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MANAGERS' USE OF COMPUTERS: END-USER COMPUTING IN PERSPECTIVE

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Abstract

This study examines end-user computing in a managerial context by integrating the issues of hands-on use of computers, delegation of computer tasks, the use of support functions, and their perceived importance. The research was carried out within one division of a major defense contractor.

The results indicate that the managers are of the opinion that delegation of computer tasks is the most important type of end-user computing support. End-user computing was viewed as a less important type of computer support than organizational computing.

Introduction

Timely and accurate information is critical to managers in the competitive business environment. Many authors have argued that effective use of computers among managers, since managers for a major part of their jobs are knowledge-workers, is one of the critical factors in achieving business success or failure [4; 12; 11] Traditionally, managerial computer support consisted of formalized reports produced at regular intervals by a centralized computer department; but with the introduction of the personal computer in the early 1980s, computing power was placed at the managers' fingertips. However, it soon became apparent that the existence of cheap computer power was not sufficient to provide the information processing services managers needed.

Effective computer support requires the integration of advanced communication and computing technologies, improved group-decision technologies and structures, and decision-process management [7]. The introduction and use of computers must be managed to take into consideration present and future experience levels of the users, available computer technologies, business demands, economic factors, security considerations, the need for integration of data resources, computer communications, and the need for support of the user community [10; 6]

Studies of end-user computing in business organizations have covered hands-on use of computers and the use of support functions, that is, formally established organizational units or colleagues people contact to get help to solve computing problems or discuss computer-related ideas [14; 2; 5 8]. These studies also reported, to some extent, the importance of computer applications and support functions used.

However, studies published so far are lacking in three respects: (1) they do not concentrate on *managers'* use of computers and need for support; (2) they have not looked at managerial computer use in its totality, that is, they have concentrated on managers' hands-on use of computers and omitted delegation of computer tasks; and (3) the role of end-user computing compared to other types of computer support that is available in organizational settings has not been analyzed.

This article seeks to develop an integrated approach to managerial computer utilization. By understanding the patterns of hands-on use and delegation of computer tasks in an organizational setting, effective guidelines can be developed to support managerial use of computers.

The Scope of the Research

The objective of this research was to examine managers' use of computers to support their own jobs, that is, end-user computing. Types of computing other than end-user computing exist in organizational settings (for example, transaction-based systems [back-office systems] or formal planning and control systems). In order to appreciate the role of end-user computing, it is necessary to know the importance managers attach to end-user computing relative to the importance of other types of computing taking place in the organization.

End-user computing has been defined by Leitheiser and Wetherbe in the following terms: "End-user computing is the usage and/or development of information systems by the principal users of the systems' outputs, or by their support staffs" [9, p. 2]. Clearly, this indicates that managers can choose whether to execute some computer task themselves or to delegate the execution to someone else. Hands-on use and delegation gives us information in regard to *what* is done. We also need to consider *how* managers learn to execute necessary computing tasks. Consequently, the picture of managerial use of computers is not complete unless we also consider where managers go to discuss computer related matters or to ask for help.

In conclusion, end-user computing in a managerial context consists of three equally important elements: hands-on use

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of computers, delegation of computer tasks, and use of sources for discussion and/or help. The three elements may, in general, not be used to the same extent or deemed equally important. Also, within any of the three main elements, we would expect to find that some features or services are more used and perceived as more important than others. In any case, importance is a critical piece of information since, for example, an application package may be much used but not perceived as important or, conversely, another package may not be much used but highly valued. In the first instance the indication is that managers would be better served if they could delegate more while, in the second instance, higher availability of the software or more training in the use of the product may be called for. The major elements of managerial use of computers are shown in Figure 1.

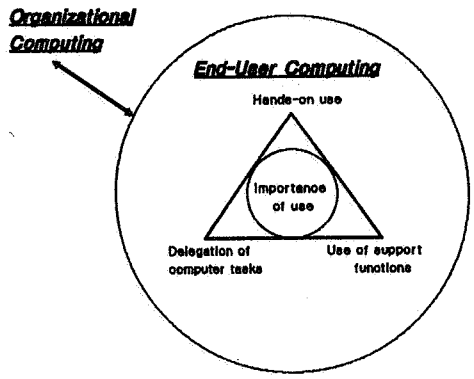

Figure 1: The Basic Elements of End-User Computing.

In summary, in order to understand the role of computer support of managers, the usage patterns and relative importance of features and services within hands-on use of computers, delegated computer tasks, and support functions need to be noted. The perceived importance among these three types of services may also vary, and the importance of end-user computing must be viewed in conjunction with other types of computing within the organization.

