of time spent on activities (n=42)

	c	g	h	i	j	m
a	-.39(.01)		-.36(.02)			.76(.00)
b	-.38(.01)					.41(.02)
c						-.52(.00)
d					-.31(.05)	
e		-.35(.05)				-.35(.05)
h				.45(.01)		-.52(.01)
i					-.38(.02)	-.46(.00)

a: group meetings
b: one-on-one meetings
c: using the telephone
d: reading non-computer documents
e: drafting reports
g: travelling
h: studying/training
i: analyzing computer reports
j: informal meetings
k: thinking/planning
m: all types of meetings

Table 11-6: Correlations among the effects of characteristics of the organization on the use of CBIS (n=48)

	g	h	k
c		.38(.01)	.33(.02)
d	.43(.01)		
h			.50(.00)

c: level of technology in the industry
d: intensity of competition
g: the firm's financial situation
h: technical advice available
k: the nature of the computer department

Table 11-7: Correlations among the effects of characteristics of the manager's function on the use of CBIS (n=46)

	d	f	i
a	-.37(.04)	.29(.05)	
b		.31(.05)	
c		.34(.05)	.51(.00)
d			.31(.05)

a: the tasks they perform for the organization
b: the size of the area (within the organization)
c: the attitude of my people toward computers
d: support we receive from the computer department
f: our "political clout"
i: the education level of my staff

Table 11-8: Correlations among the effects of characteristics of a task on the use of computer-based support (n=45)

	b	f	g	h	i
a	.30(.05)		-.32(.05)		
c			.34(.02)		.38(.01)
d		.30(.05)			
g				.28(.05)	
h					.33(.02)

a: task size
b: frequency of performance
c: the financial components included
d: task complexity
f: task structure
g: my own skills & experience
h: tradition
i: time available (deadlines)

rated. Was this because the support was not available when needed or was it because it was unnecessary? This is an important point in terms of management's attitude toward the computer resource and requires further investigation.

The links between the "political clout" of his area and "the tasks performed" and "the size of the area" point out the managers' perceptions that clout is caused by their size and what they do.

11.2.8 The effects of characteristics of a task on the use of computer-based support

The cause of the inverse correlation between "task size" and "my own skills and experience" is not clear. It may mean that the larger the task the less his own input is required but that for small tasks his skills and experience are key factors in determining the need for computer support. That, in turn, may mean that some managers may not consider computer support for "small" tasks no matter how appropriate it may be.

11.2.9 The preferred characteristics of computer-based tools

This response set created the most correlations (26!) which would have made the matrix format used in the preceding tables very unwieldy. The list format chosen for Table 11-9 is simpler to interpret but also has a weakness. One must keep in mind that, because it is a "one direction" presentation, links from Reason 2 back to entries in the Reason 1 column are not obvious - although they are just as important. The following analysis has taken this into account.

When the data were analyzed there were few unexpected relationships among managers' valuation of the characteristics of computer-based tools. "Must require no extra hardware and software" was linked to a number of other characteristics: must access multiple databases; must have processing flexibility; must provide good forecasting models and must require no staff or supply changes. The latter is straightforward since both arise from cost concerns but the correlation with forecasting models, flexibility and access to databases are also positive and seems contradictory since any of these could, or even must, require additional resources. The most likely explanation is that managers are overwhelmingly concerned with the financial aspects of the computer support they would like.

A number of other correlations including: the inverse relationship between "will find a reasonable answer" and "training must be provided"; the positive link between "must fit with our politics" and "will find the right answer"; and the negative correlation between "are we buying or producing too soon?" and "must provide good documentation" will require further clarification not available in the data gathered in this project.

Table 11-9[1]: Correlations among the preferred characteristics of computer-based tools (page 1 of 2)

Response 1	Response 2	n	R^2	Level of confid.
easy to use	flexibility	47	-.32	.05
	graphics capability	47	-.29	.05
	good menus, etc.	47	.39	.01
multiple databases	telecommunications	47	.35	.02
	forecasting models	47	.40	.01
	no extra HW or SW	46	.46	.00
variety of reports	forecasting models	47	.32	.05
runs on a micro.	graphics capability	46	.33	.05
flexibility	forecasting models	47	.47	.00
	no extra HW or SW	46	.29	.05
will find a "reasonable" answer	long term value	44	-.30	.05
	finds "right"answer	44	-.63	.00
	graphics capability	44	.35	.02
	training provided	44	-.35	.02
statistical analysis	forecasting models	47	.44	.00
cost of acquir. and maintain.	fits with other apps.	47	.42	.00
	good documentation	47	.31	.05
telecomm.	fits with "politics"	47	.36	.02
	good menus, etc.	47	.38	.01
long term value	maintenance in-house	46	.54	.00

[1]This table format has been used to present the correlations among the managers responses concerning the preferred characteristics of computer-based tools because they produced an extremely unwieldy matrix. Care must be taken reading from the Response 2 column back to the Response 1 column.

Table 11-9: Correlations among the preferred characteristics of computer-based tools (page 2 of 2)

Response 1	Response 2	n	R^2	Level of confid.
fits with our "politics	finds the "right" answer	46	.36	.01
	fits with other apps.	47	.33	.02
	graphics capability	47	-.28	.05
	maintenance in-house	47	.34	.02
forecasting models	no extra HW or SW	46	.40	.00
finds "right" answer	graphics capability	46	-.31	.05
fit with other apps.	graphics capability	47	-.37	.01
	good documentation	47	.35	.02
	training provided	47	.39	.01
easy to use quickly	easy to modify	47	-.32	.05
	good menus, etc.	47	.34	.02
easy to modify	maintenance in-house	47	.41	.00
	good menus, etc.	47	-.35	.01
are we buying or producing it too soon?	good documentation	47	-.30	.05
no extra HW or SW	no staff/supply changes	46	.31	.05

11.2.10 Managers' attitudes, current use & intentions concerning CBIS

The data summarized in table 11-10 produced the highest proportion of correlations but none were surprising. The higher the manager's attitude rating the more positive he was about current and future use of computer-based tools for himself and for his area of responsibility.

The only point which stands out is that "intentions concerning CBIS for his area of responsibility" is not significantly correlated with either "attitude about use for himself" or "current level of use for himself". Apparently the managers separate direct (personal) use of CBIS from the more organization oriented use of computer-based tools in their function.

11.2.11 Summary of findings from the correlation analysis

The great majority of the correlations demonstrated among the managers' responses to the structured question sets were expected and most of the others were not significant - but a number of the findings could be important and merit further investigation.

The correlation between a manager's sense that he lacked the education needed to use computer-based tools and a number of other reasons given for limited direct use raises the possibility that those other reasons may be used, by some managers, to cover their belief that they lack education. This belief could, in turn, perpetuate their refusal to become more directly involved with computer-based tools. The same concern applies to

Table 11-10: Correlations among managers' attitudes, current use & intentions concerning CBIS (n=44)

	b	c	d	e	f	g	h
a	.40(.01)	.52(.00)	.40(.01)	.47(.00)		.60(.00)	.41(.01)
b		.47(.01)	.69(.00)	.33(.01)	.50(.00)	.50(.00)	.75(.00)
c				.39(.01)		.88(.00)	.40(.01)
d				.42(.01)	.56(.00)	.42(.01)	.75(.00)
e					.32(.02)	.77(.00)	.45(.00)
f							.80(.00)
g							.52(.00)

a: attitude concerning CBIS for himself
b: attitude concerning CBIS for his area
c: level of current use of CBIS for himself
d: level of current use for his area
e: intentions concerning CBIS for himself
f: intentions concerning CBIS for his area
g: current use + intentions concerning CBIS for himself
h: current use + intentions concerning CBIS for his area

the correlation between the managers' belief that they just don't have room in their office for a computer and numerous other reasons given for limited direct use. To what extent is that simply covering up negative feelings toward computer-based tools?

A third correlation that raised an important issue was the managers' inverse linking of the size of the tasks their area performed for the organization and the value of the support they received from the computer centre. The reasons why what should be a strong positive correlation is not requires further investigation.

Finally, a number of correlations among the managers' valuations of various functions and characteristics of computer-based tools will require more detailed examination. In particular, the overwhelming effect of "must require no additional hardware or software" raises issues that must be dealt with at both the organization and individual levels.

11.3 Regression analysis of the sources of effect on managers' responses

The final set of tests of the framework defined (or refined) in the preceding chapters was a comparison of the relative strength of the effect of the organization, the function, the personality type and other characteristics of the individual on his answers to the structured questions. To achieve this a multiple linear regression model was run against all responses in all quantitative data sets.

The dependent variable (y) in each run of the model was the manager's response to a question or his perception concerning a topic while the independent variables were:

. the organization to which he belonged (ORG)
. the function he performed for the organization (FUNCT)
. his personality type as defined by the MBTI (PERS)

Although it would have been useful to use all of the demographic characteristics discussed in Chapter 8 as independent variables in addition to these three, that would have made the regression model extremely unwieldy. It was decided to run a correlation analysis among them and to use those which had the lowest correlation with the three factors above and with each other. As a result of this analysis[1] the following demographic factors were included in the regression model:

. the manager's level of formal education (EDUC)
. the manager's time in his current position (JOB)
. the manager's experience with computers (EXPER)

Once the independent variables had been chosen a second difficulty had to be dealt with: the organization codes (ORG), the function codes (FUNCT) and the codes for personality types (PERS) are only "nominal" class variables which meant that the basic MLR model was not appropriate for testing them[2]. The regression tests actually run examined three factors.

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[1]For example, length of time with the firm (FIRM) was excluded because it was significantly correlated with ORG ($p<.01$), EDUC ($p<.01$) and EXPER ($p<.05$).

[2]A particularly clear discussion of the underlying issue of the use of dummy variables in regression analysis can be found in Miller and Erickson [1981].

The correlation coefficient (R^2) for each run of the model was computed and the F-test was used to determine the probability that the null hypothesis (all coefficients in that run were actually zero) was true.

The second set of tests focused on the nominal variables (ORG, FUNCT and PERS). The F-test was used to define whether or not membership in one group of a set (e.g. organization A rather than organization D) had a statistically significant effect on the outcome of the regression. Since the model used developed a separate "line" for each these variables, analysis at this level of detail did not provide coefficients - but their degree of relevance was defined by their F-test value.

The third, and most traditional, analysis was of the three "ordinal" variables (EDUC, JOB and EXPER). The results for each include the coefficient and an evaluation of the null hypothesis (this coefficient is actually zero) using the t-test.

For both the F-test and t-test values given in Tables 11-11 to 11-20 the correlation coefficients (R^2) were frequently high, often over .60. Because of this and also because interest in this set of tests was more on the relative effect of the independent variables than their statistical significance, the level of significance was relaxed to .10[3].

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[3]All test values at or below .10 are highlighted with bold print in tables 11-11 through 11-20.

Simply knowing the level of statistical significance of each variable for each "y" was, as just mentioned, not enough to answer the question of the relative strengths of the effects of the six variables. Fortunately, because the t-test value for the ordinal variables was, in fact, at the same degree of analysis as the F-test value for the nominal variables they could be directly compared.

Using this fact, the relative effect of each of the six variables on each "y" was calculated by giving each a "score" from 1 to 6 (1 for the most statistically significant variable and 6 assigned to the variable with the least statistical significance in that run of the model). Once the relative effect of the variables in each run (row) had been defined an "overall" ranking for each variable for that question set was determined by adding the rankings in each column. Those overall rankings appear at the bottom of Tables 11-11 to 11-20.

As a result of this situation each line in Tables 11-11 through 11-20 includes:

y - the response being tested
R^2 - The proportion of that y explained by all of the independent variables in that run of the model.
F - The probability that all of the coefficients in that run are actually zero (H_0).

An F-test value for each of ORG, FUNCT and PERS defining the significance of membership in each group on the dependent variable.

The t-test value (and the coefficient) for the ordinal variables EDUC, JOB and EXPER for that run of the model.

(The overall ranking of each of the six variables for that set of topics appears at the bottom of each table.)

11.3.1 Limitations imposed on the use of CBIS in the manager's area of responsibility

Only three cases of the regression model applied to this set of topics (see Table 11-11) yielded statistically significant results.

"I don't have enough staff" (p=.01)[4] was strongly affected by the organization to which the manager belonged (ORG) and by the function he performed for that organization (FUNCT). Personality type (PERS) and level of education (EDUC) were also strong factors although not quite at the pre-defined level of significance.

"Access to computers is too limited" (p=.05) was driven mainly by the manager's function (FUNCT) and, not surprisingly, by his level of experience with computers (EXPER).

"Lack of technical advice" (p=.01) was affected by the manager's organization (ORG), and also (inversely) by his computer experience (EXPER). His function (FUNCT) and his personality type (PERS) also contributed noticeably to the managers' perceptions of this issue.

Overall the function he performed for the organization (FUNCT) and the organization itself (ORG) appear to be the strongest factors shaping his perceptions concerning the limitations imposed by the organization on the use of CBIS in his area of responsibility.

[4]The value following each dependent variable is that of the F-test for that application of the regression model.

Table 11-11: Regression analysis of the limitations imposed on the use of CBIS in the manager's area

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
our budget is too limited	.58	.29	.52	.14	.29	.15 (-.05)	**.06** (.06)	.26 (-.10)
I don't have enough staff	.75	**.01**	**.01**	**.01**	.12	.14 (-.17)	.98 (.00)	.35 (.18)
lack of relevant information	.59	.19	.65	**.03**	.24	.46 (-.11)	.79 (-.02)	.92 (.03)
out of date information	.63	.11	.34	**.03**	.42	.57 (-.08)	.33 (-.07)	.61 (-.13)
information overload	.48	.56	.80	.30	.36	.72 (-.06)	**.07** (-.15)	.92 (.03)
coordinating with others	.54	.34	.20	.53	.46	.97 (.01)	.53 (-.04)	.92 (-.03)
too many people to manage	.52	.48	.44	.53	.94	**.02** (-.27)	.19 (-.06)	.53 (.11)
lack of technology	.59	.18	.55	.18	**.10**	.74 (-.04)	.72 (.02)	.23 (-.27)
limited staff training	.56	.33	.34	.61	.90	.36 (-.17)	.12 (-.01)	**.09** (.48)
limited access to computers	.67	**.05**	.28	**.01**	.42	.59 (-.08)	.78 (.02)	**.02** (.72)
lack of tech. advice	.77	**.01**	**.00**	.11	.15	.18 (-.17)	.14 (-.08)	**.05** (.48)
we have problems defining our information needs	.44	.71	.56	.56	.42	.98 (-.01)	.43 (-.06)	.91 (-.04)
		Rank:	2	1	4	6	3	5

11.3.2 Factors affecting computer use in the manager's area of responsibility

Of the models summarized in Table 11-12 only two showed significant effects of the six variables. "Creative use is encouraged" (p=.06) was primarily driven by the manager's time in the position (JOB) while the function he performed (FUNCT) was also a factor.

"I don't know where to get information on computers" (p=.01) was strongly affected by the organization (ORG).

The manager's computer experience (EXPER) and his level of education (EDUC) exerted the strongest overall effect on his perceptions about the factors impinging on the use of computers in his area of responsibility.

11.3.3 Ratings of input/output (communication) methods

Four of the dependent variables described in Table 11-13 were significantly affected by the regression model. "Written memos, letters, etc." (p=.05) was driven by FUNCT and by EDUC but ORG was also a statistically significant factor.

"Standard organization-wide computer reports" (p=.01) was most affected by FUNCT but length of time on the job (JOB) also had some effect, although not a the pre-defined level of significance.

"General reading" (p=.07) was affected to a statistically significant level by only one variable (JOB) but the organization (ORG) and his experience with computers (EXPER) also had an effect on managers' valuation of this communication method.

Table 11-12: Regression analysis of the factors affecting computer use in the manager's area of responsibility

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
creative use is encouraged	.66	.06	.05	.18	.94	.69 (.02)	.08 (.04)	.34 (.07)
my staff has adequate train.	.62	.13	.64	.17	.50	.27 (.06)	.88 (-.01)	.62 (.04)
I encourage my staff to use computers	.29	.99	.51	.94	.99	.39 (-.04)	.62 (.01)	.26 (.09)
my people have a + attitude	.46	.68	.26	.92	.92	.16 (-.04)	.66 (.01)	.14 (.07)
we need more training	.46	.64	.53	.43	.53	.66 (.02)	.99 (.00)	.87 (-.01)
some use them too much	.58	.26	.88	.03	.46	.45 (-.04)	.45 (-.02)	.71 (.04)
they have changes the way we do our work	.32	.96	.69	.60	.98	.31 (.04)	.51 (.01)	.24 (.09)
the org. makes it too hard to get computers	.46	.65	.39	.81	.36	.13 (.10)	.85 (-.01)	.48 (-.08)
I find it hard to keep up with developments	.56	.41	.21	.67	.42	.22 (.08)	.58 (-.01)	.25 (-.40)
lack of telecommunication equipment	.37	.93	.95	.83	.66	.67 (-.02)	.63 (.01)	.42 (-.09)
I don't know where to get info. on computers	.75	.01	.00	.34	.86	.68 (.01)	.40 (-.02)	.52 (.05)
they have found problems we didn't know we had	.40	.85	.96	.94	.57	.81 (-.01)	.82 (-.01)	.32 (.10)
we can do things now we couldn't do before	.38	.92	.61	.84	.90	.64 (.02)	.97 (-.00)	.49 (-.06)
		Rank:	3	4	6	2	5	1

Table 11-13: Regression analysis of the managers' ratings of input/output (communication) methods

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
the telephone	.44	.72	.74	.82	.46	.31 (.08)	.26 (-.04)	.93 (-.01)
written memos, letters, etc.	.66	**.05**	**.10**	**.06**	.29	**.06** (.25)	.21 (-.07)	.72 (.08)
Electronic mail	.67	.31	**.10**	.39	.49	.98 (-.01)	.65 (-.06)	.44 (-.25)
Voice mail	.63	.57	-	.59	.57	**.07** (.50)	.16 (.28)	.58 (-.16)
one-on-one meetings	.59	.18	.23	.60	.71	.13 (.19)	**.10** (-.09)	**.06** (-.42)
group meetings	.63	.11	.11	.27	.60	**.08** (.24)	.47 (-.04)	.18 (-.31)
meetings with subordinates	.54	.37	.64	.34	.64	.48 (.07)	.14 (-.06)	**.06** (-.34)
standard organization-wide computer reports	.73	**.01**	.42	**.01**	.46	.97 (-.01)	.18 (-.09)	.79 (.07)
meetings with outsiders	.49	.55	.77	.88	.90	.20 (.23)	.86 (-.01)	.32 (-.30)
ad hoc computer reports	.51	.51	.37	.66	.84	.21 (.27)	.94 (.01)	.77 (.10)
general reading	.65	**.07**	.12	.45	.45	.53 (.10)	**.04** (.15)	.15 (-.40)
professional/trade groups	.53	.47	.13	.76	.87	.87 (.03)	.33 (-.08)	.66 (-.14)
formal reports within the organization	.65	**.08**	**.03**	.55	.22	.63 (.07)	.34 (-.07)	.70 (.11)
meetings with my boss	.57	.30	.56	.73	.65	**.08** (.31)	.40 (-.07)	.88 (-.05)
facsimile machines	.56	.28	.26	.48	.16	.27 (.19)	.20 (.10)	**.06** (-.58
informal ("hallway") meetings	.57	.24	.25	**.09**	.63	.45 (-.12)	.59 (-.04)	**.07** (-.50)
		Rank:	1	5	6	3	2	4

The organization (ORG) was the only variable which significantly affected "formal reports within the organization" (p=08).

In descending order of strength, the six variables affecting the managers' perceptions concerning communication methods were: ORG; JOB; EDUC; EXPER; FUNCT; PERS. It is interesting to note that, while EXPER and FUNCT were statistically significant determinants of three dependent variables, they lie near the bottom in this "overall" ranking.

11.3.4 <u>Manager's reasons for limited direct use of CBIS</u>

Only two topics in this set were affected at or below the .10 level by the six independent variables (see Table 11-14). "I don't have enough education (p=.01) was strongly affected by the manager's personality type (PERS) and (inversely) by his time in that position (JOB).

"There is no room in my office" (p=.10) was significantly dependent on the six variables as well. Although no one of them occurred at the .10 level of significance EDUC and JOB had the strongest influence on manager's perceptions concerning this topic.

The rankings of the six independent variables, in terms of their effect on manager's responses to these topics, was: JOB; EXPER; ORG; FUNCT; EDUC; PERS.

Table 11-14: Regression analysis of managers' reasons for limited direct use of computer-based tools

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
I don't have the time	.55	.56	**.08**	.85	.48	.86 (.04)	.32 (.12)	.98 (.01)
I have competent support	.61	.32	.12	.67	.79	.53 (.12)	**.08** (.17)	**.07** (-.61)
The org. discourages the use of computers by managers	.56	.52	.34	.28	.69	.15 (.27)	.31 (-.09)	**.10** (-.54)
for me the benefits don't match the costs	.37	.96	.33	.97	.99	.32 (.29)	.32 (.15)	.19 (-.66)
hardware not available	.60	.36	.12	.79	.88	.40 (-.14)	.19 (-.11)	.34 (.28)
output comes too late	.57	.48	.80	.41	.58	.15 (-.18)	.62 (-.03)	.40 (.18)
programs not flexible enough	.48	.78	.86	.58	.70	.94 (.01)	**.07** (-.19)	.42 (.29)
too much effort needed to get the computer resources	.59	.40	.29	.53	.93	.79 (.04)	**.10** (.14)	.51 (.19)
my peers wouldn't understand the output	.67	.17	**.05**	.12	.43	.20 (-.16)	.12 (-.10)	.31 (.21)
I don't have enough educ.	.81	**.01**	.12	.19	**.03**	.65 (-.02)	**.10** (-.05)	.29 (.11)
no room in my office	.71	**.10**	.82	.47	.30	.18 (-.11)	.18 (-.06)	.36 (.13)
it is an inefficient use of my time and know-how	.52	.71	.77	.73	.39	.55 (-.17)	.55 (.10)	.96 (.03)
few other managers use them	.70	.13	.19	**.10**	.17	.81 (-.04)	.21 (-.10)	.14 (.42)
the training I would need is not provided	.66	.23	**.06**	.67	.88	.64 (.12)	.42 (-.10)	.42 (-.23)
my time is too "broken up"	.50	.75	.21	.40	.61	.84 (-.06)	.14 (.03)	.47 (-.31)
		Rank:	3	4	6	5	1	2

11.3.5 Proportions of time spent on activities

According to the analysis summarized in Table 11-15 none of the managers' perceptions of how they spent their time were affected at the .10 level by the six variables in this model although, in a few cases, ORG and JOB did occur at significant levels. Overall, the ranking of the six variables was PERS; ORG; JOB; EXPER; EDUC; FUNCT.

11.3.6 Effects of characteristics of the organization on the use of CBIS

Again, none of the models (in Table 11-16) demonstrated any statistically significant effect of the six variables in the model. The relative strength of the variables overall was: ORG; JOB; PERS; FUNCT; EDUC; EXPER.

It is interesting to note that, although EXPER had a statistically significant effect on two dependent variables it ranked last in effect on the topics in this set as a whole. Clearly this factor had a wide range of effect on these independent variables.

11.3.7 Effects of characteristics of the manager's function on the use of CBIS

None of the managers' perceptions of the effect of characteristics of the area of the firm which they directed on their use of CBIS was significantly affected by the model being tested. However "the attitudes of my people toward computers" (p=.15) presents an interesting situation. The levels of effect of FUNCT, EDUC and JOB were all below the threshold of .10 and ORG and EXPER had effects significant below the .20 level.

