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**THE USEFULNESS OF
COMPUTER-BASED INFORMATION TO PUBLIC MANAGERS***

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ABSTRACT

This paper employs data from 260 public managers to assess two broad images of the potential of information technology and computer-based information (CBI) to serve public managers: the "knowledge executive" and the "CBI consumer." The data were collected as part of a longitudinal study of computer use in over 40 U.S. cities in 1976, and again in 1988. We find that computer-based information is important for most managers, that many report they are extremely dependent upon it, and that they currently find it more valuable for control of financial resources than for management of operations. We further find that, among four sets of factors that might account for the differential usefulness of computer-based information to managers, quality and accessibility of the information and the manager's style of use are particularly important. Finally, we conclude that the managers who are most satisfied with the usefulness of computer-based information are those who use support staff to mediate their computer-based information environment rather than those who use the computer to access information directly. We suggest that such indirect use of computing might be the most appropriate mode for many contemporary managers, and that this has interesting implications for the design of information systems.

KEYWORDS

Computer-based information (CBI)
Usefulness of information
Factors affecting usefulness of CBI
Manager's style of computing use
Accessibility of CBI
Quality of CBI
Cost of CBI use
Mode of computing provision

Professionalism of the organization
Public managers
Knowledge executive
CBI consumer executive
Executive information systems
Managerial task
Information broker
American municipalities

ACM CATEGORIES

J.1, K.4, K.6

THE USEFULNESS OF COMPUTER-BASED INFORMATION TO PUBLIC MANAGERS

INTRODUCTION

Computers and information systems are now present everywhere in American public and private organizations. Over the past three decades an extensive literature has developed on how managers can and should use computer-based information (CBI) to increase their personal effectiveness and that of their organizations. In fact, some have suggested that organizational effectiveness can be measured by the extent to which managers are able to acquire the information that reduces the uncertainty and ambiguity they perceive in their organizational environments (Tushman and Nadler, 1978). But the value of computer-based information to managers remains unclear. Empirical research shows that managers typically use a variety of information sources and that, while computer-based information can play a role in decision-making, it often plays a small role (Jones and McLeod, 1986; Mintzberg, 1972, 1973). The research also shows that an important influence on the use of computer-based information, or any other information media, is the managers' perceptions of its utility (Daft, Lengel and Trevino, 1987; Millman and Hartwick, 1987; Schenk, 1992).

We use data from a large sample of department heads in 46 U.S. city governments to address two key questions about CBI: (1) How useful is computer-based information perceived to be among public managers? and, (2) What accounts for the managers' assessments of CBI?

Contrasting Styles of Managers and CBI Use

It is widely believed that information technology can substantially support the basic managerial function of guiding an organization's resources toward the fulfillment of key goals. As put by

Kling (1980), "analysts of almost every persuasion have suspected that a technology that enlarges the information processing capacity of people or organizations by orders of magnitude must have potent influences on their interactions and work techniques." The underlying premise is that information technology: (1) provides managers with data that are more timely, comprehensive, and accurate; (2) enables managers to perform more precise, systematic, and sophisticated analyses of these data; and, (3) provides managers with hands-on control of and direct access to information (rather than relying on information filtered by others). This view of the contribution of CBI to managers is advanced most enthusiastically by information technologists, consultants and academics--people with a vision of how managers ought to use the technology. But how do managers themselves actually view computer-based information? The broad literature suggests that managers have various styles of using computer-based information, but we concentrate on two dominant user styles.

The first style is "the knowledge executive" (Cleveland, 1985) for whom CBI is indispensable. This type of manager has extensive CBI at his/her fingertips, actively searches files, performs ad hoc analyses, and generates reports -- all of which provide information leading to insight and guiding action. This manager typically places particular importance and credibility in CBI, relative to other types of information. Beginning with such classic works as those by Leavitt and Whisler (1958) and Simon (1960), through the enthusiasm for management information systems and decision support systems in the 1970s (Gorry and Scott-Morton, 1971; Keen and Scott-Morton, 1978), to the more recent observations about the "control revolution" (Beniger, 1986), the image of the knowledge executive, an active and direct user of information technology, has been widespread, and perhaps dominant.

A second style is "the manager as CBI consumer" -- an indirect user of computer-based information that has been generated and interpreted by staff. This manager is primarily interested in a few key data measures and in overall trends from the vast array of CBI that might be

available in the organization. The manager relies on the information filtering and analytic skills of staff who are directly involved with computer systems and CBI. These information brokers anticipate the manager's information needs and attempt to provide no more data than are essential. While computerization has extended the information base and the analytic methods available to the brokers, the manager's own involvement with the information environment is relatively unchanged. This image has been implicit in the early writings about corporate information centers (Dunlop, 1971; Hammond, 1982), and to a lesser extent, executive information systems and executive support systems (Rockart and Treacy, 1982).

There are many ways computers could be involved in the tasks performed by a manager, ranging from electronic communication, to word processing, to data retrieval and analysis. CBI refers to a subset of these broader uses of the computer. It refers to data, analyses or reports obtained from the computer, whether obtained directly by a manager or indirectly through others. Thus, it could include facts selected from a database, a comparative analysis, the output of a computer model, or a periodic, routine report. In this study, we operationalize CBI more narrowly to focus on the public managers' use of computer-based data and reports for managing finances and operations. On the finance side, these managerial tasks include making budgets, allocating manpower, monitoring departmental expenditures, and identifying slack resources. On the operations side, the tasks include evaluating subordinates, evaluating the performance of departmental divisions and subunits, identifying operations problems, and determining solutions to these problems.

Employing data from 260 public managers, we explore the perceived usefulness of CBI to managers for finance and operations tasks, the key factors influencing those perceptions, and the linkages between the managers' style of use and their assessments of the utility of CBI. We offer three conclusions. First, computer-based information is important for most managers, and many even report they are very dependent upon CBI. CBI is particularly important for control of

financial resources, but the majority of managers also find CBI valuable for control of operations. Second, there is substantial variation in the extent of usefulness attributed to CBI by managers. After assessing four sets of factors that might account for differential usefulness of CBI to managers, we conclude that the quality and accessibility of CBI and the manager's style of computer use are particularly important. In contrast, the cost of CBI use, the professionalism of the organization, and whether the manager is served by a centralized or decentralized computing installation have limited or no association with CBI utility. And third, it is those managers with the characteristics of the CBI consumer who attribute the greatest usefulness to CBI. We now present the literature, research questions, data and inferences which result in these conclusions.