Research Design

The investigation used a field study design. The two major issues that determined the design of the study was the definition of the term manager and the concept of use. The objective was to study end-user computing in a managerial context. Naturally, the extent of end-user computing will vary among managers. A major concern was that managers working in a staff or specialist capacity may have drastically different computer support needs compared with line managers. The major worry here is the impact of a more narrow set of tasks on the need for computer support. Therefore, the study was limited to managers in a line position. Within the line-management population, managers at different levels may have different computer support needs. In particular, top managers may have different computer support needs than middle managers. Also, previous research has documented that middle managers use computers more than top managers [1; 8]. Therefore, the study focused on middle managers. There is no clear definition of middle managers. In the context of this research managers below the level of divisional executive officer and above the level of foreman were labelled middle managers. The decision rule used was that managers who, in principle, carried out a managerial role, rather than the direction of people on an hourly basis, should be included in the study.

The concept of use of computers also covers non-use. As indicated previously, managers may chose hands-on use of computers or delegate. Our main concern here was that managers that do not use computers themselves may be inclined not to participate in a study if the outcome of the study does not relate directly to them. The danger of over-representation of managers who actively use computers would be greatest in a general survey since this design alternative gives the respondent no other incentive to participate than interest in the subject area or research in general. The questionnaire used for this research was lengthy and asked many detailed questions. These two additional factors may also contribute toward biased and low response rates.

Based on these considerations, a division within a major defense contracting company in the Minneapolis/St. Paul area was invited to participate in the study. The division's main tasks were marketing, contract bidding, production planning, production, and distribution of finished goods. Sales in 1987 were approximately $ 200 million and had tripled since 1984. The division had been experiencing healthy growth. The number of employees had increased at approximately the same rate and there were employees of every age. The division began using PCs in 1982 and the number of personal computers had increased steadily in numbers until approximately half of the management population had direct access to PCs at the time of the study (1988). Managers used many different computer applications and many support functions were in place. Computer use and support had grown rapidly over the previous years. Growth of development in the main business areas, as well as in computing, could be characterized as rapid but steady rather than revolutionary.

In all, 110 middle managers were identified as candidates for participation in the data collection. The average age of the managers was 46.3 years. They had, on average, 24.9 years working experience, worked 18.2 years for the company, and 10.8 years for the division.

A questionnaire was developed as the main vehicle for data collection and was extensively tested prior to distribution (a copy of the questionnaire is available on request). Local names for computer applications and support functions were adapted to ensure that participants would recognize which aspects of computer use the study covered. Participants were also guaranteed that the information they provided would be treated confidentially and that only aggregated data would be reported. Ninety-nine middle managers returned the completed questionnaire, for a response rate of 90 percent.

Accurate collection of data regarding personal use of computers is problematic. Ideally, the computer should measure use as it occurs. This scheme requires development and installation of complex software. Additionally, data registration would have to take place over a longer period of time. These prerequisites could not be met in this research setting. Therefore, perceptional and recall data were used. Because of the concern regarding the accuracy of recall data, the participating managers were asked to base responses on their use of computers and support functions over the last six months only. The pre-tests of the questionnaire documented that the managers felt comfortable with quoting the typical number of hours they used computer applications in a week over a period of six months. Although they could not guarantee the exactness of the information given, they felt that the numbers gave a correct picture of the volume of use and the relative intensity of use among applications. Their use of support functions could not be mapped in the same manner since the contact pattern over a week was too infrequent. In this instance, respondents were asked to write down their use of support functions over the total period of the last six months.

The measurement of delegation of computer tasks posed some difficulties. As previously explained, the actual delegation behavior could not be directly observed. In regard to perceptual measures, one could ask about how many times managers delegated computer tasks or the frequency of delegation relative to their hands-on use. In the context of this research, the main objective was to map

Table 1
Hands-on Use of Computers, Delegation of Computer Tasks, and Their Perceived Importance

	Hands-on Use		Delegation	
	Average number of hours use per week	Perceived importance	Average relative delegation frequency	Perceived importance
Averages for all managers	3.34	2.26	4.51	2.73
Itemized application areas:				
Word processing	1.38**	2.84**	5.35**	3.67**
Spreadsheet/financial modelling	0.64	2.74**	4.62	2.99**
Business and presentation graphics	0.21	2.36	4.84**	3.04**
Flowchart and diagram graphics	0.20	2.18	4.97**	2.94**
Database query/Reports	0.19	2.44	4.75	2.76
Project scheduling	0.09	2.03	4.81	2.78
Electronic messaging and/or mail	0.01	1.81	4.53	2.33
Custom programming	0.08	1.57	4.29	2.05
Access to company internal databases	0.40	2.57	4.85**	3.05**
Access to company external databases	0.00	1.47	3.58	1.29
Miscellaneous applications	0.23	2.57	3.07	2.50

Notes: Each of the four variables – number of hours use per week, importance of use, delegation frequency, and importance of delegation – was submitted to a statistical analysis of variance separately. Stars (**) indicate application areas where the Scheffee statistical procedure for detecting differences found significantly higher means.

