

A STUDY OF THE CORPORATE USE
OF
PERSONAL COMPUTERS

Judith A. Quillard
John F. Rockart
Eric Wilde
Mark Vernon
George Mock

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Center for Information Systems Research
Sloan School of Management
Massachusetts Institute of Technology

1.0 Introduction

A recent cover story in Business Week began, "The personal computer is sweeping into corporate offices on the wings of a popular revolt". The article, entitled "Computer Shock Hits the Office", quotes predictions by International Data Corp. that 1.85 million "desktop machines" will be shipped to U.S. business managers and professionals in 1983. This number is more than twice the 1982 total, and the projection for 1985 is well over 3 million. To quote Business Week's summary of the impact these personal computers are having:

The results already are astonishing. Even those managers who type only by the "hunt and peck" method are now using their desktop computers to do everything from analyzing financial data to sending their mail electronically and tapping into large corporate databases. [Business Week, 1983]

Time-sharing has long been available to corporate users. Its use began to grow significantly when "user friendly" packages such as RAMIS, FOCUS, and NOMAD, became available. Now the personal computer is being adopted by users as an easy-to-learn, flexible, fairly powerful tool.

This report presents the results of a research project which studied the use of personal computers in large corporations. During the November 1982 to April 1983 timeframe, eighty-three users of personal computers and thirty-four information systems managers in ten major U.S. firms were interviewed. The research was a continuation of a previous study on the corporate use of time-sharing conducted at the Center for Information Systems Research. (See Rockart and Flannery 1981, 1983a, 1983b.) The focus of both projects has been on how to effectively manage end user computing.

We view our findings regarding personal computers as being a picture at a particular point in time of a quickly evolving phenomenon. This picture, however, yields some valuable insights into what is proving to be a major trend affecting most U.S. corporations.

The remainder of this report is divided into seven major sections which represent both our findings and our interpretation of these findings. The next section discusses the results of the original CISR study of end user computing (EUC) and reviews some of the literature regarding the use of personal computers by corporate managers and professionals. Section 3 gives an overview of the study methodology and the ten research sites.

The findings from the project are presented in the four subsequent sections. Section 4 focuses on the users of personal computers. Characteristics such as prior computing experience, initial training on personal computers, and users' sources of ongoing personal computer (pc) support are presented. We also discuss the overall impact the use of a pc is having on these individuals' jobs. Section 5 examines the applications for which personal computers are being used. The type of application, why a pc was selected, who developed it, the development tool, and the source of data are the major areas discussed.

In Section 6, we turn to the information systems (I/S) department's perspective of the corporate use of personal computers. The strategies, policies, and standards that these ten firms have adopted will be discussed. Then, Section 7 will examine support organizations and support services. The users' opinions concerning specific services will be explored.

Finally, Section 8 contains the general conclusions and recommendations from the project. We will probe the differences between personal computers and time-sharing as end user computing tools and the impact personal computers are having on the I/S department. Our recommendations will stress the importance of setting strategy for pc use, of defining the responsibilities of I/S management and user management, and of providing appropriate support. These recommendations concerning overall management issues are essentially in agreement with those from the earlier CISR study of time-sharing users.

2.0 End User Computing

The growing use of personal computers in the corporate environment is an integral part of the phenomenon of end user computing. In this section, we will review the results of the first CISR study of end user computing and examine some of the many articles concerning personal computers as an end user tool.

2.1 CISR Study of Time-sharing Use

"The Management of End User Computing: A Research Perspective" [Rockart and Flannery, 1983a] contains the results from CISR's first EUC study which focused on time-sharing users.* This research project interviewed 200 end users of time-sharing systems and 50 I/S managers. A major, not unsurprising finding, was a 50-100% annual increase in the use of time-sharing by managers and professionals to perform a variety of tasks. Four major factors underlying this growth in end user computing were identified in CISR's study [Rockart and Flannery, 1983a, pp 3-4]:

1. An awareness of the potential of computer-based tools in facilitating decision-making and improving productivity;
2. Improvements in technology, both hardware and software, which make computing easier and less costly;
3. The general business and economic environment which has intensified the need for more effective analysis, planning and control; and
4. The inability of the I/S department to satisfy the demand for new applications because of the large systems development backlog in most organizations.

In the paper, Rockart and Flannery present their findings including a categorization scheme for end users and a categorization of applications.

*A version of this paper has recently been published in the Communications of the ACM [Rockart and Flannery 1983b].

These categories will be described later when we discuss the personal users and applications. Their recommendations for managing EUC encompass the areas of strategy, control, and support. Some of their key findings and recommendations are summarized in Figure 2.1

2.2 Literature Review of Personal Computer Use in Corporations.

While the use of personal computers by managers and professionals appears to be spreading rapidly, articles about the corporate use of personal computers have already become ubiquitous.

From articles appearing primarily in the business press and I/S trade journals such as Bayle (1982), Wohl and Carey (1982), Marengi (1982), Small Business Computers (1982), and Business Week (1983), an overall view of the use of personal computers in corporations can be gained. The composite picture is one of increasing growth in the use of personal computers by managers and professionals. Personal computers and software packages such as spreadsheets are making computing tools more widely accessible than ever before. This accessibility is due both to the relatively low cost of the personal computers and to the ease-of-use and flexibility of the software. People are finding the pc to be a useful tool for analyzing, manipulating and presenting information. For the most part, the phenomenon has been driven by end users, as personal computers are being acquired directly by the people who use them. There is no clear consensus regarding the appropriate management and control policies for pc use.

Examined more closely, and setting aside the technically focused pieces, the articles can be divided into four broad categories. First, there are a number of articles that discuss the advantages and benefits people can gain from the use of personal computers. For example, G. David Hughes in a Harvard Business Review article [Hughes, 1983] discusses how personal computers can make sales representatives more efficient. Deborah Wise, in Infoworld, [Wise, 1982] interviewed stock brokers and analysts who have found personal computers to be a productivity aid.

FIGURE 2.1

Results from Rockart and Flannery Study of EUC

- o End users can be classified into six distinct types; each type needs differentiated education, support, and control from the I/S function.
- o End users are primarily in staff functions. They develop and use a wide spectrum of application ranging from "operational systems" to complex analytical programs.
- o Organizations need to have a strategy for end user computing. New corporate policies are needed to address such areas as justification and pricing of I/S services.
- o A "third environment"(in addition to the traditional COBOL and time-sharing) must be developed by the I/S department, in order to effectively manage the growing number of multi-user applications with large departmental or multi-departmental databases.
- o A "distributed" support organization should be developed. I/S should involve "functional support personnel" (end users in each functional area who spend most of their time programming and aiding other end users) in the I/S end user management process.
- o A major education program for I/S personnel, line management and end users needs to be developed.
- o Effective mechanisms and procedures for allowing users access to corporate data are needed.
- o Control needs to be exercised, primarily through line management.
- o I/S can provide "environmental control" (e.g., hardware standards, software standards, etc.) through incentives.

Source: Rockart and Flannery 1983a, pp 20-27.

A second category concerns drawbacks and problems. The issues raised include both that users will waste time programming [Kinne, 1982] and that applications critical to the business will be implemented on personal computers without adequate controls/backup/documentation [Business Week, 1982]. Other questions concern accessing corporate data via personal computers [Krass and Wiener, 1981]. Problems related to data management, such as maintaining the integrity of corporate databases and preventing users from creating and using inconsistent and/or redundant data are raised in articles such as [Business Week 1982] and [Kinne, 1982]. Another data-related issue has been dubbed "VisiSnowing" by Steven Caswell, President of Network Innovations of Ottawa. It is the danger that people will unquestioningly believe the output from a pc because it is computer generated. [Business Week, 1982] [Kinne, 1982] [Zientara, 1983a]

Next, there have been articles which attempt to present the opinions of individual I/S departments, or I/S groups in general, concerning personal computers. In general, the I/S opinions have ranged from mixed [Bayle, 1982 and Johnson, 1982] to positive [Zientara, 1983b and Data Decisions, 1983]. However, many articles exhort I/S managers not to regard personal computers as a threat [Infosystems, 1982 and Hoard, 1983].

Finally, there have been a growing number of articles offering advice on how to manage the growing use of personal computers in corporations. These articles often focus on the role I/S departments should play in controlling and supporting the use of personal computers. [Ewers, 1982 and McKibbin, 1983].

3.0 Methodology

Ten major U.S. corporations participated in this study. Figure 3.1, while disguising the company names, lists their approximate sizes and general industries. Although the firms represent a number of industries and differ in their corporate structure, they are all similar in having active pc use by a significant number of people. More detailed descriptions of each company are presented in five masters theses [Cagnoli 1983, Mock 1983, Vancollie 1983, Vernon 1983, Wilde 1983].

The data was collected in two phases. Four companies were visited in November - December, 1982. Trips to the other six companies occurred during January - April, 1983. In total, we met with 83 users of personal computers and 34 I/S managers.

Structured interviews were conducted at each company with seven to twelve personal computer users in as many functional areas as possible to obtain a broad-based sample of attitudes and applications. In addition, structured interviews were conducted with information systems (I/S) managers. At the four companies visited during the first phase, we met with one or two I/S managers with responsibility for supporting end users. During the second phase, we interviewed the corporate director of I/S in four of the six firms and two to five I/S managers responsible for supporting end users.

Beyers & Schepens, the accounting firm, differed from the other companies because their divisions (as opposed to their corporate I/S department) had primary responsibility for supporting pc use. Thus, at Beyers, the "pc policy/support" viewpoint was primarily provided by a partner who was head of the company-wide pc policy committee and to whom reported the support group for the tax division.