LITERATURE AND RESEARCH QUESTIONS

We use perceived usefulness of CBI as the dependent variable in this study.¹ We define usefulness as the degree to which an individual believes that use of CBI enhances his or her work. Usefulness seems one good measure of information systems success for several reasons. First, user perceptions are valid measures of systems success, and are increasingly recognized as such in research and practice. Second, when computer use is voluntary, as is the case with managers, their perceptions of its utility can be considered a reasonable surrogate for "objective" measures of system success (Ives, Olson and Baroudi, 1983).

We distinguish broadly between two types of users who are along a continuum from direct to indirect use and who can be related to our characterizations of managerial styles of use (Figure 1). These are: (1) "Indirect" users whose use of computers and CBI is mediated by other people or who specify to others the information requirements of the data/reports they receive, users consistent with our characterization of the "CBI consumer," and (2) "Direct" users who use terminals or personal computers themselves, users consistent with our characterization of the "knowledge executive."² Figure 1 shows these styles of use and compares them with other key

characterizations of use by the CODASYL End-User Facilities Committee (reported in Lefkovits, 1979), Davis and Olson (1985), McLean (1979), and Rockart and Flannery (1983). The shaded areas in the figure indicate other characterizations that are comparable to the two styles of managerial use we analyze.

[Figure 1 about here]

As shown by the comparisons in Figure 1, we view managerial use of computing as a continuum from indirect to direct use. Moreover, neither direct use nor indirect use is mutually exclusive. A predominantly direct user is likely to use CBI indirectly, and a predominantly indirect user might use CBI directly. However, for the purpose of this analysis we characterize managers in terms of their dominant pattern of use as primarily direct or indirect. That pattern is inferred from the use characteristics reported by the individual managers--whether they are experienced with computing, use CBI directly or indirectly, and rely upon experts for CBI.

Perceived Usefulness of Computer-based Information

Some empirical work has questioned the extent that CBI is actually useful to managers. Managers have many sources of information besides those provided by computer systems, and CBI might be less well suited to the managers' information needs than these other sources. Thus, for example, some of our own earlier work concluded that (for managers in the late 1970s) "...the value of computing for managerial control is evident, but limited" (Danziger and Kraemer, 1986).

However, there are reasonable grounds for expecting that CBI now has more substantial value to managers (and other end users) than it did a decade ago. These include the continuing enhancements in the versatility and ease of use of software and hardware, the introduction of executive information systems specifically intended to assist managers, the greater computing

competency of end users, and the trend in most organizations towards providing more user-oriented computing services. It also seems that in many public organizations the quality of CBI, is now considerably higher,

Davis & Olson (1985)	CODASYL End User Facilities Committee (Lefkovits, 1979)	McLean (1979)	Rockart & Flannery (1983)	Manager's Style of Use (this paper)
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INDIRECT USERS

Primary User Makes decisions based on system output	Indirect User Uses computers through other people	CBI Consumer Indirect user of CBI that has been generated and interpreted by staff
	Intermediate User Specifies information requirements for reports they receive	

INFORMATION BROKERS

Secondary User
Interacts with system to prepare input or reports but does not directly use output in his/her job

DIRECT USERS

Integrated User Person who uses the system output also develops it	Direct User Uses computer terminal	Non-DP Trained User Uses code written by others	Nonprogramming End User Uses code written by others	Knowledge Executive Direct user of CBI, and might place particular importance and credibility in CBI relative to other information
			Command Level User Performs simple queries and generates unique reports for own use with report generators	

DP Amateur
Writes code for his/her own use

End User Programmer
Writes code for his/her own use

DP Professionals
Write code for

Functional Support Personnel
Sophisticated programmers

others

writing code for others

**End User Computing
Support Personnel****DP Programmers**

Figure 1. Comparison of End User Classifications

particularly that which tracks the status of financial and human resources and that which measures performance. Thus our expectation is that most managers find CBI useful in some cases, although few are highly dependent upon it, and that there has been some increase in the usefulness of CBI to managers during the last decade. This raises two research questions:

Question 1a: Is CBI useful to the majority of managers?

Question 1b: Has the utility of CBI has increased during the past decade?

Factors that Influence the Perceived Usefulness of Computer-based Information

The literature on the perceived utility of CBI to executives (and other end users) indicates that utility can be based on a complex set of factors, including characteristics of the information, the individual, the task, and the environment. Figure 2 is a list of the factors that research indicates might affect the perceived usefulness of CBI. Each of these explanatory factors can be elaborated as research questions for our analysis.

CBI Characteristics

Quality

Accessibility

Cost of CBI use

Individual Characteristics/Style of Use

Years of experience with computing

Direct use of computing

Indirect use of CBI
Reliance on experts for CBI
Task Characteristics
Operations management
Financial management
Environmental Characteristics
Professionalism of the organization
Mode of computing provision

Figure 2. Factors that Might Affect the Perceived Usefulness of CBI

CBI Characteristics

The literature identifies several characteristics of CBI as particularly important for end users: (a) the quality of CBI; (b) the accessibility of CBI; and (c) the cost of CBI use (Culnan, 1983; Zmud, 1986).

a. *CBI quality.* It is widely assumed that CBI will be more useful to a manager if the information is of high quality. The research supports this assumption (Hogarth, 1980). Although there are various aspects of quality (also referred to in the literature as accuracy), quality will be assessed here primarily in terms of three indicators: whether CBI provides precise information, new information, and up-to-date information. One might argue that information quality is key to the usefulness of information.

Question 2a: Will CBI be more useful to the manager if the available data are of higher quality?

b. *CBI accessibility.* CBI will be more useful if the information is easy to obtain (Culnan, 1983). At the heart of the accessibility issue is the frequently heard lament that while relevant data are "in the system," these data are not easy to get and/or to analyze for management

purposes. A related aspect of accessibility is whether computing saves the manager time in looking for information (Culnan and Markus, 1987; Tushman and Nadler, 1978).

