

# Journal of International Information Management

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Volume 5 | Issue 2

Article 5

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1996

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### Recommended Citation

Kim, Chung and Peterson, Dane (1996) "Comparison of computer use among managerial levels in large organizations," *Journal of International Information Management*: Vol. 5: Iss. 2, Article 5.

Available at: <http://scholarworks.lib.csusb.edu/jiim/vol5/iss2/5>

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# Comparison of computer use among managerial levels in large organizations

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## ABSTRACT

*In spite of the rapid advances and expanding roles of information systems in business organizations, it has been speculated that computer use and its impact may still be stronger at lower management levels. A survey of one hundred and eight managers was conducted, investigating computer usage and the perceptions of the benefit of computers. The results indicate that there was no differences among managerial levels with respect to their self-rating as a novice or expert computer user. On the other hand, there were differences with respect to the types of software used and the tasks supported by the software. The lower level managers were more likely to use database type software to perform data retrieval and report generation, whereas the middle level managers were more likely to use office system software or decision support/spreadsheet type software to perform planning and data analysis. The upper level managers were more likely to use database-type software or office systems for a variety of activities including analysis, planning, decision making, and communication. With respect to the computer benefits, the lower level managers generally perceived greater benefits of using the computer than higher level managers.*

## INTRODUCTION

Earlier studies on Information Technology (IT) have commonly argued that IT had a greater impact on lower level managers than on higher level managers. A study by Brady (1967) stated that upper level managers were not making maximum use of computers because of a lack of appreciation of the benefits of using computers. Later studies also confirmed that upper level managers were spending little time working directly with computers (McCullough & Wooten, 1986). It was further predicted that computer impact would continue to be great at lower managerial levels, even as significant advances in IT developed to support decision making tasks required by upper level managers (Brady, 1967).

When IT was first introduced, the main objective of the developed systems was to automate manual processes. Thus, lower level management was influenced the most. There was a lag in the development of practical systems geared to assist higher level managers. Recently however, significant changes have occurred in IT. There has been tremendous progress in the development of hardware and software. Numerous applications have been developed to assist managers in corporate-wide decision-making. Electronic mail and computer networks linking managers and employees in different locations has dramatically improved the communication process. With the advent of these more advanced systems, there appears to be a more positive attitude among upper level managers. According to a recent study, upper level managers responded favorably to the concept of new information systems, acknowledging the benefits in various dimensions such as information retrieval, evaluation of alternatives, and "what if" analysis, etc. (Alavi, 1982). In a more recent study (McCullough & Wooten, 1986), upper level managers thought computers were extremely helpful.

The increasing interest and appreciation of computers by upper level management suggests a need for new investigations on the impact of computers on upper level managers. The role of upper level managers has been very important for the successful adoption and utilization of IT in business organizations. Research on IT suggests that the appreciation and support of upper level management is one of the critical factors for systems success (Guimaraes, Igarria, & Lu, 1992; Hough & Duffy, 1987; Igarria, Pavri, & Huff, 1989; Sanders & Courteney, 1985). Without the support of upper level management, valuable information systems may not be implemented successfully. In order to deploy computers effectively for strategic advantages in business organizations, it is imperative that we first understand the current status of computer influence on upper level management. Unfortunately, there are only a few studies which empirically examine computer use and their perceived benefits among managers of different levels. Moreover, these studies were confined to specific types of systems such as DSS (Guimaraes, Igarria, & Lu, 1992) or microcomputers (Igarria, Pavri, & Huff, 1989; Lee, 1986).

The present study is motivated by two questions: (1) How are computers being used by upper level managers? (2) Is the impact of computer technology still greater at lower organizational levels? The finding of this type of study will give some insight as to the computer skill requirements for managers at different levels and where additional education on IT would be most useful.

## LITERATURE

Computers influence the decision-making of individual managers, which in turn, can affect the productivity of organizations. There have been numerous attempts to measure the impact of computers on organizations. However, it is difficult to measure how computers influence the decision-making performance and the overall productivity of managers. Thus, other surrogate measures, such as computer use (Trice & Treacy, 1988) or user satisfaction (Bailey & Pearson, 1983; Doll & Torkzadeh, 1988; Melone, 1990) have frequently been used as measures of the impact of

computers. Since the purpose of this paper is to assess computer impact on a wide array of decision-making performances, this paper examines computer use, managerial tasks, and perceived benefits in order to assess computer impact on managers.