FIGURE 3.1

Ten Firms in the CISR Study of Personal Computer Use

Alexander Hamilton Bank	Top 25 commercial
Allnut Brands	Food products; Fortune 100
American Electronics	Over \$5 billion; R&D division
Beyers & Schepens	"Big 8" accounting
Blaine Corporation	Personal care products; \$2 billion
California Beverage	Fortune 100
Dobbs Insurance	Top 10 in assets
Jupiter, Inc.	Energy; over \$10 billion
Marlowe Plastics	Over \$1 billion
Weston Industries	Industrial Products; \$1 billion

3.1 Interview outlines

Four different outlines were used for the interviews which address the following persons and issues:

3.1.1 Director of Information Systems

When possible, the corporate director of information systems was interviewed to obtain a broad framework for the role of personal computers in each company. We were interested in learning the history of end user computing in that firm and then discussing the corporate I/S views on the perceived benefits and/or drawbacks of pc use.

3.1.2 Manager, End User Computing Support

These interviews provided a detailed framework for understanding the role of personal computers in the ten companies, which included the organizational structure of I/S and the history of personal computers in each company. Topics covered in the interview included controls on pc acquisition and use, standards for hardware software, data, and applications, and specific support services offered or planned.

3.1.3 User, Personal Computer

We interviewed between six and twelve users in each company and gained information on their familiarity and expertise with computing in general and their reasons for using a pc. A detailed look was taken of the applications and pc hardware and software configurations. We were concerned also with the effect(s) that the pc has had on the way in which users perform their jobs. Finally, we surveyed users' attitudes towards support services for personal computers.

3.1.4 Application Summary

Each user was asked to discuss his/her one or two most important applications in detail. Specific questions covered the purpose the

application serves, its importance and scope, the periodicity of use, the reason for choosing a pc, and a detailed summary of how it was developed and the software tools used for the development.

3.2 Potential Biases

Given the nature and timeframe of this study there are potential biases present in our sample that should be identified. First, the ten companies were all advanced in their progress in the area of pcs. This was intentional as we preferred firms that had a sizeable base of users and had taken some time to think about the issues involved with the corporate use of pcs.

In addition, it should be noted that the user selection was not random. Our contacts within the I/S departments arranged the user interviews based upon our request to interview users in a variety of departments. We also asked for users who had not just started working with a pc.

It is hard to speculate on the effect this lack of randomness has on our results. However, two important facts did come out during our interviews. First, we found several users who were by no means pleased with their I/S departments and were quite candid about their views. Secondly, and somewhat surprisingly, we found I/S departments to be not particularly familiar with what users were doing. Consequently, I/S did not have complete knowledge of what we would see. These two facts imply that while our sample was not random, at least some of the most obvious potential biases were probably not very strong.

4.0 The Users

This section presents a profile of the personal computer users who were interviewed. First, they will be categorized according to the six types of end users identified by Rockart and Flannery. Then the users will be described in terms of their job functions, past computing experience, and their sources of initial awareness of personal computers, initial training, and ongoing support. The section will close with a discussion of the impacts personal computers are having on people's jobs.

4.1 Types of End Users

Rockart and Flannery (1983a) define six distinct types of end users. Their categorization scheme is based on their observations of "the computer skills, methods of computer use, application focus, education and training requirements, support needed, and other variables" of 200 time-sharing users. This categorization, which is summarized in Figure 4.1, is relevant and useful in describing the people interviewed as part of the personal computer study.

Figure 4.2 shows the classification of the 83 pc users. The most common types, as expected, were "command level users" and "end user programmers". It should be noted that, for the most part, these end user programmers were not utilizing traditional programming languages, e.g., BASIC and FORTRAN. Many of them were using software tools such as Visicalc and DSS/F to develop sophisticated, complex models. Often they were familiar with several software packages.

Noticeably absent from our sample were dependent users. Except for the one user at Alexander Hamilton Bank, all users performed at least some queries and personalized report generation. The absence of dependent users could be explained by a number of different factors. One is that dependency requires extensive support including applications development and various personalized services. These types of support are often not available for pc users. Another explanation may be the

FIGURE 4.1

Rockart & Flannery Classification of End Users

Non-programming end users	Access computerized data through a limited, menu-driven environment or a strictly followed set of procedures. Use software provided by others.
Command level users	Perform inquiries and simple calculations such as summation and generate unique reports for their own purposes. Understand the available database(s) and are able to specify, access, and manipulate information.
End user programmers	Utilize both command and procedural languages directly for their own personal information needs. Develop their own applications, some of which are used by others. (This latter use is an incidental by-product of what is essentially analytic programming performed on a "personal basis" by quantitatively-oriented managers and professionals.)
Functional support personnel	Support other end users within their particular functional area. By virtue of their skill in end user languages, have become informal centers of systems design and programming expertise. In spite of the large percentage of their time spent supporting other end users, these individuals do not view themselves as programmers or DP professionals. Rather, they are market researchers, financial analysts, and so forth, whose primary tasks is providing tools and processes to access and analyze data.
End user computing support personnel	Usually located in a central support organization such as an "Information Center". Their exact roles differ from company to company. Most are reasonably fluent in end user languages and, in addition to aiding end users, sometimes develop either "support" or application software.
DP programmers	Similar to the traditional COBOL shop programmers except that they program in end user languages. Some firms have a central pool of these programmers to provide service to end user departments wishing to hire "contract programmers" and to build a larger base of knowledge of end user languages within the corporation.

Source: Rockart and Flannery 1983a, pp. 6-7.

FIGURE 4.2

Personal Computer Users: Rockart & Flannery Classification

Non-programming end users	1
Command level users	29
End user programmers	30
Functional support personnel	17
End user computing support	<u>6</u>
	83

FIGURE 4.3

The Users: Functional Classification

STAFF		68
Corporate Strategy/Planning	11	
Marketing	4	
Finance	15	
Scheduling/distribution/purchasing	10	
Personnel	2	
Research & development	9	
Engineering	3	
Information systems	10	
Other	4	
LINE		15
Management	9	
Marketing/sales/consulting	6	
		<u>83</u>

bias of our sample selection process. Some managers indicated that their secretaries are using personal computers in a dependent fashion (usually for data entry with applications developed by the manager), but I/S did not know about these users and hence we did not interview any of them.

4.2 Functional Classification

Figure 4.3 shows the functional classifications of the 83 users. A majority of the users occupied staff positions although there were a number of line managers. This parallels what Rockart and Flannery (1983a) found in their study in which usage was concentrated in the major staff groups.

4.3 Computing Experience

The 83 personal computer users have a range of previous computing experience, as shown in Figure 4.4. However, previous computer experience cannot be taken to definitely predict level of personal computer use, although there are some patterns. The matrix in Figure 4.5 shows, for the three largest end user classifications and various levels of prior experience, the number of people in each category. From this table, one can generalize that most "user programmers" and "functional support" types have had at least some prior programming experience. Also, at this point in time, most of those pc users with little previous computer experience are at the "command level".

Figure 4.6 shows that users, in general, feel they have at least a moderate level of technical understanding of personal computers. With the exception of American Electronics and Marlowe, in each of which technical understanding was rated as high, however, we saw users across the entire range of "knowledge" within each company. The reason for the skewed distribution at American Electronics can easily be explained by the fact that we talked exclusively with engineers. At Marlowe, however, the explanation is not as easy. A number of factors may be responsible. These include the number of home-hobbyists among our sample, and the

FIGURE 4.4

<u>Previous Computing Experience</u>	
DP (or computer professional)	11
Non-DP, but significant programming experience	15
Some programming experience	19
Significant use of high level fourth generation software tools	3
Some use of high level tools	5
Experience with word processors or other specialized applications (e.g., airline reservation)	3
Other (e.g., CAD)	1
Little experience with computers	24
(No response)	2
	<hr/>
	83

FIGURE 4.5
Prior Experience by End User Type

<u>Prior Experience</u>	<u>Type of End User</u>		
	Command Level	User Programmer	Functional Support
DP professional	2	2	5

Significant programming	2	9	3

Some programming	3	10	4

Significant use 4th gen. tools	2	1	0

Some use 4th gen.	2	2	1

Specialized and other experience	1	1	0

Little computing experience	17	5	2

Note: This table contains data for 74 of the 83 users in our sample.