Question 2b: Will CBI be more useful if data are more accessible to the manager?

c. *Cost of CBI use.* Much of the data that might be of value to managers is contained within databases initially designed for other uses. A common problem therefore is the need to reformat the data in a way that is useful to the managers' problems or questions. While relevant data may be readily available and quickly produced from the computer, their usefulness to managers may be significantly reduced if time and money must be expended in reorganizing, extracting, aggregating, or otherwise formatting the data for managerial use. These factors are referred to as the cost of CBI use.

Question 2c: Will CBI be more useful if data are in a form that reduces the cost of use to managers?

Individual Characteristics/Style of Use

The notion that individual characteristics and a manager's style of computing use might be an important factor was first articulated by Mason and Mitroff (1973), who developed several rich classifications. Most current research tends to focus on four characteristics of the individual--experience with computing, direct/indirect use of computers, direct/indirect use of CBI, and reliance on experts. As will be seen later, managers' style of use can be inferred from several of these characteristics.

d. *Experience with computing.* Both theory and research indicate that continued use of an information source reinforces or improves perceptions of the source's utility. Also, a longer period of use can increase the individual's effectiveness in using computers, and hence improve the utility of use (Culnan, 1983; Fishbein and Ajzen, 1975). Therefore, we expect that managers with greater computing experience are likely to rely upon CBI more extensively and to find it more useful.

Question 2d: Will managers who are more experienced with computing find CBI more useful than those less experienced?

e. *Direct use of computing.* Research also indicates that direct use reinforces the perception of the utility of information sources more than indirect use (Culnan, 1983; Millman and Hartwick, 1987). Presumably, direct use can provide the manager with greater control over CBI and increase the likelihood that CBI meets the manager's information needs. Thus, we expect that CBI will have greater usefulness for managers who are more active, direct users. They are more able to access, manipulate and understand CBI than managers who rely upon others.

Question 2e: Will managers with greater direct use of computing find CBI more useful?

f. *Indirect use of CBI.* If direct use of information sources does reinforce the perception of the utility of CBI because of increased control (Question 2e), indirect use of CBI might lower the utility attributed to CBI, because the manager has less control over the CBI. However, it might be that managers who are frequent indirect users of CBI might find it quite useful independent of their level of direct use. Nevertheless, our research question assumes that control and usefulness are linked.

Question 2f: Will managers who are more frequent indirect users of CBI find it less useful?

g. *Reliance on experts.* Some empirical research concludes that executives tend to rely more upon people as information sources than on CBI, or that they rely upon experts to interpret CBI (Mintzberg, 1973; Schenk, 1992). These findings are supported by theory which explains the executives' preference for human sources on the grounds that people provide richer substantive information, filter information for relevance, and provide information about the social context of the information. Human sources therefore are perceived to be more useful than "pure data" for supporting the complex and ambiguous nature of executive decision making (Daft and Lengel, 1986). In addition, recent empirical research on executive information systems (EIS) indicates that executives use human information sources more than CBI even though they do not find the human sources to be the most accurate. This is because the "executives can query the human information sources more extensively than other sources. They can also challenge or receive confirmation of their interpretation of the information directly from the source" (Schenk, 1992). Thus, it is possible that executives who rely heavily upon experts to interpret their CBI might find CBI more useful than would those who are direct users.

Question 2g: Will managers who place greater reliance on experts find CBI more useful?

Task Characteristics

h. *Nature of managerial tasks.* The tasks that a manager performs have implications for his/her use of CBI, just as do individual characteristics. There are various ways in which the tasks that managers perform might be classified, but the most common distinction in the literature is in terms of task complexity, and the most common classification of tasks on this

dimension is between routine and non routine tasks. The research shows that the more complex (less structured, less routine) the task, the greater the manager's need for multiple sources of information and multiple inputs from preferred sources. Therefore, we would expect the managers to judge CBI to be more useful for structured, routine tasks than for complex tasks. The management of financial resources can be considered a more routine task, in the sense that most of the needed data are known, agreed upon, and frequently available. In contrast, the management of department operations is non routine in that the needed data tend to be unstructured, more subjective, and less easily available.

Question 2h: Will managers find CBI more useful for management of financial resources than for management of department operations?

Environment Characteristics

There are a variety of environmental factors that might be expected to influence manager's use of CBI, such as organization size, organization centralization, and environmental complexity (Huber and Daft, 1987). Prior research on cities has shown that these factors appear to be relatively less important regarding variation in computer impacts than two key features of the government environment itself: decentralization of computing, and professionalism of the government (Danziger and Kraemer, 1986; Kraemer, King, Dunkle and Lane, 1989).

i. *Mode of computing provision.* The research suggests that end user's satisfaction with CBI is contingent upon the organizational arrangements through which computing is provided (Danziger and Kraemer, 1986; Millman and Hartwick, 1987). In the last decade there has been particular emphasis on the value of decentralized computing (i.e., a computing unit that serves a department directly), because it is assumed decentralized computing service is more responsive to the needs of the end user. Our research question is guided by this assumption.

Question 2i: Will managers receiving their CBI from a decentralized (departmental) service provider find the CBI more useful?

j. *Professionalism of the organization.* Research by Culnan (1983) and others indicates that use of CBI is influenced by organizational norms. One of the key norms influencing public managers is professionalism. Since the early 1900's many U.S. local governments have adopted practices to strengthen the role of professionalism in public management. The idea is that local government should be run in a "business-like" manner by professionals rather than in a "political" manner by politicians. A main feature of these management practices is to limit the role of politicians to the setting of policy, while leaving the actual running of government to appointed professionals who are more likely to emphasize rational decision-making based on facts. Thus, managers in more professional governments are likely to place greater importance and credibility in CBI than those in less professional governments.

Question 2j: Will CBI be more useful to managers in governments characterized by the more professional management practices?