The means of weekly hands-on use per week are calculated based on use as well as nonuse. Subjects who do not use the computer are calculated as "0".

Delegation frequencies were measured on a scale from 1 to 6 with 1 denoting "never delegate" and 6 denoting "always delegate."

Importance scores were measured on a scale from 1 to 4 with 1 denoting "not at all important" and 4 denoting "very important."

delegation patterns relative to the amount of hands-on use. The number of times managers delegate would not represent the appropriate data since number of hours of direct use of computers and the number of times delegation occur measure two different phenomena. Consequently, the concept of frequency of delegation was regarded as the proper measure.

Results of the Research

The outline for presentation of results is as follows: first, findings regarding managers' hands-on use of computers and their delegation of computer tasks to secretaries and other types of staff is presented. Information about managers' use of support functions is then noted. Next, the relative importance of hands-on use of computers, delegation, and the use of support functions and the importance of end-user computing compared with other types of organizational computing is discussed. Following that, differences in use between more and less innovative middle managers are addressed. Finally, relationships among use of computers, generation of change in business ideas, and generation of change in computer ideas are explored.

Managers' Hands-On Use and Delegation of Computer Tasks

The questionnaire elicited information about the eleven computer applications included in Table 1. The respondents also had the opportunity to supplement the survey with information on other applications they used but that were not itemized (miscellaneous applications).

The managers' hands-on use of computers was measured by the number of hours of use per week per application. Delegation was measured by a scale asking the respondents how often they delegated computer tasks in each of the eleven itemized application areas relative to their own hands-on use (ranging from 1 to 6 with 1 denoting never delegating and 6 denoting always delegating – this scale contains six alternatives since it is very likely that the extremes, that is, that a manager always or never delegates computer tasks for a specific application area, are highly probable choices). The perceived importance of each application area was measured for both hands-on use and delegation (ranging from 1 to 4 with 1 denoting not at all important and 4 denoting very important). Each variable was then separately submitted to an analysis of variance to detect differences among means. The results are presented in Table 1.

Table 1 identifies word processing as the most used application. Previous research findings that spreadsheets were used extensively [8] was not replicated here. However, hands-on use of spreadsheets was perceived as more important than all applications except word processing.

Application areas where delegation occurred more frequently revealed a somewhat richer pattern. Word processing was delegated most frequently and was perceived as more important. The delegation of business and presentation graphics, flowchart and diagram graphics, and access to company internal databases occurred frequently and were also perceived as important, indicating that the middle managers surveyed have delegated computer tasks at a satisfactory level. Spreadsheets/financial modelling is again the exception; a significant importance rating in this area is not matched with a significant delegation frequency. The reasons might be of a technological, organizational, or business nature. Perhaps spreadsheet software is not available at an adequate level. The people managers are supposed to delegate these tasks to may not be familiar enough with the software to carry out the delegated tasks at a satisfactory level of quality and speed. Finally, spreadsheet applications may not be delegated because to do so may not be appropriate. That is, the data may be confidential or require managerial judgement. Further research is required to settle this issue.

Managers Use of Support Functions

Support functions were defined as persons or formal organizational units managers would contact to ask for help or to discuss computer-related issues. Twelve support functions were itemized in the questionnaire. Respondents could also supplement the list by identifying other support functions they had used but that were not itemized.

Frequency of use was measured by the number of times over the last six months the respondents had contacted the support functions. The importance of each support function was measured on a scale from 1 to 4 (1 denoting not at all important and 4 denoting very important). The ratings were submitted to an analysis of variance to detect which support functions were most used and which support functions were perceived as most important separately. The results are shown in Table 2.

On average, each manager contacted support functions over nineteen times in a six month period. Other managers and workers were contacted significantly more often than any other support function. Managers and workers were also perceived as most important and as the most helpful discussion partners. Only four managers contacted support functions other than those listed in the questionnaire (miscellaneous support functions, such as consultants working for the corporation). The high importance rating of miscellaneous support functions must, therefore, be interpreted with care since utilizing these sources is not a typical action in the management population.