FIGURE 4.6

Level of Technical Understanding of the PC Field

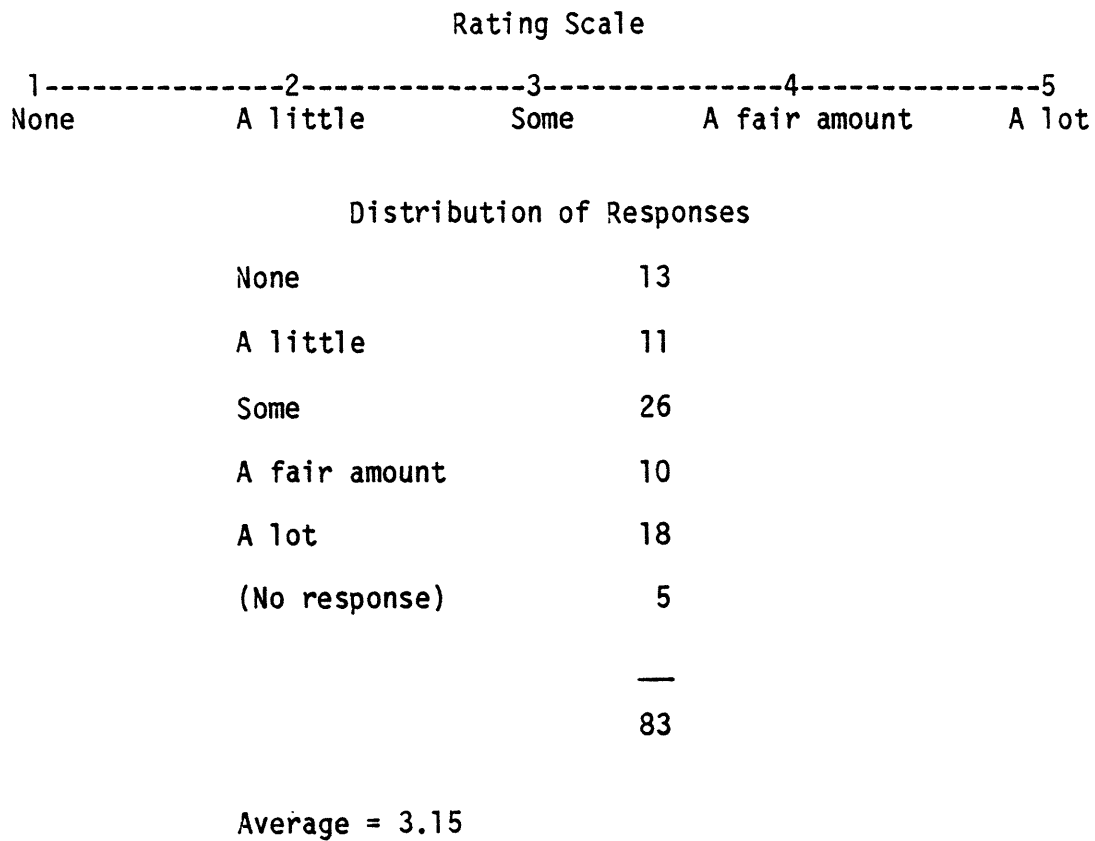


FIGURE 4.7

Source of Initial Education/Training

	No. of users
Manual/self-taught	73
Course	6
Peer	11
Other	4
(Multiple Answers Allowed)	

availability of IFPS and FOCUS on time-sharing which reduce the need for a pc for many users.

These ratings indicate it is not necessary to feel that one fully understands this technology to take advantage of the benefits it offers. Many of the less knowledgeable users did indicate a desire to learn more, but this seemed to be more out of a desire to understand an interesting technology rather than a necessity to get more out of the machine.

4.4 Sources of Initial Awareness, Training, and Ongoing Support

The mass marketing of pcs does seem to be having an impact. Thirty-one of the users we spoke with indicated they first became aware pcs could be useful in the corporate environment through the mass media. The next closest factor was exposure through peers which was mentioned by twenty-five users. Other sources of awareness mentioned by users were their managers, I/S (especially at Jupiter where I/S was highly proactive towards pc use), exposure at home, professional literature, and exposure to personal computers in computer stores.

Another descriptor of the users, as shown in Figure 4.7, is the way in which they learned to use their personal computer. Seventy-three of the 83 users said they taught themselves primarily with the manual. Courses, peers, and other ways were mentioned only 21 times in total. Clearly, users of all backgrounds and experiences are turning to the manuals and teaching themselves by trial and error.

Although most of the ten firms had established formal pc support groups, Figure 4.8 shows that a significant number (28%) of users feel self-sufficient. Also, for ongoing support many users (21%) turn to someone within their department, often on an informal basis. These statistics indicate many of the current pc users feel they and other users have enough knowledge to solve most of their own problems. The fact that most of these users have learned by reading the manuals and by trial and error on the machine may explain part of this. Section 7 will look more broadly at the question of support.

FIGURE 4.8

Sources of Personal Computer Support

	<u>No. Times Mentioned</u>	
Formal pc group within I/S	13	16%
I/S department	13	16%
Formal group in user dept.	5	6%
People in dept. informally	17	21%
Self-sufficient	22	28%
Computer stores/Other	10	13%
	—	—
	80	100%

(Data from 70 Users; Multiple Responses Allowed.)

FIGURE 4.9

Amount of Personal Computer Use

<u>Category</u>	<u>Hours of Use per Week</u>	<u>No. of Users</u>
Occasional	less than 2 hours	9
Frequent	between 3 and 9 hours	19
Consistent	between 10 and 14	13
Heavy	between 15 and 19 hours	7
Dedicated	over 20 hours	14
No response		21
		—
		83

The importance of this general picture of the users is the indication that people are formulating their own opinions of the usefulness of personal computers and are capable of operating independently. They are able to learn about personal computers on their own time, using resources they feel comfortable with, rather than relying on I/S to provide them with information.

It should be cautioned, however, that this picture of relative self-sufficiency may not always hold true. From the perspective of research concerning the diffusion of innovations, the users we interviewed are most likely the "innovators", "early adopters", and perhaps some "early majority" types. (See Rogers and Shoemaker, 1971, Chapter 5, for a description of the five categories of adopters of innovations. The other two categories are "late majority" and "laggards". People are classified on the basis of when they began to use the innovation.) It is well established in innovation research that the different categories of adopters have different personality traits, socioeconomic characteristics, and communication behavior. Because of the obvious implications for education, training, and ongoing support, organizations should be aware that the nature of the user population is likely to change as the use of personal computers spreads.

4.5 Amount of Use

The length of time users spend at their personal computers varies significantly. Among the 83 users we interviewed the average time per week spent on the pc was 12 hours. There were, however, responses ranging from 2 to 40 hours per week. Figure 4.9 summarizes these responses in terms of a classification scheme similar to that developed by Cagnoli (1983, pp 76-77).

The results indicate that people are actively utilizing their personal computers, but are rarely doing the bulk of their work on the pc. (The reader should be reminded that our interviewees were selected by people within I/S, so in some cases our sample may have included more

"dedicated" users than was representative of the company so as to introduce us to some of the more "interesting" users.)

4.6 Impacts of Personal Computers on Jobs

The results of our interviews indicate that personal computer users believe personal computers are having a positive impact on people's jobs. The job effects users described to us can be summarized into four categories: (1) increased speed of work; (2) more work accomplished; (3) quality of performance improved; and (4) enhanced understanding of work.

The 'speed' and 'more work done' classes are fairly straightforward. People are saying that the personal computer allows them to perform some tasks (most obviously, complex calculations) more quickly. Related to this, some people state that they are getting more work done.

The 'quality' category includes responses such as "better decisions", "improved accuracy", "more confidence in information", and "more precision". Under "enhanced understanding" are included "performance of analysis not otherwise possible", "look at more forecasts in detail", "helps highlight more problems", and "graphics helping to provide more understanding".

To fully understand the impacts of the pc on individual jobs we also asked users to indicate whether or not the pc had changed their job at all in terms of the number or types of tasks performed. Although we found very few occasions where the pc had caused a significant change in the job, almost all users cited some way in which their job had changed. The following examples give a flavor for what we heard:

- o "Ability to attack more technical problems" - This user was able to solve problems that were more technical in nature more easily than before.
- o "My boss is giving me things he might have given someone else before" - This user's manager will give him tasks that are more complex than what he was doing previously.

- o "Less selective on jobs taken" - The pc allows the user to attack problems he might have avoided before.
- o "Helps get analysts involved in the computing age" - These analysts would not have used any computer before, but spreadsheet packages ease the introduction of personal computers.
- o "No longer use dictation" - This user found dictation to be inefficient and can now turn to a word processing package instead and compose clear drafts for his secretary.

Not included in the above list are the responses of the users who indicated their skill has made them the informal source of support in their functional area. Although not as prevalent as in the earlier CISR study of time-sharing use, these functional support positions are emerging in the pc arena.

This study did not objectively assess or measure job impacts, but it is very clear that pc users are very positive about the effects. The effects noted above on jobs are similar to the benefits to be gained from the use of DSS and office systems as noted in studies by Rice (1980), Keen (1980), and Poppel (1982). These impacts differ from the potential changes outlined by Zuboff (1982). The users in our study did not mention the problems of task routinization, social isolation, or the other negative aspects of computer-mediated work which Zuboff and others have observed.

There are several explanations why our results did not coincide with those of Zuboff. First, the fact that pc use has, in most cases, started very recently could mean these effects have not had time to appear. More importantly, however, the perspective of the users in our study was indeed far different from that of the users studied by Zuboff. Most pc users at this point have the machine because they want it, not because it was pressed upon them. This strongly differentiates them from the users she saw.

Of the 83 users in our study, only three voiced negative consequences of their use of personal computers and these three complaints were small

in nature: "Word processing doesn't help me much", "Preparing slides with the graphics becomes tedious", and "I was slowed down because of program conversion".

This absence of negative comments may have resulted from users' unwillingness to admit they had chosen to use a technology that hindered their performance, but this is probably a minor factor. A more likely explanation is that pc users have a choice as to whether or not they use this technology. If it is not giving them any benefit, they can simply not use it. In only a few cases have managers required use of the pc and none of these involved the three users above who saw negative consequences of their pc use. The difference between what we have observed and what studies such as Zuboff's have shown is summarized by recognition that the users we saw were performing "pc-assisted" work as opposed to "computer-mediated" work.

5.0 Applications

During the interviews with personal computer users, a total of 187 applications were identified. For each person's most important application (and, occasionally, the two or three most important), we completed an "application questionnaire". In all, we collected detailed data on 101 applications. For the other 76, only limited data was obtained.

This section will present the purpose of the applications, their development, scope, data sources, and the reasons why a personal computer was chosen for this application. As will be evident, we encountered no major surprises.

5.1 Application Purpose

The two columns in Figure 5.1 show the purpose of all 187 applications and of the 101 applications. It is not startling to see that the significant majority of applications are analysis and, primarily, financial analysis. Financial analysis covers a very broad range of applications, from budgeting to product pricing to financial statement work.

The next largest individual category is report generation, which includes the generation of presentation graphics. These applications perform minimal calculations such as column totalling, and sixty percent of them produce graphics, charts, or plots.