METHODS, DATA AND MEASURES

Methods and Data

To measure the extent to which public managers find CBI useful and to assess the factors that might account for differential levels of utility, this analysis uses data obtained from intensive studies of computer use in 42 U.S. cities in 1976 and in 46 cities in 1988 (Danziger and Kraemer, 1991). In both studies, investigators from the project spent 1-2 person weeks conducting field research in each city to gather data on the local conditions, the political and administrative system, and the information systems of the government. Data collection methods included semi-

structured interviews with top management, MIS professionals, and user department personnel. In addition, user survey questionnaires were distributed to approximately 2,500 city government employees in the 42 cities in 1976 and to approximately 5,000 city government employees in the 46 cities in 1988. The user survey focused on questions regarding the use and impacts of computerization in the job. The questionnaire contained sections completed by all respondents and also special sections designed for specific roles, e.g., clerical office workers, staff professionals, division heads, managers.

Because this analysis focuses on those in public management roles, it uses only the responses of department heads to the user survey. In local governments, department heads report directly to the senior government executive such as the city manager, chief administrative officer or mayor. Thus, the public managers in this analysis are similar in level to many corporate executives. Depending upon city size, a specific set of department heads were surveyed, selected from particular government departments: finance, budget, police, library, planning, personnel, fire, public works, public health, public welfare, assessment, traffic, utilities, treasury, central garage, parks and recreation, building, and community development. Response rate by city varied between a low of 38% of the department heads to a high of 100% of the department heads targeted for participation in the survey. The overall response rate for department heads is 75%.

The sample for the analysis consists of the 260 department heads located in 46 cities. These managers had computer-based information available to them for use in either operations management or financial management, and they did not have missing data on any of the key variables used in the analysis. The respondents constitute 55% of the total number of department heads who were surveyed. Analysis of differences of means between the departments heads included and excluded from the sample indicated that for most of the key variables there was no statistically significant difference between the two groups. The major difference was the frequency of direct use of computing (mean score of 2.91 for the department heads in the analysis

vs. 2.48 for those excluded due to missing data--see the Appendix for how we measure this variable).

Measures

We briefly characterize the measures for our dependent and independent variables here, and we describe them more fully in the Appendix. Our two dependent variables are the perceived usefulness of CBI, both for "financial management" and for "operations management. These two measures are derived from a factor analysis of the managers' assessments of CBI usefulness on each of ten specific departmental management activities.

Figure 2 specifies four sets of independent variables. First, there are three characteristics of the CBI, each based on the managers' evaluations of three or four statements assessing information quality (e.g., precision, timeliness), information accessibility (e.g., ease of information availability), and the cost of using CBI (e.g., information overload). Second, characteristics of the individual as a CBI user are based on the managers' years of experience with computing, frequency of direct computing use, frequency of indirect use of CBI, and reliance on experts to provide CBI. Third, two relevant features of the environment of the manager are measured: the extent to which the manager reports that his/her CBI comes from decentralized or centralized computing services, and the overall professionalism of the manager's organization. Finally, the task characteristics are defined as operational or financial management, and each task is the basis of one of the dependent variables.

FINDINGS

General Usefulness of CBI

The first question in our analysis is: How useful is CBI to the contemporary public manager? We answer this question at two levels: the general usefulness of CBI, and the usefulness of CBI for key managerial tasks. Table 1 indicates that CBI is a crucial resource for most public managers. One in four managers (25%) report that CBI is important for doing his/her job in nearly all cases, and CBI is important in most cases for a further 42% of the managers. Not one of the 260 managers reports that CBI is never important to his/her job. Given that these data were collected in 1988, the importance of CBI can be expected to be even greater today as the technology has penetrated both more widely and deeply within organizations and management.

In a quite surprising finding, fully 52% of the managers acknowledge that they are "totally dependent" or "very dependent" on computing in doing their job. Less than one in five managers reports that he/she is slightly or not at all dependent on computing. It is noteworthy that this notion of "computing" is a broad one, referring to the use of CBI whether direct or indirect, and also to the direct use of computers for tasks such as electronic messaging and word processing. While these findings are consistent with our expectations regarding Question 1a, managers are generally more positive about the value of CBI and are more dependent upon computing as a whole than we expected.

Table 1. Perceived Importance of CBI and Dependence on Computing by Public Managers

	% of Managers
Importance of computer-based information to job ^a	
In nearly all cases	25%
In most cases	42%
In some cases	33%
In no cases	0%
Manager's dependence on computing in doing job ^b	
Totally dependent	5%
Very dependent	47%
Somewhat dependent	32%

Slightly dependent	15%
Not at all dependent	1%

N = 260 department heads in 46 cities

- ^a Exact wording: In general, how often is computer-based information important in doing your job?
^b Exact wording: In general, how dependent are you on computing for doing your job?

Change in the Usefulness of CBI

Table 2 provides specific measures of the utility which managers attribute to CBI on selected managerial activities. And, using the corresponding questionnaire items from our research in 1976, the table also reveals whether the utility of CBI has changed between 1976 and 1988. While the 1988 survey does not use the same respondents as 1976, a longitudinal comparison of this kind seems reasonable, since the survey questions, the set of cities, and the department head roles are comparable between 1976 and 1988.

The usefulness of CBI clearly depends upon the kind of managerial task to which it is applied. According to managers, the usefulness of CBI for presenting financial data is considerably higher than the CBI that deals with individual and subunit performance. More than three-fourths of the managers find CBI useful or very useful in the budgetary process while less than one in four managers find that CBI has this level of usefulness as they assess the efficiency of the subunits in their departments.

Table 2 also reveals the substantial increase in the usefulness of CBI to managers during the dozen years from 1976 to 1988. On each of the four indicators, there has been a significant increase in the usefulness of CBI. The proportionate increase is greatest for assessing performance and efficiency, although the most (statistically) significant 1976-1988 differences are on the usefulness of CBI for the finance functions. Finally, a particularly striking change has been the large increase in the proportion of managers who now rate CBI to be more important than personal experience in identifying city problems. While 75.5% of the managers placed

greater importance on personal experience in 1976, only 42.4% still found it more important than CBI by 1988. Overall, these data indicate that the usefulness of CBI to managers has substantially increased, although these data do not support the vision of a managerial revolution in which CBI has become the crucial factor in management decision and action.

Usefulness of CBI for Managerial Tasks

Table 3 provides a broader examination of the usefulness attributed to CBI, focusing on operations management and financial management.