Table 11-15: Regression analysis of the proportion of time spent on activities

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
group meetings	.49	.74	.98	.76	.53	.94 (.14)	.89 (.11)	.88 (.66)
one-on-one meetings	.64	.25	.05	.94	.46	.55 (.49)	.05 (-.73)	.74 (.43)
using the telephone	.68	.14	.17	.79	.74	.97 (-.04)	.08 (.66)	.88 (.19)
reading non-computer docs.	.52	.65	.81	.61	.56	.17 (1.2)	.44 (-.28)	.50 (-.94)
drafting memos, reports, etc.	.60	.38	.23	.95	.92	.16 (-1.5)	.54 (-.26)	.32 (1.6)
working at a computer	.61	.33	.05	.11	.89	.20 (-.54)	.50 (.12)	.30 (.68)
travelling	.57	.47	.58	.93	.51	.90 (-.08)	.73 (-.10)	.20 (-1.4)
studying/training	.56	.51	.59	.99	.29	.76 (.12)	.76 (.05)	.74 (-.20)
analyzing computer reports	.50	.71	.54	.35	.50	.68 (.25)	.96 (-.01)	.99 (.01)
informal meetings	.54	.65	.71	.98	.45	.83 (.18)	.25 (.42)	.69 (.53)
thinking/planning	.64	.29	.48	.62	.26	.80 (.22)	.88 (-.05)	.79 (-.37)
		Rank:	2	6	1	5	3	4

Table 11-16: Regression analysis of the effects of characteristics of the organization on the use of CBIS

Dependent Variable (y)	R^2	p>F	p>F for:			p>¦t¦ (and coefficients) for:		
			ORG	FUNCT	PERS	EDUC	JOB	EXPER
size	.54	.36	.33	.18	.17	.73 (.06)	**.02** (.21)	.41 (-.26)
degree of evolution	.52	.41	.39	.31	.30	.46 (.11)	.99 (-.01)	**.05** (-.50)
level of technology in the industry	.51	.48	.50	.87	.90	.64 (.09)	.67 (-.04)	.74 (-.11)
intensity of competition	.54	.35	.17	.35	.73	.53 (.12)	.73 (.03)	.74 (-.11)
management structure	.51	.46	.91	.33	.22	.44 (-.13)	.74 (.02)	.98 (.01)
products/services offered	.51	.47	.29	.31	.31	.35 (-.18)	.41 (-.07)	.54 (.21)
financial situation	.59	.20	.64	.78	**.07**	.85 (.04)	.40 (.07)	.36 (-.30)
technical advice available	.57	.25	**.07**	.79	.62	.87 (-.03)	**.08** (.10)	**.07** (-.60)
physical structure	.44	.70	.48	.57	.51	.65 (-.09)	.34 (.08)	.93 (-.03)
locus of decision making	.37	.90	.41	.83	.95	.22 (.25)	.35 (.09)	.62 (-.17)
nature of the computer department	.38	.87	.88	.49	.85	.64 (-.08)	.53 (.05)	.86 (.05)
		Rank:	1	4	3	5	1	6

Table 11-17: Regression analysis of the effects of characteristics of the manager's function on the use of CBIS

Dependent Variable (y)	R^2	p>F	ORG	p>F for: FUNCT	PERS	EDUC	p>¦t¦ (and coefficients) for: JOB	EXPER
the tasks we perform	.46	.67	.12	.47	.93	.27 (-.19)	.30 (.08)	.71 (.11)
the size of my area	.40	.84	.56	.87	.82	.73 (.07)	.08 (.18)	.54 (-.23)
the attitudes of my people toward computers	.61	.15	.16	.05	.36	.02 (.46)	.06 (.15)	.16 (-.44)
support from the computer centre	.45	.70	.24	.31	.81	.97 (.01)	.76 (-.03)	.63 (.17)
my attitude toward computers	.55	.30	.13	.71	.13	.27 (.19)	.74 (-.02)	.38 (.23)
my "political clout"	.48	.58	.45	.54	.75	.84 (.04)	.32 (.08)	.87 (.05)
the existance of appropriate computer packages	.47	.62	.52	.48	.70	.92 (.02)	.53 (-.05)	.27 (.38)
the budget of my area	.50	.52	.29	.32	.56	.12 (-.34)	.52 (.06)	.17 (-.53)
the level of education of my staff	.55	.33	.20	.23	.43	.26 (.20)	.67 (.03)	.96 (.01)
		Rank:	1	2	6	3	4	5

The rankings of the six variables in terms of this set of topics was: ORG; FUNCT; EDUC; JOB; EXPER; PERS.

11.3.8 Effects of characteristics of a task on the use of computer-based support

Only one dependent variable in this set, described in Table 11-18, was significantly affected by the six variables in this model. "Frequency of performance" (p=.09) was affected by ORG at less than .10 but was also strongly affected by PERS (p=.12) and JOB (p=.12).

Managers' perceptions of the importance of "the financial components of the task" (p=.13) was not affected at the pre-determined level but, of the six variables, three (ORG (p=.01), FUNCT (p=.06) and JOB (p=.05)) were significant.

The relative strength of the six variables in terms of these topics was: JOB; ORG; EXPER; FUNCT; PERS; EDUC.

11.3.9 Preferred characteristics of computer-based tools

This topic produced the largest and most complex set of results from the regression analysis. Six responses (see Table 11-19) had a level of significance lower than .10.

"Must run on a microcomputer" (p=.05) was affected most strongly by personality type (PERS) and the manager's time in his job (JOB) but both the manager's function (FUNCT) and his experience with computers (EXPER) were also statistically significant in defining this response.

"Must provide good forecasting models" (p=.09) was significantly affected by EXPER, JOB and ORG. Although

Table 11-18: Regression analysis of the effects of characteristics of a task on the use of computer-based support

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
task size	.47	.66	.22	.56	.83	.85 (-.04)	.41 (-.07)	.41 (-.27)
frequency of performance	.65	**.09**	**.07**	.51	.12	.99 (.01)	.12 (-.10)	.49 (-.16)
financial components	.63	.13	**.01**	**.06**	.14	.19 (.26)	**.05** (.18)	.66 (-.14)
task complexity	.44	.75	.60	.73	.64	.82 (-.05)	.30 (-.11)	.18 (-.51)
internal vs. external orientation	.31	.97	.98	.73	.96	.81 (.05)	.25 (.11)	.62 (.17)
task structure	.58	.27	**.07**	.27	.51	.48 (-.10)	**.04** (-.15)	.30 (-.26)
his own skills & experience	.52	.46	.17	.81	.82	.79 (-.04)	.37 (-.07	.85 (.05)
tradition	.61	.17	.30	.40	.21	.63 (-.04)	**.08** (.06)	.28 (.14)
time available (deadlines)	.48	.60	.60	.93	.50	.42 (-.18)	.48 (.07)	.25 (.44)
		Rank:	2	4	4	6	1	3

Table 11-19: Regression analysis of preferred characteristics of computer-based tools

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
easy to use myself	.45	.61	.45	.81	.64	.27 (.27)	.60 (.05)	.80 (-.11)
access databases	.51	.43	.22	.72	.36	.98 (.00)	.13 (.13)	.15 (-.48)
variety of reports/formats	.36	.89	.71	.35	.90	.40 (.15)	.18 (.06)	.73 (-.29)
runs on a microcomputer	.67	**.05**	.19	**.06**	**.03**	.20 (.16)	**.03** (-.13)	**.10** (.36)
developed "in-house"	.62	.14	.54	.51	.24	.61 (.06)	**.01** (.20)	.56 (.13)
lots of processing flexibil.	.42	.73	.27	.99	.36	.12 (-.25)	.41 (-.06)	.51 (-.18)
finds a "reasonable" answer	.42	.76	.77	.67	.74	.78 (-.06)	.54 (-.06)	.21 (.51)
does statistical analysis	.54	.30	.16	.61	.50	.90 (-.02)	.90 (.01)	.12 (-.43)
costs to acquire & maintain	.38	.86	.65	.26	.51	.74 (-.06)	.90 (.01)	.52 (-.24)
communication linkages	.60	.15	**.10**	.18	.50	.74 (-.05)	.78 (.02)	.32 (.27)
fits with current activities	.43	.75	.55	.85	.89	.63 (-.11)	.32 (.10)	.30 (-.41)
long term value	.49	.55	.45	.60	.26	**.05** (-.48)	.31 (-.09)	.76 (-.15)
fits with our politics	.60	.14	.13	.53	.35	**.08** (-.29)	.93 (-.01)	**.05** (-.60)
good forecasting models	.63	**.09**	**.05**	.35	.13	.99 (-.01)	**.02** (.18)	**.02** (-.70)
finds the "right" answer	.44	.73	.49	.97	.58	.41 (-.21)	.82 (.02)	.65 (-.21)
fits with our other applics.	.47	.58	.67	.64	.45	.18 (-.24)	.98 (-.00)	.86 (.06)
easy to use quickly	.65	**.06**	.13	.11	.46	**.08** (.25)	.32 (.06)	.23 (.31)
graphics capability	.72	**.01**	**.01**	.15	**.01**	.86 (.02)	.67 (-.03)	.23 (.30)
easy to modify	.35	.91	.94	.84	.68	.45 (-.19)	.50 (-.07)	.55 (.26)
can be maintained in-house	.68	**.03**	**.05**	.12	.07	**.01** (-.50)	.24 (-.07)	.42 (-.15)
a good report writer	.66	**.05**	.26	.13	.21	.14 (-.19)	.16 (-.08)	.60 (-.12)
buying/producing too early?	.50	.43	.77	.13	.21	**.09** (.31)	**.08** (-.14)	**.06** (.61)
good documentation	.60	.15	.22	**.09**	.45	.94 (.01)	**.10** (.10)	.88 (-.03)
supplier provides training	.41	.78	.94	.43	.39	.57 (-.10)	.53 (.04)	.82 (-.07)
no extra hardware or software	.58	.23	.37	.29	.13	.91 (-.02)	.32 (.08)	.13 (-.49)
no major supply/staff changes	.46	.65	.34	.68	.91	.14 (-.32)	.16 (-.12)	.88 (.03)
good front end (menus, etc.)	.48	.54	.24	.53	.43	.69 (.05)	.29 (-.06)	.15 (.32)
Rank:			2	6	4	4	1	3

not quite at the pre-defined level, PERS also affected managers' responses concerning this characteristic.

The third topic which was significantly impacted by the variables in this model was "easy to use quickly" (p=.06). Only EDUC was below the .10 level but FUNCT and ORG were also important in shaping responses.

"Must have graphics capability" (p=.01) was strongly affected by the manager's organization (ORG) and by his personality type (PERS).

"Must be maintainable in-house" (p=.03) was significantly affected by level of education (EDUC), by the organization in which he works (ORG) and by his personality type (PERS). His function (FUNCT) was also important, although not at the pre-defined level of significance.

"Must have a good report writer" (p=.05) was driven, although not at a statistically significant level, by almost all aspects of the model: the manager's function (FUNCT), his level of education (EDUC) and his time in the position (JOB) were the strongest factors.

The relative strength of the six variables in affecting managers' feelings about characteristics of computer-based tools was: JOB; ORG; EXPER; PERS; EDUC; FUNCT. The low overall rating of the manager's function was particularly interesting since it indicates that a manager's feelings about CBIS are driven more by his work experience, the characteristics of his company and his experience with computers than by the fact that he is in marketing or accounting.

11.3.10 Managers' attitudes, current use and intentions concerning CBIS

The data evaluated in the final set of regression models, summarized in Table 11-20, are somewhat different than those considered in the nine preceding tests. They are based on the researcher's observations rather than on managers' answer to specific questions and they are also highly correlated (see Table 11-10).

All of the dependent variables, except for the manager's intentions concerning the use of CBIS for himself, were significantly affected by the six variables in the model (R^2 ranged from .65 to .82). Not surprisingly, the manager's experience with computers (EXPER) contributed significantly to the determination of all eight factors. The organization in which he functioned (ORG) significantly affected his attitudes, current use and intentions for his function but not for himself while his function (FUNCT) significantly affected his attitude and his current level of use for both himself and his function but did not affect his intentions nearly as strongly. The manager's time in his position (JOB) significantly affected both current use and intentions for his function but not for himself.

These results raise a number of points. First, as a manager develops experience with computers his attitude, use and intentions all rise (all coefficients were positive) while the organization exerts a strong influence on the manager's expressed or observed attitude

Table 11-20: Regression analysis of managers' attitudes, current use and intentions concerning CBIS

Dependent Variable (y)	R^2	p>F	p>F for: ORG	FUNCT	PERS	p>¦t¦ (and coefficients) for: EDUC	JOB	EXPER
attitude:								
self	.68	.05	.12	.08	.03	.77 (.03)	.27 (-.05)	.05 (.31)
function	.71	.03	.05	.01	.14	.20 (.14)	.27 (-.05)	.03 (.42)
level of current use:								
self	.71	.03	.42	.03	.24	.15 (.15)	.38 (.04)	.03 (.45)
function	.82	.00	.01	.01	.10	.37 (.09)	.01 (-.12)	.00 (.58)
intentions:								
self	.63	.14	.15	.50	.38	.19 (.12)	.60 (-.02)	.08 (.28)
function	.65	.10	.02	.36	.82	.83 (.02)	.02 (-.12)	.03 (.42)
Current use + intentions:								
self	.72	.02	.13	.14	.14	.07 (.28)	.83 (.02)	.01 (.76)
function	.76	.01	.01	.22	.36	.86 (-.02)	.03 (-.16)	.00 (1.1)
	Rank:		2	3	4	5	5	1

and use for his function but does not seem to have much effect on his attitude and level of use. This seems to represent a separation between the individual and the "manager" that requires further investigation. The effect of function on current attitudes and use but not on intentions also invites inquiry.

11.3.11 Conclusions from the regression analysis

The preceding discussion and related tables have summarized extensive regression analysis performed on managers' responses to nine sets of structured questions and one set of researcher's observations (which were combined with responses to a number of related questions). The goal of this activity was to improve our understanding of the relative strength of six factors operating on managers in terms of their current and intended use of computer-based tools.

Each of the six independent variables exerted statistically significant influence on one or more of the managers' responses or perceptions evaluated but, in order to develop an overview, some sort of summary of the data in the preceding ten tables was required. Table 11-21 summarizes the relative strengths of the six factors on each set of managers' responses and then creates an overall ranking of the independent variables.

Table 11-21: Summary of the rankings of the six variables tested in the regression analyses

Table Number	ORG	FUNCT	PERS	EDUC	JOB	EXPER
11-11	2	1	4	6	3	5
11-12	3	4	6	2	5	1
11-13	1	5	6	3	2	4
11-14	3	4	6	5	1	2
11-15	2	6	1	5	3	4
11-16	1	4	3	5	1	6
11-17	1	2	6	3	4	5
11-18	2	4	4	6	1	3
11-19	2	6	4	4	1	3
11-20	2	3	4	5	5	1
Mean Ranking	1.9	3.9	4.4	4.4	2.6	3.4
Low	1	1	1	2	1	1
High	3	6	6	6	5	6

Although this is a simplification drawn from extensive data it appears that the organization in which the manager works has the strongest affect on his perceptions concerning the topics examined. This is followed by the length of time he has been in his job; his prior experience with computers; the function he performs for the organization; his personality type; and his level of education.

The finding concerning the effect of the organization supports the impressions created by the interview data in the preceding chapters while the relatively low ranking of his function and his personality type indicate that these are subsumed to the characteristics and culture of the organization.

11.4 Summary

This chapter has taken a different approach to the data than was used in the other chapters in the data section. As a result findings have been produced which supplement the data which emerged from those chapters.

Few surprises were demonstrated by the correlation analysis but the regression analysis, especially of the managers' attitudes, current use and intentions raised a number of issues which will require further investigation.

Summary, Conclusions, Limitations & Recommendations

This final chapter contains the conclusions which have been drawn concerning the forces driving managers' use of, and intentions concerning, computer-based tools based on the "beginning framework" outlined in Chapter 1 and the data, analysis and findings presented in chapters 7 through 11.

Limitations of the project are discussed and recommendations for further research are made where appropriate.

12.1 **Introduction**

In spite of more than forty years of research into, and development of, computer-based information systems our understanding of the actual amount and types of use of computer-based tools by middle and senior managers has remained limited, often consisting of extensions of models for lower level use, models developed from theory or the results of surveys of current users.

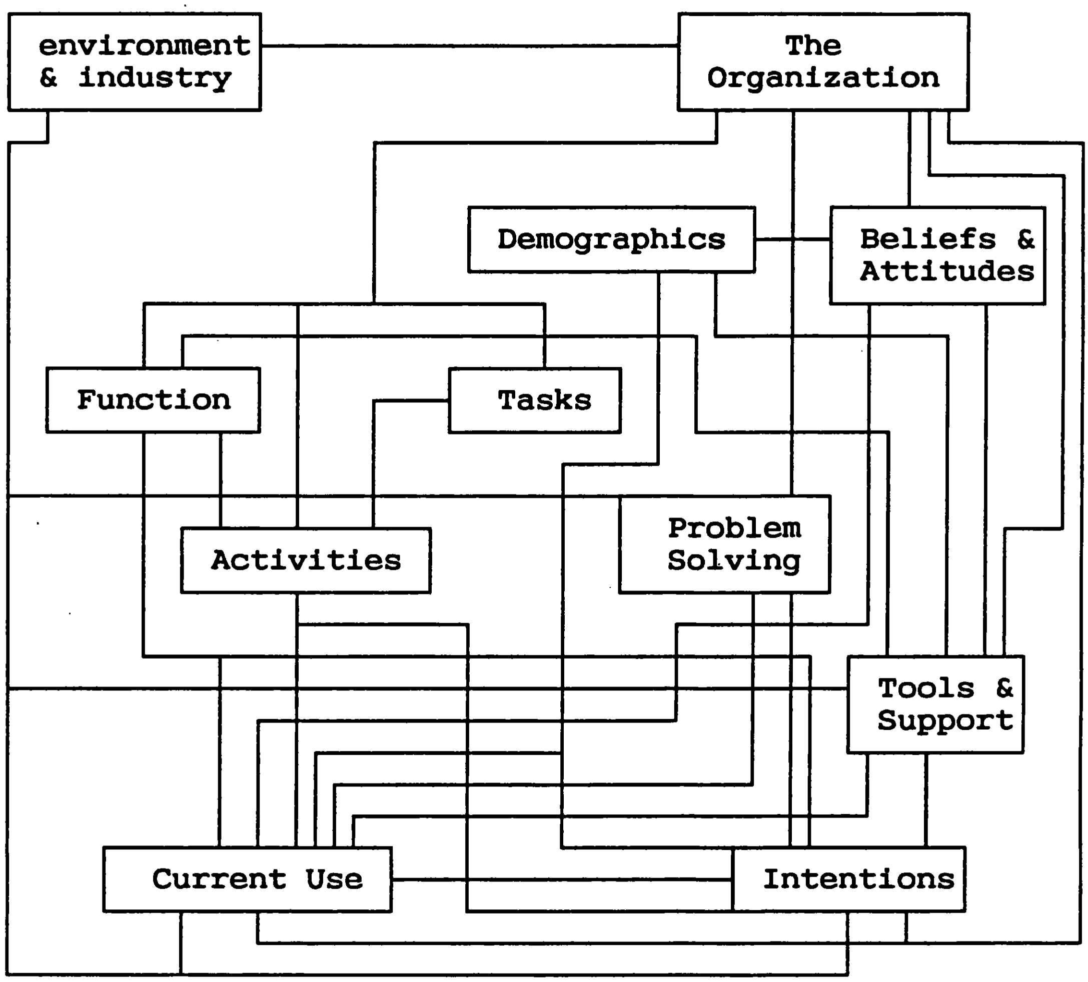
Even less insight has been available into the forces behind the use and the intentions of these managers concerning CBIS. The goal of this research has been to gather and use empirical data to develop, test and enhance a general model of the causes of the use of computer-based tools in organizations. What factors are involved, what are their relationships and their relative strengths? From a starting model (framework), outlined in Figure 1-1, this project has worked toward a framework more specifically applicable to the uses and intentions of middle and senior managers.

The preceding chapters presented and discussed data concerning the factors in the model and their possible effects on managers but, in order to be of use, these must be given some focus. To achieve that this chapter summarizes those data and draws a number of conclusions from them. Where appropriate, questions relating to a finding are raised or further research relating to a finding is suggested.

12.2 The emergent framework

Figures 7-1, 8-2, 9-1 and 10-1 has summarized the modifications of the starting framework which developed in each of those four chapters as data were analyzed. Figure 12-1 incorporates all of those changes to present a complete picture of the forces acting on the manager's current use computer-based tools and their intentions concerning them.

Figure 12-1: The emergent framework



The large number of relationships summarized in Figure 12-1 make it hard to follow and to interpret. Because of this it has been "translated" into Table 12-1 which describes the directional relationships among the factors in the emergent model.

Table 12-1: The relationships among the factors in the emergent framework

Factor Affected / Driving Factor	Ind/envr	organiz	demo/per	beliefs	function	tasks	activity	problems	tools	current	intent.
Environment & Industry		X						X	X	X	X
The Organization				X	X	X	X	X	X	X	X
Demographics & Personality type								X	X	X	X
Beliefs & Attitudes									X	X	X
Organizational Function							X		X	X	X
Tasks Performed							X	X			
Activities										X	X
Problem Solving										X	X
Tools & Support										X	X
Current Use											X

12.3 Topics supporting the framework

12.3.1 The environment & the industry

The most obvious effect of the environment and the industry on the use of computer-based tools by managers, and on their intentions concerning them, is that, except for large in-house software developments, these are the sources of both the hardware and the software that the managers could use. But a number of other effects, more specific to this research, were found.

a. Changes in the environment

In almost all organizations managers expressed concerns, based on recent experience or general apprehension, that their current information systems were either not designed to deal with sudden disturbances, such as the loss of large customer, or could not perform such activities adequately.

It may be that no CBIS can be developed to deal with unexpected situations, either external or internal, but this is an issue that offers opportunities for research combining policy, organizational design, organizational behaviour and CBIS.

b. External data sources

These were seen as an important component of some functions, particularly Finance and Marketing. Managers in areas needing links to external groups felt that not enough was being done to connect them to key components of the environment and those connections that were in place were too technically oriented to be used by most managers. This is an area in which great improvement is possible. Electronic mail, voice mail and inter-organizational computing are all areas in which more research is needed from the point of view of senior managers.

12.3.2 The organization

Two aspects of the organization were considered as possible sources of effect on managers' use of, and intentions concerning, computer-based tools.

Characteristics of the organization

This research considered almost a dozen "structural" aspects of organizations in terms of managers and CBIS. The small sample size precluded any specific conclusions concerning the effect of specific characteristics. It was clear, however, that there were differences driven by these factors.

Managers perceived the size of the organization, the products and services offered and the degree of "evolution" of the organization as the leading factors in determining the firm's level of computer use while structure was considered the least important. Since the first affects the tools available, the second the information needs and the third the sophistication of the users these results indicate that smaller, less developed firms should be careful of moving too swiftly into management computing unless they have a complex set of products and services requiring planning, coordination and control. Further research into the relative effects of these factors is needed.

Past research linking organizational characteristics to computers has generally taken the point of view of the organization as an entity - this project has demonstrated that more specific investigations of the links between the characteristics and individual managers, functions and even types of problems is needed before organizations invest resources in computer tools and support for managers.

Corporate culture

Although this term was not examined explicitly, the comments of many managers indicated a sense that the "corporate culture" is a key factor in limited use of computers - not only at senior levels. Basically, culture has its effect in two ways: lack of a sense of direction or an active limitation on investment.

a. Locus of decision making

Managers in a number of the organizations examined felt that decisions made too high in the organization (and many did believe that this happened) discouraged them from increased use of computer-based tools since they felt that those at the top tended to rely on providers of information located quite low in the organization.

b. Driving forces

Some driving forces, especially a focus on technology or on markets appeared to encourage management computing while others, particularly "the bottom line" or the personality of an individual leader, tended to discourage it.

c. A lack of management information

Managers felt that needed information was non-existent, it was too voluminous or it required excessive massaging to be useful. Remedying this situation must become a corporate priority. New, more sophisticated applications are generally not the answer. Managers need "fine tuning" of existing applications (particularly the related data files) and the addition of provisions for management level analysis and reporting.

d. Local opportunities & a corporate plan

Managers frequently expressed the belief that there were numerous opportunities for corporate benefits through improvements in basic information systems in their function. This leads to the conclusion that a primary task for each organization is the development of a set of priorities for development based on the concept of an "applications portfolio" and any development of specialized tools should be based on that model not on the short term needs of an individual or the availability of a tool or a consultant.

e. Computer training for managers

Managers' beliefs about this topic fell into two clusters. All expressed the belief (fact?) that, in their organization, it is non-existent. But a second belief held by many was that it didn't matter because it would be a waste of their time and corporate resources. A more detailed evaluation of the two sides of this issue is essential to developing an accurate model of CBIS use by managers.

f. Support staff

All managers wanted the computer to provide "better" support for their function, tasks and activities but most also indicated that they would continue to depend on skilled support staff. For most managers in most organizations this is the best type of relationship between them and computers in terms of speed of response, flexibility and cost to the organization.

g. Cost/benefit analysis

Most managers felt that the organization should not charge ahead on major investments in information systems without doing some sort of cost/benefit analysis. On the other hand, there was no clear consensus on which costs and which benefits should be considered and some managers, particularly those in Marketing, felt that service, flexibility and control are more important that simple dollars and cents considerations. This is another finding that supports the development of an applications portfolio model in each organization.

12.3.3 The individual manager

Demographic factors

Gender, age, length of service with the organization, length of time in that position, computer experience, management level, computer training and level of education were all examined for their effects on a series of topics related to use of CBIS by the managers. Some isolated effects were found. For example, managers with the least education preferred standard, printed reports to ad hoc access to files while managers with the most education felt that "there is too much delay getting output from current systems". Level of computer training also affected the manager's preference of tool characteristics. Those with little training focused on "user friendly" while those with advanced training looked to more sophisticated characteristics such as "functions performed". But no strong relationship between a manager's background and his use, attitudes or intentions was apparent.