Word-processing is a popular use for the personal computer. However, as can be seen by the fact that only 5 of the total 19 word processing applications are included in our detailed sample of 101, most people mentioned other applications as being more important. Our assessment is that although word-processing is not the application for which people are initially acquiring their personal computers, many managers and professionals are finding word processing software to be a very useful tool -- and now would hate to be without it.

FIGURE 5.1

<u>Purpose of Application</u>		
	<u>All 187</u>	<u>The 101</u>
ANALYSIS		
Financial	77	40
Marketing	8	6
Corporate Planning	8	7
Statistical	8	4
Engineering/Scientific	5	5
Production Planning/Scheduling	3	2
Other analysis	4	2
REPORT GENERATION	19	12
WORD PROCESSING	19	5
MONITORING	16	9
OPERATIONAL	8	4
COMMUNICATIONS	7	1
DATA COLLECTION	5	4

FIGURE 5.2

Comparison of Time-Sharing and Personal Computer Applications

T/S Applications			PC Applications		
<u>Purpose</u>	<u>No.</u>	<u>%</u>	<u>Purpose</u>	<u>No.</u>	<u>%</u>
Complex analysis	193	71%	Analysis	129	69%
Inquiry/simple analysis			Monitoring		
Report generation	39	14%	Report generation	19	10%
Operational	24	9%	Operational	8	4%
Miscellaneous	15	6%	Word Processing		
			Communications	31	17%
			Data Collection		

Continuing down the list, examples of "monitoring" applications are project scheduling and tracking, maintenance of approved customer lists, and tracking monthly environmental data from plant sites. Relatively few (only 8) of the 187 systems could be classified as "operational". These are traditional paperwork processing systems, such as inventory control, and product accounting. They are key applications for the running of the business and have usually been developed by the I/S department.

Seven people mentioned that a significant use of their personal computer was communications with other systems. These applications included accessing external databases (such as Dow Jones), using electronic mail, and, in one case, performing data entry to a mainframe system. Finally, the data collection applications are those where the pc is interfaced to lab equipment. The pc is used to sample experimental data and perform scientific calculations.

The percentages of the pc applications in each category are fairly analagous to the distribution of time-sharing applications examined in the earlier CISR study. While the latter (Rockart and Flannery, 1983a, p.11) used a less detailed categorization scheme, a regrouping of the 187 pc applications produces the comparison shown in Figure 5.2.

Figure 5.3 shows the software tool used to develop each of the 101 applications and the number of applications developed by the user. Visicalc is clearly the most frequently used package. Of the 101 applications, only 19 were developed using "traditional" programming languages. The most popular language is BASIC, with assembly language mentioned twice, and FORTRAN, FORTH, and Pascal each being used once. (As a rule, the people who used these languages had prior programming experience.)

For the most part the tools fit the applications. We did note a number of cases where users are overworking their software, especially Visicalc. They have filled the spreadsheets to the maximum limit and noted poor performance and slow calculation and response times. At

FIGURE 5.3

<u>Development</u>		
<u>Development tool</u>	<u>No. of applications</u>	<u>No. developed by the user</u>
Visicalc	52	47
Basic	14	12
DSS/F	4	3
PFS	3	3
Wordstar	3	3
Easywriter	2	2
Visiplot	2	2
Others	21	17
	—	—
	101	89

California Beverage a user doing marketing analysis feels that he will have to move to the mainframe soon since his spreadsheets are becoming too big for Visicalc and his IBM PC.

An important fact which Figure 5.3 shows is that the users are almost unanimously doing their own applications development. This second column says that 89 people developed the application which they were using. As will be shown in Section 5.5, the availability only on personal computers of software like Visicalc and the fact that users do not have to rely on others for application development are two major reasons why people are opting for personal computers.

Figures 5.1 and 5.3 show the major purpose of the application and the primary development tool. There is another view of the 101 applications which lessens to some small extent the overwhelming picture of "financial analysis in VISICALC". (It should be noted, however, that much of this use was not in financial departments.) Our applications questionnaire asked whether this application used any communications, graphics, data base and/or word processing tools (whether or not this was the primary tool). Of the 101 applications, 10% used communications, 20% a graphics tool, 12% a database tool, and 8% a word-processing package.

5.3 Scope

The purpose of many of these applications implies that they are affecting more than the individual user and the way in which he accomplishes his tasks. Many pc applications are becoming an integral part of departmental or interdepartmental processes. The output from many pc applications is being utilized directly by people other than the individual pc user. To help understand the extent to which organizations are being affected by pc applications, we asked the users to help us categorize the scope of each application. Our three categories were individual, departmental, and multi-departmental and considered what processes were involved and who directly used the output.

Only 16% of the applications were "individual", such as presentation graphics and salary review planning. Not surprisingly, we found that 53% of the applications were departmental in scope. In other words, these applications were relevant to the operations of an entire department. Some typical departmental applications included budgeting and project tracking. Another 32% of the applications were multi-departmental, and these included consolidated capital plans and P&L statements for field offices. These results are summarized in Figure 5.4. Personal computers do not necessarily lead to personal computing.

5.4 Data Sources

Another key issue concerning the applications is data. Figure 5.5 presents the primary source of data for each application and shows how it is entered into the personal computer.

Beginning at the top of Figure 5.5, "data collected in real-time" are those applications where the personal computer is hooked directly to a piece of scientific gear. Most of these applications which performed data sampling and analysis were from the American Electronics R&D division.

User-generated data was the source for office applications and some spreadsheets. External data the source for 16%, includes not only data purchased from databases such as Dow Jones, but also other data external to the firm. Corporate data was the primary data in 58% of the applications. Some of the external and the corporate data already exist in other computers. However, only 7 applications directly downloaded their data from another computer. Clearly the potential exists for more downloading. The corporate data used in 30 of the applications was being keyed in directly from computer-generated reports.

5.5 Why a Personal Computer

Figure 5.6 presents the reasons why the user chose a personal computer over the other alternatives (such as the traditional I/S

FIGURE 5.4

Scope of Application

	<u>No.</u>
Multi-departmental	32
Departmental	53
Individual	16
	<hr/>
	101

FIGURE 5.5

Primary Source of Data

Collected in real-time	5
User-generated	22
External	16
o Downloaded	2
o Keyed in	14
Corporate	58
o Downloaded	5
o Keyed in, computer generated reports	30
o Keyed in, manually-prepared reports	23
	<hr/>
	101

development process or time-sharing) for these applications. The table's two columns show (1) how many times each reason was cited as the primary reason for choosing a personal computer and (2) the total number of times this reason was mentioned.

The first reason on the list, and the one most often mentioned is "software available only on a pc". For these people, the software they wanted to use for their application was believed by them to be available only on personal computers, not on time-sharing. In other words, the evident, widely publicized availability of spreadsheet packages caused people to choose personal computers.

The next most frequently mentioned reason was cost. Users are saying that buying a pc with packaged software and then developing the application themselves is cheaper than other computing alternatives. A few people interviewed noted that they could justify the cost of a pc based on the reduction in their time-sharing expenditures.

The next three reasons on the list fall into a natural group. People seemed to mention them in the same breath. Underlying what they were saying is the fact that using a pc makes them independent of any other group for access to their application. Some people noted slow response times on time-sharing systems or difficulties with communications lines as factors in their decision. Being in control of the tool was a very important reason for selecting a personal computer; it was even cited as the primary reason slightly more often than "software only on pc".

There is another important grouping of two interrelated reasons, "the pc is readily available; I have access to it and already know how to use it" and "it is relatively fast and easy to develop an application on the pc". People were implying that a personal computer is easier for them to use than time-sharing. Once a person had successfully implemented one application, he or she was not at all reluctant to develop another. Our impression was that some of these applications were developed only because a pc was available.

FIGURE 5.6

Why A Personal Computer Over Other Alternatives

Reason	No. times cited as primary	Total no. times mentioned
a. Software only on PC	13	46
b. Cost	10	41
c. Feeling of control/independence	15	32
d. Assured access to computer	3	21
e. Response time	1	18
f. PC readily available	11	37
g. Fast/easy development	4	25
h. Frustration with/I/S development	3	20
i. Told to by supervisor	4	15
j. Security	2	8
k. Other	7	29

Twenty people mentioned "frustration with I/S development" as one of the reasons for selecting a pc for their application. Out of 101 applications, this is not an overwhelming number. However, the reasons "fast/easy development" and "feeling of control/independence" are in some respects positive ways of stating dissatisfaction with I/S services.

A small number of people noted that it was their manager who decided that a pc was the appropriate vehicle for the application. An even smaller number of users said that security was a reason why a pc was chosen.

5.6 No Real Surprises

There are no major surprises in this data on applications. At this point in time, in their use of the initial wave of personal computers, people are primarily utilizing them as stand-alone machines to perform analysis with spreadsheet packages.

Why financial spreadsheet applications dominate pc use is easy to explain. First, applications development for them is easier due to the high quality software available (such as Visicalc), than it is for other applications. A large number of pc users have relatively limited experience with computing. Many of them chose to use pcs because of Visicalc and its clones, (without which one might argue that there would be far less pc use in large corporations). Personal computer spreadsheets are easier to learn and easier to use than currently available spreadsheet software for mainframe time-sharing use (at least so the users say).

Second, one could argue that financial spreadsheets are conceptually much easier for pc users to design. The first logical step in applications development is to write a model of the application on paper. Many managers and professionals have long had well conceptualized spreadsheets on paper. Data base applications, graphics applications, and scientific applications often have no paper equivalent or require far

more modification and conceptualization to switch from paper to the computer. Data base applications, production planning, and scientific work often require manipulation of chunks of data too large to be practical for current personal computers. The financial applications usually work with smaller chunks of data.