Table 2. Change in the Usefulness of CBI to Managers:
Comparison of 1976 and 1988

	1976	1988		Significance of Difference ^a
	%	%	Median	
CBI on subunits' efficiency				
Very useful, useful	14	23		
Somewhat useful, not useful	86	77	2	.012
CBI on subordinates' performance				
Very useful, useful	16	28		
Somewhat useful, not useful	84	72	2	.003
CBI on current expenditure balances				
Very useful, useful	43	54		
Somewhat useful, not useful	57	46	2	.003
CBI for budgetary process				
Very useful, useful	53	76		
Somewhat useful, not useful	47	24	3	.001
Personal experience more important than CBI for identifying city problems				
In nearly all cases	31.4	6.1		
In many cases	44.1	36.3		

In a few cases	19.9	32.7	
Never	4.6	23.0	.001

^a Nonparametric difference in medians test between 1976 and 1988 responses

N= 353 department heads in 42 cities in 1976

N= 260 department heads in 46 cities in 1988

Consistent with Table 2, fully 95% of the managers report that CBI is useful for financial management, with two-thirds judging CBI to be very useful or useful. CBI has considerably less value for operations management, with almost one-fourth of the managers judging that CBI is not useful, and only 3% rating it as very useful. While the managers' assessments in Table 3 are subject to different interpretations, it is clear that CBI does have utility for the large majority of managers, and is especially valued for financial management.

These findings provide strong support for our expectation (Question 2h) that CBI is more valuable to managers on routine tasks compared to less routine management tasks. However, the earlier findings (in Table 2) also suggest that CBI has probably become relatively more important for both domains of managerial tasks over the 12 years covered by the study.

Table 3. Usefulness of Computer-based Information
for Managerial Tasks

Usefulness	Operations Management (N=211)	Financial Management (N=259)
Very useful	3%	18%
Useful	25%	48%
Somewhat useful	49%	29%
Not useful	23%	5%

Explaining Variation in Usefulness of CBI

We have seen that the usefulness of CBI varies by managerial task (Question 2h). Consequently, we are interested in knowing whether there is a difference in the explanatory factors that account for the usefulness of CBI to operations management versus those for financial management. Table 4 presents the data for three explanatory factors: characteristics of CBI, the individual, and the environment. Several broad observations are supported by the data.

First, general environmental characteristics have no systematic relationship with either usefulness index. Neither the mode of computing services provision (Question 2i) nor the professionalism of the organization (Question 2j) is systematically associated with the usefulness of CBI to managers. The fact that centralization or decentralization of computing makes little difference to the usefulness of CBI for managers is especially interesting, because this issue has received so much attention. This finding is consistent with a related analysis for all local government roles, which indicates that the quality of computing services experienced by all end users in local government is not systematically associated with whether computing is centralized or decentralized (Danziger, Kraemer, Dunkle and King, 1993).

Second, higher data quality is associated with the greater utility of CBI (Question 2a). CBI is credited with facilitating both operations and financial management where it provides new information, provides precise information, and provides up-to-date information. The provision of up-to-date information is most strongly related to the usefulness of CBI for financial management.

Table 4. Correlation Between Environmental Influences and Perceived Usefulness of CBI for Managerial Tasks

Explanatory Factor	<u>Perceived Usefulness of CBI for Key Managerial Tasks:</u>	
	Operations Management (N=211)	Financial Management (N=259)
CBI Characteristics		
<u>Quality of CBI</u>		
"The computer does not provide the precise information I need for my work."	-.14*	-.16*
"The computer makes new information available to me that was not previously available."	.24**	.11
"The computer provides me with more up-to-date information than that available in manual files."	.26**	.22**
"Computer-based data not available for the analysis of specific questions or problems"	-.09	-.17**
<u>Accessibility of CBI</u>		
"Computers have made it easier for me to get the information I need."	.31**	.17**
"Computers save me time in looking for information"	.31**	.10
"Difficulties in accessing computer-based data gathered or held by other departments and agencies"	.03	-.02
<u>Cost of CBI Use</u>		
"The computer produces large volumes of data which require considerable wading through to find the information I need."	-.08	-.14*
"Information I need is on the computer, but it requires special programming to get it out."	.04	.03
"Difficulties in transferring computer-based data between microcomputers and larger computers"	.06	-.03
Individual Characteristics/Style of Use		
<u>Years of experience with computing</u>	.14*	.03
<u>Frequency of direct use of computing</u>	.08	-.03
<u>Frequency of indirect use of CBI</u>	.14*	.14*
<u>Degree of reliance on experts to interpret CBI</u>	.16*	.15*
Environment Characteristics		
<u>Mode of Computing Provision</u>		
Decentralized computing	.03	-.06
<u>Professionalism of the Organization</u>		
Professional management practices	.09	.00

** = $p < .01$ * = $p < .05$

Third, greater accessibility of CBI is related to greater usefulness of CBI to managers (Question 2b). Ease of access to CBI has the strongest relationship to usefulness of CBI for operations management, and it is also related to usefulness for financial management. The utility of CBI on operations management is also high for managers when it saves them time in looking for information. While the cost of CBI use (Question 2c) is not associated with the usefulness of CBI for operations management, the presence of too much data is related to lower usefulness of CBI for financial management.

Fourth, greater utility is generally attributed to CBI by managers who have more computing experience, are more frequent indirect users, and rely on experts to interpret CBI (Questions 2d, e, f, g). As expected, managers with more computing experience perceive greater benefits from CBI for operations management; but the relationship between computing experience and CBI utility is not present for financial management. And, as we expected, CBI is perceived to be more useful among managers who are more reliant on experts to interpret CBI for both managerial tasks. However, we were surprised to find that managers who are indirect users of CBI -- that is, those who receive more CBI that has been generated by others -- actually find CBI more useful on both managerial tasks. We were also surprised that usefulness is not associated with the extent to which the individual is a more active, "hands-on-the-computer" manager.