Psychographic (personality) factors

The personalities of the individual managers in this research, as measured by the Myers-Briggs Type Inventory, lean strongly toward the logical, structured perception and analysis of data.

Although this research demonstrated that use of CBIS is, to a large extent, driven by the organization the personality preferences of the individual managers appear to have some narrow effects on their use of, or attitude toward, computers. Manager's comments and their responses to structured questions support the conclusion that managers identified as introverted (I) types by the MBTI are more positive toward the use of CBIS in relation to their position than are extroverts (E), who see their jobs as dealing with people, not machines. Introverts prefer to work with applications themselves at a detailed level, which also fits with the MBTI prescription.

Few significant differences were apparent among managers performing different functions in the organization but Marketing managers were exclusively Extraverted which, according to Briggs Myers, means that researcher are going to have to look at a different set of tools for this area. They will have to be quick, user friendly and very flexible. Personnel managers present a more complex mix of preferences and further research is needed to determine whether their Introversion (which encourages computer use) or their interest in Feelings (which mediates against computer use) is dominant.

Although, as mentioned above, personal characteristics appear to be over-ridden by the corporate culture and situation, the organization is a collection of individuals so, to the extent that specific individuals have the power to define the corporate attitude toward computers, personality types do affect computer use throughout the organization.

Due to the limited size of the sample and the complex of factors involved this is one aspect of the framework that requires more investigation.

Beliefs & attitudes

a. Preferred input/output (communication) techniques

Managers are still oriented toward traditional communications through meetings and the telephone. Managers who had it were universally enthusiastic about Voice mail which had reduced but not replaced both meetings and the telephone. Managers at all sites who had been exposed to E-mail felt that it had potential to cut down on meetings and telephone use but were frustrated by lack of support from policy makers and from colleagues.

These findings lead to the conclusion that the computer offers tremendous opportunities for organizations to cut down on the extent and time involved in communication among managers. But a corollary is the conclusion that increased use of telecommunications will have to be planned carefully and adequate training and motivation provided, particularly for managers in the Personnel and Marketing functions, for managers with the lowest levels of education and for extraverted personality types.

b. Characteristics of the manager's area of responsibility

There were no significant differences reported among managers in the different organizations or functions in terms of which characteristics they felt impelled or restrained the use of computers in their area of responsibility. The three leading reasons for computerization were: the tasks performed for the organization; his attitude toward computers; and the attitudes of his people. Ranked lowest were the size of the area and its budget (perhaps because computing is usually a corporate budget item).

c. The individual and the computer

No general conclusion can be drawn concerning the relationship of individual managers and computers. Attitudes expressed ranged from fear through apprehension to the desire for extensive personal use. The conclusion that can be drawn is that an organization must deal with such a range of attitudes by (a) developing a method for defining the appropriateness of use of a CBIS by a manager in a specific situation and then (b) fitting a manager to appropriate opportunities through selection, motivation and training.

d. Contradictions

A number of managers expressed conflicting beliefs or attitudes about individual computer use. Such conflicts indicate that a manager's attitudes and actions may be driven as much by circumstance as by beliefs. This supports the conclusion that properly applied motivation can significantly increase direct use of computer-based tools by managers.

e. The future

Many managers are interested in increasing their use of computer-based tools but most do not understand the ramifications of such use or even have specific applications in mind. Organizations must avoid encouraging discriminate expansion of managerial computing until the application portfolio and the evaluation model discussed above are in place.

12.3.4 <u>The job the manager does for the organization</u>

<u>Functions</u>

Few differences were evident among managers in the five functions examined. Accountants had the best grasp of the use of computers while Marketing and Personnel managers understand and use computers the least. Managers in Production and Marketing demonstrated the least comfort with, or interest in, CBIS for themselves. On the other hand, these areas, particularly Marketing, will have to become users of 4GLs and other end user tools since their information needs will continue to change rapidly and require great flexibility.

Accounting, Marketing and Personnel managers felt strongly that creative use of computers by managers is not encouraged by their organization while Production managers are particularly concerned that their people have inadequate training on computers.

<u>Tasks</u>

This was one of the most complex topics dealt with in this research but, as Figure 12-1 demonstrated, tasks had only indirect effects on managers' use of, and attitudes toward, CBIS.

a. Characteristics of a task

Managers described the number of times a task is performed, the size of a task and the need to meet deadlines as the main reasons a task should be computerized. Complexity and special needs were rated much lower indicating an ongoing bias toward operational level high volume tasks.

Managers felt that controlling and coordinating are the two most important classes of tasks they performed and that, while the computer was valuable in controlling, there was little support for coordinating. Planning was the third most "valuable" task and computer support was reported as spotty and, in all cases, inadequate.

Statistical analysis revealed no significant differences across functions in terms of the mix of tasks performed. Differences were more in terms of specialized tasks as discussed below.

b. Specialized tasks

The specialized nature of some tasks was another factor that caused some reluctance on the part of managers to get involved with CBIS. From their point of view such tasks are straightforward yet, in many cases, no relevant tools exist. Should a computer-based tool be developed for a narrow task such as "union grievance analysis"? If so who should do it? Who should use it?

c. Decision making

This was described by almost all managers as a group task. In some cases it involved working with superiors, in others with peers, in many with subordinates and in some with members of multiple levels of the organization.

Few examples of direct computer-based support for group processes were seen in this research. A few managers, particularly in Accounting, reported using a DSS such as a spreadsheet by themselves but this was rare. In most cases managers were users of printed or graphical output of a system as input to a group decision such as the corporate budget, new product analysis or a new marketing plan.

The activity of "attending meetings" was linked to this activity so a tool that will support group decision making will also have to deal with some of the implicit aspects of meetings.

d. Advising

This task was a surprising finding in this research. It was not on the original list of tasks investigated but was mentioned by so many managers that it was added early in the process. Advising could be operational, tactical or strategic and might involve subordinates, peers, superiors or outside groups. Computer support is spotty but two related activities merit further investigation: preparing presentations for those being advised and communicating with the affected parties.

e. Budgeting

Budget planning and budget control were, according to the managers interviewed, the most common corporate level tasks supported by computers. Managers at all sites reported some degree of computerization of their annual budget planning process and their periodic (monthly) budget analysis. In almost all cases the support was on a cyclical, batch report basis and although most managers appreciated the support a number expressed frustrations with the limitations and inflexibility of the reports.

Many felt that the organization was missing an opportunity for more effective management through more flexible and more intensive analysis of data already available. Better online access and the ability to do "what if" analysis were the two improvements most commonly mentioned. This was also one of the applications in which managers indicated some willingness to become more directly involved in data input and data analysis.

Activities

By far the most common activity reported was "attending meetings (it absorbed up to 45% of a manager's time) while no manager spent more than 4% of his time using computers and most spent none at all. A number of research issues arise from the data on activities. To what extent can computers replace meetings? How? How does computer use relate to planning or to preparing reports? Should managers be spending more time on computing? If so, on what activities?

Problem solving processes

It became obvious early in the data gathering stage that the issue of problem solving processes was less important than many of the other factors in the framework. Few data were developed on this aspect of the managers' use of CBIS but it was apparent that much of what the managers described as comprising their jobs was based on judgement, experience and heuristics while no support tools beyond the traditional algorithmic applications were reported.

Most managers were still fighting to get adequate computer support for the well structured problems and tasks dealt with in their area of responsibility (by themselves or their people).

a. Group problem solving

Although no examples of group decision support systems were seen in this research support for the group nature of most managerial problem solving is a clear opportunity for extended computer use.

b. Non-specific tasks & problems

Managers described many of their tasks in quite vague terms (e.g., "guiding my people" or "choosing between alternatives"). They explained that they "weren't really sure how they dealt with these types of problems" and, anyway, it was different every time. In such cases computer support for problem solving is unlikely to ever prove appropriate.

No generally useful model or technique for either defining clearly the characteristics and components of a tasks or relating these to computer-based information system exists. This presents an opportunity for research combining Organizational Behaviour and MIS.

12.3.5 <u>Tools & support available</u>

<u>The computer centre</u>

Three common themes emerged from managers' comments on this basic topic. First, virtually all believed the resources supplied to the facility by the organization were inadequate to meet the firm's needs. Second, concern was expressed with the support and other services supplied by the staff of the computer centre. This included concerns with the accuracy and adequacy of major systems currently running on the central computer. Third, all computer centres were believed to be working harder to relate to users, particularly those in middle and senior management. This was particularly reflected in the two sites which had recently acquired Directors with exceptional interpersonal skills. Such skills will become more valuable as more computer use moves out to non-technical area and as managers at higher and higher levels become involved with development and use of CBIS.

Microcomputers

An alternative to the problems with the central resources evident in all organizations was the use of microcomputers in the managers' areas of responsibility. Most managers felt that microcomputers had had both positive and negative effects on organizations and themselves.

Microcomputers were beneficial in that they brought processing to the user departments with the related understanding of both the benefits and the limitations of this type of processing, they have cut down on the time users have to wait to use the computer for a new activity and they allow more flexible and specialized processing. On the other hand organizations are facing data fragmentation, rising costs and loss of control of both standards and processing as departments expand their local processing.

Research has been done into the process of acquiring this hardware and software and a number of normative models exist. But, related to the research reported here, further investigation is needed into the effect of microcomputers on organizational behaviour topics such as the location of data, control over the information resource, changes to information flows and the effect on power structures within organizations; all topics which will affect the managers' attitudes toward increased use of computer-based tools.

The Information Centre

As hardware, software and decision making power concerning them move out to user departments more liaison between technicians and line managers (and their people) will become essential. One conclusion developed concerning direct use of computer-based tools by managers was the universally positive attitude of the managers interviewed at site A concerning the Information Centre in place there. They felt that it helped eliminate bureaucratic roadblocks preventing expanded use of computers (especially micros); it prevented mistakes in acquisitions of hardware and software; it shortened response times and it provided practical training.

Although it definitely led to increased knowledge and use of computers in the managers' areas the Information Centre did not lead to increase direct use by the managers. However, if such use is desired or required in the future the Information Centre will be the most direct way to achieve it.

Few organizations are able to afford such an investment but the principles behind it can be applied in a range of ways. The value and cost of the size, location, services and processes of such a facility in terms of its effect on use of CBIS by middle and senior management is a topic that requires more specific research.

Data in the organization

Managers also expressed reservations about the validity of the data stored on the central computer and about the limited access to that data. The difficulties experienced in attempting to link data from different applications is also a concern for some managers.

As seen by many managers, the proliferation of microcomputers has led to two problems with data. First, the corporate database could become seriously fragmented, making it even harder to link data for higher level "views". The second issue was the security of data created and use on micros: it is easier for unauthorized individuals to get at it and it is more liable to be destroyed or lost, accidentally or on purpose.

These concerns point out an issue that needs further research. What is the relationship between the corporate database (its existence, its contents, its validity, its accessability) and the current and future use of CBIS by senior managers?

Computers & communication

One outcome of this research was the development of a sense of how strongly many managers feel about the communications aspect of computing - Voice mail and Electronic mail were used by a small number of managers who were enthusiastic about their benefits.

What are the true costs of having all managers use E-mail and/or V-mail? What are the benefits? Although the impression received from this research was that the benefits are great compared to costs the issue is complicated by corporate culture and the attitudes of different personality types.

Within companies managers also expressed frustration that the separate computers were not adequately linked. Some gave this as a reason for limited computer use. Organizations cannot depend on the gradual spread of electronic communication from manager to manager - too many expressed concern or reluctance. It must become a policy issue with both motivation and training "attached".

Acquiring/allocating resources

Few managers perceive this as adequate or fair. A number felt that the process was so long, so complex and, in the end, so dependent on "politics" that their use was seriously restrained. Most of the organizations examined must soon come to terms with problems in both the process for allocating resources and the managers' beliefs about it - particularly if they want managers to invest more of their own time and effort in using computer-based tools.

Developing applications

Managers discussed many approaches to developing or improving computer applications but their primary interests were software packages (low cost, speed of implementation), prototyping (ability to work from experience and flexibility), report writers (access to central files) and "end user computing" in general (control, limited bureaucracy and independence).

A particularly interesting application of prototyping was the development of an application prototype on a microcomputer before moving the application to the mainframe. This has obvious benefits in terms of flexibility and limited demand on the central facility but the transfer to the mainframe presents both administrative and technical problems which require further study.

Most managers had some familiarity with all of these tools or techniques but two conclusions must be drawn concerning this topic. First, organizations must develop guidelines for acquisition of such tools (including standards, processes and even specific products), particularly as users become more involved in such acquisition. Second the organizations must create policies concerning who can use such tools and how and, related to this, standards and training for application creation must be laid down.

<u>Advanced applications</u>

Although a specific advanced application (DSS) was the original force behind this project the data gathered concerning these applications has lead to two conclusions. The first is that few managers have any knowledge of, or experience with, DSS, EIS, or ES and that even fewer have any interest in becoming skilled users of such tools. The second conclusion reached is that they are right.

Managers should not become involved with advanced applications for two reasons. The first is that the concepts are those of computer scientists and consultants and distract from the manager's need to efficiently and effectively achieve the goals of his area of responsibility. The second reason is that it became obvious from the data that much remains to be done to link managers to existing applications (TPS and MIS) and to bring those broader applications up to speed. This is not to say that there is no place for tools such as a DSS in the organization. But for the foreseeable future their place is in the hands of specialists - not managers.

Centralized vs. decentralized resources

Most managers were enthusiastic about the use of packages, particularly on microcomputers in their area. Speed of access, specialized functions and flexibility were mentioned as advantages. Further research into the balance between central facilities and local processing should include a detailed evaluation of such reasons for the popularity of packages. Is lack of access to the central computer a valid reason for acquiring packages?

Characteristics of computer-based tools

The final conclusions drawn in this research concerning computer-based tools focus on the managers' ratings of an extensive set of characteristics. Their clear priority was for tools with good documentation, which are easy for managers with little experience to use and which provide some training. Managers did not worry that they might be getting involved with a tool "too early". All felt that they were perpetually playing "catch up" with the rest of their organization or specialty. Finally, managers did not care whether an application was developed in-house or was supplied from outside - accuracy and usefulness were their priorities. These are important points for organizations intent on developing a more positive attitude toward CBIS on the part of their middle and senior managers.

12.4 The relative strength of the factors in the framework

Most of the data presented and analyzed and the conclusions drawn from them examined the factors in the framework individually. But the relationships among the factors and, perhaps more importantly, their relative power are also important. No direct questions were asked concerning this but some conclusions can be drawn from the interview data.

Of the components of the model the organization was (implicitly or explicitly) the strongest factor in defining the managers' current use of, attitudes about and intentions toward CBIS. The second strongest factor was the availability of tools, support and training which are, to a great extent, specific aspects of the corporate culture.

The third most important factor was the function performed. Differences in both use and attitude were evident between some functions (particularly Accounting and Marketing).

Personality type had a small effect on use and a little more on attitude but it was subsumed to the organization. Tasks, activities and, particularly, problems types and problems solving processes had little effect on current use since neither the tools used not the users are sophisticated to focus on these narrow, specific topics.

These conclusions drawn from interview-based data were cross checked by multiple regression analysis which was applied to all of the quantified responses of the managers to the structured question sets. This process, described in section 11.3, did not included either "the environment and the industry" or "tools and support available" because data on these factors were not in a numeric (coded) form. But the outcome of the regression analysis also led to the conclusion that "the organization" was the strongest force behind the managers' beliefs and actions concerning CBIS. "The manager's time in his position" was found to be the second strongest factor behind their responses with "experience with computers", "function performed", "personality type" and "level of education" following in order of strength of effect on managers' current use, attitudes and intentions.

Although these data are not conclusive it appears that organization is stronger than the manager's function which is, in turn, stronger than his personality type in driving both his current use of computer-based tools and his intentions concerning them.

12.5 Related topics

12.5.1 Correlations among responses

Another statistical test run on managers' answers to structured questions was a correlation of the responses in each question set. This led to a number of conclusions which require further investigation. Managers with a strong sense that "I lack the education needed to use computers more intensively" also felt that they had a number of other good reasons for limited use of CBIS. The same was true of managers who reported that "there is no room in my office for a computer". This possible rationalization of reasons for avoiding computers poses a significant problem for organizations that do decide to increase the use of CBIS by all managers.

A strong inverse correlation between the managers' perceptions concerning the value of a task for their area and, therefore, for the organization, and the support provided by the computer centre must be investigated and resolved by organizations at the corporate level.

12.5.2 Incumbents, functions, tasks and tools

Many managers interviewed felt that future managers would use computers much more actively than the current generation because of the experience they are acquiring with them at lower levels. This raises a fundamental issue that must be dealt with - to what extent can the incumbent in a position, the activities required of that position and the computer-based tools used be separated?

Research is needed into the extent to which an activity relates to the task at hand and, therefore, would not be more or less amenable to computer use by a future manager, and the extent to which it is a function of the individual and could, therefore, be supported to a different extent by computers if the future manager so wished.

12.5.3 Terminology and models

A point which emerged early in this research was the gap between the theory of computing at higher levels of organizations and the managers' actual familiarity with (and use of) computer-based tools. As mentioned in the discussion of advanced tools, not only did few managers use them but even fewer were familiar with the terminology (such as Decision Support Systems or Executive Information Systems).

This problem was not mentioned frequently in the literature reviewed - probably because most past research on computer use by managers was done in "artificial" situations or with managers who were already users of the tool being investigated.

A model must be developed which will allow researchers to communicate with managers on their own terms. This is essential if a manager, without a technical vocabulary, is to explain not only what is currently being done by computers in relation to his job but also where potential applications of the various types of CBIS may lie. A terminology linked to common concepts would provide both questions which are meaningful to managers and data whose analysis can be translated into models and concepts useful to both researchers and policy makers.

For example, researchers must realize that, from the point of view of an organization and individual users, the differences between, for example, a transaction processing system (TPS) and an expert system (ES) are functional (what will it do for us), operational (how does it work), economic (what are the costs and benefits) and structural (how does it fit in with what we are now doing)?

12.5.4 Levels of computer use

A basic conclusion drawn from this project is that there is much less hands on use of CBIS by middle and senior managers than the current writing in the MIS field would lead one to believe. The concept of varying levels of use, outlined in Chapter 6, was strongly supported by the managers interviewed.

All managers were at least "offline" direct users of CBIS but none reported developing complete applications (a few do use Lotus 1-2-3 extensively to massage data from other applications or data they have put together themselves). The general attitude was that this is work more appropriate for technical specialists who should be located in the user department.

This research has dealt with some aspects of this issue but more focused research will be required to develop a clearer classification of how and why computers should be used directly by senior managers (and how and why they should not).

12.5.5 "I" and "we"

One interesting finding arose from the fact that, in English, the pronoun "you" is both singular and plural. Questions asked the manager in terms of "you" were intended to refer to that individual. But few managers answered these questions in terms of "I" - they consistently referred to "we".

This has ramifications for research into individual use of computers by managers. The first is the need to focus questions more tightly so that the manager is forced to make the distinction between the individual (and his characteristics) and the group (with its goals, values and constraints). The second consideration is the validity of such a distinction. Should a manager be doing things that are good for him but not necessarily good for his function or for the organization?

12.5.6 Proportion of time spent on activities

The responses from managers concerning the ways in which they actually spend their time generally reflected past research. Meetings are still by far the most common activity and most managers indicated that a lot of time is also spent on the telephone or reading reports.

Accountants spent the most time preparing and reading reports while Marketing managers spent the least.

Managers often expressed frustration that so little of their time (less than 10% overall, less than 4% at site E) was spent on planning and analyzing. They also reported that, at most 4% of their time is spent actually working with a computer - and most managers spend 0% of their time with a computer.

In terms of this research the question to be answered in the future is: how can the computer expand, supplement or replace some of these activities in an effective way? (Voice mail, discussed earlier, could be an example of this.)

12.5.7 Current use, attitudes & intentions

In classifying the managers' valuation of current use of computers, their attitudes and their intentions it was clear that, in all three cases, the managers put a much higher value on the use of computers for their function than for themselves (although they see themselves as part of the function). Forced to choose, virtually all managers would choose an application for their area over a narrower but more directly useful one for themselves.

The only significant difference in terms of personality types was that Judging types indicated much higher intentions concerning CBIS that did Perceiving types. Since almost 80% of the managers in this research were J types this may affect the direction computing will take in the next few years.

Accountants did report significantly higher current use of computers than other managers while Personnel managers had the lowest level of use. Marketers had a significantly lower attitude toward computers (at least for themselves) while Accountants' attitudes were highest. It certainly will not be possible to impose similar tools or use similar policies and procedures to implement management computing in the different functions.

Two concepts that will support further research in this area are the mix of cultures within an organization and the application portfolio.

12.5.8 The effectiveness of CBIS for managers

Managers expressed strong opinions concerning the effectiveness of computer applications for their jobs. The tools were seen as potentially useful but all managers described many opportunities for improvement due to a number of causes: lack of any application at all; lack of valuable functions in existing applications; long delays in developing or modifying applications; poor data or poor understanding of that data; islands of both data and processing; lack of links among microcomputers; lack of user friendly access; lack of flexibility and lack of training of people at all levels in his area of responsibility.

12.5.9 The appropriateness of CBIS use by managers

No manager questioned the appropriateness of CBIS for their organization - for many a major concern was the inadequacy of such corporate level tools. In the same vein all recognized the value of computer-based tools in their corporate function. Again, the concern was the lack of quality, general applications or tools to support specific tasks and activities.

But many managers had strong concerns with the appropriateness of direct use of computers by middle and senior managers. Some reasons given for this concern were: it doesn't help with what I do; it doesn't suit the way I work; it will take too long to get up to speed; I have good people to do that.

At our present level of understanding of individual processes and with the limited supply and rigidity of tools it is hard to dispute such objections.

12.6 Limitations

Although the data and analysis in chapters 7 through 11 support these conclusions, questions and recommendations it is important to point out that, in terms of its stated goals, this research had a number of limitations. The first was the lack of the structure provided by the set of tightly focused hypotheses which guide a theory testing project. Another basic limitation was the small sample sizes. Six organizations not only do not represent all organizations but they do not even represent all industries. The limited number of managers leads to the same problems - lack of complete representation and limited data analysis. A third limitation was the large volume of data gathered. This volume meant that some data could not be analyzed completely and some types of analysis could not be done. (For example, although correlations were run on all responses in each question set correlations were not run on responses across question sets.)

However, these limitations represent the nature of a theory development project and can be overcome by future research focusing on "subsets" of this project.

12.7 Recommendations

In addition to the recommendations made above concerning specific aspects of this research a number of broader recommendations arise from the conclusions and the limitations described above.

This research has developed enough of an understanding of managers' feelings about the factors in the emergent framework to allow many of the points developed through interview data to be translated into structured question sets which will be more specific, reproducible, useable with larger numbers of managers and amenable to statistical analysis.

The existing (and new question sets) should be focused on understanding the interactions among the major factors in the framework rather than on a more detailed understanding of the characteristics of each factor.

A larger number of organizations should be examined in future versions of this research and industries not included in this first project should be added.

information-based fields such as banking or life assurance would be particularly appropriate.

Additional firms from the fields covered in this study should be added. (The findings in the two hospitals which took part in this project were similar in many ways, in spite of the fact that they are located 1000 miles apart and operate under different political jurisdictions.)

Finally, an additional factor, raised by the managers themselves, should be added to the research. This is the concept of the "appropriateness" of their use of computer-based tools. This has been dealt with in this project through the interview data but a model or even an instrument for defining and measuring the appropriateness of current and intended direct use of computer-based tools by managers should be the ultimate result of this research.

12.8 Summary

The conclusions in this chapter are based on a complex set of data which, in turn, were made necessary by a complex research model. In spite of this a number of points have emerged which could provide guidance to researchers. Foremost among these are:

1. The factors in the emergent framework do not all have the same degree of effect on a manager's use of CBIS. They range from the organization (the strongest), through the tools and support available, the function performed, personality type, tasks comprising the function, types of activities in the job to problem types and problem solving processes.

2. Most managers were not, and do not intend to become, direct users of computers. The main reasons for this were given as lack of time to learn, tools that are not user friendly, the availability of specialists and a general sense that such use would be inappropriate for middle and senior managers.

3. Managers spend great amounts of time working in groups - within their area of responsibility, within the organization or with outsiders. Computers could be of value to the extent that they could cut down on these meetings or could make them less time consuming. This may seem straightforward but computers are limited in their ability to deal with the "hidden agendas" of meetings.

4. Although most managers were not interested in acquiring resources for themselves many expressed frustration at the difficulties encountered in acquiring resources for applications with obvious benefit for the organization through their function. Even stronger was their sense that "organizational politics" has too much effect on resource allocation.

5. Some organizations appeared to be in danger of losing control over computing with the spread of microcomputers. The costs of hardware and software may be the least of these problems. Redundant, poor quality programming, wasted management hours, data fragmentation and poor security will be more costly as managers pull more processing into their areas.