Finally, financial analysis involves applications which are probably low on the priority list of I/S development projects. A production planning application is probably a good mainframe candidate given its scope, significance, and number of users. But a financial analysis application tracking the production department's budget and expenses probably is not. Alloway and Jonikus support this contention in their paper, "The Project Selection Bias Against Management Support Systems" (1982). They state that the I/S project approval process will put a low priority on management or decision support systems due to their limited scope, narrower range of perceived benefits, and lower importance or urgency to the company as a whole.

There could, however, be some bias in our findings given the industries and divisions of the companies we visited. Alexander Hamilton Bank and Dobbs obviously have a predominance of financial applications. At California Beverage, Allnut, Weston, and Jupiter, we visited corporate headquarters where little R&D, production, or engineering work is going on. Where R&D and production divisions were investigated (American Electronics and Marlowe), we found a large number of more sophisticated applications developed by experienced programmers and technical people. Whether these facts have biased our results cannot be answered conclusively, though, interestingly, at Blaine we visited a wide variety of divisions including R&D and still found the financial analysis applications dominant.

Finally, the large number of financial applications reflects how new personal computers are to the corporate environment. The pcs are operating as stand-alone machines which again favors the spreadsheet applications which handle less data. If networking and downloading of

data become more prevalent in the upcoming months, we are sure to see a wider range of pc applications. Perhaps, based on the computer industry press, we should have expected to see more communications, but the infrastructure of networks (and databases) needed to promote and support communications does not exist in most corporations.

When asked about future applications for pcs, users expressed a very strong interest in networking, downloading, and access to external data bases like Compuserve -- (all in addition to more of the same applications they are doing now, particularly using integrated software like Lotus' 1-2-3). Therefore, we are likely to see a new group of applications which handle larger quantities of data, have ready access to external data, and which may handle some of the same functions that time-sharing handles at the present, especially if pc become integrated into existing time-sharing systems. These prospects raise some important issues, especially in terms of data control and maintenance of corporate databases.

6.0 Management of Personal Computers

In this section of the report, we will shift from a description of who was using personal computers for what purposes and reasons to an examination of the strategies and policies by which the ten corporations were managing the use of personal computers. These management approaches were the focus of our interviews with the information systems managers in the ten firms. This section and the next one, which focuses on support, present primarily the perspective of those responsible for setting pc-related strategies and policies and providing user support.

6.1 Strategy

All ten of the companies have similar long term strategies in the area of end user computing which center around the concept of the "workstation". A workstation is viewed as a device that will allow people to fully bring the power of the computer to bear on their jobs. This workstation will communicate with corporate mainframe computers and with other workstations. Users will be able to obtain information from the company's mainframe databases (subject to appropriate restrictions) and manipulate that information as necessary. Other users may be data creators who will create data locally and then feed it into the corporate databases. It is generally agreed that each workstation will be to some extent "custom tailored" to its particular user.

The personal computer is viewed by most of the companies that we interviewed as being the forerunner of the multi-function workstation. Several of the companies (American Electronics, Allnut and Blaine) feel that personal computers as we know them today will give way to a whole new generation of workstations. Other firms are more concerned about how the personal computers they are buying today can be made into workstations in the future. These firms tend to be more concerned with standardizing the hardware they are purchasing to ease communications problems. However, at this point in time the vast majority of the personal computers in these companies are being used as stand-alone

computers. We observed no personal computers being used in local area networks and relatively few which were communicating with the corporate mainframe.

In the short run, the ten companies see several important roles for the personal computer. The factor mentioned by more I/S managers (Allnut, Beyers & Schepens, Blaine, California Beverage, Marlowe, and Weston) than any other is the personal computer's ability to increase the level of computer literacy at these firms. Some of the companies mentioned the ability of the pc to reduce the applications backlog faced by their I/S groups (American Electronics, Allnut, Blaine, California Beverage). Several of the companies are using the personal computer to bring computing to places where it would otherwise be impractical or too expensive. Some of Beyers & Schepens smaller branch offices and some of California Beverage's bottling plants are examples of this. In 1983, though, the majority of personal computers are not being purchased as part of a well-considered long term strategy. They are being acquired because individual users want them.

Figure 6.1 summarizes who within each firm is responsible for formulating pc strategy. Directions concerning personal computers are developed by I/S management in seven of the companies. The other three, Beyers & Schepens, Allnut, and Blaine, had committees composed of user and I/S managers to develop their company's personal computer strategies and policies. At Beyers & Schepens this seems to have occurred because of the large potential impact of the pc on how this firm will conduct its business in the future. The Beyers & Schepens committee is a user committee with I/S representation. At both Allnut and Blaine, the major reason for an advisory committee is to allow the active participation of the users, who are well represented on both committees.

In some of these firms (again see Figure 6.1), strategy formulation for personal computers is rather isolated from strategy formulation for other end user computing (time-sharing) and office automation. For the most part this is due to the assignment of responsibility for these areas

FIGURE 6.1

Strategy Formulation Summary

Company	PC Strategy Set By	Does Same Group Also Set:	
		Other End User Computing Strategy	Office Automation Strategy
A.H. Bank	I/S	Yes	No
Allnut	Committee	No	No
American	I/S	Yes	Yes
Beyers	Committee	No	No
Blaine	Committee	Yes	Yes
Cal. Beverage	I/S	Yes	No
Dobbs	I/S	Yes	Yes
Jupiter	I/S	No	Yes
Marlowe	I/S	Yes	No
Weston	I/S	Yes	Yes

to different groups within the I/S organizations. The one notable exception is Blaine where a committee sets policy in all three areas.

6.2 Policies and Standards

All but one of the firms had issued a written policy statement specifically addressing the use of personal computers. (The exception was the R&D division of American Electronics.) These policies varied considerably in terms of formality, scope, and detail.

As examples, the appendix contains the personal computer policies of Allnut Brands and Dobbs Insurance Companies. Both policies were issued by corporate I/S management.

Key areas where most organizations had developed or were considering policies/standards included, (a) justification; (b) hardware; (c) software; (d) acquisition and servicing; (e) data; (f) copyright laws; and (g) application guidelines. We will briefly discuss each of these areas.

6.2.1 Purchase Justification

In all ten of the companies, the user departments are responsible for preparing the purchase justification for a pc. In eight of the companies the justification criteria are the same as those required to purchase any other kind of capital equipment. In these eight firms this means that it is relatively easy to justify a pc because the price of a system is usually less than \$10,000. The two companies where justification is handled differently are the Alexander Hamilton Bank and Beyers & Schepens, the "Big 8" accounting firm. At Alexander Hamilton a "request for pc" form must be completed detailing proposed use of the machine and economic justification for its purchase. At Beyers & Schepens there is a policy that a new pc should have a six month payback period, however this policy is only loosely enforced.

In four of the firms the approval of the I/S department must be obtained, in addition to those approvals required by their normal capital expenditure processes, before the pc can be purchased. In all but one case this approval is perceived by the users as being given readily. Only at Alexander Hamilton Bank did some users feel that the I/S department was on occasion reluctant to approve pc purchases (and this was because I/S was actively promoting the use of the Bank's Wang OIS systems as a preferred alternative to personal computers).

The major purpose for requiring I/S approval in almost all of the companies is so that users consult with I/S before they buy a system. In this way, the appropriateness of the pc for their application can be verified. If a better solution exists, such as a program on time-sharing, or paper and pencil, then the user can be saved from future disappointments and frustrations. In most cases users have easily obtained I/S approval for their purchases, for acquisition justification tends to be a fairly flexible process in these organizations. If users can demonstrate that they have carefully considered their proposed purchase, and have at least one good application in mind, they can usually obtain the necessary approvals.

6.2.2 Hardware

Every company has formal standards for hardware, except the R&D division at American Electronics, which has no standards at all. At American, where users are very sophisticated and applications are diverse, users are encouraged to purchase the equipment that will best solve their problems, whatever that equipment may be. All other companies are concerned with limiting the number of hardware vendors to facilitate program sharing, communication, take advantage of volume purchase agreements, and allow pc support groups to provide adequate support. The greater the diversity of hardware the thinner the resources of the pc support group are stretched.

Most companies have adopted more than one personal computer as a standard, with the Apple and IBM machines being the most popular. The reasons given for adopting more than one standard include the differing availability of software for the machines and uncertainty as to where the fast moving pc market is headed.

At about half the companies, the standards for hardware are fairly rigid, that is, users only are allowed to purchase one of the approved systems. The others are more flexible, with the company policy usually stating that the user is still free to choose any hardware but that support will only be provided for the recommended systems.

6.2.3 Software

Only one of the ten companies, Beyers & Schepens, has formal standards for software. At Beyers users could still deviate from the standard, but they would have to explain why they were doing so. While none of the other companies had formal standards for software, most of them evaluated and recommended software.

6.2.4 Acquisition and Servicing

Practically all of the policies concerning acquisition and servicing are geared towards hardware and do not consider software. The ten companies were using a variety of sources to acquire their equipment including nationwide retailers (Computerland), local computer/electronics stores, and the hardware manufacturers directly. All of the companies have either formal or informal agreements with their suppliers which allow them to purchase equipment at a reasonable discount.

The companies that are using Computerland or local computer stores to acquire hardware are doing so for several reasons. Users, who are most often the driving force behind purchasing a pc, are familiar with these stores. They are usually conveniently located and allow the user to test hardware and software. Even though many of the companies have their own

in-house support groups and demo centers, the local retail store continues to be a source of support and information. Yet, some dissatisfaction was voiced in our study with regard to the level of professionalism found at these stores. Some felt they are not attuned to the needs of a large corporate client.

Several of the companies now have direct agreements with the hardware manufacturers. A number of the other firms are looking into establishing relationships directly with hardware vendors. Most of the firms are passing along their corporate discount to their employees if the employee wishes to buy a personal computer for home use.