Finally, from among all the foregoing factors, we found CBI accessibility, CBI quality and reliance on experts to have the most significant influence on the perceived usefulness of CBI. We conducted regression analyses³ to assess the relative importance of the factors related to usefulness for operations and financial management. We found three factors to be especially significant for operations management: CBI accessibility (the availability of new information), CBI quality (its time savings benefits in looking for information), and reliance on experts (the manager's greater reliance on experts to interpret CBI). We also found two of these factors to be

significant for financial management: CBI quality⁴ and reliance on experts (Figure 3 and Table 5).

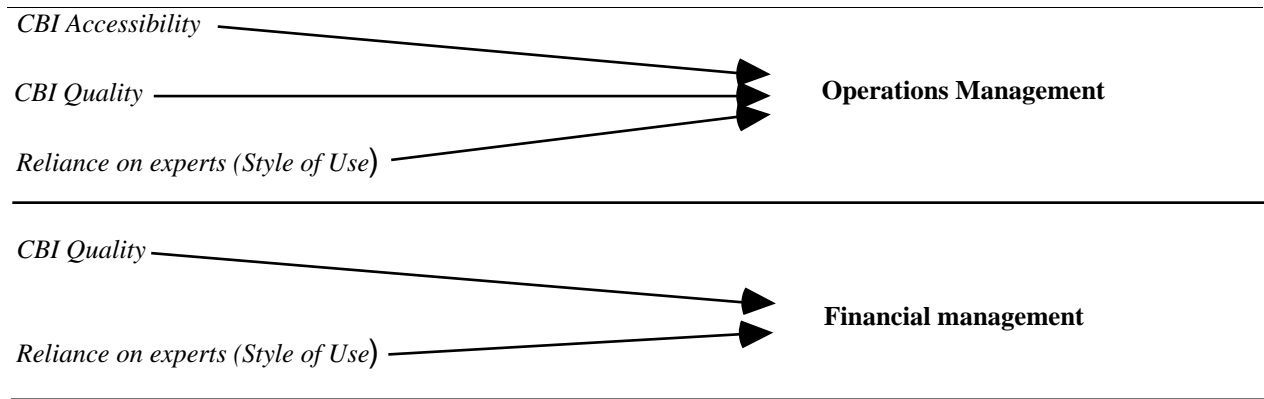


Figure 3. Key Factors Explaining Variation in Usefulness of CBI by Managerial Task

Table 5. Stepwise Regression Results for Key Factors

	Beta	F	Sig. F
Operations Management			
<u>CBI Accessibility</u>			
"Computers save me time in looking for information" (Access)	.27	16.64	.00
<u>CBI Quality</u>			
"The computer makes new information available to me that was not previously available" (Quality)	.16	5.66	.02
<u>Reliance on Experts (Style of Use)</u>			
Degree of reliance on experts to interpret CBI (Style of Use)	.13	3.92	.05
F = 11.49 sig. F = .00 R ² = .14			
Financial Management			
<u>CBI Quality</u>			
"The computer provides me with more up-to-date information that is available in manual files" (Quality)	.20	11.66	.00
"Computer-based data not available for the analysis of specific questions or problems" (Quality)	-.16	7.53	.01
<u>Reliance on Experts (Style of Use)</u>			

Degree of reliance on experts to interpret CBI (Style of Use) .15 6.03 .01

F = 8.99 sig. F = .00 R² = .10

DISCUSSION

Computer-based information is a valuable resource for many public managers. More than half the municipal department heads in this study describe themselves as very dependent upon computing and two-thirds report that, in most cases, CBI is important in doing their job. As might be expected, managers find CBI to be particularly useful as they allocate, monitor and control their financial resources. In local government, financial data were among the first to be automated and financial applications have always been the area of most intensive computerization. Managers rely on automated current balance reports, either printed or on line, to provide accurate and timely information. And it is now possible for managers to receive a vast array of routine and special reports which analyze their financial activities in diverse ways.

Managers find CBI considerably less useful for operations management than for financial management. While financial data are quantifiable and can be systematically gathered as part of ongoing departmental activities, it is more difficult to collect valid and reliable computerized data on the performance of subunits and personnel. Such performance data are usually less easily quantified and their interpretation is more subjective. The automated applications which gather and analyze such data are typically more limited and less sophisticated. As we expected, CBI does seem most useful to managers on more routine and quantifiable task domains.

This analysis also provides some interesting evidence regarding the validity of the alternative images of managers as users of CBI, as described at the beginning of the paper. *First, most managers do not have an aversion to CBI. On the contrary, and to a surprising extent, most managers admit to being very dependent upon computing, and attribute broad importance to CBI in their work.* And the majority of managers now find CBI more useful than personal

experience in identifying problems, a dramatic shift in the utility attributed to CBI between 1976 and 1988.

Secondly, CBI seems to be valued more highly by the managers we have termed CBI consumers than by the knowledge executives. Indeed, CBI is judged most useful by managers who are higher users of CBI generated by others and who rely upon others to screen and interpret that information for them. CBI is not judged as useful by those managers whose computing use is more frequent, direct, and hands-on.

And third, the managers seem very practical in their assessments of CBI. The managers place particular importance on the quality and accessibility of CBI. Of all the explanatory factors examined, the usefulness of CBI to managers is most directly associated with the novelty and timeliness of the CBI, and the extent to which it saves time in searching the information environment. Accessibility seems somewhat less important to the managers than data quality, supporting our assumption that quality would be the most important factor shaping the managers' perceptions of usefulness.

Overall, the most unexpected pattern of findings is the consistent associations between CBI usefulness and a style of computing use that is indirect and relies heavily on information brokers. These characteristics are most compatible with the image of the manager as a consumer of CBI, not as a direct user.

Like many others, we have argued that the most effective managers will be those who move beyond reliance upon information brokers (Danziger and Kraemer, 1986) and behave more like knowledge executives. In this view, the evolving information technology best supports the manager who becomes a direct user of computing. And the preferred role for staff professionals is not that of information brokers but of mentors, who help train their managers to be active users

of computing. This prescription for managers is supported by the considerable performance improvements experienced by middle level staff professionals who are more active, hands-on-the-computer users (Danziger and Kraemer, 1986).