6. Managers felt strongly that the primary focus of future investment in CBIS should be on corporate level applications, including enhanced management analysis and reporting in existing systems. Local applications supported by specialists were a second priority while tools for their personal use rated very low (when considered appropriate at all).

7. Managers in general recognized the benefit of both *ad hoc* access to data for planning and decision making and the ability to develop and modify applications more quickly. But there are a number of underlying issues that they felt must be dealt with at the corporate level including: the ongoing problems with the organization's data (validity, location, security and access), lack of training for managers and lack of resources in the manager's area of responsibility.

8. Because of the history of the development of CBIS all organizations have islands of data and processing and some functions are better supported by computer-based tools than others. In terms of both operations level applications and those intended for middle and senior managers the "application portfolio" concept will

provide guidance to the organization as it evolves toward an information system that is an accurate model of the organization.

9. Finally, to develop a better understanding (and better models) of this topic, researchers must come to terms with multiple, sometimes conflicting "agendas". The traditional agenda is technical - the use of specific classes of tools such as DSS (the beginning point of this research). But as research moves toward more sophisticated situations in organizations the psychological agenda, including topics such as motivation and personality types; the sociological agenda of men and women working in groups, often with conflicting goals; and the corporate agenda of efficiency, effectiveness and appropriateness must all be built into research projects.

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Appendix I - The Organizations

Introduction

This Appendix contains brief outlines of the six organizations whose managers took part in this research project. Only those factors which I felt help to define the context and driving forces of the managers' activities and their relationships with computer-based tools are included.

Each description is comprised of three parts: the organization; the significant aspects of the computing context (from the points of view of user/managers) and, finally, my comments on any special aspects of the organization relating to this research.

The first part - the organization - is further subdivided to improve its readability. The aspects of each organization described are:

- its name
- its location(s)
- its age
- the nature of the organization
- its size
- the form of ownership
- the number, type and location of employees
- the organizational & management structures
- the industry of which it is a member
- the size and structure of the market(s) it faces
- the products and/or services produced by the organization
- the significant competition faced
- the dominant culture of the organization
- the locus and process of decision making in the organization
- the firm's policies on training and education
- the sources of financing available and (where possible) those actually used
- the driving force behind the organization.

As organizations have adopted the computer as an operational and management tool each has developed its own set of resources, policies, procedures and structures. These arrangements are too extensive and complex to be captured in detail in a brief description so the second part of the outline of each organization is much less structured than the first. For each organization, I have attempted to describe the hardware, the software, the personnel, the history and the management of the firm's computer resources as they relate to middle and senior managers.

Appendix I - Research Site A

a. the organization

Name: Maritime Telegraph & Telephone Company, Ltd.

Location: Head office in Halifax, N.S. Regional offices in numerous smaller centres throughout Nova Scotia.

Age: 80 years

Description: MT&T is the privately owned, government regulated telephone service monopoly for the province of Nova Scotia. For more than seventy-five years it also had a monopoly on telephone hardware but during the past five years competition has been allowed in a number of areas. In markets involving new technologies (such as cellular telephones) no monopoly has been granted. This means that the company's attitude, processes and culture must undergo a major change.

It is one of the largest employers in Nova Scotia and has the most complex computer structure east of Montreal. On the administrative side the computing is restricted to a central mainframe computer, a few minicomputers with limited connections, more than four hundred microcomputers and at least three different groups of technical support staff.

Size: MT&T is the third largest privately owned telephone company in Canada and the largest in eastern Canada. Revenues for the fiscal year 1990 were $495,800,000.00 and net income was $50,000,000.00.

Ownership: MT&T has more than 14,000 individual shareholders and, by law, no entity can control more than 10% of the voting shares. It is considered a "blue chip" stock in Canada and currently pays a dividend of $1.30 per common share (current market price is about $21.00/share).

Employees: 4,200 employees located at head office in Halifax, at technical depots or at the various regional offices. MT&T is the fifth largest employer in Nova Scotia.

Organizational/Management Structure: The company's management structure is extensive. It has eight specific levels beginning with section Supervisors as the lowest. Then come level 1 managers, level 2 managers, level 3 managers, General Managers, 4 Vice Presidents, the President and, finally, the Board of Directors (although they are not often involved in the day to day management decisions).

Appendix I - Research Site A

The Industry: The telephone industry in Canada is complex. There is a separate company in each of the ten provinces. Six, including MT&T, are regulated by the Federal Government while the others are still regulated by their Provincial governments. To facilitate long distance communication, research and other common interests the companies have created a common entity, Telecom Canada, based in Ottawa. This means that a company has to be concerned not only with its own policies and procedures but also those of Telecom Canada and the appropriate regulatory body.

The telephone industry is, by its nature, capital intensive. For example, between 1979 and 1990 MT&T's capital assets grew from $435,000,000 to $1,500,000,000. In 1990 they claimed a depreciation expense of almost $100,000,000.

New technologies are having an effect on the telephone industry as well. Fibre optics have begun to replace copper wire (MT&T has laid 1,714 kilometres to the end of 1989) but, although this is a much more efficient medium the tremendous growth in demand on the system, driven by facsimile machines, cellular telephones and data transmission, means that the company is barely keeping up with demand.

Another important factor in the industry is the emergence of competition. This is happening in two ways. The first is that the telephone companies are moving into markets in which competition has traditionally existed (paging, hardware). This means that they must be able to clearly separate costs between regulated products and services (for which they are allowed to charge on a cost-plus basis) and competitive products and services for which they must recover costs. As mentioned below this has led to a major information change within MT&T.

The second source of competition is still only a threat. A large private firm (Unitel) has applied to the Federal regulatory body for permission to offer long distance services in direct competition with Telecom Canada. Since long distance is very profitable and its revenue "subsidizes" the costs of providing local service (particularly in rural areas) this threat is being taken very seriously by all members of the industry.

Market Size & Structure: There are approximately 1,000,000 individuals and 150,000 businesses in Nova Scotia. At the end of 1989 there were more than 469,000 business and private lines in place. Based on the past five annual statements this number is growing at about 6% per year.

Products/Services: This is, as it turns out, a topic on which few people in the organization are clear. Most managers know that the firm has eight Strategic Business Units (SBU's) but few were clear on exactly what each does.

Basically, they provide local telephone service which includes the network but also equipment (handsets, switchboards, facsimile machines, etc.). They also provide long distance services in cooperation with other telephone companies in Canada and around the world. Cellular telephone service, transmission for cable television and for high speed computer connections are also available. In addition they are beginning to supply LANs (local area networks) to the sites of their largest customers.

Competition: MT&T is a regulated monopoly within Nova Scotia. But as was mentioned above, in the last decade they have moved into a number of business in which they face competition. In paging they solved this problem by buying all their competitors, making it an "unregulated" monopoly in the region.

In cellular telephone they have created a subsidiary (MT&T Mobile, Ltd.) which is going head-to-head with one of Canada's most aggressive entrepreneurs in telecommunications (again Unitel). This is a critical situation for them - right now neither service provider is making money on cellular telephone service.

The firm's long standing monopoly on home and business equipment (handsets, PBX's, etc.) was removed in the mid-1980s. This has caused three problems for MT&T. First, since the company had always required each customer to rent at least one handset per line, there was the obvious loss of revenue from diminished rental income - customers can now buy a handset from one of many sources at a cost much less than the total rental charges during the life of the equipment. The second problem was the need to restructure their marketing and accounting systems to enable them to become a seller, at competitive prices, of such equipment. Finally, the telephone network had to be adjusted to allow the attachment of non-proprietary equipment.

Organizational Culture: MT&T has, for many years, been a fairly stagnant, bureaucratic organization. Steady employment at the company has traditionally been considered by Nova Scotians to be security for life - so much so that each year about 10,000 people (1% of the population) apply for a job with MT&T.

Related to this is low employee turnover, a belief in employee training and promotion from within. This is demonstrated by the fact that the managers who took part in this research had an average of more than twenty years with the company and half had never worked anywhere else.

A number of factors including the move to a more competitive environment, rapidly changing technologies and the need for higher productivity are forcing MT&T to undertake an extensive review of staffing needs - including management. Changing computer needs "at the user end" is one aspect of the review so my research fit in well.

Locus/Process of Decision Making: An Executive Committee consisting of the President and the four Vice Presidents is heavily involved in reviewing or planning many activities, even those relating to low levels of the organization. (It was the expressed belief of most of the managers interviewed that many decisions are made too high in the organization).

At a broader level the company has in place almost forty "task forces". Each of these is made up of from four to ten people and examines one strategic or tactical issue facing the organization. Every manager who took part in this research chairs at least one of these committees.

Training/Education: MT&T has an aggressive training program for all employees, particularly those in the computing and engineering areas.

There is a training department, a clear policy of training for technical and lower level staff and a range of equipment to support training. They also encourage general education. Not only do they reimburse employees for University tuition for approved courses but one local University offers one or two courses a year on site.

Unfortunately this attitude does not extend above the lowest management levels. Although all staff are offered the opportunities for training no allowance is made for time off from work weeks of fifty hours or more to attend courses, to study or to practice.

Source of Financing: The firm uses the three traditional sources of funds for private corporations - retained earnings; debt (both institutional financing and public bond offerings) and equity (both common and preference shares). For example, according to the 1989 Annual Report retained earnings increased by $18,000,000; short term debt rose by $34,000,000 and long term debt by $12,000,000; preference shares worth $18,000,000 were issued and the number of common shares outstanding rose by 1.2 million (mainly through the dividend reinvestment plan for normal shareholders and the employee' stock investment plan).

Appendix I - Research Site A

Driving Force: For many years the driving force behind the firm was "service". It was a regulated monopoly so it could go to the regulatory board and recover its cost plus a pre-defined return on equity.

Much of the core business still works this way but, as was mentioned above, competition is becoming more and more important to the firm. This means that quality control, productivity and, particularly, cost definition and control are growing rapidly in importance.

b. the computer context

Introduction

This organization has been the regional leader in computing for more than twenty-five years. It has six aspects: the central "mainframe" computer"; a number of minicomputers spread throughout the firm; more than 400 microcomputers (approximately one for each ten employees) spread even more broadly throughout the firm; a systems development (and maintenance) group; an Information Centre and numerous "local" functions, the most relevant examples of which are described below.

The traditional computer centre

This facility is located in a specially designed building and is the largest and most complex in eastern Canada. It is headed by the Data Centre Manager who reports to the General Manager - Planning who, in turn, reports to the V.P. Corporate Services.

The central computer is an Amdahl 5990-500, described by the Data Centre Manager as "a medium sized mainframe". It supports approximately 2000 terminals in Nova Scotia and Prince Edward Island; has 96 disks with 130 gigabytes of online storage; 16 tape drives; a high speed laser printer (about 10,000 lines per minute) and a number of other character and graphics printers. The operating system is an IBM-based MVS-XA; it supports both IMS and DB2 database management systems and a number of languages including the 4GL FOCUS for end users.

All this equipment requires a staff of only about 24 people (scheduling, operations and technical support) to run three shifts a day every day.

The applications which run on it are of two types. About 75% of the work is traditional large scale, transaction based activities such as billing, A/P and payroll. They currently have about 120 such applications available on the mainframe.

The other 25% is user initiated operations using packages or FOCUS. The computer centre staff only ensure that facilities are available for user needs - they don't get involved in helping users.

Telecommunications are based on 9600 bpi leased lines in Nova Scotia and PEI. Satellite is the main technique used to link MT&T with other Canadian telephone companies (there is a permanent connection among the mainframes of all ten provincial companies). The terminals at Head Office (about three miles away) will be linked by high speed optic fibre by the end of 1991.

Systems development

This is the aspect of the computing infrastructure that most users think of when they say "the computer people". It is managed separately from the Computer Centre and is headed by the Systems Development Manager who reports to the General Manager - Planning who reports to the Vice President of Corporate Services. It has a staff of approximately 75 analysts, designers, programmers and technical specialists dedicated to creating and maintaining core corporate systems. This includes not only applications created in house but also the evaluation, installation and maintenance of mainframe- and minicomputer-based packages. For example, the corporate G/L is an MSA package which has been upgraded and modified a number of times by this group.

Individual analysts, designers and programmers are assigned to the development of long term projects such as CHRIS (computerized human resource information system) so that they become, in effect, specialists. But they can be, and have been, moved from one project to another on short notice.

Minicomputers

As mentioned above the firm has a number of smaller minicomputers spread throughout the Province. For example, all maintenance and inventory control is run on a Hewlett-Packard in the main warehouse while toll (long distance) data are gathered by a dedicated minicomputer in the Operations Centre. Because these systems were not relevant to the users in this study they were not examined in detail.

Appendix I - Research Site A

Microcomputers

These relatively new devices are spreading rapidly throughout the organization. They are not controlled or supported at all by the Computer Centre and only marginally by the Systems Development group. It is the Information Centre (see below) which actually coordinates and controls this aspect of computing at MT&T.

Any manager may attempt to get a microcomputer by preparing a multi-page business plan explaining the need for one in his area of responsibility. Uses, software, payback period and many other points must be made clearly. This is reviewed by a central committee and if it is accepted it is given a priority rating. As it rises to the top of the priority list it is funded, at which stage the Information Centre will advise on the most appropriate hardware and software, help the manager select his equipment and provide basic training.

Microcomputers are used for a variety of applications at MT&T but the great majority are based on LOTUS 1-2-3. Networking of microcomputers, either to each other or to the central computer, is, at most, in an experimental stage in the areas taking part in this research. Specific uses of microcomputers related to this research are discussed in the body of this report.

Miscellaneous operations

In addition to the standard "central" computer system this organization has a number of specialized services. Four which relate directly to this project are:

a. The Information Centre - this aspect of computer use and support is unique among the six sites which took part in this project. It is headed by a supervisor (the incumbent has more than fifteen years experience in computing and in the organization) who reports to the Planning Staff Manager who reports to the G.M. Planning.

   It began in 1984 as a subdivision of Systems Development, specializing in "short term" service to managers using the fourth generation language SAS. This changed to FOCUS in 1987 and expanded into microcomputer-based packages such as LOTUS 1-2-3 and graphics packages. It became a separate group soon after and now performs a range of functions: evaluating microcomputer hardware and software at the request of managers; providing specialized services based on microcomputers or the central computer (e.g., preparation of overheads from graphical data); training, or arranging training for, various staff levels; special projects (e.g., they are currently investigating executive information systems (EIS) and networks for microcomputers); coordinating the current voice mail system; repair of microcomputer hardware at all company sites in Nova Scotia and investigating office support software (document storage, E-mail, etc.).

At the time of my interviews the Information Centre has a staff of fourteen programmers each of whom informally specializes in a few topics. The Supervisor feels he could use twice as many and still not meet the users' needs (wants?). The Director of the Centre felt that they have strong support from the senior executives but "we have never had a senior manager in a training class."

b. Corporate Budget Modelling - This is the only situation in this research where managers commonly used the term "decision support system". The corporate budget planning application has evolved in four stages since 1979. The current version is actually a package called 1-Up which is produced by Comshare, Ltd.

From 1979 to 1981 the modelling system used was Finance 4, a card-based package run on the mainframe to produce an Income Statement and limited statistics. In addition to limited output it took "hours to run". The second version (1981 to 1985) used the IBM Plancode language to develop an expanded version of the Finance 4 system which ran on the central computer and took only thirty minutes to run.

The third version (1985-1989) used Lotus 1-2-3 and Chartmaster on an IBM PC. Very quick and clean for "one company models" but it couldn't do multi-dimensional consolidations well. An unlimited series of reports could be produced and Chartmaster was used to turn some data into graphs.

1-Up, the current package, was implemented in October 1989 to produce internal and external budget plans for single or multiple organizations. It is basically a multidimensional spreadsheet with some statistical ability and a powerful report writer. Chartmaster still has to be used separately to produce graphs although the manufacturer of 1-Up intends to add that capability to the next release.

The budget development procedure is very long but quite straightforward. Each lower level manager prepares budget requests almost nine months before the beginning of the new fiscal year and discusses these with his superior. As budgets are approved at each level they move up until a single, G.L.-based set of numbers is available. These are gathered and checked by the Dept. of Budgets and Forecasts and then passed to the Senior Financial Planner. He enters these into the model and produces a "first forecast" of revenue, expenses, asset changes, deprecation cash recovery and so on. A number of graphs are also prepared to support this.

This is taken directly to the V.P. of Finance (three steps up the organizational chart). If the forecasted budget provides adequate profit (actually R.O.E. as defined by the regulatory board) it is approved. "This has never happened on the first try." The V.P. will suggest two or three ways to improve the situation, the Planner will run the model using these changes and the V.P. will examine the results. Once an appropriate budget has been developed the V.P. takes this to the Executive Committee for approval. If revisions are needed they are again put into the model, the results are sent to the Committee and, finally a budget emerges. In addition to the short-term budget the same system is used for five year capital budgets and proposed revisions of current budgets (usually done once or twice a year).

The application is run by one person - the Senior Financial Planner. The incumbent is an accountant who had no computer experience until he got involved in budget forecasting. It is clear from interviews and observation of the application in operation that is currently dependent on the personality, skill, experience and corporate contacts of this individual.

c. PCRS (profit centre resource system) - This is another example of a "decision support system" within this organization. In 1984 MT&T started selling equipment "outside the tariff" (in unregulated fields) so they must be able to assure the regulators that these products are absorbing all of their costs.

In February 1988 the company committed to a full cost/profit accounting architecture to replace the traditional balance sheet model. By the end of 1991 the shell of this will be complete. Once the detail levels are filled in 1992-93, each activity and item within the firm will be allocated according to a very clearly specified model.

A prototype of the computerized aspects of this new approach is being developed by a team of twelve computer and accounting specialists using LOTUS 1-2-3 on microcomputers. It is intended that this will grow as the details of the accounting model are filled in. (Test reports are now being run on ten areas such as Business Services and Mobile Telecommunications.) When it is finished the application will be converted to run on the mainframe computer using FOCUS and DB2 to ensure that all departments will have immediate access to the profit centre system both for information reference and data entry and that the effects of any activity will be apparent throughout the company within minutes.

The development process (on both the accounting and computing ends) is driven by about 150 studies which will cover about 2,500 corporate accounts (assets, revenues, etc.). A study determines how one or more accounts will be attributed to one or more of about 85 business segments (profit centres).

d. Business Services Financial Support - This micro-based application is a good example of how such tools can be used to meet the special information needs of specific parts of an organization. It is localized within one Division and focuses not on long term planning and analysis but on monthly financial reporting and control of operations.

The Business Services Division is one of the most important parts of MT&T since it is the department which markets telephone systems to businesses and then installs, maintains and upgrades those systems. (Business Services is probably the department which is suffering the most from the changing context of the organization since competition is much more intense for business customers than for residential customers.)

All aspects of this application are done by one employee - the Senior Methods Analyst. The incumbent had fifteen years experience as a payroll clerk and supervisor before beginning this job in Business Services seven years ago. He had no computer experience but, quickly realizing that the job couldn't be done without one, he acquired a microcomputer and learned how to use it. In fact, he created the current position where no computer support had previously existed.

This function is based on two clusters of equipment. A terminal, a local printer and a small plotter linked to the mainframe give access to central files for data entry, inquiry and report production. At least 600 graphs and text reports are available through the central accounting system for this one department. The Methods Analyst selects the reports and graphs needed (or wanted) by managers from a menu, requests them from the Computer Centre and they are delivered the next day after being produced in a batch mode overnight.

A 286-based microcomputer running Wordperfect, Lotus 1-2-3 and Harvard Graphics is used to prepare a large number of predefined reports each month within the Division. In addition the General Accounting staff send all financial reports for Business Services to this person. He forwards them to the relevant managers, gets back comments and explanations and prepares reports for higher managers. This accumulates further until a three or four page report is ready for the V.P. of Marketing. In addition, the Methods

Analyst will often manually load the contents of corporate-wide reports received from the Computer Centre into "his" microcomputer, massage these data and produce more focused reports for the managers.

In addition to the basic administrative budget control this function coordinates all maintenance budgets and capital expenditures as well as the development of the annual budget for the Division. At peak times a pile of up to six feet of spreadsheets, text reports, graphs, etc. are being reviewed and manipulated. Other than budget figures and basic accounting adjustments few data originate in this function but a tremendous amount of analysis of pre-existing data are produced.

This application is particularly relevant to this research not because it represents direct use of a computer by a manager but because it is an excellent example of the "normal" relationship between middle and senior managers and computers at all sites in this research - indirect use through a skilled intermediary.

c. comments

This is a firm that is going through rapid change in its environment and, to a lesser extent, in its corporate culture. I was fortunate to catch them at this stage.

In addition to the technical and competitive changes described above the increasing education level of employees, the growing need to learn new skills, the planned downsizing of the staff, the saturation of some markets and even government insistence on employment and pay equity are changing procedures and shaking beliefs that have been held by some of the interviewees for almost thirty years.

Appendix I - Research Site B

a. the organization

Name: The Sir Mortimer B. Davis Jewish General Hospital of Montreal

Location: The hospital is located in central Montreal, Quebec in a mixed residential and retail area.

Age: 58 years

Description: This organization is a medium sized teaching and tertiary care hospital. It is one of forty-four hospitals providing varying types and levels of medical care to a population base of approximately three million in the Montreal region.

Size: The hospital is comprised of three large complexes which occupy a total of about 1,000,000 ft.^{2} of wards, operating rooms, labs, administrative offices and storage space. All facilities are located within a two block area and are physically connected. "The Jewish" has 628 beds although, due to a shortage of nurses, up to 50 of these are closed at any one time.

The hospital has a budget of about $110,000,000 per year. Basic statistics for 1989 include:

- number of admissions - 15,638
- total patient days - 194,814 (85% of maximum capacity; 91% of actual capacity)
- number of deliveries - 3,805
- patients operated on - 16,432
- emergency visits - 50,494

Ownership: The Hospital is owned by a private, non-profit corporation of citizens which has its own Board. Nonetheless it is considered to be a public facility because a huge proportion of its funding comes from the Provincial government. This also means that the true control comes from the government and, to a lesser extent, the Montreal Regional Medical Services Council set up by the Government.

Employees: There are about three thousand "full-time equivalent" employees. This includes full-time cleaning and cafeteria staff; approximately one thousand two hundred nurses (full and part-time), one hundred house staff (doctors) and about five hundred and fifty medical and dental practitioners attached to the hospital.

The hospital is moving toward a higher percentage of part time nurses to allow for more flexible service to patients.

Appendix I - Research Site B

Organizational/Management Structure: The hospital is run by a Board of Directors comprised of volunteers from a number walks of life - although business people and government representatives predominate. The chief executive officer is the Executive Director. Serving under him are three senior Directors: Administration; Professional Services (medicine) and Nursing Services. Reporting to them are a second level of Directors and numerous managers and supervisors in both administration and medical care.

The hospital has set up a separate entity (the Foundation) to which individuals and organizations make donations or bequests for the Hospital.

The Industry: Medical care is one of the fastest growing aspects of Canadian society. Like England, Canada has socialized medicine so, beyond a monthly premium charged in some provinces, basic and advanced care, with a few exceptions such as cosmetic surgery, are free.

This has had two effects on the industry in the Montreal area. The first has been the "putative" rationalization of service through specializations in each hospital (see Products/Services below). The management of the hospital reported, however, that, so far, little rationalization has actually taken place.

The second effect has been the development in Quebec of Regional Councils which include not only the hospitals but also the long term care facilities, nursing homes and other "nodes" of the medical care industry. These Councils are intended to address the rationalization issue but so far have had little success due, in part, to the inertia of the existing organizations. The Councils are essentially coordinating bodies which have no real authority over health care facilities - they work on the basis of persuasion and compromise. Existence of the Councils means that the administrators of a hospital are responsible to the hospital's Board of Directors, to the Regional Council and to the Ministry of Health of Quebec.

Since medical care is, under Canada's constitution, a provincial responsibility, the funding is done by the province, not by the Regional Council. This means that the administration has to comply with a large set of complex, sometimes conflicting set of responsibilities and controls.

Market Size & Structure: The market for the Hospital's services is drawn to some extent from the city of Montreal in general (particularly Jewish patients) but 90% of patients come from within five miles.

The patient mix is getting older fast with approximately 25% of the patients over 65 (this is the demographic mix that Canada, as a whole, will reach in about 2050). This aging is a serious problem for administrative and medical management because beds that could be used for medical patients are often filled for lengthy periods by geriatric patients awaiting a "place" in a senior citizens home or long term care facility.

Products/Services: The "Jewish General" provides specialized service in intensive care, obstetrics, neonatal intensive care and neurosurgery. It also serves as a reference point for patients needing specialized services they don't provide and as a general hospital (secondary and primary care) for people living in the immediate area.

Competition: In terms of patients the hospitals in Montreal don't compete. Each hospital has its specialties in both medicine and patient mix as outlined above but, above all, there is more than enough demand to keep all facilities working at, or above, capacity.