Of all the formal support functions, only user groups and the information center were perceived as important. The frequency of use of user groups and the information center is not significantly higher than for other formal support functions; however, this study did not elicit information that could provide insight into the discrepancy between importance scores and frequency of use. Researchers have speculated that formal support functions manned by computer experts do not work well because experts cannot understand the real reasons why users have problems. Conse-

Table 2
Frequency of Use of Support Functions and Their Perceived Importance

	Average number of times contacted over the last six months	Perceived importance
Averages for all managers:	19.34	2.28
Itemized support functions:		
Managers and workers (not experts)	9.71**	3.32**
User group (formally established organizational computer support units with members from the community)	2.11	2.85**
Engineering computing support group	1.27	2.28
Information center	1.65	2.85**
End-user computing support group	0.44	2.00
Small computer applications group	0.32	1.67
Microcomputer support group	0.06	1.56
Central systems support group	0.91	2.08
Hotline/help-desk (for central systems)	0.22	1.69
Vendors and external consultants	0.96	2.15
Friends and relatives	1.22	1.79
The in-house computing newsletter	0.42	1.74
Miscellaneous support functions	0.33	3.57**

Notes:
Each of the two variables – average number of times contacted and perceived importance – was submitted to a statistical analysis of variance separately. Stars (**) indicate application areas where the Scheffe statistical procedure for detecting differences found significantly higher means.

The average number of times a support function was contacted over the last 6 months is calculated based on those who use support functions and those who do not. Subjects who do not use a support function are calculated as "0".

Importance scores were measured on a scale from 1 to 4 with 1 denoting "not at all important" and 4 denoting "very important."

quently, users would perceive expert help as not as effective [14]. This chain of reasoning does not explain why the managers in this study perceived user groups and the information center as important to them. It might be that managers are of the opinion that these sources for help ought to be able to support them but that in reality managers do not get the answers for which they are looking.

The Importance of Managerial Use of Computers

The average importance scores for the three areas of end-user computing are shown in Table 3.

Table 3
Average Importance Score for Hands-on Use, Delegation of Computer Tasks, and Use of Support Functions

	Average importance score
Hands-on use of computers	2.26
Delegation of computer tasks	2.73**
Use of support functions	2.28

Notes:
Stars (**) indicate average importance scores that are significantly higher than importance scores for other areas.

Importance scores were measured on a scale from 1 to 4 with 1 denoting "not at all important" and 4 denoting "very important."

Managers' delegation of computer tasks was perceived as more important than hands-on use of computers and use of support functions. *Therefore, in the context of this research we conclude that not only do managers delegate computer tasks more often than they execute computer tasks themselves but delegation of computer tasks is also more important to managers than hands-on use of computers.* The reason for this might be that delegation is the most preferred method of executing computer tasks or that managers delegate the most important computer tasks because of the time commitment for completion or their complexity of the task. It is also striking that the average importance scores for hands-on use of computers and use of support functions are relatively low. Managers perceive that hands-on use of computers and use of support functions are, in general, not very important.

An indirect comparison between the importance of managerial use of computers and the importance of other types of computing was carried out by incorporating a question about the overall importance of computers for the managers' jobs. It was supplemented by three questions derived from Trice and Treacy's [13] theoretical expositions on the importance of computers. Trice and Treacy argue that if computers are important, people will depend on computers to get their jobs done, they will have control over the computer activities that are necessary to get their job done, and computer use will have become a routine procedure. The results of the analysis are shown in Table 4.

The rating of computer support and the degree to which managers depend on computers to get their jobs done were found to be significantly higher than the average scores for the degree to which managers perceived they were in control of the computer activities that were necessary to support their jobs and the degree to which using computers had become a routine procedure for them. An argument would be that if end-user computing was the most important and most common aspect of computing in an organization, managers should score high on the control and routine

issues. The essence of end-user computing is that the user is in control of computer use and that exerting control also leads to familiarity of use. Conversely, a high degree of dependency upon the smooth functioning of centralized transaction and budget and planning systems would indicate that computers are perceived as important. However, perceived importance would not imply that the manager is in control since centralized transaction and budget and control systems are run by the central electronic data processing department. *Therefore, it is concluded that end-user computing is not the most important aspect of computing taking place in the particular setting of this research.*

Table 4
Importance Scores of Computers in General

	Average score
Computer support is important in my job.	4.56**
I depend on computer support to get my job done.	4.24**
I have control over computer activities that are necessary to support my job.	3.48
Using computers has become a routine procedure for me.	3.53

Notes:

The introduction to the four items read: "Consider the last six months of computer use, circle a point on the scales below to indicate how much you agree or disagree with each of the following statements." The five-point scale used was: 1) Strongly disagree, 2) Disagree, 3) Undecided, 4) Agree, and 5) Strongly agree.