Yet even after a dozen years during which the usefulness of CBI to the managers has increased significantly, the managers who are most satisfied with the usefulness of CBI are those who use support staff to mediate their computer-based information environment. This conclusion is consistent with early experiments about computer support for top level executives conducted within IBM, which found that, even with CBI available, top level executives primarily deal *through people for information*. After seven years of experimental work within IBM, Robert Dunlop (1971) concluded:

Most of the men I have seen at the top executive level in the IBM Corporation are there because of their information-gathering and interpretative ability. They know what is going on and what is coming next...Administrative assistants and key individuals at the corporate headquarters are generally the intelligence sources for top level decision making. The automation of the information from the formal reporting structure is what we are working with, and it is just now coming into its own. The criterion for making it to the top of American industry is primarily the ability to deal with people, manipulate people and organizations, and *deal through people for information* [emphasis added] (Dunlop, 1971: 249).

These early findings are consistent with subsequent empirical research on managers and CBI (Mintzberg, 1972, 1973; Daft and Lengel, 1986; Jones and McLeod, 1986; Schenk, 1992). Moreover, our field research reinforces a very straightforward explanation for why the hands-on manager remains a rare bird. The evolution of a knowledge executive requires more than the desire to become a hands-on user. Most significantly, direct, hands-on use of computing requires

time, expertise, and regular use. Managers must develop a substantial level of computing expertise in order to make effective use of most of the software and organizational databases from which they might generate their own CBI. This requires, among other things, an easy familiarity with how to use software packages that select and analyze data and a sound understanding of the elements, strengths and limitations of available databases. And it requires that the manager use a given computerized database and support system with sufficient frequency to remember the appropriate variables, commands, and protocols necessary to use them with facility. But most managers operate under extraordinary time pressure. The demands on their time are so extensive that they seldom, if ever, can create regular blocs of time to learn major new computing skills that might have eventual payoffs or, or if they did, to sustain their mastery of complicated applications.

Moreover, there is a serious question about whether managers should attempt to gain such computing mastery, even if they can. As one anonymous reviewer for *MIS Quarterly* put it:

A defining attribute of managers is that they delegate physical and intellectual tasks to others. It is part of what makes them so valuable. The insistence of IS researchers that managers (executives) should not delegate information gathering tasks, but should jockey their own keyboards, mice or light pens is a blatant contradiction to this otherwise very robust modus operandi. It does not make sense. You don't make it to the top (or anywhere near it) as a manager if you don't delegate, and information gathering is no exception.

It seems to be inevitable that most managers will use IT in delegation mode. The information intermediary is the newest member of the cadre of secretarial, clerical, accounting and other professional personnel to whom managers have always delegated the more routinized of their information processing tasks. The "unexpected finding..." that (CBI consumers) "...find CBI more useful than the more active, 'hands-on-the-computer'

managers" is not unexpected when viewed from this perspective (Anonymous reviewer, 1992).

In sum, very few managers have the time, expertise and motivation to develop and sustain this level of personal competency and involvement with computing. Even if the manager needs a certain type of CBI regularly, the manager has the authority to require others to provide this information. And it is almost always easier for the manager to request *ad hoc* analyses from staff, rather than to perform the analysis personally. Thus it is usually quite rational for a manager to rely upon skilled staff who serve as information brokers, providing CBI in selective, preanalyzed chunks that the manager can scan or use as the basis for further information requests.

We found few knowledge executives, in our field work, despite the widespread imagery that many managers now are very active in personally accessing and analyzing data on their own desktops. Managers' increasing use of electronic communications and of word processing is making some inroads on managers' preference to leave hands-on computing to others. These are information processing tasks which are relatively straightforward and which are quite amenable to frequent, routinized use by the manager. Managers' willingness to master these kinds of direct uses of computing holds alive the possibility that many managers will eventually become so extensively involved in hands-on computing that they begin to resemble the image of the knowledge executive. But in the near future, most managers will continue to experience greatest value from CBI when they are served by effective information brokers, rather than when they attempt to undertake their own computing (King, Danziger, Dunkle and Kraemer, 1992).

These findings suggest that it would be useful to establish "information brokers" at the executive level in organizations where they do not already exist. The central tasks of these brokers would include providing the manager with the CBI he/she requests, frequently discussing with the manager what CBI can be derived from existing systems and databases, and providing samples of

CBI that the manager or the information broker thinks might be useful. A secondary task for the information broker would be to sit with the manager, at the manager's request, and coach the manager's own direct, hands-on use of appropriate automated information systems.

As noted by the anonymous reviewer, these research findings do not imply that efforts to make information systems more user-friendly and accessible should be abandoned. Rather they suggest that the focus of design efforts for executive information systems, as with earlier design efforts for DSS, should be as much on the information intermediaries who serve the executives and managers as on the executives themselves. At minimum, such efforts can make the job of information intermediaries easier. Under the best of circumstances, they could dramatically enhance the utility of the CBI serving managers and they might also increase the likelihood that managers can and will use the systems directly, when appropriate.

One important message of this research, then, is that neither the managers nor the IS professionals have necessarily failed if the manager continues to use information intermediaries. The test is whether the managers use CBI, are satisfied with the information, and find it makes them more effective, regardless of how the computer-based information is acquired.

END NOTES

1. The MIS literature views the utility of computers and CBI both as an independent variable and a dependent variable (Trice and Treacy, 1988). Studies aimed at understanding user acceptance of technology view the perceived usefulness of CBI as an independent variable potentially explaining computer use (Davis, 1989; Ginzberg, 1981; Swanson, 1987). In contrast, studies aimed at understanding the work impacts of computers and information systems view the usefulness of CBI as a dependent variable, and specifically, as a measure of systems success. Most of these studies define systems success as the satisfaction of users with the information provided by the system, their evaluation of work impacts, and in some cases, the mode of computing services provision (Danziger and Kraemer, 1986; Doll and Torkzadeh, 1988; Ives, Olson and Baroudi, 1983; Millman and Hartwick, 1987). There are also a few studies that examine objective measures of systems success (LeBlanc and Kozar, 1990).