On the other hand, because all hospitals are financed to a great extent by one source (the Province of Quebec) there is a form of competition for the dollar resource. They also compete for private donations and research dollars and, to a lesser extent, for both doctors and nurses.

Organizational Culture: The culture is quite formal although the perception is that "compared to "French" hospitals we are much looser in obeying rules". The hospital is driven by the need to provide adequate service to patients so investment in the administrative side takes a back seat to investment in medical resources. The hospital staff, like many workers in Quebec, is heavily unionized (they have fourteen separate employee agreements).

The Hospital also has a strong focus on research - even compared to teaching and patient care. They are trying to increase credibility with universities (they are affiliated with McGill) with other hospitals and with the Government and, thereby, ensure their long term viability.

Locus/Process of Decision Making: Decisions are quite centralized. An Executive Committee consisting of the Executive Director, the three senior Directors and a few other managers such as the Director of Finance and the Director of Human Resources make most decisions for the entire organization.

Medical staff are beginning to get involved in decisions and nurses, as their level of training rises, also are beginning to demand an active part in the decision making process.

Training/Education: There is a focus on education for nurses. Doctors have ongoing training as needs arise and administrators go to one or two conferences each year.

But only a fraction of 1% of the budget goes toward this training and most is done in the hospital by staff. They do, however, encourage academic training for nurses, physicians, occupational therapists, physiotherapists, medical technologists, pharmacists and radiology technicians.

There is currently no provision for computer training for even the most senior administrators or their support staff.

Source of Financing: The Hospital's budget has remained flat, except for inflation, for the past few years in spite of increasing demand. About 3% comes of their income is from private sources and about 97% comes from the Province of Quebec through the Ministry of Health.

Driving Force: The hospital has three sources of demand: the citizens of the surrounding community (patient care); young doctors and nurses (teaching); and internal and external medical researchers (research). The driving force is to balance these interests, to balance the budget and to maintain credibility with the Government, with the medical community and with the population.

Growth is a driving force to the extent that they are currently not even able to keep up with demand for services and facilities. The focus of their growth is on facilities and services, not number of patients. They have recently completed 200,000 square feet of new space in two new buildings and established a new Radiation-Oncology Centre. This was achieved primarily through private donations.

They are also focusing on development of new programs and technology and improvement of existing programs. Balancing this positive drive is the strict control on such developments by the Provincial government.

b. the computer context

The Information Systems (IS) department is run by the Head of Information Systems who reports to the Director of Finance. As of late 1988 this institution was spending about .75% of its budget on computing compared to between

2 and 3% for a number of other large hospitals in the same area.

The first application on a computer was payroll which began in 1970. A stores recording system was next followed by personnel, A/P and other standard transaction-based applications. A hospital-wide steering committee, created in 1988, meets three or four times a year to set plans and review progress. There are still a lot of "bits and pieces which don't fit together too well." [Head of IS] The committee has begun to develop a strategic plan for future computing development but it was very hard to get a strong sense of specific forces and guidelines for such a plan. "Our focus is on record keeping, not decision making." [Head of IS]

The hospital has acquired a package called INTERNET which will gradually allow the use of applications to be decentralized.

The Central Facility

The hardware in the central computing facility was recently upgraded to allow for a new Personnel system and for future development. It is comprised of three NCR minicomputers.

One of these is dedicated to medical administrative applications including a patient index, outpatient directory, cytology, radiology and the blood bank. Admissions, another basic system on this computer, has the potential to provide useful data for different areas of the hospital including finance (costs) and nursing (staffing requirements). As of mid-1991 none of these units had online access to the system which means that a lot of operational work has to be done by IS staff to produce anything non-standard. (An online facility is available in IS but it is <u>not</u> user friendly so has not been moved out to end users.) According to the Head of IS the application provides "a lot of standard reports but someone always wants something new".

A second computer is used for financial applications such as A/P, A/R (outpatients only), inventory management, payroll, budgeting & reporting and accounting for the Foundation. The accounting system was bought as a package but has been heavily tailored to meet the special needs of the Jewish General by both internal staff and an outside consulting firm (IST). Updates are in done batch mode but there is an online inquiry capacity. (This seems to conflict with managers in user areas who reported that they have no on-line capacity. Certainly it is never used by these managers.) The system provides a large set of traditional printed accounting reports for line managers.

The new Personnel system, controlled by the Director of Human Resources (who took part in this research), also runs on this CPU and has close technical links to the Payroll system. The Personnel system is the first administrative system to be online. It seems to work well except for the report generator which is not considered user friendly and which is, in reality, avoided by the users.

The third minicomputer is dedicated to the development of new or modified applications by the staff of the computer centre. Some applications are developed from scratch while others are modified packages. The computer staff work frequently with a consulting firm (IST) which develops or modifies applications - including the new personnel system.

Microcomputers

The IS department has no control over microcomputers since they are paid for from research funds, equipment budgets and so on. The Head of IS has no real idea of how many there are or where they are located. The steering committee also has little control over microcomputers although they are hoping that the Provincial government will institute some guidelines. (Of the senior managers interviewed only the Director of Finance had a microcomputer in his office and he was adamant that he will never use it directly.)

c. comments

This organization had the most limited use of computers of all of those which took part in this research. Very few terminals or microcomputers were evident in any senior manager's office. Those that use them do so for specialized activities, have had them programmed by a consultant or one or their own staff and have someone on their staff actually using the computer. Printed reports or even briefings based on output were the ways managers in this organization "use" their computer.

Appendix I - Research Site C

a. the organization

Name: Camp Hill Medical Centre

Location: The hospital is located in central Halifax, Nova Scotia.

Age: The Camp Hill Medical Centre is a recent creation of the Province of Nova Scotia. It is the result of the amalgamation of two older hospitals - Camp Hill Hospital which has traditionally been the veteran's hospital and the Halifax Infirmary which was founded a century ago to serve the Catholic population of Halifax.

The amalgamation of the two facilities began in 1987 and was completed in early 1991. In addition to this, the new Medical Centre has recently been required to absorb the staff and patients of a small Halifax hospital (the Civic Hospital) which has been closed by the Government.

Description: This institution is a medium size tertiary care hospital. It is one of the three main hospitals providing general service to the Halifax region and a few specialized services for the entire Province.

Size: The hospital is contained in five buildings on two sites two kilometres apart. It consists of approximately 1,000,000 square feet including medical, administrative and support units. In addition to the normal hospital structures (operating rooms, wards, offices, etc.) it also has a large component of acute long term care and adult psychiatric beds.

Ownership: The hospital is owned by a private, non-profit corporation of citizens which has its own Board. Nonetheless, with most of their funding coming from the Provincial Government, they are considered a public establishment in which the ultimate control comes from the Provincial government.

Employees: Approximately 3000 administrative and medical staff. The latter group consists of approximately 900 nurses and 500 staff doctors, dentists, therapists and other support functions.

Organizational/Management Structure: The Board of Directors has sixteen members consisting of a mix of volunteers from the community and representatives of the Government, the hospital administration and the medical staff. It is the senior body relating the hospital to all interested parties and must approve all major decisions such as capital expenditures, the annual budget and changes in focus but it is not involved in the direct running of the hospital.

The senior administrator at Camp Hill is the Executive Director. He, in turn, has six Assistant Executive Directors (AEDs) reporting to him for: Finance/Administration; Patient Services; Nursing Services; Hospital Services; Human Resources; and Program Planning. The Medical Director also has AED status. Reporting to the AEDs are numerous managers and supervisors in both the administrative and medical sides of the hospital.

The administration aspect of the hospital is a traditional hierarchical structure but medical decisions are made on a team basis at relatively low levels.

The Industry: Medical care is one of the fastest growing aspects of Canadian society. Like England, Canada has socialized medicine. Beyond a monthly premium charged in some provinces (not in Nova Scotia) all medical care, with a few exceptions such as cosmetic surgery, is free.

Market Size & Structure: The demand for the Hospital's general services is drawn mainly from the Halifax-Dartmouth region but patients come from the entire province of Nova Scotia for the specialties described below.

Products/Services: The hospital provides general services (primary and secondary care) for the local area in cooperation with the other hospitals in Halifax.

In addition, the hospital specializes in ear, nose and throat (ENT) and opthamological surgery for the entire population of Nova Scotia. They also have a number of orthopaedic specialists and this service is seen as a growth area.

Long term care for war veterans for the entire Province is also offered as is psychiatric care for veterans and other geriatric patients.

Competition: The hospitals in Nova Scotia do not compete for patients. Those requiring primary or secondary care are treated locally while those needing specialized treatment or major surgery go to one of the Halifax hospitals.

They do, however, compete for the limited funds available from the annual hospital budget pool provided by the Government. They also compete for research funds, mainly through doctors on staff. A third point of competition is skilled staff, particularly nurses.

Appendix I - Research Site C

Organizational Culture: The organization, including administrators, is strongly patient oriented. Priority in systems is given to patient support which leaves little for administrative development.

Locus/Process of Decision Making: The major decisions are made by the executive committee consisting of the eight administrators described above. Since the greater part of their funding comes from the Provincial Government, all decisions are made within constraints defined by the Government. Major capital expenditures are also made in concert with all other hospitals in Nova Scotia.

Medical decisions, other than budgets, are made by the Medical Director, the AED Patient Services and the AED Nursing Services (who are supported by specialist sub-committees).

Training/Education: The hospital has a global budget for personnel education. It is used primarily to respond to specific needs on the medical side. Only a fraction goes to administrative upgrading and about 1% of this training budget goes to computer training.

Source of Financing: The annual budget is currently about $100,000,000 per year and rises at about 4% per year. 95% of this is provided by the Province of Nova Scotia and 5% comes from the sale of services.

Driving Force: The hospital has three sources of demand: the citizens of the surrounding community (patient care); young doctors and nurses (teaching); and internal and external medical researchers (research). The driving force is to balance these interests, to balance the budget and to maintain credibility with the community, with other hospitals and with their main source of funds - the government.

Growth is a driving force to the extent that they are currently not even able to keep up with demand for services and facilities. The focus of their growth is on facilities and services, not number of patients.

They are also focusing on final integration of medical and support services; development of new programs and technology and improvement of existing programs - particularly through increased nursing training. Balancing this positive drive is the strict control on such developments by the Provincial government.

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b. the computer context

The Infirmary got its first computer in 1976 to run basic accounting functions while Camp Hill hospital began computing in the late 1970s, also with accounting. Since then growth in both hardware and software has apparently been somewhat haphazard. This is exacerbated by the fact that, although the computer staff has grown from two to ten people over the past three years, that is well below the number actually needed to keep up with expanding demands.

The central facility

There is, at present, no central facility at Camp Hill. The current computing situation is a mixture of the old systems from both hospitals plus a new, Unisys computer running a Patient Care System for both Camp Hill Medical Centre and the Victoria General Hospital (the largest hospital in eastern Canada). This application is currently doing only basic record keeping but, over the next five years, it is expected to be upgraded to a state-of-the-art online Patient Information System including admissions, pharmacy, scheduling, dietary, labs and other support services. Operation of this facility is contracted back to Unisys. During 1991-92 the goal is to install at least one terminal from this system on each ward at Camp Hill.

The hospital itself has three minicomputers (two MAI and one Data General) and a number of microcomputers, none of which are connected to each other. The Director of Computing Services reports that there is a package (ORIGIN) on the MAI computers which will do ad hoc reporting but no-one knows how to use it.

The accounting applications (G/L, payroll, A/R, A/P and physical plant) are on one MAI using packages supplied by MAI. The entire accounting system is being redone on a five year plan. The Inventory management system is actually two very different systems split between two minis (these two systems are being amalgamated and upgraded in spite of numerous political problems). The Data General is basically empty except for bookings (appointments) and medical abstracts.

Microcomputers

No-one is quite sure how many microcomputers are owned and used by the Centre but estimates range from eighty to one hundred. There is agreement that they are used almost exclusively for word processing and spreadsheets although a few copies of Harvard Graphics, a database management system and a statistics package (SPSS) are used in some departments.

Acquisition of microcomputers is based on a "statement of need" prepared by the senior manager of the area requesting the additional microcomputer. This is reviewed by a committee chaired by the Director of Computing Services. If a specific request is approved it is added to a waiting list which is passed each year to the hospital-wide Capital Budgeting Committee where it is given a priority rating. Each year the microcomputer committee is allocated some funds from the Capital committee and they must use these to provide added service to as many areas as possible.

c. comments

All hardware is capitalized so each year it is a struggle to get hardware upgrades or even more terminals but over the past five years the Capital Budgeting Committee had filled most requests for computing support to some extent.

The Director of Computing Services reported that, over the next three years the goals of his department are:

1. to finish the amalgamation of all existing applications
2. to support the enhancements to the Patient Information System
3. to get terminals in all nursing units
4. to begin to provide standards and organized training to users of microcomputers
5. to "get everything talking to each other".

Appendix I - Research Site D

a. the organization

Name: Dalhousie University

Location: Halifax, Nova Scotia

Age: The University was founded in 1818 by the Earl of Dalhousie using profits from a privateering expedition during the War of 1812.

Description: Dalhousie is a medium size university offering undergraduate, graduate (Masters and Ph.D.) and professional degrees. It is also heavily involved in government and privately funded research and in community activities.

Size: It is the largest university in eastern Canada with almost 11,000 students and 3,000 employees. It consists of more than forty buildings and covers approximately sixty acres.

Ownership: It is owned by a non-profit Corporation of Governors. This is represented administratively by the Board of Governors which includes representatives of alumni, employees, faculty, the administration, the Province of Nova Scotia and the community at large.

Employees: Approximately 1,450 teaching staff and 1,550 support staff.

Organizational/Management Structure: Under the University's statutes, the Board of Governors is responsible for the operation of the University. Basically, they are concerned with financial matters, relationships with the Government and other administrative activities.

Internal regulation, particularly academic policy and decisions, is the primary concern of the other senior body, the Senate.

The ongoing management of the University is the responsibility of the President, the Vice-President Administrative and the Vice-President Academic. The next management level is Deans on the academic side and department Directors in the administration.

The Industry: Nova Scotia has more university places per capita than any other province in Canada - there are five universities in Halifax alone. Universities in Canada are heavily supported by Federal and Provincial governments and, in recent years, increases in these grants have not even kept up with inflation.

This means two things for Nova Scotia's universities. First, none have enough money in any given period to operate properly. Dalhousie, being by far the largest in the Province, is the worst off. For example, the entire science library was recently declared unfit for occupation. Second, the government has started a program of "rationalization" which means that part or all of some schools may disappear in the next few years.

Market Size & Structure: The basic market for Dalhousie remains men and women who have just completed high school and are taking a first degree plus students with a first degree taking a professional degree such as Law, Medicine, Library Science or Management.

But the market is changing. The proportion of women in the student body has risen to over fifty percent during the past twenty years and the proportion of mature students (those not coming straight from school) and part-time students is continuing to rise as well.

The number of foreign students has remained relatively stable but the number of these from Asia has almost doubled in the past decade.

Dalhousie is also becoming more proactive in recruiting and supporting students from indigenous minorities; particularly blacks and MicMac indians.

Products/Services: Undergraduate, graduate and professional degrees; research; extensive publications; community service and education; and facilities used by many groups in Halifax. Dalhousie has the only Medical School in Nova Scotia; the only Law School; the only School of Nursing; the only School of Library Science and is the only broad based Ph.D. granting University in Nova Scotia.

Research Centres are becoming a more significant aspect of the University's product as well. These include the Centre for International Business and the Marine Transportation Centre.

Community services provided by Dalhousie include the Dalplex Activity Centre, Dalhousie Legal Aid and Henson College which each year offers hundreds of courses to individuals and organizations in the community at large.

Competition: It is only at the undergraduate level that the other ten universities in Nova Scotia compete academically with Dalhousie. Because of budget constraints and Dalhousie's relatively large capital plant, they have had to cut back on faculty so that their undergraduate class sizes are the largest in Nova Scotia.

In fact, the true competition among the universities is for the limited funds available from the Government for all universities.

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Organizational Culture: The administrative side is a basic bureaucracy - except for senior managers. Because universities pay relatively poorly, senior administrators are attracted by the university atmosphere or some other non-monetary factor. Also, because of Dalhousie's extremely bad financial condition administrative staffs have been slowly shrinking for some years. This has required that senior managers become more involved in day-to-day operations than they would in most organizations.

The academic side is more loosely organized, as it is in most universities. The clash between the relatively structured, budget- and rule-driven administration and the more ad hoc, independent academics is an ongoing problem.

Locus/Process of Decision Making: This is an ongoing controversy at Dalhousie. Although the division of responsibilities between the Senate and the Board of Governors seems clear there are some areas of overlap which have never been resolved. Essentially the problem arises when an issue includes both financial aspects (Governors) and academic aspects (Senate).

Training/Education: Ironically, the training provided to administrators in the university setting, particularly in relation to computers, is virtually non-existent. This is due partly to lack of resources in the computer area, partly to the heavy workload of senior managers and partly to the eclectic collection of hardware and software in place in administrative departments.

Source of Financing: The University's budget for 1989 was more than $130,000,000. About seventy percent came from the Province of Nova Scotia and thirty percent from other sources including: student tuition and fees; an annual revenue campaign; bequests and donations and fees for services provided to those outside the University.

Driving Force: In the long run it is the provision of educational services to Nova Scotian and visitors along with research. In the short term it is financial survival through slashing costs and generation of more revenue. (Nova Scotia spends the least money per university student of any province in Canada.)

Appendix I - Research Site D

b. the computer context

Dalhousie University Computing and Information Services (UCIS) is divided into four areas: Communications Services; Computer Facilities and Operations; Academic Computing Services and Administrative Computing Services. For this research only the last of these was of direct interest.

Central Computing

Administrative Computing is based on an IBM 4381 minicomputer running under MVS. The financial system (CUFS), the Registrar's system (Student Information System) and the Payroll system are all on this CPU. In addition a number of general use packages are available to administrators (at least in theory). These include a 4GL (IMAGINE), which is supposed to work with CUFS, and the statistical package SAS. Electronic mail is also available to users of the IBM but, because only about 25% of the six hundred possible administrative users actual take advantage of it, it is effectively non-existent.

There is no integrated database system for administrative applications and, because of financial restraints, it is unlikely that one will be acquired soon. This means that connecting data from multiple applications is technically difficult and must be done by a programmer. Because of this situation IMAGINE and SAS are rarely used by administrators.

The Student Information System was written by an outside contractor a decade ago and is batch oriented so online access, while now possible, is quite rigid. Student accounts are part of the financial system (CUFS) and are not available to the Registrar's staff online.

The Human Resource system is on an MAI minicomputer which connects only with difficulty to the IBM. Discussions are continuing on whether, and how, to move this application to the IBM.

Microcomputers

At Dalhousie acquisition of microcomputers is a department decision since they are purchased from equipment budgets. Administrative Computing can make suggestions on standard hardware and software but have no final authority. This has led to a proliferation of microcomputer configurations and has made both maintenance and training difficult. A number of areas have connected their microcomputers using Ethernet and Novelnet but it is not campus wide.

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No one is sure how many microcomputers are being used in the administrative area but estimates range from 100 to 120. Many are hard-wired to the IBM and run in terminal emulation. Using NetMaster it is possible to download data from the IBM to a micro for use in a spreadsheet but due to technical complexity, lack of training and lack of time few administrators ever do this. None of the senior people I interviewed had ever tried it.

Support for Users

Administrative Computing services provides an Information Centre service for users who need guidance on microcomputer hardware and software; demonstrations of either hardware or software; familiarity courses or installation of miscellaneous software. Unfortunately it has never been adequately staffed so potential users do not take it seriously.

All user managers interviewed commented on the lack of access to on-line data for their area - particularly in the accounting/finance and student service areas. Most managers also found the apparent lack of a report writer or a fourth generation language frustrating, especially in light of the very limited resources available from Administrative Computing services.

c. comments

Essentially administrative computing at Dalhousie is marked by islands of hardware; a broad range of software; numerous data files which are entirely independent of each other; users who are minimally trained and a technical support group which is understaffed, under financed and overworked.

Three of the senior managers taking part in my research do use either the central facility or a micro-computer directly but this is because of their attitudes and experience before coming to the University and, in most cases, in spite of the facilities and training available to them rather than because of it.

Appendix I - Research Site E

a. the organization

Name: IMP Group Limited

Location: The Head Office of IMP Group Limited is in Halifax, Nova Scotia and the facilities of its subsidiary IMP Aerospace are located at an industrial site near the International Airport (approximately twenty-five miles away).

Age: 25 years

Description: IMP Group Limited is a complex organization comprised of three Divisions and more than a dozen independent industries. It operates IMP Aerospace and eight smaller industrial plants in the Halifax area; its Air Service arm operates in Gander, Newfoundland and eight other airports; Aerospace Manufacturing, Industrial Products, Ropes and Slings and Innotech are located in Nova Scotia; the Marine Division operates in all four of Canada's Atlantic Provinces and in New England; a marine manufacturing plant is located in Grimsby, England; it has recently acquired a small competitor in Montreal and it is involved in a development project in Moscow. IMP Group has customers in the United States, Cuba, the USSR, Brazil, England and Canada.

The firm continues to grow both through acquisition and development of new opportunities. In addition, it is privately owned by its conservative, highly entrepreneurial President who is very "bottom line" oriented. This means that figures on sales, profits, volumes or even staffing are hard to acquire.

The senior managers have, for the most part, been with the firm for many years. For example, the Executive Vice-President began over thirty years ago as a labourer in the Aerospace plant. The firm is a classic meritocracy but this has led to a lack of management education. The senior managers in this organization had the lowest overall level of formal education of any group in this research.

There is also a rapid rate of change throughout the organization to deal with environmental threats and opportunities.

Size: This is difficult to say due to the diversity of the undertakings and the secrecy of the firm. In 1988-1989 IMP Group Limited had sales of approximately $200,000,000 Cdn. of which IMP Aerospace contributed about half.

Ownership: IMP Group is controlled by its President and majority owner.

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Employees: IMP Group has approximately 1,900 employees of whom about 800 work for IMP Aerospace, the division on which this research focused.

Organizational/Management Structure: There are two levels of management of interest in this project. The broadest is that of IMP Group. This is headed by the President who is the focus of all decision making and planning in the organization. Below him is the Executive Vice-President who is responsible for support services such as computing, accounting/finance, personnel, labour relations, legal and contract administration for all divisions of IMP Group.

The other aspect of management structure relevant to this research is that of IMP Aerospace. This wholly owned subsidiary is headed by the Senior Vice-President for Aerospace (in effect, the President of IMP Aerospace). Reporting to him are a number of Vice-Presidents and Directors.

The Industry: There are two important characteristics of the aerospace industry in Canada. First, there is only one significant customer - the Federal Government. Second, this is a "job shop" industry based on long term multimillion dollar contracts.

The main activities are building new aircraft; designing, building and repairing electronic equipment; repairing rotary and fixed wing aircraft; modifying the same vehicles; subcontracting to other aerospace or related firms for specific products or services.

Market Size & Structure: Until 1989 IMP Aerospace had one customer - the Federal Government - with the good and bad features of that situation. In the last two years they have aggressively sought contracts with other countries and subcontracting work with Canadian and American aircraft manufacturers. This has brought the realization that the culture of IMP Aerospace must change from that of "cost plus" pricing allowed by the Government to a competitive fixed price form of agreement in which they must "swallow" any cost overruns.

Products/Services: IMP Aerospace does not build aircraft but they are active in unscheduled and scheduled maintenance; they are involved in modifications of old equipment (e.g., replacing propellers with turbo props) and they are now moving into an avionics (aviation electronics) subcontracting market.

In addition they manufacture many of the parts used in all three markets and will wholesale these to other organizations.

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Competition: Aerospace is an oligopolistic field. There are about five significant firms in the aviation field in Canada. The others are located in Montreal, Toronto and Winnipeg. The Federal Government has an unwritten policy of using defence contracts as political and social tools. This means that, in spite of a firm's competence and experience, the "best man" does not always get the job. On the other hand, IMP's competence is enhanced by the fact that they are the only significant player in the field in eastern Canada. One implicit aspect of this is that all the firms in the field compete for retiring senior military officers whose contacts could give them an edge. This has worked out well for IMP since the military officers they have hired have turned out to also be good managers.

Organizational Culture: Since much of the senior management at IMP Aerospace (not to mention the President of IMP Group) came from the military there is an underlying military feeling at IMP Aerospace.

Another characteristic of IMP Aerospace is the degree of team work and consensus forming which goes on. Because all senior staff are located in a small area meetings can be convened quickly and problems sorted out at the highest level. Also, managers are expected to "hit the ground running" when they join the team and quickly fit their expertise in with the existing people and skills.

But the dominant culture at Aerospace, as at all divisions of IMP, is <u>the bottom line</u>. The firm is quite small for its field and, in addition, is growing rapidly so cash is always at a premium. The President of IMP Group is a traditional entrepreneur so this also drives the culture toward a very "dollar oriented" outlook.