Stars (**) indicate average scores that are significantly higher than scores for other areas.

Discussion

A major finding that emerged from this research is that managers delegate computer tasks more than they actually use computers and that delegated computer tasks are perceived as more important than hands-on use of computers. The computer applications that managers use most, delegate most, and perceive as most important can best be understood in the context of knowledge work. Knowledge work is defined by Davis and Olson [3] as "work that involves thinking, processing information, and formulating analyses, recommendations, and procedures." The information processing that is required may be partitioned into four distinctive steps: (1) information collection, (2) information analysis, (3) information enhancement, and (4) information communication. The computer support that managers appear to utilize and prefer in this context is summarized in Table 5.

The results indicate that managers are not extensive users of traditional computer applications such as programming languages or database systems. They are prone to take advantage of computer applications that are easy to use such as word processing packages and, if they want to analyze data, spreadsheets. If they need information from corporate databases, they are inclined to delegate the task of accessing data to staff. It is somewhat surprising to find that managers, at least in the present sample, even prefer to delegate business graphics tasks. It seems logical that use of business graphics and word processing would follow a common pattern. That is not the case according to the findings in this research project.

It also seems logical that electronic mail would play a significant role in making the distribution of computer output more effective. However, no evidence was found to support this notion. It might be that the electronic mail system in the participating division was not developed to a level where managers would have found it natural to use (the electronic mail system in place only covered approximately 30 percent of the management population). However, managers were not convinced that an expansion of the electronic network would benefit them. On the question of whether they currently had the computer communication arrangements they needed, the average score was 3.5 (on a scale from 1 to 5 where 1 denotes strongly disagree and 5 strongly agree.) The average score is between undecided and slightly favoring expansion of electronic communication services. One reason for this attitude may be that electronic communication only carries formal information. A major part of managerial communication is negotiations. Managers often have ideas for adjustments or development of products, production processes, or administrative processes. In these instances informal communication in the form of personal contacts, immediate feedback, and body language

Table 5
Managers' Preferences in Regard to Hands-on Use of Computers and Delegation of Computer Tasks in the Context of Knowledge Work

Phase of Knowledge Work:	Hands-on Use of Computers	Delegation of Computer Tasks
Information collection		Access to internal databases
Information analysis	Spreadsheets	Spreadsheets
Information enhancement	Word processing	Word processing
		Business graphics
		Flowchart and diagram graphics
Information communication		

may play an important part in idea refinement and development. Electronic communication does not allow for these more subtle forms of information exchange.

Managers' preference for the easier to use aspects of use of computers was also found in regard to managers' use of support functions. Managers contact other managers and colleagues more and perceive the people they work with as a more important source for help than any other support function available to them. The reason for this, as explained earlier, may be that experts are not readily available. However, it might also be that colleagues and co-workers know more about business needs and subsequent need for computer support. More research is needed to expand our understanding of the relationships among business needs, level of information and computer literacy, and computer support.

Computer support of knowledge workers is a complex issue. Managers use a variety of computer applications and they require a flexible arrangement of technologies and staff to enable effective use and delegation of computer tasks. Generally speaking, effective computer support of managers requires integration on five levels as shown in Table 6.

Table 6
The Five Levels of Integration Needed to Promote Effective Use of Computers Among Managers

Level	Description
1	Manager to technology integration (user interface) to allow ease of use.
2	Integration among application packages to allow similarity of use and transport of output (data and graphics).
3	Manager to support staff integration to allow effective delegation and partitioning of work tasks.
4	Manager to peer integration to allow effective communication, planning and scheduling.
5	Manager to database (internal and external) to allow access and update of basic information.

Organizations cannot rely on strategies promoting computer use by singling out smaller segments of their employee population. It is, for instance, not sufficient to promote computer use only among managers since managers are likely to delegate computer tasks to staff. This fact makes a larger audience of employees in the organization a target for support activities.

We have to keep in mind that the conclusions and recommendations from this research are based on findings from only one division. Consequently, the conclusions may not be generalizable. Further studies are needed to verify them. It is also probable that the relative amount of hands-on use, delegation frequencies, and use of support functions will change as users mature, the technology penetrates into more areas of organizational life, and the technology matures. However, the results of this study are based on a genuine cross sample of managerial users as well as non-users. It is also, to a large extent, in accord with and supplements previous findings [1; 14; 8]. This study has also shown that future studies of end-user computing in a managerial context must consider the inter-relationships among hands-on use, delegation, and use of support functions.

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