2. Much of the research on end users focuses on the second category only--users who interact directly with the computer. For example, Rockart and Flannery (1983) define six categories of "direct" end users ranging from "nonprogramming end users" to "DP programmers." Although their research was aimed primarily at classifying end users, such research is usually aimed at assessing the success of specific computer applications (Doll and Torkzadeh, 1988; McLean, 1979; Davis, 1989). We believe, consistent with Ives, Olson and Baroudi (1983), that both categories of users are needed when trying to assess the use of CBI broadly, without reference to a specific system or application. This broader definition seems especially important when trying to assess managerial use of CBI. Although direct use of computers among managers continues to increase, empirical evidence has revealed that the proportion of managers who use computing directly is still relatively small (Jones and McLeod, 1986; King, Danziger, Dunkle, and Kraemer, 1992).

3. We used multiple stepwise regression analysis (Table 5) to assess the relative importance of these factors, and any broad interactive effects among them. The three factors for operations management were significant at $p < .05$ and the factors for financial management were significant at $p < .015$. For each dependent variable, the regression equation is significant at the .001 level.

4. Two measures of CBI quality had significant regression coefficients with financial management: more up-to-date information (positive) and the unavailability of needed data from the computer systems (negative).

APPENDIX: MEASUREMENT DETAILS

Dependent Variables

Perceived Usefulness of CBI

Department heads indicated for ten specific departmental management issues the extent to which computer-based information was not all useful, somewhat useful, useful, or very useful.

Principal components factor analysis produced a 2-factor solution using 7 of the 10 items, explaining a total of 74% of the variance, with high loadings (.70 and above) on each factor.

Management Task	<i>mean</i>	<i>sd</i>
<i>Financial Management</i>		
"How useful to you has computer-based information been...		
1) during the annual budget preparation process,		
2) for day-to-day expenditure decisions,		
3) in managing your financial resources in order to prevent overspending,		
4) in identifying where there might be slack resources that could be to other purposes."*		
	1.87	.74
Coefficient alpha of .87. Variance explained 55%.		
<i>Operations Management</i>		
"How useful to you has computer-based information been...		
1) in evaluating the relative performance of the subunits within your department or division,		
2) in identifying problems, abuses or inefficiencies in the unit (s) you supervise,		
3) in providing indicators of departmental or subunit performance, e.g., employee turnover or absenteeism, service needs, facility usage, cost of programs."*		
	1.10	.69
Coefficient alpha of .82. Additional variance explained 18%.		

* Scale was: (0.00) not at all useful; (1.00) somewhat useful; (2.00) useful; (3.00) very useful.

Independent Variables

In addition to the management task variable which is used to partition the dependent variable, three other independent variables--characteristics of CBI, characteristics of the manager, and the environment--were measured. All specific measures for the independent variables were assessed for multicollinearity and there was virtually none. Only one pair of variables was correlated as high as .60 and correlations for the great majority of the sets were quite low (about .10 to .20). The specific measures of the independent variables are as follows:

Characteristics of CBI

Managers responded to the following statements with noted response categories (scale range 0-3).

<i>Quality</i>	<i>mean</i>	<i>sd</i>
"The computer does not provide the precise information I need for my work"*	.86	.68
"The computer makes new information available to me that was not previously available" *	1.79	.77
"The computer provides me with more up-to-date information than that available in manual files." *	2.21	.92
"Computer-based data are not available for the analysis of specific questions or problems" **	1.03	.83
<i>Accessibility</i>		
"Computers have made it easier for me to get the information I need" *	2.18	.73
"Computers save me time in looking for information" *	2.08	.80
"Difficulties in accessing computer-based data gathered or held by other departments and agencies" **	1.04	.99
<i>Cost of CBI use</i>		
"The computer produces large volumes of data which require considerable wading through to find the information I need" *	.89	.69
"Information I need is on the computer, but it requires special programming to get it out" *	1.16	.79

"Difficulties in transferring computer-based data between microcomputers and larger computers" **	1.02	.99
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* Scale was: almost never true, sometimes true, frequently true, or nearly always true. (3.00 - 0.00).

** Scale was: not a problem, at times a problem, often a problem, very often a problem. (0.00 - 3.00).

Characteristics of the individual

Three measures were used as noted below.

<i>Years of experience with computing</i>	mean	sd
"For how many years have you been directly involved in using computers or computer-generated information?" (Range 1 to 35)	10.97	6.64

*Frequency of direct use of computing**

"In doing your job, how often do you: 1) use a microcomputer, 2) use a microcomputer as a terminal to a larger computer, 3) use a microcomputer on a local area network, and 4) use a computer terminal?"**	2.91	2.05
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*Frequency of indirect use of CBI **

"In doing your job, how often do you request others (by phone or in person) to get information from a computerized file?"** and "How often do you receive reports which contain data from computer files?"**	4.26	.84
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Reliance on experts

"How much do you rely on experts or technically trained individuals to interpret and summarize computer-based information?"	.96	.70
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* The intercorrelation between frequency of indirect use of CBI and frequency of direct use of computing was 0.05.

** Scale was: (0.00) never; (1.00) at least once a year; (2.00) several times a year; (3.00) a few times a month; (4.00) a few times a week; (5.00) daily.

***Scale was: (0.00) no reliance; (1.00) some reliance; (2.00) extensive reliance.

Environment characteristics

Two measures are used, as described below.

<i>Decentralization of computing</i>	mean	sd
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Bivariate indicator of location of "mainframe" computing for the specific respondent: (0) = computing services solely or primarily from a central installation; (1) = computing services solely/primarily from installation located in manager's department .07 .26

Professionalism of organization

Index of professional management practices from responses to three items in the Local Government Context Survey completed in each of the 46 cities.

"Do departments and agencies within your local government establish written objectives for the programs and services they provide?"*

"Do city departments have measures of performance in meeting the objectives of city programs?"**

"Have city departments and agencies implemented cost accounting procedures to track or estimate the cost of major programs or activities?"*** . 7.36 2.77

Three scores are summed, with scale range from 1 to 12; coefficient alpha .65.

* Score 0 = no, 2 = yes, for some programs, 4 = yes, for most programs

** Score 0 = no, 1 = yes, for a few programs, 2 = yes, for about half of the programs, 3 = yes, for most of the programs, 4 = yes, for all the programs

***Score 0 = no, 1 = in a few cases, 2 = yes, in many cases, 3 = yes, general procedure

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