Locus/Process of Decision Making: At IMP Aerospace most decisions are made by the Executive Committee which is comprised of the Senior V.P., the Vice Presidents and the Directors. Some decisions are delegated down but, on the other hand, many decisions made by this senior group cannot be implemented until, and unless, approved by the President of IMP Group.

Because the Executive Committee tends to take a production/engineering/quality control approach to management while the President of IMP Group takes a financial approach approval is not always automatic.

In addition, some decisions which affect Aerospace strongly (e.g., computing resources) are made by the Corporate Services group at Head Office 25 miles away. The conflicts and communication gaps are being cleared up gradually but the locus and process of decision making are still behind some management problems.

Training/Education: The firm is highly entrepreneurial but does have a policy of supporting training and education. For example, the firm will reimburse employees for expenses incurred taking training or university courses (mainly on their own time) which are approved in advance.

In spite of this explicit policy it is quite difficult for senior employees to take courses or even to attend seminars because they work long hours, may be located in rural areas and, in some cases, can be required to leave for another site or another continent on short notice.

The training provided managers on computing is limited by these factors but also by the lack of training resources and by resistance from a number of the senior (older) managers.

Source of Financing: Because IMP Group Ltd. is narrowly owned, equity is a limited option. Financing is provided mainly by retained earnings and debt. The firm tries to expand by making acquisitions which can pay for themselves immediately (including their acquisition costs) and they will also become involved in joint projects, particularly in international activity.

Driving Force: Without doubt the main driving force within the firm is the personality of the President and owner. He is hard driving, creative, hands on and very clearly dollar oriented. Managers in all areas have commented on his pervasiveness, either in person or through driving their analysis toward his point of view. (e.g., I like it but what would Ken do?)

Externally the main factors to be considered are the military and fiscal policies of the Government of Canada.

b. the computer context

The two main factors to be considered in describing the firm's computing system as it relates to managerial support are the central computing facility and the local support available at IMP Aerospace.

The Head Office Facility

The central computing facility of IMP Group Limited is headed by a Director of Information Services who reports to the Vice-President of Finance. It is built around a mainframe computer and operates in the traditional model of development and maintenance of applications and operation of the hardware and related software.

Prior to 1983 all clerical work was done by hand or by outside organizations. Because of the rapid growth of the firm in the early 1980s computerization became necessary and a UNIVAC running MAPPER was installed at Head Office in 1983. This has been upgraded a number of times but the current Director of Information Services reported that "we always seemed to be playing catch-up. No-one is happy".

The hardware was upgraded again in early 1990 to a powerful dual processor UNISYS 2200-402. It is currently supporting about 220 terminals (115 at IMP Aerospace) and numerous remote devices such as printers (about 20 at IMP Aerospace) and plotters (2 at IMP Aerospace). Technical staff at the central facility increased at the same time, from 8 to 17 people.

Most applications for all units of IMP Group are now on this machine but there are some exceptions. The Personnel functions have been constructed in "bits and pieces" over the past few years and currently reside on two (or three, the Director of Personnel wasn't sure) microcomputers in the Personnel offices. The G/L and A/P applications were put on an IBM minicomputer some years ago and cause numerous problems in both updating and access. They are very difficult for the normal user to approach at all. It is intended to move not only these applications, but also the Personnel system to the UNISYS 2200 over the next year or two.

In addition to the upgraded hardware and staff the final aspect of the computing facility relating to this research is MAPPER. This is a fourth generation language (4GL) developed in the late seventies to run on Univac (now UNISYS) hardware. This language has a "database-like" storage facility, a detailed language for the development of applications by professional programmers, a word processor, graphics (but not drafting) capability, an electronic mail system and a user-oriented language to allow "end users' to make inquiries or create reports from stored data.

The new philosophy of the computer staff was expressed by the Director of Information Services: "We want to get away from supporting structures. We must support functions. Structures change too much around here."

Appendix I - Research Site E

Support for IMP Aerospace

The support available for management at IMP Aerospace has two main components. The first is the central computer and, specifically, MAPPER. A staff of four (Manager of Systems Development, two programmers and a technician) working at Aerospace ensure that standard systems are running properly, that ad hoc reports are produced as quickly as possible and that changes are made to current systems as needed.

There are a number of applications on the central computer supporting management at Aerospace. One is a Contracts System which helps plan a contract and which then tracks each contract in terms of hours, dollars and schedule checkpoints. It is a menu driven application on the UNISYS which allows the user to create a contract within a highly structured format; to enquire about an existing contract; to revise an active contract; to change the rates in a contract and numerous other administrative aspects of contract administration.

The accounting system, run partly on the UNISYS and partly on the IBM, provides monthly budget control reports to all senior managers (although they are considered so out of date as to be of limited use) and a simple budget planning system based on last year's figures. Related to these two systems is a Costing System which allows managers to develop cost models for future negotiations.

The Human Resource application provides reports on new hires, layoffs, absenteeism and hours by contract and by worker on a monthly basis but this is resident on microcomputers so provides no access to users at Aerospace.

A Production Reporting application (linked crudely to the Contracts system) on the UNISYS provides data on the hours, expenditures, errors and so on for each work area. It does not provide project related data but that is expected within two years - the current limitation is on data accuracy and the slow data capture process.

Finally, a Materials Management System runs partly on the UNISYS and partly on microcomputers in the office of the Director of Materials Management. This is primarily a record keeping system with limited analysis and report generation capabilities.

Only one of seven senior managers has a MAPPER terminal in his office - the others refer their information needs to people in their area or to one of the programmers. Departments with computing needs have gone more to microcomputers.

Microcomputers

As of June 1990 there were about twenty microcomputers at the facility. The uses are quite varied and there is no organizational standard for hardware or software. Because a computer is always a capital expenditure a manager or worker must make a good case to the Senior V.P. of Aerospace. If he agrees, the request goes to the Director of IS at head office. If he agrees it is passed on to the President of IMP Group. If he agrees, it is returned to the Director of MIS who will negotiate hardware and software with the manager.

The company principle is to use microcomputers only where the UNISYS is inappropriate (in engineering analysis or word processing, for example). Currently no senior managers at Aerospace have microcomputers in their offices.

c. comments

Margaret Thatcher would love this company. It is relatively small, growing fast, self reliant, aggressive and successful. They are just going through the change from an entrepreneurial, personality-driven firm to a more professional organization. Most of the revenue is being plowed back in to expand or to go into new fields such as avionics. It is one of the largest employers in its area and has a cadre of devoted senior managers.

The President of IMP Group is very "bottom line" oriented and is still getting over the shock of having to spend three million dollars on the new UNISYS in the spring of 1990.

Appendix I - Research Site F

a. the organization

Name: Oland Breweries Limited

Location: Halifax, Nova Scotia

Age: 124 years

Description: For more than a century Oland was an independent brewery in Nova Scotia and for most of that time it was the largest brewery in Atlantic Canada.

In 1972 Oland Breweries was acquired by a much larger national brewery, Labatt Brewing Company Ltd. which is, in turn, owned by John Labatt Ltd. which is, in its turn, controlled by Edper Enterprises Ltd. one of Canada's largest conglomerates.

Administratively, Oland is now Labatt Brewing's Atlantic Provinces division. This makes the management "picture" quite complex. The Halifax office is the Atlantic branch of Labatt but it is the Head Office of the Oland organization.

Oland has three breweries in Atlantic Canada. The largest is at the Head Office in Halifax; a second is located in Saint John, New Brunswick and the third is in St. John's, Newfoundland. They produces both Oland's own brands and the national (Labatt) brands for the eastern Canada market.

Size: unavailable (but it is the largest brewery in eastern Canada.)

Ownership: Oland is a wholly owned subsidiary of Labatt Brewing Co. Ltd.

Employees: Oland has almost 250 employees, almost all of whom are unionized hourly waged production workers. Administrative staff is very small (about 20 people including the President and four Vice-Presidents) because most support is supplied by the Head Office of Labatt Brewing in London, Ontario.

Organizational/Management Structure: The local structure is very simple. The President of Oland has four Vice-Presidents reporting to him: Finance, Human Resources, Marketing and Production.

The structure becomes complicated when the relationship with Labatt's is included. The President of Oland is also the Regional Vice-President of Labatt Brewing so reports to the Executive V.P. of Labatt Brewing in two capacities. In addition, each of the Oland V.P.'s is also the Atlantic Regional Vice-President for his specialty. So each reports to the

President of Oland and to the Vice-President for his specialty at Labatt's Head Office in London, Ontario.

Locus/Process of Decision Making: This is as confusing as the management structure. Local, short term decisions are made in Halifax but long term decisions, particularly capital investment are made at the national level. This means that a good investment with solid payback at Halifax may not be funded because the money goes to a project in a region three thousand miles away.

Computing, production technology and training plans have all suffered recently from this and the Oland senior managers are often frustrated by their lack of control over their own fate.

The Industry: This is one of the most competitive industries in Canada. Labatt's and its main competitor, Molson Breweries Ltd., control 95% of the Canadian market. Both major breweries have expanded capacity recently although the demand for beer in Canada has grown very little in recent years.

Each of the ten provinces considers beer from other provinces to be foreign and puts a tariff on such "imports". This means that both "national" brewers have tried to have a facility in most provinces. This, in turn means that most facilities are quite small and, as continuous production facilities, very inefficient in their use of capital.

In addition, the American brewing industry is pressing very hard to have import tariffs lowered or dropped so that they can share the market. Because beer is very heavily taxed at both the Federal and Provincial levels beer prices in Canada are about double those in the U.S.

Low volumes, high labour costs and taxes and a stagnant market mean that even more rationalization is likely to occur in this decade.

Market Size & Structure: The market for Oland Breweries is the four eastern-most provinces in Canada. But, because of the nature of Canadian liquor retailing all bottled products must be sold to the Provincial governments who own all liquor stores. Only draft beer can be sold directly to retail outlets such as taverns. A smaller local competitor (Moosehead Breweries) has been selling directly to consumers through an outlet at their plant but Oland has no plans to imitate this.

Products/services: Oland Brewery produces all Oland and most Labatt's products for Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland. This means that approximately eight brands are produced and packaged in cans or bottles, in a variety of sizes. Draft beer is also produced for bulk delivery to retailers.

Competition: Nationally, Molson Breweries and Labatt's dominate the Canadian market with shares of about 45% each. Local breweries and imported beers complete the current picture but, when American breweries are finally allowed to move in, the situation will change very rapidly and drastically.

Organizational Culture: The organization is basically a branch plant of an intensely cost driven manufacturer.
A second important factor in the culture is that most of the employees are relatively low skilled and strongly unionized. Local managers must walk a fine line between head office management and local labour practices.

Training/Education: Oland supports education for all employees and limited job-related training but none of the four Vice-Presidents who took part in this research had been able to take a course in the preceding two years.

Source of Financing: The firm does not get to retain its profits from year to year. The profits (and losses) of all the firms owned by Labatt's are pooled and either paid out as dividends or used "somewhere" in the company - but there is no direct relationship between improved profits and capital investment or training in a particular operation.
Labatt's is a publicly traded company but most voting shares are in a few hands so equity as a source of funds is limited and, of course, Oland Breweries does not have the option of borrowing funds or realising equity as an independent organization would.

Driving Force: Increasing (and defending) market share and reducing costs.

b. the computer context

The firm has three levels of computing. The broadest is the central computer facility of Labatt Brewing in London, Ontario. Financial record keeping and reporting for all aspects of Labatt's is done there, as are all budgeting and all production record keeping and analysis. Numerous printed reports are then sent to operations all over Canada. The V.P. Production and other managers at Oland have any data on Head Office reports which interests them entered manually and analyzed on a micro-computer to meet their own special needs.

Appendix I - Research Site F

Locally the firm has an IBM minicomputer and two fulltime staff but flexibility and creativity are restricted. For example, it does not offer managers a 4GL or E-mail.

At the most decentralized level all four senior managers interviewed have a microcomputer in their area. But only the V.P. Finance, who has a computer background, uses his directly.

The V.P. Production has never used his but it is working almost fulltime at the hands of two subordinates who use it for analyzing data, scheduling, order forecasting and trouble shooting on the production line.

The Vice-Presidents of both Marketing and Human Resources have put their microcomputers in the hands of assistants who manually enter data from other systems and then "massage" it for the V.P. For example, hand written reports are sent from Production to Human Resources each month detailing all employee absences. These data then are entered into a simple set of programs on the H.R. microcomputer for record keeping and analysis by the Department secretary.

c. comments

This organization was, basically, very easy to study. The President was away during my time at the site but all four Vice-Presidents were willing and helpful. Because of the small size of the management team at Oland Breweries they were in touch with all levels of activity.

But their position at the bottom of a four layered corporate structure made it much more complex. For example, to what extent were their limitations on direct computer use a result of the restrictions placed on them from above and to what extent were they self imposed? I had the sense that only the V.P. of Finance would eagerly embrace direct computer use.

Appendix II - Data Gathering Tools

Introduction

This Appendix contains examples of the four sets of questions used to gather data in this research project. The development and application of all four question sets are described in Chapter 8.

- the Interview Guide (pages 1 to 34) was the core tool for both collection and analysis of data. Basically, it consists of numerous sets of open ended and structured questions concerning the organization; the manager's function, task and activities; his background and his beliefs concerning aspects of organizational computing as it applies to him. It was administered to all fifty line managers who took part in the research.

- the Use/Attitude worksheet (page 35) was developed to support estimation of the degree of use of CBIS by each manager, the intensity of his attitude toward computer-based tools and the strength of his intentions concerning them. Each of these factors was scored on a six-point Likert scale based on comments and answers from the manager and the researcher's observations and inferences.

- the Outline of the Organization (pages 36 to 40) is a set of questions concerning the basic characteristics of each organization whose managers took part in this project. Most of the data gathered using this tool are summarized in Appendix I and were used to guide the interviews and to support analysis of the managers' responses.

- the Outline of Computing at the Site (pages 41 & 42) is also a set of questions used to gather basic data on the current computing situation at each site, particularly as it relates to managers. These data were used in the same way as those concerning the organization in general.

MANAGERS & COMPUTERS - INTERVIEW GUIDE

Manager: __________

1. The Function (Position)

A. Title: ____

B. Does a Job Description exist for this position? yes ____ no ____

   1. If yes, when was it created/updated? ____________________

   2. Copy available? yes ____ no ____ 3. In hand? yes ____ no ____

C. Does an Organizational Chart exist? yes ____ no ____

   1. If yes, when was it created? ____________________

   2. Copy available? yes ____ no ____ 3. In hand? yes ____ no ____

D. General Description of the Position

____

____

____

____

____

____

____

____

____

E. What position, in the organization, do you report to?

____

/

F. How many management levels are there between your position and the C.E.O.?

____

G. (a) How many people in the organization are you responsible for? __________

(b) How many people report directly to you? __________

(c) What positions do you supervise directly?

1. __________ No. ______
2. __________ No. ______
3. __________ No. ______
4. __________ No. ______
5. __________ No. ______
6. __________ No. ______
7. __________ No. ______
8. __________ No. ______
9. __________ No. ______

H. Which aspects of this position do you think the senior people in the organization (Directors, C.E.O., etc.) consider most important?

1. __________
2. __________
3. __________
4. __________

I. With what groups do you communicate, coordinate, perform joint projects or have other official relations?

a. Internal

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

b. External

1. ______________________________

____

2. ______________________________

____

3. ______________________________

____

4. ______________________________

____

5. ______________________________

____

J. What tasks does this position require you to perform?

a. Planning tasks

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

b. Controlling tasks

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

c. Co-ordination tasks

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________

1.J. (continued)

d. Decision making tasks

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

e. Advising tasks

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______

f. Other tasks (staffing, memberships, etc.)

1. ______
2. ______
3. ______
4. ______
5. ______
6. ______
7. ______
8. ______
9. ______

K. Which of the following problems or limitations do you feel affect the ability to perform the functions required of this position? Put an X in the column that most closely represents your sense of the severity of that problem for you and your people.

Problem	No problem (0)	Occasionally (3)	Severe (5)	Don't know (9)
1. Budget limitation	_____	_____	_____	_____
2. Not enough staff	_____	_____	_____	_____
3. Not enough data	_____	_____	_____	_____
4. Timeliness of data	_____	_____	_____	_____
5. Too much data	_____	_____	_____	_____
6. Coordinating with other groups	_____	_____	_____	_____
7. Too many workers to manage	_____	_____	_____	_____
8. Lack of technology	_____	_____	_____	_____
10. Limited staff training/educ.	_____	_____	_____	_____
11. Access to computers	_____	_____	_____	_____
12. Availability of advice on technology	_____	_____	_____	_____
13. defining our information needs	_____	_____	_____	_____
14. ________________ ________________	_____	_____	_____	_____

L. How would you rate each of the following forms of acquiring or delivering information in terms of achieving the goals of this position?

	unimportant					essential
the telephone	1	2	3	4	5	6
written memos and letters	1	2	3	4	5	6
electronic mail	1	2	3	4	5	6
voice mail	1	2	3	4	5	6
individual meetings with those outside your area	1	2	3	4	5	6
group meetings (committees, etc.) with those outside your area	1	2	3	4	5	6
meetings with subordinates	1	2	3	4	5	6
standard computer reports	1	2	3	4	5	6
meeting with outsiders	1	2	3	4	5	6
special (ad hoc) computer reports	1	2	3	4	5	6
magazines, books, etc.	1	2	3	4	5	6
professional groups (meetings, magazines, etc.)	1	2	3	4	5	6
formal reports in the organization	1	2	3	4	5	6
meetings with my boss (supervisor)	1	2	3	4	5	6
fax machines	1	2	3	4	5	6
informal ("hallway") meetings	1	2	3	4	5	6
courier	1	2	3	4	5	6
______________________	1	2	3	4	5	6
______________________	1	2	3	4	5	6

M. In terms of the depth and breadth of computer use in your area of responsibility mark each of the following statements as true or false.

		True	False
1.	The organization encourages creative use of computers	____	____
2.	My staff has adequate training in the use of computers	____	____
3.	I encourage my staff to use the computer	____	____
4.	in general, my staff has a positive attitude toward computers	____	____
5.	we could use the computer more effectively if we got more training	____	____
6.	some of my people spend too much time using the computers	____	____
7.	the computer has significantly changed the way in which we do our work	____	____
8.	The company makes it too difficult to get computer resources	____	____
9.	I find it difficult to keep up with computer developments in my field	____	____
10.	Lack of communication between equipment items (hardware) can be a problem	____	____
11.	I don't have enough information on what hardware is available to deal with the types of problems we face	____	____
12.	I don't have enough information on what software is available to deal with the types of problems we face	____	____
13.	I don't know where to look to find the information I need concerning hardware, software and services	____	____
14.	Use of the computer has helped us identify problems we had never noticed before	____	____
15.	Use of the computer has enabled us to do things we could not do before	____	____
16.	____	____	____

N. What other types of technology are available to your area of responsibility?

1. Electronic mail yes ____ no ____ Used? yes ____ no ____

   How? ____________________

2. Voice mail yes ____ no ____ Used? yes ____ no ____

   How? ____________________

3. Fax yes ____ no ____ Used? yes ____ no ____

   How? ____________________

4. Outside databanks yes ____ no ____ Used? yes ____ no ____

   How? ____________________

5. an information centre yes ____ no ____ Used? yes ____ no ____

   How? ____________________

6. special devices yes ____ no ____ Used? yes ____ no ____

   How? ____________________

7. cellular telephone yes ____ no ____ Used? yes ____ no ____

   How? ____________________

8. pagers yes ____ no ____ Used? yes ____ no ____

   How? ____________________

9. ____________ yes ____ no ____ Used? yes ____ no ____

   How? ____________________

O. Which of the tasks described above in Section J are supported by a computer? How?

1. ____________________ ____________________
____
2. ____________________ ____________________
____
3. ____________________ ____________________
____
4. ____________________ ____________________
____
5. ____________________ ____________________
____
6. ____________________ ____________________
____
7. ____________________ ____________________
____
8. ____________________ ____________________
____
9. ____________________ ____________________
____
10. ____________________ ____________________
____
11. ____________________ ____________________
____
12. ____________________ ____________________
____

P. Following are a number of ways in which the area for which you are responsible might use the computer. Mark each one as True (we do use the computer in this way) or False (we do not use the computer in this way).

	True	False
1. we do not use the computer at all	____	____
2. we use the organization's central computer	____	____
a. we get printed reports from it	____	____
b. we have a printer in our office(s)	____	____
c. we have terminals connected to the computer	____	____
3. we occasionally/frequently use outside consultants for hardware, software, advice, other	____	____

Explain ____

____

	True	False
4. some/all of our workers use microcomputers	____	____
5. some/all of our workers use an information centre	____	____
6. other	____	____

Explain ____

____

"

Q. What output do you, as a manager, get from the computer? This output may be printed, it may be on a screen or it may be in graphical form. It may come from a central computer or from a microcomputer. It may come from within the organization or from an outside source (Government, suppliers, etc.). You may receive it directly or indirectly, that is, through a subordinate or even through another part of the organization.

Please describe each output briefly and rate it on the accompanying scale from 0 (useless) to 5 (invaluable)

Description	Useless				Invaluable
1. ______ ______	0	1	2	3	4 5
2. ______ ______	0	1	2	3	4 5
3. ______ ______	0	1	2	3	4 5
4. ______ ______	0	1	2	3	4 5
5. ______ ______	0	1	2	3	4 5
6. ______ ______	0	1	2	3	4 5
7. ______ ______	0	1	2	3	4 5
8. ______ ______	0	1	2	3	4 5
9. ______ ______	0	1	2	3	4 5

1.Q. (continued)

	Description	Useless					Invaluable
10.	______	0	1	2	3	4	5
11.	______	0	1	2	3	4	5
12.	______	0	1	2	3	4	5
13.	______	0	1	2	3	4	5
14.	______	0	1	2	3	4	5
15.	______	0	1	2	3	4	5
16.	______	0	1	2	3	4	5
17.	______	0	1	2	3	4	5
18.	______	0	1	2	3	4	5

Comments ______

R. Although averages and estimates can be tricky, even dangerous, it is important to develop a sense of how each manager taking part in this project spends his/her time. Please estimate what percentage of you time in an "average" month you spend doing each of the following activities. It is highly likely there are activities which are not on this list - please add them. In the same way some of the activities listed may be irrelevant to your position. Please mark them N/A.

OTHERS INVOLVED → / ACTIVITIES ↓	TOTAL	YOUR SUPERIORS	YOUR PEERS	YOUR SUBORDINATES	CUSTOMERS	SUPPLIERS	GOVERNMENT	CONSULTANTS	ADVISORS	OTHERS	DONE ALONE
GROUP MEETINGS											
ONE-ON-ONE MEETINGS											
USING THE TELEPHONE											
READING NON COMPUTER DOCUMENTS											
WRITING/CREATING MEMOS, REPORTS, ETC.											
WORKING AT A COMPUTER											
TRAVELLING											
STUDYING OR TRAINING											
READING/EVALUATING COMPUTER OUTPUT											

1.R (continued)

Analysis of time spent on the main activities of the function

OTHERS INVOLVED → / ACTIVITIES ↓	TOTAL	YOUR SUPERIORS	YOUR PEERS	YOUR SUBORDINATES	CUSTOMERS	SUPPLIERS	GOVERNMENT	CONSULTANTS	ADVISORS	OTHERS	DONE ALONE
INFORMAL MEETINGS											
THINKING (PLANNING, ANALYZING, ETC.)											
________											
________											
________											
ALL MEETINGS											

COMMENTS ________________________________

____

____

____

____

2. The Person

A. Gender: Male _____ Female _______

B. Age: Under 20 ____ 20 - 29 ____ 30 - 39 ____

40 - 49 ____ 50 - 59 ____ 60 - 69 ____ 70 + ____

C. Highest level of formal education completed:

1. High School ____
2. Technical School ____
3. Some University ____ Degree Sought ____________________
4. Undergraduate Degree ____ Degree Received ________________
5. Some Graduate Study ____ Degree Sought ____________________
6. Graduate Degree ____ Degree Received __________________
7. Other ____ Explain ___________________________

D. Other training & education received: Explanation:

1. Professional designation ____ ___________________________________
2. In-house training ____ ___________________________________

____

3. Other courses ____ ___________________________________

____

4. ________________________ ____ ___________________________________
5. ________________________ ____ ___________________________________

E. Experience (in years):

1. With the company ______________________
2. In this position ______________________

2.E. continued

3. Other positions

a. With this organization — Description — How long?

______________________________ __________

______________________________ __________

______________________________ __________

b. With other organizations — Description — How long?

______________________________ __________

______________________________ __________

______________________________ __________

F. Computer training

a. Mark each of the following statements about the type and amount of computer training you have received as either true (T) or false (F). Where appropriate explain your answer.