At this point in time, none of the companies have set up contract service agreements. Some have not considered it and the rest feel that they do not have enough pcs yet to warrant the expense and trouble.

6.2.5 Data

While all of the companies expressed concern over data related issues, few of them had yet adopted formal policies with respect to data. In all of the companies there are no restrictions as to what users can do locally on their personal computers. Some of the firms are beginning to formulate policies with respect to pc-mainframe communications and access to mainframe data. The Alexander Hamilton Bank and Marlowe Plastics are not allowing access to corporate databases. On the other hand, Allnut and Blaine are actively working to improve the interface between the pc and the mainframe. The rest of the companies fall in between these extremes.

6.2.6 Copyright Laws

Dobbs and Jupiter were the only companies with formal policies concerning copyright laws and software rights. When users purchase a pc at Dobbs they must sign a release stating that they will obey all copyright laws and that they will take appropriate action to prevent the

illegal copying of software. Several of the other companies were concerned about copying and had issued memos on the subject.

6.2.7 Application Guidelines

Several of the companies have developed guidelines as to which types of applications are best suited to personal computers. Again, these are meant to be guidelines and not strict policies. Three major themes in these guidelines are that pc applications should (1) not be very complex functionally; (2) handle low volumes of data; and (3) not compromise corporate auditing practices.

7.0 Support Organizations and Services

In the ten companies we saw a variety of organizational approaches to providing support to personal computer users and a variety of services being offered. The first part of this section will describe the support organizations. The second part will report on the services being offered and the users' opinions concerning these services

7.1 Support Organizations

Four firms had established separate and distinct "corporate personal computer groups", while two firms had given personal computer responsibility to existing "information centers". (At Marlow Plastics, the info center was involved in supporting end users, but not directly responsible.) In addition, four firms had given responsibility for pc support to divisions, either through existing systems managers or by establishing new groups.

The new pc groups tended to have two to five person staffs. The manager of the group was usually from the I/S organization but has had significant experience interacting with users. Because supporting pc usage is a relatively new activity in most firms, these new pc groups are almost like entrepreneurs with a fledging business.

Figure 7.1 summarizes the support organizations for the ten firms, by showing the formal support which exists at the corporate and divisional levels. These are the support groups that are part of the I/S organization. However, the functional support people we found in each user group should not be overlooked. Functional support in all instances was "outside" the I/S organization. As described in Section 4.1, the people providing functional support are personal computer users who are assisting others in their department. In three of the companies, we found cases where the role was a clearly acknowledged part of the person's job. The other functional support people were informal sources of support.

FIGURE 7.1

Support Organizations

	Corporate Existing	New	Division Existing	New
A.H. Bank		PC group		
Allnut		PC group		
American			MIS manager	
Beyers		Task force	Support group	
Blaine	Prof. Sup- port group		Info Resource managers	
Cal. Beverage		PC group		PC group
Dobbs		PC group		Info Center
Jupiter		Task force	DSS group	
Marlowe	(Info Center)		Systems managers	
Weston	Info Center		Systems managers	

Our recommendations will emphasize that the importance of these functional support people not be underestimated. As we saw in Section 4.4, as many users are turning to other users for ongoing support as are turning to support groups that are under the I/S umbrella.

7.2 Services Provided

The primary services provided by these support organizations are listed in Figure 7.2. For each service, the figure shows how many companies were providing that service at the time of our interviews, how many were planning to in the next six months, and the users' rating of the importance of this service. These ratings are based on data collected in the last six companies visited. In those firms, users were asked the importance of each service and responded on a scale of 1 (not needed) to 5 (critical/necessary).

(The I/S managers also rated the importance of these services. There is no statistically significant difference between the means of the users ratings and the means of the I/S ratings. This was tested using a two-tailed Student's t-distribution.)

The most common services, offered by nine of the ten firms, are central purchasing, hardware evaluation and selection, software evaluation, and consulting as to whether a pc or another alternative is most appropriate. The services offered by only one or two of the firms are organizing user groups, facilitating access to external databases, and providing information on the availability of corporate data.

7.2.1 Users' View of Services

The "user importance rating" column in Figure 7.2 highlights several important considerations:

- o Almost all services are seen as at least useful by a majority of users responding, and most are considered important.

FIGURE 7.2

Support Services

Service	No. of Companies Offering	Planning To	User Rating of Importance
Consult on pc vs. other solutions	9	-	3.83
Central Purchasing	9	-	3.71
Hardware evaluation/selection	9	-	3.55
Software evaluation	9	-	3.42
1-on-1 instruction	8	-	2.94
Newsletter	7	1	3.64
Demo Center/Store	6	1	3.40
Software Library	6	2	3.79
Software selection	6	-	3.02
Classes (indepth)	5	3	3.66
Seminars (overview)	5	-	3.59
Develop applications software	5	-	2.25
Broker user developed software	4	-	3.39
Hotline	4	-	3.61
Develop systems software	3	-	2.45
Database extracts	3	1	3.59
Data availability	2	-	3.54
Access to external databases	2	-	2.97
User groups	1	3	3.60

Importance Rating Scale

1-----2-----3-----4-----5
Not Only occas. Useful Important Critical/
needed useful necessary

- o The few services seen as most important all help the user get started.
- o Software development services are relatively unimportant.
- o Generalized education is more highly valued than individualized help.

The fact that 15 of the 19 services mentioned received average ratings above 3.0 shows pc users are, in theory, interested in receiving formal support. In some cases, however, users noted they themselves might not need a given service, but they could see the usefulness of this service for less experienced users. Also, they feel a formal support group, run by I/S, can provide these types of services to newer users.

Consulting on using a pc vs. other alternatives, centralized purchasing, and software libraries received the highest ratings of all the services mentioned. The common thread running through all these services is that they help ease the initial introduction to the pc and the relevant software packages. Most users are not familiar enough with all the computing alternatives available to them (pc or otherwise) to know which would serve them best. Helping the user determine whether or not to use a pc and to coordinate its purchase allows him or her to rely on others' expertise in these areas. The software library concept refers to a central library of various software packages that are available to users on a trial basis. The aim is to allow users hands-on evaluation of software. This can reduce the risk of selecting inappropriate software and reduce the learning curve once the purchase is made.

The fact that the most highly rated support services are those that ease initial use is in line with one of the elements of the dynamics of innovation outlined by Keen (1980) in conjunction with decision support systems. Keen includes in his list the issue of uncertainty being reduced by "trialability and ease of understanding". The services just discussed work to fulfill these functions.

Systems and applications software development received (from both users and I/S) the lowest importance ratings of all services. These

relatively low scores indicate that users feel they can rely on themselves and the marketplace for most of their software needs. This is a logical extension of the findings in Section 5 which showed most applications using fourth generation tools like Visicalc. The five companies noted as developing applications software mostly do so on an ad hoc basis.

Rockart and Flannery (1981, 1983a) have noted the importance of locating and collecting data for use by end users. Personal computer users feel information on the data available and help in obtaining abstracts from corporate databases are important services, but not significantly more important than many of the other services mentioned. Data availability will become more critical over time as more and more users look to download data from the mainframe.

A reason for concern regarding these data-related services arises when we note that few of the I/S departments are providing them. Unlike some of the other services on the list, users cannot go elsewhere for database extracts. Except in the two companies which had policies forbidding pc users direct access to mainframe databases, the I/S managers interviewed recognized the importance of the data issue and, to be fair, the technical obstacles in trying to link personal computers and mainframes should be noted. In the 1982-83 timeframe of these interviews, good, reliable hardware/software for pc-mainframe linkage did not widely exist.

An instance of a service most support groups are providing but users do not think important is one-on-one instruction. The users rate classes and seminars as more important for a formal support group to provide. Our assessment is that much of the one-on-one instruction is being done on an ad hoc basis. As the user community grows (and it appears to be rapidly), the support staff (even as it expands) will not be able to spend a significant amount of time with any individual user. However, at present, one-on-one instruction (and applications development) are serving as an effective vehicle for the central support group to learn who their clients are and what their needs are.

8.0 Implications and Recommendations

Having presented the findings of the study, we will explore in this section some of the implications of the corporate use of personal computers and discuss some recommendations concerning the management of pc use. Two key areas which will be examined are (1) the differences between personal computers and time-sharing as end user computing tools and (2) the impact personal computers are having on the I/S function.

It is obvious that personal computers have become the major impetus in spreading end user computing in corporations. Our overall recommendations concerning the management of personal computers as an end user computing tool agree with the recommendations from the earlier CISR study of time-sharing users. Section 8.3 will emphasize those issues raised in Rockart and Flannery (1983a) that are most critical to the use of personal computers.

8.1 Differences Between Personal Computers and Time-sharing

Other end user computing facilities, such as mainframe time-sharing and departmental minis, are usually provided to users by I/S departments. Users most often play a minimal role in the selection of the system, how it is implemented, and what software tools are made available. This has created some problems, for end user computing has often been a low priority item within many I/S organizations. Those responsible within I/S for selecting software and providing support to time-sharing users often have limited experience in their company's functional areas. This means that they have often been in a relatively poor position to judge what kind of software would be helpful to end users. (See Rockart and Flannery, 1981).

On the positive side, because I/S has been in a sense "running the show" with time-sharing and has had a history of implementing mainframe-based systems, it has been able to bring a good deal of

technical expertise to the evaluation and selection of end user time-sharing tools and techniques. Moreover, I/S has been able to channel this service in directions that are beneficial to the company as a whole.