1. I have never received any training in computers T ____ F ____

2. I have had in house training T ____ F ____

____

3. I have had instruction (seminars, etc.) from an outside company

T ____ F ____

____

4. I have had some formal education in computing T ____ F ____

Sources — Nature

______________________ ________________________________

______________________ ________________________________

5. I have a degree/diploma in computing T ____ F ____

____

2.F. continued

b. Mark each of the following statements about your interaction with a computer (in terms of your position with this organization) as either true (T) or false (F). Explain your answer where appropriate.

1. I have no relationship with any computer T ____ F ____
2. I occasionally/frequently have reports from a computer delivered T ____ F ____
3. I occasionally/frequently request a predefined report be run T ____ F ____
4. I occasionally/frequently request a report via a terminal T ____ F ____
5. I occasionally/frequently generate reports using a prewritten package T ____ F ____
6. I occasionally/frequently generate a report using a programming language T ____ F ____
7. I occasionally/frequently use a microcomputer T ____ F ____
8. I occasionally/frequently use the information centre T ____ F ____
9. I have (and use) a microcomputer at home T ____ F ____
10. I have a terminal at home T ____ F ____
11. I take a microcomputer on trips T ____ F ____
12. Other (be specific) ____

____

G. Results of Personality Inventory

E/I ____________________ S/N ____________________

T/F ____________________ J/P ____________________

Comments ____

____

____

____

H. In terms of your own use of computers is the following statement true or false? Indicate which by circling the appropriate word after the statement.

I am currently personally using computer-based tools to the greatest extent possible to support me in doing my job for the organization.	TRUE	FALSE

If your response to the above question was FALSE (that is, if there are still opportunities in your position for you to use the computer in more or better ways) please evaluate the reasons below in terms of how much effect each has had on limiting your use of computers. Rate each statement on a scale of 0 (this has had nothing to do with the problems of using computers in my position) to 6 (this has been a major contributing factor in the limited use of computers in my position). Circle the number (0,1,2,3,4 or 5) which best represents the degree of effect of that particular factor on limiting your personal use of computers.

If there are factors which have limited your use of computers which are not on the list please add them to the end of the list and rank them on the 0 to 5 scale. Also, your comments on any aspect of limits on the use of computers by managers would be appreciated.

	not a factor					a major factor
I just don't have the time to learn how to use a computer	0	1	2	3	4	5
I have competent staff to do this sort of thing for me	0	1	2	3	4	5
the organization discourages the direct use of computers by managers	0	1	2	3	4	5
the benefits of being able to use a computer directly don't match the costs in terms of time and effort	0	1	2	3	4	5
the hardware I would need is not available to me	0	1	2	3	4	5
the delay between when I need the data and when I could get it from a computer is just too long	0	1	2	3	4	5
computer programs aren't flexible enough to deal with the types of problems I face in my job	0	1	2	3	4	5
it would take too much effort to get the needed resources from the organization	0	1	2	3	4	5

2.H. (continued)

	not a factor					a major factor
my peers wouldn't understand the output of a computer analysis - they are used to written or verbal reports	0	1	2	3	4	5
I don't think I have the education to be able to use a computer properly	0	1	2	3	4	5
there is no room in my office for a terminal or a microcomputer	0	1	2	3	4	5
using a computer would be an inefficient use of my time	0	1	2	3	4	5
there is no point in me using a computer since few other managers in the firm use them. "There is no-one to talk to."	0	1	2	3	4	5
the training needed to make me an efficient computer user isn't available in the organization at this time	0	1	2	3	4	5
my time is so "broken up" that I don't have the blocks of time needed to do analysis on a computer.	0	1	2	3	4	5
______________________________ ______________________________	0	1	2	3	4	5
______________________________ ______________________________	0	1	2	3	4	5

Comments____

____

____

____

____

I. When deciding whether or not to use a computer system to do (or just to support) any of the tasks which make up you position there are many task characteristics to be considered. Please rank the characteristics listed below in descending order of importance (in terms of computerization). That is, if you could only computerize a limited set of tasks, which characteristics would determine your choice? Give the most important characteristic a 1, the second most important a 2, and so on. Feel free to add (and rank) any characteristics which you consider important but are not in this list.

Characteristic	Ranking
size of the task (number of people involved, time required, etc.)	_____
how often the task is performed	_____
financial (dollar) orientation of a task (as opposed to people, hours, etc.)	_____
complexity of a task (number of interrelationships, number of decision makers, etc.)	_____
value to other departments	_____
internal (company) vs. external (government, suppliers, customers) orientation	_____
the structure of a task (clarity of rules, etc.)	_____
your skills and/or experience (would you computerize things you understand well or those you don't)	_____
tradition ("that's always computerized)	_____
time available to do a task (deadline operations)	_____
value of the task to your supervisor	_____
the need for quick feedback (communications)	_____
________________________________	_____
________________________________	_____

Comments ____

____

____

J. When you must evaluate computer-based tools that you might adopt for your area of responsibility there are many factors to consider. Please rate each of the following factors in terms of importance in such an evaluation. In addition to your own wishes remember to consider the type of work you and your staff do, the groups you deal with, the resources available, the time constraints on decision making and so on.

Characteristic	Irrelevant					Extremely Important
easy to use myself	1	2	3	4	5	6
number of databases accessed	1	2	3	4	5	6
variety of reports and formats available	1	2	3	4	5	6
runs on a microcomputer	1	2	3	4	5	6
developed in our own company	1	2	3	4	5	6
allows a lot of processing flexibility	1	2	3	4	5	6
it will find a "reasonable" answer to a problem	1	2	3	4	5	6
statistical analysis	1	2	3	4	5	6
cost	1	2	3	4	5	6
communication linkages	1	2	3	4	5	6
fits well with our activities	1	2	3	4	5	6
appears to have long term value	1	2	3	4	5	6
fits with the "politics" of our planning and control procedures	1	2	3	4	5	6
has good forecasting models	1	2	3	4	5	6
it will find an "ideal" answer to a problem	1	2	3	4	5	6
fits with other applications in our area	1	2	3	4	5	6
easy for non-tech people to use right away	1	2	3	4	5	6

2.J. (continued)

Characteristic	Irrelevant					Extremely Important
graphics capability	1	2	3	4	5	6
we must be able to modify it with a minimum of effort	1	2	3	4	5	6
it must be maintainable or upgradeable "in house"	1	2	3	4	5	6
it must have "report writer" capabilities	1	2	3	4	5	6
are we buying/producing too early?	1	2	3	4	5	6
it must have good quality documentation	1	2	3	4	5	6
it must provide good training	1	2	3	4	5	6
it must not require extra hardware or system software	1	2	3	4	5	6
it must make no major demands on staff, supplies or equip.	1	2	3	4	5	6
it must have front end flexibility	1	2	3	4	5	6
______________________	1	2	3	4	5	6
______________________	1	2	3	4	5	6

Comments: ____

____

____

____

____

____

3. <u>The Manager's Perceptions</u>

A. How do you believe that the use of computers in your position in the organization compares with:

	Less	Same	Greater	Don't Know
1. other managers in this organization	____	____	____	____
Explain ______				
2. managers in similar fields in this industry	____	____	____	____
Explain ______				
3. managers in this field in this region	____	____	____	____
Explain ______				
4. managers in this field in Canada	____	____	____	____
Explain ______				

B. Rate each of the following characteristics of your organization in terms of its impact of the use of technology in the organization (1 = irrelevant, 6 = extremely important).

	Irrelevant					Extremely Important
1. size of the organization	1	2	3	4	5	6
2. evolution & sophistication	1	2	3	4	5	6
3. level of technology in the indus.	1	2	3	4	5	6
4. intensity of competition	1	2	3	4	5	6
5. management structure	1	2	3	4	5	6
6. type of product or service	1	2	3	4	5	6
7. organization's financial sit.	1	2	3	4	5	6
8. advice available (int. extern.)	1	2	3	4	5	6
9. physical organization	1	2	3	4	5	6
10. type & point of decision making	1	2	3	4	5	6
11. characteristics of comp. dept.	1	2	3	4	5	6

C. Rate each of the following characteristics of your area of responsibility in terms of its impact the use of computers (1 - irrelevant, 6 - extremely important).

	Irrelevant				Extremely Important
1. functions performed	1	2	3	4	5	6
2. size	1	2	3	4	5	6
3. the attitudes of your people	1	2	3	4	5	6
4. support/training from the computer (I.S.) department	1	2	3	4	5	6
5. your attitude toward computers	1	2	3	4	5	6
6. the political "clout" of your area	1	2	3	4	5	6
7. existence of appropriate packages	1	2	3	4	5	6
8. the budget of your area	1	2	3	4	5	6
9. education level of staff	1	2	3	4	5	6

D. For the tasks you perform to fulfil the requirements of your position rate each of the following characteristics in terms of its effect on your use of computers to support that task (1 - irrelevant, 6 - extremely important).

	Irrelevant				Extremely Important
1. size of a task	1	2	3	4	5	6
2. number of times it has been perf.	1	2	3	4	5	6
3. financial content of a task	1	2	3	4	5	6
4. complexity of a task	1	2	3	4	5	6
5. internal vs. external orientation	1	2	3	4	5	6
6. the structure of a task	1	2	3	4	5	6
7. your skills and/or experience	1	2	3	4	5	6
8. tradition	1	2	3	4	5	6
9. time available to do a task	1	2	3	4	5	6

E. a. What do you feel are the most important characteristics of the current computing situation in the organization and <u>particularly</u> in your area?

Positive

Negative

b. What changes do you feel could (or should) be made in the organization and <u>particularly</u> in your area to help middle and senior managers to be able to use computers to better support them in controlling operations, in planning for his responsibilities and in making better management decisions?

1. at the organizational level

3.E.b. (continued)

2. in your area of responsibility

3. on the level of individual managers

c. What do you see as possible problems in future computing

1. in the organization?

2. in your area of responsibility?

F. Do you intend to become more actively involved in the use of computers in your job? If so, how?

G. What reports (or other output) does your area produce for (a) other parts of your organization and (b) other users? Do you see this changing in the next year or two? Why?

4. General Questions

A. Information Processing Activities

How does the use of computer-based information systems affect the way in which the following functions are performed in your area of responsibility (compared to doing them manually)?

1. Data Collected (type, volume, sources, etc.)

2. Processing (type (what if, etc.), amount, coordination, usefulness, etc.)

3. Output (method, quantity, detail, recipients, etc.)

4.A. (continued)

4. Storage (method, location, technology, volume, period, etc.)

5. Control (amount of feedback, location, type, who does it, etc.)

6. Communication (parties, location, frequency, value, etc.)

B. a. Are you familiar with the concept of "end user computing"? How do you feel about it? Do you feel that it could be valuable in your area? How?

b. Are you familiar with the term Decision Support System (DSS)? Explain.

c. Are you familiar with the term Expert System (ES)? Explain

d. Are you familiar with the term Artificial Intelligence (AI)? Explain.

e. Are you familiar with the term Executive Support System? Explain.

C. What does the term "effectiveness" mean to you in terms of managing your area of responsibility in the organization? How do you decide whether or not you are being effective (1) in the short term and (2) in the long term? Who sets the standards by which this effectiveness is measured? How do you feel this effectiveness could be improved?

D. Do you think that computers (microcomputers, the central computer, outside resources, etc.) could help improve your effectiveness? If so, how?

5. Observations

Physical Surroundings

Mode of Activity (focused/multi-tracking)

Attitude - project/researcher

Attitude - CBIS

5. Obervations (continued)

Miscellaneous

Attitude/Use Worksheet

Org.: ______________

Funct.: ____________

Level: _____________

MBTI: ______________

Attitude: Self

0 1 2 3 4 5

Function

0 1 2 3 4 5

Comments/Observations:

Current Use: Self

0 1 2 3 4 5

Function

0 1 2 3 4 5

Comments/Observations:

Intentions: Self

0 1 2 3 4 5

Function

0 1 2 3 4 5

Comments/Observations:

4. <u>Support</u>

Training

Trouble shooting

Turnaround time

Information centre, hand holding, etc.

5. <u>Staff</u>

Number

Structure

Skills

Experience
- technical
- the business/industry
- turnover/vacancies

6. <u>Philosophy</u>

7. <u>Other</u>

Support from senior management

Financial support

Training/education practice

Consultants

Relationships with users

Problems?

Trends?

OUTLINE OF COMPUTING AT SITE ____________

1. Hardware

Central Computing
- Location(s)
- Size
- configuration
- history
- plans

Microcomputers
- number
- locations
- type(s)
- controls - acquisition/applications
- training
- networking
- administrative responsibility

Other
- internal
- external

2. Software

Applications
- developed in-house (users, age, functions, problems, plans, external factors)
- packages
- combination

Support software
- database(s)
- spreadsheets
- word processing
- 4GL's, report writers, etc.
- graphics
- statistics
- other

Administrative authority/control

3. Telecommunications

Mainframes/minis

Micros

External links

Electronic mail/voice mail?

H. Comments

2. The Industry

A. Description ____________________

____

____

____

____

B. Age ____________________

C. Number of players ____________________

D. Competition structure

1. Monopoly _____ 2. Oligopoly _____ 3. Numerous firms _____

4. Pure competition _____ 5. Other ____________________

E. Current Environment ____________________

____

____

____

F. Level of technology: Current ____________________

____

____

Trends ____________________

____

____

G. Regional/National/International ____________________

____

____

P. Driving Force (profit; personality; bureaucratic process; etc.) ____________

Q. Experience With Computers ____________

R. Source of Financing ____________

S. Location of the Computer Function ____________

T. Comments ____________

J. Physical Structure ______________________________

K. Type/Range of Product/Service ______________________________

L. Market Structure & Evolution ______________________________

M. The Organizational Culture ______________________________

N. Corporate Training/Educ. Practices ______________________________

O. Locus of Decision Making ______________________________

OUTLINE OF THE ORGANIZATION

1. **The Organization**

A. Name ______________________ B. Code __________

C. Location ______________________ D. Age __________

E. Sector:

Manufacturing/Processing Continuous _____ Job Shop _____

Services ______________________

Government ______________________

Not For Profit ______________________

Other ______________________

F. Number of employees <100 ____ 100-299 ____ 300-499 ____

500-999 ____ 1000-1999 ____ 2000-4999 ____ 5000-9999 ____

10000-19999 ____ 20000-49999 ____ 50000-100000 ____ >10000 ____

rate & type of growth ______________________

____

G. Workforce Composition ______________________

____

____

____

H. Current revenue ($C) ______________________

rate of growth ______________________

profitability ______________________

____

I. Position in the Industry ______________________

____

____

____

Appendix III - MBTI (Myers-Briggs Type Indicator)

Introduction

This Appendix contains brief descriptions of the classifications used to help evaluate whether personality affects a manager's use of, or beliefs about and attitude towards, computer-based tools.[1] It describes the main characteristics of the two "ends" of each of the four scales on which this model of personality is based - EI, SN, TF and JP. It also contains brief explanations of the four possible combinations of data gathering preferences (S or N) and data processing preferences (T or F).

Extraverts-Introverts (EI)

This scale defines a person's general attitude toward the world around him or her. Extraverts (E preference) are oriented primarily toward the outer world; thus they tend to focus their perception and judgement on people, objects and activities. Extraverts like variety and action. They tend to work faster, dislike complicated procedures (especially ES__ types) and are often good at greeting people (especially E_F_ types). Extraverts are often impatient with long slow jobs but are interested in the results of their job, in getting it done and in how other people do it. They like to have people around (especially E_F_ types) and don't mind the interruption of answering the telephone (again, especially E_F_ types). Extraverts often act quickly, sometimes without thinking, but almost always communicate freely (especially E_F_ types).

Introverts (I preference) are oriented primarily toward the inner world; thus they tend to focus their perception and judgement on concepts and ideas. Introverts like quiet concentration, tend to be careful with details and dislike sweeping statements (especially IS__ types). They have trouble remembering names and faces (especially I_T_ types) and dislike telephone intrusions and interruptions (again, especially I_T_ types). Introverts are interested in the ideas behind their job and tend not to mind working on one project for a long time uninterruptedly and they work contentedly alone. They like to think a lot before they act - and sometimes don't act. Finally, they may have some problems communicating with others (especially I_T_ types).

[1]The classifications and concepts in this Appendix are drawn from Briggs Myers & McCaulley [1985]

Appendix III - MBTI (Myers-Briggs Type Indicator)

Sensing-Intuition (SN)

This scale defines the person's preferred way of perceiving the world. It can be thought of as the way they gather data which will be processed to solve problems. The SN index measures the degree to which a person prefers to use the process of sensing, which reports observable facts or events through one or more of the five senses; or prefers to use the less obvious process of intuition, which focuses on meanings, relationships and/or possibilities that have been worked out beyond the reach of the conscious mind.

Sensing types dislike new problems unless there are standard ways to deal with them and they prefer dealing with known facts and an established order of doing things. They are patient with routine details (especially IS_J types), are impatient when the details get complicated (especially ES__ types) and enjoy using skills already learned more than learning new ones. Sensing types work more steadily, with a realistic idea of how long it will take to do a job (especially IS__ types) and usually reach a conclusion step by step (again, especially IS__ types). They are not often inspired and rarely trust the inspiration when they are. They tend to be good at precise work (especially IS__ types) and they seldom make errors of fact.

Intuitive types enjoy learning a new skill more than using it, like solving new problems and dislike doing the same thing repeatedly (especially _N_P types). They work in bursts of energy, powered by enthusiasm, with slack periods in between (especially EN__ types) and they often reach a conclusion quickly (again, especially EN__ types). Intuitive types are patient with complicated situations (especially IN__ types), are impatient with routine details (especially ENP_ types) and dislike taking time for precision (especially EN__ types). They follow their inspirations, good or bad (especially with inadequate type development) and frequently make errors of fact.

Thinking-Feeling (TF)

The TF scale defines the way in which a person prefers to "process" data that have been gathered by sensing or intuition. Basically, thinking and feeling are processes of judgement. This index determines the extent to which a person relies on thinking to make decisions impersonally on the basis of objective analysis and logical definition of consequences versus using feeling to make decisions primarily on the basis of person or social values.

Appendix III - MBTI (Myers-Briggs Type Indicator)

Thinking (T preference) types do not show emotion readily, are often uncomfortable dealing with people's feelings (especially I_T_ types). They tend to decide impersonally, sometimes paying insufficient attention to people's wishes and may hurt people's feelings without knowing it. They like analysis and putting things into logical order. They can get along without harmony but need to believe that they are being treated fairly. They tend to be firm minded and are able to reprimand people or even fire them when necessary. Thinking types are very oriented toward analysis and respond more easily to people's thoughts than to their values (especially I_T_ types).

Feeling (F preference) types tend to be very aware of other people and their feelings (especially E_F_ types). They are very people oriented and respond more easily to expressed values rather than to thoughts. They tend to be sympathetic and dislike telling people unpleasant or critical things. They often let their decisions be influenced by their own or other people's likes or dislikes. They enjoy pleasing people, even in unimportant things, and they like harmony. Their efficiency may be badly disrupted by office feuds. Feeling types need occasional explicit praise.

Data Gathering/Data Analysis

My research is concerned with the relationships between managers and computer-based tools. Since such tools primarily capture and process data it is important to examine how individuals prefer to perform those functions to determine if any discernable links exist between human preferences and attitudes toward the technology.

There are four possible combinations of data capture (sensing or intuition) and data processing (thinking or feeling). These are:

(1) Sensing/Thinking managers tend to focus on external facts and to analyze problems logically. They focus on the specific details and are very practical in their problem solving. They prefer well defined positions and the extensive use of rules.

(2) Sensing/Feeling managers are primarily concerned with facts that they can collect and verify directly with their senses. Because of their Feeling orientation in data analysis they evaluate facts with a personal and human concern. They tend to be well organized and give great attention to detail.

(3) Intuition/Thinking managers emphasise a theoretical or technical approach to problem solving and they prefer situations which lack structure and require abstract skills. They prefer impersonal organizations that emphasise conceptual skills.

(4) Intuition/Feeling managers rely primarily on intuition when making decisions and generally avoid specific details. They like to be involved with new ideas, concepts and projects, and they prefer to focus on broad themes such as serving society. Their ideal organization is decentralized, has few rules and standard procedures, no strong leaders and loosely defined lines of authority.

Judging-Perceiving (J/P)

The J/P index describes the process a person uses primarily to deal with the outer world, that is, with the extraverted aspects of life. A Judging type prefers to use a judgement process (either Thinking or Feeling) for dealing with the outer world while a Perceiving type prefers a perceptive process (either Sensing or Intuition) for dealing with the outer world.

According to Myers-Briggs Judging types work best when they can plan their work, follow their plan and get things settled and finished. They tend to be satisfied once they reach a judgement on a situation, thing or person but may decide such things too quickly (especially E__J types). They may not notice new things that need to be done and they hate interrupting a project they are on, even for a more urgent one. Judging types don't investigate all aspects of a new chore - they want only the essentials needed to begin their work (especially ESJ_ types).

Perceiving types adapt well to changing situations and don't mind alterations to ongoing activities. They may have trouble making decisions (especially I__P types) and may start too many projects so that they have trouble finishing them (especially EN_P types). They want to know all about a new chore before beginning and may put off unpleasant tasks. But perceiving types tend to be curious and welcome a new light on a situation being studied.

Appendix IV - Recommendations for Policy Makers

This Appendix contains a series of findings and recommendations based on the data and analysis in this thesis. It is a modified version of Chapter 12 but takes a more applied approach to the conclusions and recommendations found there.

The contents of this Appendix are intended to provide guidance to senior management charged with developing policy and procedures for an aspect of corporate computer use in which not much has been available.

Appendix IV - Recommendations for Policy Makers

Introduction

All organizations have a history of computing and each has a unique combination of hardware, software, staff, computer files, policies and procedures which they must live with in the short term. The research in which I have been involved for the past five years has had three levels. The most basic level investigated how middle and senior managers currently use computer-based information systems to support them in their jobs given these constraints.

The next level consisted of identifying and classifying the managers' attitudes toward CBIS and developing an understanding of their intentions concerning such tools for both themselves and their areas of control in the organization.

The most subtle level of the research attempted to identify and evaluate the causes of the use, attitudes and intentions revealed by the first two levels of my research.

My research model

To guide both the research and the analysis of the data collected I have developed a model of what I found to be the factors contributing significantly to managers' current use, attitudes and intentions concerning computer-based information systems (CBIS). Table A below shows the components of that fairly complex model and the relationships among them.

Appendix IV

Table A: The factors in the model and the relationships among them

Factor Affected / Driving Factor	Ind/envr	organiz	demo/per	beliefs	function	tasks	activity	problems	tools	current	intent.
Environment & Industry		X						X	X	X	X
The Organization				X	X	X	X	X	X	X	X
Demographics & Personality type								X	X	X	X
Beliefs & Attitudes									X	X	X
Organizational Function							X		X	X	X
Tasks Performed							X	X			
Activities										X	X
Problem Solving										X	X
Tools & Support										X	X
Current Use											X

Following are brief descriptions of each factor:

The <u>environment/industry</u> - the environment of the organization has little direct effect on the functioning of most managers. Although some of the information used by managers comes from the environment it is, in most cases, filtered through the organization.

But in those situations in which the manager is directly involved with the environment the characteristics of that environment must be defined and evaluated.

The industry can have more direct effects on the organization because of factors specific to that industry including the nature of the customers or the competition or even the degree of Government regulation.

Appendix IV

The organization - Because it was the central factor in this research a model of the organization had to be developed which would describe it in terms of its use of, and attitude toward, computer support for managers. I have included two types of characteristics in my description and evaluation of organizations.

The first consists of objective attributes such as size, location, financial situation type of market. The second type of factor is harder to describe in general terms but includes such factors as the locus of decision making and the attitude of senior managers toward CBIS. I have used the term "corporate culture" to include this type of characteristics.

The manager - Three classes of individual characteristics were investigated in this research. The first was demographic factors: gender; age; length of service with the organization; experience in that position; management level; computer experience; computer training and level of formal education. The second type of characteristic was personality (psycho-graphic) factors as measured by the Myers-Briggs Type Indicator. The final, and least specific, class of factors based on the individual managers was their attitudes toward many aspects of computers and their use (and the beliefs behind these attitudes).

Data about beliefs and attitudes was derived indirectly from answers managers gave to questions during interviews and from my own observations. As the power of the individual over his use (or non-use) of CBIS grows, this could be a key factor in determining his level of use.

My model proposes that the use of CBIS by an individual is affected not only by the characteristics of the individual but by the organization, the function he performs and by the tools and support available.

The formal functions performed by a manager - closely related to the organization is the set of formal functions performed by the managers in the organization. Such functions (e.g., Marketing) are examined both as independent systems performing a variety of tasks and as subsystems functioning within the constraints of the organization.

The tasks and activities which comprise each organizational function - In my model functions are broken down into sets of clearly identifiable tasks such as "prepare the annual budget". All work done in the organization is also described in terms of activities which are the most specific descriptions of how a manager spends his time (e.g., read a report).