One of the obvious fundamental differences between the personal computer and time-sharing is that users are now able to purchase their own hardware and software, and are doing so eagerly in the companies we visited. The advantage of this is that users are often best able to determine the kinds of tools which will be useful to them. Furthermore, because of the low cost of these systems, each user can purchase the hardware and software tools that best suit his or her needs. Thus, users do not have to settle for using a time-sharing package that was purchased to meet a wide range of needs but does not completely satisfy their individual needs.

On the other hand, I/S loses many of the advantages cited previously of having a measure of control over end user computing. A new set of problems appears because end users are now able to purchase their own personal computer systems. These problems will be discussed in the next section on the impact of the personal computer on I/S.

Another difference between time-sharing and personal computers is the company's ability to determine the level of computer usage, and the cost of this to the company. It is easy to get usage statistics with time-sharing systems as well as to determine the amount of money that the company is spending on such systems. This is much more difficult to do with personal computers.

While I/S is the expert when it comes to time-sharing systems and the tools offered on time-sharing, in many cases it is the users who are becoming the experts on personal computer systems. We encountered numerous users who were more knowledgeable about aspects of personal computer hardware and/or software products than the I/S support people.

A final major difference between personal computers and other end user computing is that technological change, both in terms of hardware and software, is occurring at a much faster rate for microprocessor-based systems. While mainframe systems require large capital outlays for both hardware and software, and thus are not frequently replaced, the low cost of personal computers and especially the low cost of pc software means that users can more readily switch to improved technology. Thus, just as users have started to take on the responsibility of evaluating what system is right for them, the job has gotten tougher due to the quickening pace of technological change. (However, the price of a bad decision is now lower!)

8.2 Impact of Personal Computers on the I/S Function

The impact of the personal computers on the I/S function is growing as fast as the number of personal computers that are finding their way into large companies. In all ten of our companies the I/S departments feel that the pc has a legitimate role to play in their organizations and that it will effect the way in which they deliver computing services in the future. Specifically, the four following major effects of the pc on I/S were cited by either I/S personnel or users in one or more of the ten companies we visited.

8.2.1 Shift in Role of I/S

While some, mainly users, spoke of a loss of I/S dominance, it is difficult tell what is meant by this statement. It is true that users are now in control of their computing destiny to a greater extent than ever before. But does this really diminish the role of I/S? It is probably more accurate to say that personal computers will cause the role of I/S to change.

Prior to the advent of end user computing, I/S was responsible for essentially every aspect of a company's computer-based information systems. If users had an idea for a new system, wanted a change to an

existing system, or simply wanted to see a list of all accounts receivable over 57 days old, they had to go to I/S. With the advent of end user computing, and especially personal computers, users are now able to build their own small information systems, manipulate data, and display it in a form that is meaningful to them. In the sense that the user no longer has to rely on I/S for everything any more, I/S has lost some of its dominance.

Yet, from another perspective, the role of I/S is increasingly powerful. Users soon learn that much of the data they are interested in exists in one form or another somewhere in one of the company's mainframes. Users must rely on the ability of I/S to make data accessible to them from the mainframe.

This is key to the role that we, and the I/S managers with whom we spoke, believe I/S will play in the future. Most of the I/S departments in the ten companies believe that I/S will be freed from some of the applications backlog and will be able to concentrate on building large systems and corporate databases. It is from these systems that users will draw the data they need to do their own computing. Yet I/S will also have to devote a considerable level of resources to supporting end user computing directly. For the applications backlog to really be reduced, I/S will have to make a strong commitment to seeing widespread end user computing become a reality. Many of these firms are still unsure just how much of their I/S departmental resources should be devoted to supporting end user computing.

8.2.2 Reduced Control Over End User Computing.

The use of personal computers can impact the amount of control the I/S department has over end user computing. As mentioned earlier, unlike time-sharing the users have been making most of the relevant decisions with regard to pcs. Realizing that personal computers are here to stay, several I/S groups have since become very active in supporting pc use in hopes of guiding users in directions which are consistent with the firm's overall I/S strategy.

8.2.3 Affect Relationship Between I/S and Users

Another major effect of the personal computer is a changing relationship between I/S and users. Some of the I/S managers and users we spoke to see the pc as a vehicle for improving the relationship between I/S and users. By turning over certain applications to end users on personal computers and supporting them, I/S can change its image from slow, unresponsive, and out of touch with users to fast, innovative, and supportive. However, if handled improperly, this opportunity to improve I/S-user relations can be lost, and relations could even grow worse. This can happen when excessive control measures are imposed by I/S.

8.2.4 I/S Use of the Personal Computer Engine

Finally, the personal computer is changing the way I/S itself is conducting its business, although this has occurred at a slower rate than one might have expected. Several I/S groups have embraced the pc as being another way to implement new systems. This usually happens when there is a very good application, which can run using the limited power of the pc and where implementing the system on a mini or mainframe is either too expensive or outright infeasible.

One company was developing an order entry system for its sales representatives. The system was being designed to run on a portable micro which would have the capability to dial into the corporate central system. A division of another firm was developing on a personal computer a system to calculate quotations for the sophisticated equipment they sold. A personal computer is to be placed in each of the company's local service centers.

Other ways that I/S departments are making use of pcs include using the pc to prototype a large system, and as intelligent terminals to improve programmer efficiency.

8.3 Recommendations

The results of this study emphasize many of the recommendations concerning the management of end user time-sharing computing made by Rockart and Flannery (1983a) and summarized in Figure 2.1. Personal computers, although a different form of computing, are primarily just another manifestation of EUC. It is logical to expect the same general principles to apply.

This section will stress the importance of EUC strategy and the need to define the roles of I/S management and user management with respect to the management and control of EUC. As part of these recommendations, we will also present what we view as key aspects of providing support.

8.3.1 EUC Strategy

Perhaps the most critical message is that organizations need a strategy for the utilization of personal computers. Perhaps more important, however, is the need for an overall strategy for end user computing. This strategy must, eventually, integrate time-sharing, personal computers, graphics systems, office automation, etc., and fit these tools into the firm's overall information systems strategy. This EUC strategy must be reflected in plans and policies. To overstate, most I/S departments have four-inch thick documents describing their plans for "traditional" information systems, and only four-page memos for end user computing.

A strategy is needed so that growth in EUC is perceived as fitting into corporate long range plans. Plans and policies will outline how the use of EUC tools can help achieve business goals.

8.3.2 Roles of I/S and Users

Users must be active in establishing personal computer strategy, plans, and policies. We advocate a committee composed of I/S management

and user management as being a very effective mechanism for making strategy and policy decisions. In our view, Blaine Corporation, where such a committee was responsible for office automation, personal computers and time-sharing, was doing an especially effective job of managing EUC.

User departments need to take additional computing management responsibility. End user computing means that applications development is being done by users. Therefore, it is the user departments who must control justification and must manage use. I/S cannot have primary responsibility for this process. And the managers responsible for control and management should have a voice in strategy and policy. Clearly user management will have to be educated as to the potential benefits and drawbacks of personal computers (and other EUC tools) if they are to make informed business judgments.

I/S expertise is needed to help set policies and guidelines. It is the I/S department's role to manage information technology for the firm. In order to ensure coherence with the overall information infrastructure of the firm, I/S must be active in the setting of strategy and standards. (This implies that I/S must fully understand personal computers and other EUC technologies.)

In short, in the new computing environment, there is a need to reexamine and redefine the respective roles of I/S management and user management. Managing end user computing must be a partnership effort.

8.3.3 Key Aspects of Support

The results of our study show three key areas where personal computer users want formal support. The first is consulting as to what the best solution is for a given application problem. Users would like one contact to go to for this advice. Second, users want services which help them get started and which keep them informed about other personal computer activities in the firm. This includes knowledge of product

evaluations and applications developed by others. Finally, access to corporate data is an increasingly important service that will have to be provided by a central group in the I/S organization.

However, the recognition of a partnership between I/S management and user management should also extend into the area of providing support. As our study shows, users are getting support not only from I/S but also from other users. The importance of these functional support people should not be underestimated.

There appear to be three key reasons why users are turning to others in their departments for support. The first reason is physical proximity; it is simply easier to go to someone whose office is down the hall. The second is that users often prefer to get computing advice from someone who knows the functional area and therefore can understand the context of their problem much more completely. Thirdly, many users do have a great deal of experience with various pc software packages and, as suggested in Section 8.1, in some instances their knowledge exceeds that of the I/S support group.

This strongly suggests that I/S establish links with functional support people. Also, given that one reason users turn to other users, is that they are "local" suggests that I/S support not be totally centralized. EUC support groups which are under the I/S umbrella should also be located at the divisional, even departmental, level.

8.3.4 Conclusion

The ten firms in this study were proactively addressing the issues raised by the increasing growth of end user computing -- a growth that is being fueled by personal computers. We learned much from studying their approaches to managing personal computers. Our research findings are descriptive of corporate users and uses of personal computers and how use is being controlled and supported. Our implications and recommendations are a prescriptive set of key management issues.

As a conclusion, there are three major areas specific to personal computers on which I/S management must focus its attention:

1. Migrating from the personal computers of today to the multifunction workstations of tomorrow.
2. Providing users with appropriate access to corporate databases.
3. Integrating the management of personal computers with the management of other end user computing tools.

References

Alloway, R.M. and Jonikus, M.J. "The Project Selection Bias Against Management Support Systems", CISR Working Paper No. 97, Sloan School of Management, MIT, Cambridge, Massachusetts, September 1982.

Bayle, E. "The Fortune 500 Microcomputers", Popular Computing, September 1982, pp 62-68.

Business Week "How Personal Computers Can Backfire", Business Week, July 12, 1982, pp 56-60.

Business Week "Computer Shock Hits the Office", Business Week, August 8, 1983, pp 46-49.

Cagnoli, G. "Corporate Use of Personal Computers", unpublished Master's, thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, February 1983.