Appendix IV

The relationship among functions, tasks and activities in my model had to be flexible since the same function may consist of different activities in different organizations and different individuals complete the same tasks using different sets of activities.

Problem solving processes - this component of my model consists of the models, the heuristics and the processes used by organizations, groups and individuals to deal with "real" problems.

Tools/support available - this is the most traditional part of the model. It consists of a description of the resources available, the classes of applications, systems development alternatives and related factors as they affect the organization or the individual manager.

Current Use of computer-based information systems - What tools are actually being used? How? Why? Are there tools not being used which could be used?

The current use of CBIS by managers is affected by the organization, particularly the culture; the tools and support available; the functions he performs; and by his attitude toward computer-based tools. Current use in turn affects his intentions.

Intentions - No manager seems to be content with the support provided to him by the computing resources in his organization. My interest in this research is to define the types of changes intended by managers and the causes behind those intentions.

In my model intentions are affected by the organization (the corporate culture), the function performed for the organization (and its required activities), the current level of use, the tools and support available and the attitude of the manager.

The relationships among the factors in my model

Most of the data collected and analyzed in my research and the conclusions drawn from them have examined the factors in my model individually. But the relationships among them and, perhaps more importantly, their relative power are also important. No direct questions were asked concerning this but from managers' comment and my own observations some conclusions can be drawn.

Of the components of my model (Table A) the organization was clearly the strongest factor in defining the current use, attitudes and intentions of managers toward CBIS. The second strongest factor was the availability of tools, support and training which is, to a great extent, a specific aspect of the corporate culture.

The third most important factor was the function performed. Differences in both use and attitude were evident between some functions. It is important to note that, to some extent, these differences are caused not by any inherent characteristic of a function but by some other factor (for example Accounting has the most positive attitude but also the most extensive history of computer use).

Personality type had a small effect on use and a little more on attitude at the individual level but it was subsumed to the organization. The one way in which personality can significantly affect the computing resource is if a specific personality type dominates the decision making concerning acquisition and allocation of those resources.

Tasks, activities and, particularly, problems types and problem solving processes had little effect on current use since problems of concern to managers are generally quite standardized. Computers are used to structure and analyze specific or special problems but this is actually done by subordinates, not by the managers themselves.

My findings & recommendations

I have summarized below the main findings of a four hundred page research report as they relate to the men and women charged with developing policy for organizations. Where relevant I have added recommendations on what an organization may want to do about a finding, how they could go about it and, most basically, how they can evaluate the relevance of that finding for them.

Dealing with the environment

All organizations exist in an environment comprised of a number of components including suppliers, competitors, customers and regulators. Many of the managers who took part in my research expressed concern that their information systems are unable to predict changes in their environment, to gather adequate data on the effects of such changes or to support response planning and design. In fact, this was an issue that rated higher than improved internal use of computers for some managers.

Appendix IV

At an operational level many managers also want to be able to use computer networks to help them communicate better with suppliers, customers, regulators and other external groups.

Defining information needs

A number of managers felt strongly that their organization has not "stood back" and objectively evaluated their information needs at all management levels and for the short, intermediate and long terms. To what extent should organizations be spending time planning and rationalizing this resource as they do with physical resources such as buildings, inventory or staff?

Most organizations have in place some form of "steering committee" which allocates computer resources throughout the firm but a number of managers, including some who serve on such committees, felt that they usually look at one application at a time or take a short term view rather than considering the computer factor at a strategic level.

Support for the infrastructure

Before an organization can build sophisticated applications at senior levels they must be able to provide data, hardware, software and technical support at lower levels. Many of the managers in this project expressed concerns about the lack of computing support for infrastructure tasks such as scheduling and cost accounting.

Many also felt that tasks such as budgeting, in which some activities are supported by computing, need upgrading. Although the concept of marginal costs & benefits was never used some managers expressed the belief that resources should be spent first on "core" activities such as these.

Allocating resources

Few managers perceived this as adequate or fair. A number felt that the process was so long, so complex and, in the end, so dependent on "politics" that their use was serious restrained. A number of organizations must soon begin to reconsider both the process for allocating resources and the managers' beliefs about it.

Level of computer use in various functions

It was clear that Personnel and Marketing were the two areas in which the computer is currently used the least at the management level and also that these two functions have the fewest managers with a good comfort level with computers. Accounting has the highest level of use (although such use is usually quite traditional and lacks flexibility) while Planning and Production have islands of sophistication in a sea of processing needs.

Producing reports

Accountants produce the most reports for the organization as a whole. Personnel would produce almost as many reports as Accounting but, because they are relatively "backward" in the development of computer applications, they offer opportunities for development of a number of management applications.

Planning produces reports on an ad hoc, project basis and directs them to the relevant interest groups. Marketing also offers opportunities for ad hoc reports although these will be more oriented to Marketing staff and customers than to the organization as a whole.

Production demonstrated the greatest range of sophistication in reporting - from materials management which can be quite advanced to specialized areas such as Nursing Services in which little true management reporting exists.

Basic tasks performed

Managers described the tasks that comprise their jobs in terms of classes: planning, communicating, coordinating, advising, decision making and "other". Generally managers felt that controlling and coordinating were the tasks they spent most time at and that, while the computer is quite useful in controlling (because of its operational components), there is little support for coordinating. Planning was the third most pressing task and computer support is reported as spotty and, in all cases, inadequate. Advising, decision making and other tasks at the management level were rarely supported by computers.

Other tasks described by some managers were analysis (a few managers with quite advanced computer skills use spreadsheets to support this) and budgeting, which is discussed below.

Organizations and individuals should not necessarily increase the use of computers to support all, or any, of these tasks but such a list does provide a starting point for discussions of uses and priorities.

Appendix IV

Support staff

All managers indicated that they wanted to use the computer more to support them in their function, tasks and activities but most will continue to depend on skilled support staff. For most managers in most organizations this is the best type relationship between them and computers in terms of speed of response, cost to the organization and doing the whole job.

Advanced applications

In the computing field terms such as "Decision Support System", "Expert System" and "Executive Information System" are gaining popularity as applications that are, or will be, essential for middle and senior managers. Should an organization be concerned because they are not providing these tools to their managers (and lower level staff)? In a word: no. Once the organization's information needs have been identified; data have been defined and organized; the required training has been given to staff; and the other components of a corporate plan have begun to evolve, tools such as these will fall into place. In most cases organizations have found that the cost of such sophisticated tools is beyond the payback.

This is not to say that they should not be investigated - but they must be investigated in context.

Local applications

Related to an overview of information needs is the problem of small applications developed by departments or even individuals. These may affect the organization in two ways. First, if such as application is developed by a senior manager the opportunity cost to the firm can be high. Second, no matter where it is developed such an application may be unreliable or it may localize data that is needed at a higher, corporate level.

This is not to say that all locally developed applications are bad but they must be clearly controlled at the policy level. Few organizations now have such a policy in place.

Characteristics of tools

When asked to rate a set of characteristics of CBIS managers tended toward tools that are "user friendly", that perform specific functions they need or that fit in with what is already in place. Few cared where the programs came from or whether they run on the central computer or on a local microcomputer.

Both technical staff and the steering committee must consider these characteristics if they want a particular tool or application to be used by the managers themselves.

The computer centre

The perception of the computer centre by senior managers is generally one of well meaning but overworked technicians who have little sense of what goes on the organization, let alone the needs, capabilities and time restraints of senior managers. Managers are concerned that the functions throughout their area of control are poorly supported by computing - few even envision the installation of DSS or EIS until more basic problems are resolved.

As interviews with the fifty managers in this research proceeded it became clear that most of them saw the company's computer department (by whatever names it is known) as having a direct effect on their current use of computers. An even stronger link was seen between the computer centre and the potential for increased use of computer-based tools in their areas of responsibility - and it was rarely positive.

The managers indicated four ways in which they believed that end users (or potential end users) could be affected by the computer department. The first potential source of problems is restricted resources such as hardware, software, technical advice and other support.

The second source of concern in terms of the development and use of CBIS for management activity is the relationship between the computer specialists and the rest of the organization.

A third concern expressed by managers was the lack of objectivity in the allocation of restricted resources and the fourth was the lack of training for managers - both in computing concepts and in specific applications.

One would have thought that, after forty years, solutions to these basic issues would have become part of corporate policy but such was clearly not the case in most of the organizations I examined.

Microcomputers

Most managers feel that microcomputers have had both positive and negative effects on organizations and individual managers. On the one hand they have brought processing to the user departments with the related understanding of both the benefits and the limitations of this type of processing and have cut down on the time they have to wait to use the computer for a new activity. On the other hand organizations are facing data fragmentation, rising costs and loss of control of both standards and processing as departments expand their local processing.

Research has been done into the process of acquiring this hardware and software and a number of normative models exist. But, related to my research, further investigation is needed into the effect of microcomputers on organizational topics such as the location of data, control over the information resource, changes to information flows and the effect on power structures within organizations.

Data (files) in the organization

Managers expressed concerns about the validity of the data stored on the central computer and about the limited access to that data. The difficulty in linking data from different applications was a problem for some managers as well.

The proliferation of microcomputers led to two problems as seen by many managers. First, the corporate database could become seriously fragmented, making it even harder to link data for higher level "views". The second issue was the security of data created and use on microcomputers: it is much easier for unauthorized individuals to get at it and it is more liable to be lost or destroyed, accidentally or on purpose.

An Information Centre

One factor that will determine the level at which managers will use computers is their comfort with the technical aspects of computing. Communication between users and computer staff has been a problem as long as computers have performed business activities. But when the potential user can chose whether and how to use an application improvement of such links is essential.

Of the six organizations who took part in this project only one was large enough and had enough people with technical skills to develop a true Information Centre. This consists of approximately fifteen programmers who have been "hived off" from the computer centre to a more user friendly location. They provide advice to users one at a time or in small groups. Their mandate is restricted to microcomputers and they provide advice and training about hardware, software and telecommunications.

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All managers at this site with whom I spoke are enthusiastic supporters of the IC although few have used it themselves. One manager commented that they had created an unofficial corporate standard for microcomputing and another described it as "the human face of the Computer Centre".

Despite the costs involved any organization that decides to get into end user computing should have some degree of this type of service for all staff from clerks to the President. Many senior managers have absolutely no background in computing and expressed, sometimes directly, a reluctance to take courses with clerical staff. Others explained that the nature of their work meant they never got to finish a six week lunch hour course. This type of facility (or service) can provide the flexibility needed to get senior managers to partake in some level of training.

Managers whose people had dealt with the Information Centre demonstrated more comfort with computing (although not necessarily more knowledge) than their colleagues and believed it was an important time saving measure for dealing with their needs.

The Director of the IC did tell me, however, that "we have never had a senior manager attend a course".

Two points about this are important for other organizations. First, it is not necessary to set up a fulltime IC - one staff member dedicated to advising two mornings a week will meet the needs of a lot of users. Second, the problem of "missing managers" can be overcome by a focus on training for managers only. Of course, this must come from the top of the organization (as it does in "site A").

Telecommunications

One of the most common and the most popular use of computers reported by managers to whom it is available is communication.

V-mail & E-mail

By far the most popular aspect of computer support for the senior managers who had experienced it was Voice Mail. Although this is basically a computer-controlled answering machine system, it was seen as a solution to at least two problems - telephone tag and keeping in touch while away from the office.

Electronic mail, sending typed messages through a computer system is much less used but those who do use it had two comments: (a) it can be very useful especially since it can give a printed copy of everything and (b) it is pretty useless because no-one except me uses it!

Communication is likely to prove to be the most fruitful short-term way to get senior managers comfortable with the computer. In most organizations the equipment, the software and the technical knowledge already exist. The hold-up seems to come from the corporate culture. In one organization which has installed the E-mail software (but has few users) the President (and owner) commented to this researcher: "it's nice to have you here to take a look at our operation but whatever you do, don't recommend that I get a computer."

Another factor in restricted use is the inertia of tradition. Although many managers taking part in the project complained about the number of meetings that they had to attend, these meetings serve a "political" purpose since they allow the manager to spend time with people from other parts of the organization and to demonstrate why his area is valuable to the organization. In addition, many things can be done at a meeting that never appear on an agenda or minutes.

To successfully use computer communications the manager must separate the structured aspects of meetings (which can be dealt with electronically) from the more dynamic aspects which still require personal interaction. A number of the managers currently using electronic communication (particularly at "site A") reported that they began with vertical communication (mainly down) and gradually moved toward lateral communication with peers located further and further away in the organizational structure. Communication outside the company is used intensively by only a few managers.

Linking systems

As a manager's area of responsibility becomes more computerized two negative things can happen. Separate systems can't "talk to each other" which means that applications at higher levels which require data from multiple systems force the use of a technical person to get things connected. This is time consuming and costly when possible at all.

The second problem is the proliferation of reports from all of the systems providing data to a manager. Theoretically, the higher one rises the fewer (but better organized) reports one should have to deal with. This was not demonstrated by the managers in this research. For example, one senior manager reported receiving fifty reports on a regular basis and another described twenty-three. A common effect of this situation is that managers often spend considerable time integrating, summarizing and evaluating the contents of numerous reports.

In order to overcome these problems the organization must look to linking systems that are currently isolated. This may take place at the file level or at the program level but whichever method is chosen it should be "transparent" to managers and give them increased flexibility, confidence in and control over the output.

Direct & indirect use of CBIS

Most managers describe themselves as "indirect" users of a computer. They mean that they express a need and someone else actually prepares the required information. The support that is felt to be most useful does not reside in the central computing facility but in a more localized group.

One way of doing this is through an Information Centre (see above) but the most common situation is having one person in each area who is knowledgeable about the type of work done in that area (e.g., cost accounting or customer service) and who is also a skilled computer user. This person can use the appropriate hardware and software well enough to meet the foreseeable needs of that manager.

In most cases this situation has arisen informally as one or two people in each department become interested in, and skilled at, using microcomputers or terminals. Each organization should formalize such an arrangement by defining the level of need for such a person in each area and then developing a set of priorities for this type of support. This process goes against the currently popular concept of "a computer on every manager's desk" but it fits much better with the needs and capabilities of most of those managers.

Characteristics of individual managers

When one works at a lower level of an organization two facts about using computer applications are clear:

1. the individual has little or no power to choose whether to use a specific application. If it is part of the job it must be used.

2. there is little choice about how to use a specific application. Aside from basic parameters one's choices are defined by the pre-written programs in the application.

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For middle and senior managers this is not always the case. They often are in a position to use or not use a specific tool, application or report and to decide how they will use it. Because of this I investigated the effects, if any, of a number of characteristics of managers as individuals on their current use of CBIS, on their attitudes toward them and on their intentions about expanded use of such tools.

The characteristics I investigated were: gender; age; length of service with an organization; length of time in the current position; experience using computers; management level (senior or middle); computer training; level of formal education; and personality type as measured by the Myers-Briggs Type Indicator. A few of these characteristics did produce notable effects. For example, managers with the least education prefer traditional, batch reports while those with more education want to develop more capability for ad hoc reports; Extraverted types prefer to deal with people face to face and avoid technology; Introverted (reflective) types prefer to use computer tools in their area of responsibility and are more likely to use computers themselves as are Judging types.

But overall three findings were most evident concerning the characteristics of individual managers:

1. personal characteristics are over-ridden to a great extent by the policies and practices of the organization;

2. managers talk about computer applications in terms of "we", referring either to his area of responsibility or to the organization as a whole - rarely did a manager speak of "I" in terms of computer applications. Because of this, individual characteristics are ameliorated by the characteristics and responsibilities of the function;

3. the limited size of my sample and the complex relationships among the factors in my model mean that each organization should attempt to define the mix of types in that organization and their effect upon the organization's computer policy and practices.

Negative attitudes

A number of managers displayed what could be considered negative attitudes toward the appropriateness of CBIS as a support tool for them (or their positions). The organization, before imposing a tool on such managers should consider that this attitude represents one of three situations:

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1. The manager has a negative attitude which he will not change. This may arise from a lack of understanding, from resentment, from fear of change or replacement or some other personal source. There are two ways to resolve this situation.

   First, don't bother to provide computer support to that person. This solution will usually prove to be short sighted and represents an example of the problem of confusing the position and the incumbent. If the tool is appropriate for that job it must be used by the incumbent.

   The second alternative is to move the manager to an area where this attitude will do no harm (or even to retire him).

   NOTE this situation is particularly severe in cases in which the negative attitude affects not only subordinates but others throughout the firm (as in the problems with E-mail use cited earlier in this report).

2. The manager has a negative attitude but it can be changed. Solutions range from training (internal or external) to temporary movement to a highly computerized area for experience to provision of a technically experienced support person in the manager's area.

3. The manager is right. There are some positions, particularly those involving a high level of face to face tasks or travel in which computerization is not appropriate. The type of analysis described in the preceding section should be used to re-evaluate the intended application.

Enthusiasm

The inverse of reluctant managers is enthusiastic managers, of which a number were found in this research. Obviously this is generally better than managers with negative attitudes but it can have a pitfall. These managers, through pressing for more and more sophisticated hardware and software for their people and themselves can not only wind up with inappropriate tools which waste a lot of his time and effort but can skew the spread of such resources throughout the organization. This in turn can create resentment from managers who feel that they and their areas of responsibility are under served.

The "black box" model of CBIS

Most of the managers interviewed in this research have little formal training in the concepts or applications of CBIS and many do not distinguish among the four aspects of an application: capturing input; storing and accessing data (files); processing input and data; and producing output in some form.

Managers tend to see an application as a black box; at best they see input, processing and files as a set of black boxes. In order to improve computer support for senior managers the organization does not necessarily have to invest large amounts in hardware, computer packages and more staff. It can begin by examining in more detail the specifics of each of these aspects of computer applications, particularly as they relate to middle and senior managers. Questions to ask should include:

What information is currently available to middle and senior managers? How complete is it (from the users' point of view)? how concise? how relevant? how timely? how flexible? how much control do managers have over the data they receive? what is the relationship between receiving data and <u>using</u> it?

What are the strengths and weaknesses of our current input? Are the data that will be needed to produce this information needed at senior levels actually being captured? What alternative sources can we tap into?

What files are currently kept on computers in the organization? Are these available to end users with no technical training? What about timeliness of data? security? Linking separate files?

What software (programs) are available to help this type of user access data and prepare reports? How user friendly is the software? how flexible? who controls it? is there a generic, user friendly interface?

<u>Levels of use</u>

End user computing is a catch-all term that describes everything from accessing an online file through a terminal to creating a sophisticated application from start to finish. None of the managers interviewed reported the latter level of use but a number do use a terminal occasionally and six (of fifty) reported using packages on microcomputers.

For the organization a basic issue is determining what level of use is appropriate for the incumbent in each position. For clerical staff and lower level managers this is straightforward. But it certainly is not for middle and senior managers. Intervening factors include his personality, his education, prior experience with computers and attitude toward technology.

It is unlikely that an organization can develop a blanket policy for the level of use for each manager but a general policy defining equipment available, training and goals for management computing will provide useful guidance.

Training

Many managers complained that lack of training for people at their level is a major reason for their limited use of computer-based tools. The conclusion I draw from my research is somewhat different. Training should be pursued but the managers should look at it not as learning how to sit at a keyboard to "crunch" data and produce reports but as a way of doing four things:

1. Learning what a computer can actually do (and what its limitations are).

2. Determining what hardware and software are available for his area of responsibility.

3. The true costs and benefits of using a computer directly.

4. Learning how to express requests for the information needed to support him in doing his job and, in many cases, who to make the request to.

Other topics

In addition to interviews managers were asked to answer a series of structured questions on a number of topics which appear to affect their current use of computers, their attitudes or their intentions.

All managers felt that they were constrained in their use on computers by limitations imposed by the organization. The most common complaints were: lack of local computer hardware; lack of packages to do the job; lack of training in principles of computing; lack of support staff and lack of support for the creative use of computers in the organization.

Managers still spend much of their time communicating face to face or by telephone. But managers who have been exposed to Voice Mail were universally enthusiastic about its ability to cut down on both meetings and time spent on the telephone. Electronic mail was believed to have the same potential but managers who have tried to use it are frustrated because many colleagues ignore it.

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Marketing managers are the most reluctant to use computers for communication while Production and Accounting managers are the most enthusiastic.

Managers' direct use of computers is limited by lack of time, training and user friendly tools but the primary cause is the availability of competent support staff. This is an important finding in this project since it indicates that training and friendlier tools may not increase such use. Would it actually be counter productive for most managers to use computers themselves? (The most senior managers are the most concerned that "the benefits don't equal the costs for me".)

The managers perceive the size of the organization, the products and services offered and the degree of "evolution" as the leading factors in the firm's level of computer use while structure is considered the least important. Since the first characteristic affects the tools available, the second the types of information needed and the third the sophistication of the users these results indicate that smaller, less developed firms should be careful of moving too swiftly into management computing unless they have a complex set of products and services requiring planning, coordination and control. Each organization must determine how their mix of these factors should direct the development of CBIS.

The responses from the managers concerning the ways in which they actually spend their time generally reflected past research. Meetings are still by far the most common activity and most managers also indicated that a lot of time is spent on the telephone or reading reports. Accountants spend more time preparing and reading reports while Marketing managers spend much less time on this activity than those in the other functions.

For each organization the question to be answered in the future is: how can the computer supplement or replace some of these activities in an effective way? As is discussed elsewhere in this report the managers at "site A" were very enthusiastic about voice mail since it cut down on both telephone and written communication.

Managers often expressed frustration that so little of their time (less than 10% overall, less than 4% at "site E") is spent on planning and analyzing. Can the computer effectively support these activities?

On the other hand, although a number of managers expressed concern that they are behind their colleagues in actual use of computers, over 80% of managers interviewed reported that they spend 0% of their time using a computer and none reported spending more than 4% of his time with a computer.

There were no significant differences reported among managers in the five functions (Accounting/finance; Marketing; Personnel; Production and Planning) in terms of which characteristics they felt impelled or restrained the use of computers in their area of responsibility. The three leading reasons for computerization were: the tasks performed for the organization; his attitude toward computers; and the attitudes of his people. Ranked lowest were the size of the area and its budget (perhaps because computing is usually a corporate budget item).

I also investigated which characteristics of a particular task managers felt made it most amenable to computer support. Managers described the number of times a task is performed; the size of a task; and the need to meet deadlines as the main reasons a task should be computerized. Complexity and special needs were rated much lower indicating an ongoing bias toward operational level high volume tasks.

Are there particular characteristics that make a computer-based tool attractive to managers? When asked to rate a set of characteristics of CBIS managers leaned toward tools that are "user friendly", that perform specific functions they need or that fit in with what is already in place. Few cared where the programs came from or whether they run on the central computer or on a microcomputer. "Are we getting involved too early?" was rated very low and the managers' normal comment was "That's certainly not an issue around here. We seem to always be playing 'catch up' in computing". There were no significant differences in preferences between the organizations I investigated; between the various functions or between personality types.

Summary

All organizations have a long way to go before they meet all the requirements (needs? wants? demands?) of middle and senior managers in terms of support for their area of responsibility by computer-based information systems. But, in most organizations, the resources which will be available to improve the situation will increase little in the foreseeable future. However, some consensus on a set of priories has emerged from my research which may help guide the organization in developing applications to support higher levels of management.

1. Operational level systems must be completed and connections among them must be simplified so that

management level applications can be built on them. Each application should be looked at in terms of input, processing, storage, output produced, controls required and the other applications with which it should (must?) work.

2. An information requirements plan must be developed at the highest levels of the organization to put the use of hardware, software and people resources in context. Cost/benefit analysis should be ameliorated by longer terms considerations such as employee training, ease of use and service to customers or other external groups.

3. Many managers discussed some aspect of their organization's "data resource", usually from a negative point of view. The organization should take a long look at their computerized data base in terms of its contents; its validity; its accessability to managers; and its security.

4. Most managers have no interest in becoming direct users of CBIS. They feel it would be inefficient and inappropriate. The organization should consider developing in each area at least one person who can act as an intermediary with technical staff and a specialist in the processing required by that department.

5. Telecommunications is an aspect of computing that offers a quick and obvious payback but it must be supported (and used) at the highest levels if it is to succeed.

6. Training for managers in a number of aspects of computer and improved communications between computer specialists and user/managers must be improved if senior managers are to be willing to commit their own time and the resources of their area of responsibility to more sophisticated applications.

7. A model for the provision of local support to managers is another aspect of an overall plan that could both relieve the staff in the computer centre of some of the smaller tasks they now do for users and provide the users with faster, more focused access to data. Of course, this will require more than just a warm body in each department - hardware, software, training and communications must all be part of this model.

8. Managers spend a great deal of time working in groups. This is a specific set of activities for which computer support will have a rapid payback for

the organization. Elimination of meetings; better preparation; or simply cutting down on travelling are all possible benefits. Of course, the "corporate culture" may work against this - to what extent do meetings in your organization perform functions other than dealing with the formal agenda?