Data Decisions "Micros at Big Firms: A Survey", Datamation, Volume 29, Number 11, November 1983, pp 160-174.

Ewers, J. "Coping With Micros", Computerworld, December 13, 1982.

Hoard, B. "Micro Termed Positive Influence on Computing", Computerworld, February 7, 1983.

Hughes, D.G. "Computerized Sales Management", Harvard Business Review, Volume 61, Number 2, March-April 1983, pp 102-112.

Infosystems "Microcomputers: Friend or Foe of the MIS Managers?" Infosystems, October 1982, pp 44-54.

Johnson, B. "Micros Seen Receiving Mixed MIS Reception", Computerworld, February 21, 1983.

Keen, P.G.W. "Decision Support Systems and Managerial Productivity Analysis", CISR Working Paper No. 60, Sloan School of Management, MIT, Cambridge, Massachusetts, October 1980.

Keen, P.G.W. "Value Analysis: Justifying Decision Support Systems", MIS Quarterly, Volume 5, Number 1, March 1981, pp 1-15.

Kinne, H.C. "Personal Computers: An Executive's Best Friend", Today's Office, November 1982.

Krass, P. and Wiener H. "You Mean I Can't Just Plug It In?", Datamation, Volume 27, Number 10, September 1981, pp 196-204.

McKibbin, W.L. "The MIS Role in PC Acquisition", Infosystems, Volume 30, Number 11, November 1983, pp 46-48.

Marenghi, C. "Corporate Users Cite Gains from Shift to Micros", Computerworld, October 25, 1982, p 13.

Mock, G. "Management of End User Computing: The Applications of Personal Computers in Information Systems of Large Corporations", unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1983.

Poppel, H.L. "Who Needs the Office of the Future?", Harvard Business Review, Volume 60, Number 6, November-December 1982, pp 146-155.

Rice, R.E. "The Impact of Computer-mediated Organizational and Interpersonal Communication", in M. Williams ed., Annual Review of Information Science and Technology, Volume 15, Knowledge Industry, White Plains, New York, 1980, pp 221-249.

Rockart, J.F. and Flannery, L.S. "The Management of End User Computing", in C. Ross ed., Proceedings of the Second International Conference on Information Systems, Cambridge, Massachusetts, December 1981, pp 351-364.

Rockart, J.F. and Flannery, L.S. "The Management of End User Computing: A Research Perspective", CISR Working Paper No. 100, Sloan School of Management, MIT, Cambridge, Massachusetts, February 1983(a).

Rockart, J.F. and Flannery, L.S. "The Management of End User Computing", Communications of the ACM, Volume 26, Number 10, October 1983(b), pp 776-784.

Rogers, E.M. and Shoemaker, F.F. Communication on Innovations, 2nd edition, The Free Press, New York, 1971.

Small Business Computers "Grass Roots Microcomputing in Large Corporations", Small Business Computers, September/October 1982, pp 18-21.

Vancollie, G. "Management of Personal Computers", unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, February 1983.

Vernon, M. "Personal Computers in the Corporate Environment", unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1983.

Wilde, E. "Personal Computers in the Corporate Environment: The Users' Perspective", unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1983.

Wise, D. "Wall Street's Financiers are Bullish on Micros", Infoworld, July 1982, pp 13-14.

Wohl, A.D. and Carey, K. "We're Not Sure How Many We Have...", Datamation, November 1982, pp 106-108.

Zientara, M. "IRD Exec: Micro Boom to Spark False Assurance", Computerworld, February 14, 1983(a).

Zientara, M. "DP Managers Encouraging Personal Computing", Computerworld, March 28, 1983(b).

Zuboff, S. "New Worlds of Computer-mediated Work", Harvard Business Review, Volume 60, Number 5, September-October 1982, pp 142-152.

APPENDIX

Two Personal Computer Policy Statements

Allnut Brands Policy on Personal Business Computers
(issued early 1982)

Policy Statement

It is the policy of Allnut Brands to promote the effective use of technology-based productivity tools (namely, personal computers) through an active program of coordination and support. This responsibility resides in Corporate Information Services (CIS) and:

1. Recommends policy and strategy to senior Allnut Brands management.
2. Supports all Allnut Brands Units in identifying the appropriateness of personal computers for specific needs.

It is also the policy of Allnut Brands that each Unit is responsible for determining the business justification for personal computers in their organization.

Definition

Personal computers are technology based information tools, sometimes referred to as "micro" computers which are usually desk-top-sized and cost less than \$10,000 to purchase.

Corporate Information Services

A. Consulting and Advisory Role

CIS will maintain a current knowledge of the state-of-the-art technology and developing trends relating to personal computers, and will help potential or current users by:

1. Assisting Allnut Brands business units in determining the appropriate use of personal computers as productivity and decision making aids.
2. Assisting clients in the actual use of these tools through education and training programs appropriate to individual area needs
3. Providing support in determining the appropriate hardware and software to meet needs at minimum cost.

B. Concurrence Role

Corporate Information Services Personal Computer Center will be the central facility for concurring on the purchase and placement of personal computers to ensure that:

1. Hardware and software is obtained at the lowest cost.
2. Adequate service is negotiated and provided when required.
3. Users of personal computers are informed of new developments.
4. Information Services overall strategies and support resources remain tuned to the developing activity in the individual units.

This will enable CIS to maintain a central inventory of equipment and software in order to facilitate sharing of experience, software development, etc.

User Area Responsibility

Decision authority on use and placement of personal computers resides with the unit head and is based on the units assessment of business justification and assurance that its usage is consistent with the units mission. The user will be responsible for equipment operation and physical security.

Accounting Considerations

Accounting Financial Policy requires that all costs related to the purchase of personal Computers be expensed at the time of purchase. Control of these expenditures will be through the normal budget process.

Dobbs Insurance Companies Policy on Personal Computers
(issued Fall 1981)

Micro-Computers are becoming more powerful and functional with potential for satisfying some personal business function needs at Dobbs. To facilitate their application, we have developed a policy for their acquisition and usage.

For the purpose of this policy, this definition will apply to personal business computers:

They will usually:

- o Be desk-top size.
- o Cost less than \$10,000 to purchase.
- o Be user installed, and have no vendor hardware/software support requirement.
- o Provide support to business function of individuals

This policy does not apply to "Turnkey" business systems which are marketed as a package consisting of hardware and software designed to handle a specific business function.

Policy

The user and Divisional Systems Department will determine whether a personal computer can solve the business problem in question prior to referring their recommendation for purchase to Information Systems Support (ISS). ISS will review the solution and provide any required advice and counsel regarding the request to the Divisional Systems Department.

All on-going considerations for personal computer systems security, documentation, auditability and controllability will be the responsibility of the user.

Process

The user Department Head will ensure that acquiring a personal computer is a cost effective solution to the business need and that its usage is consistent with the department's mission. The Department Head will ensure that those uses which have financial implications are carried out in such a manner as to provide satisfactory control.

The appropriate Divisional Systems Department Head will ensure that acquiring and using a personal computer is consistent with both the division's current business plans and the corporate long range data processing strategy.

The ISS Section Head will review the solution and recommend other alternatives when appropriate. When the personal business computer remains the desirable choice, the Divisional Systems Department will collaborate with ISS in selecting the appropriate equipment which ISS will normally order through the Purchasing Department.

Standard Operating Procedures:

Equipment Acquisition

Will be from a list of approved vendors, models and options, developed by ISS (with contracts pertaining to acquisition and maintenance normally pre-negotiated by Corporate Administration on a volume basis). Exceptions must be approved by ISS, with contracts negotiated by the Corporate Administration.

The user Department Head will approve the requisition by signing and forwarding it to the Divisional Systems Department.

Requisitions will be approved by the Divisional Systems Department which will submit them to ISS for approval and normal execution through the Purchasing Department.

Equipment Operation

Will be the responsibility of the user who will also be responsible for physical security.

Software Acquisition, Off-the-Shelf Software - These are programs readily available from computer stores and vendors.

The user Department Head will sign and forward the requisition to the Divisional Systems Department.

Requisitions will be reviewed by the Divisional Systems Department prior to submitting them to ISS for approval and normal execution through the Purchasing Department (when pre-negotiated contracts exist). If contract negotiation is required, it will be handled by Corporate Administration.

Will be charged directly to the user cost center.

Programming Support

Will be provided by the user or Divisional Systems Department in accordance with arrangements made between the user and the systems department.

In order to promote sharing of common purpose programs, ISS will maintain information regarding software acquired or developed within the Company.

Users will inform ISS of their development activities in order to maintain that information.

Software Acquisition, Contract Software - These are programs to be developed by outside contractors to the user's specifications.

Will be approved by the user Department Head.

The supplier will be selected by the Divisional Systems Department in conjunction with ISS.

The contract for services will be developed by Corporate Administration on request from the Divisional Systems Department for approval by the Divisional Systems Department.

Equipment Maintenance and Repair

For non-standard equipment, it will be the responsibility of the user. Maintenance and Repair will be negotiated and arranged with the vendor at time of acquisition by Corporate Administration. For standard equipment pre-negotiated contracts will normally address maintenance.

Guidelines for acceptable performance will be prepared by ISS in conjunction with the "approved vendor list".

Telecommunications

Personal computers will not be connected to teleprocessing networks except via timesharing. Connections to timesharing will be determined and enabled by the appropriate Divisional Systems and Information Systems Operations using standard operation procedures.

Connections to outside vendor network services (examples are Dow Jones News & Stock Quote Reporter, CompuServe and the Source) must be approved by the user Department Head, the appropriate Divisional Systems Department and ISS.

Education

For a specific piece of equipment, education will be the responsibility of the user, initially. Education will be provided centrally in the future for approved products by Information Systems Support when it becomes cost effective.