## **COMPUTER USE**

Previous studies consider computer use as an important means of assessing computer impact (Igbaria, Pavri, & Huff, 1989; Lee, 1986; Trice & Treacy, 1988). Computer use is measured in various dimensions, including frequency, number of packages used, time spent on computers, and level of sophistication of usage (Igbaria, Pavri, & Huff, 1989). Although computer use may not be an indicator of performance per se, it is regarded as a variable that can predict the impact that information systems have on performance. The degree of impact is naturally expected to vary with the amount of use that is made of the system (Trice & Treacy, 1988).

Earlier studies have reported limited use of computers by upper level management compared with lower level management. For example, the study conducted by Brady (1967) reported that there was no instance of direct use of computers by top management, although computers greatly assisted lower level managers in analyzing data and in preparing detailed plans to be presented to higher level managers. A recent study by Igbaria et al. (Igbaria, Pavri & Huff, 1989) also found that among computer users, lower level managers used microcomputers more extensively. Another study by Lee (1986) reported a negative relationship between total hours of microcomputer usage and organizational level indicating that the users at higher managerial levels tended to use microcomputers for fewer hours than users at lower managerial levels. As to the level of sophistication or diversity of application, however, these studies reported that there was no difference between the management levels.

Recent advancements in IT for business decision making and the growing importance of computers for business management indicates a need for more active participation in terms of computer use by upper level managers. As recent studies report an increasing appreciation of computers by upper level management (Alavi, 1982; Hough & Duffy, 1987) it might be expected that there is currently no, or little, difference in the level of computer expertise among various management levels.

## **TASKS FOR MANAGEMENT LEVELS**

Upper level management performs a number of planning and strategy formulation activities and is concerned with controlling activities that move the organization toward the predetermined goals. Upper level managers are typically engaged in a high level of interpersonal contacts using verbal media. Recently various user-friendly information systems such as executive information systems have been developed to aid upper level managers in identifying problems and in keeping track of organizational performance.

The middle level management assures that resources are obtained and used effectively and efficiently in meeting the organizational objectives. This level of management is concerned with controlling activities that move the organization toward the determined goals. Managers at this level are typically interested in performance success in such critical areas as personnel considerations, equipment and material acquisition, forecasting, and budget planning. The decision-making at this level requires analysis of various types of "what-if" questions using quantitative models. In addition, reports must be prepared for upper level management.

The lower level management, the largest group of managers in most firms, is essentially supervisory, and tends to center on day-to-day operations. The managers at this level are engaged in cost, quality, and personnel control activities, and they depend heavily on computer-generated information. Management Information Systems (MIS) reports and various data base systems have assisted these managers in their analysis of everyday activities and plans. In addition, summaries often must be prepared for higher level management.

Because different management levels require different sets of responsibilities, the types of software used and the perceived impact of computers may also be different among the managers at various levels.

### COMPUTER BENEFITS

While the costs associated with computers are relatively easy to assess, computer benefits are diverse and difficult to measure (Ginzberg, 1979). Previous studies have assessed the impact of computers in various dimensions of computer benefits. A study by Brady (1967) examined computer impact on upper level managers by using various computer benefit criteria including faster decisions, more time for decisions, more thorough analysis, more choices, anticipation of results, and added information. The importance of measuring computer benefits as a means of measuring the value of computers has also been recognized in later studies. Knutsen and Nolan acknowledged computer benefits on six dimensions. Ginzberg (1979), recognizing the diverse nature of information technology benefits which can affect organizational performance, suggests nine types of benefits as follows:

1. Mandated
2. Cost saving
3. Improved asset utilization
4. Improved planning
5. Increased organizational flexibility
6. Improved organizational flexibility
7. Greater accuracy
8. Timely information
9. New/more/better information

Keen (1981), recognizing the qualitative aspects of DSS benefits, enumerated system benefits on a more personal basis of decision-making. Alavi (1982) described IS benefits with five dimensions: (1) personal efficiency, (2) problem solving, (3) learning and training, (4) communication, and (5) control. The benefits criteria developed by these authors were confirmed through a Delphi method by Money et al. (1988).

As most of these benefits are difficult to estimate in monetary terms, the current study assesses the managers' perceptions of the benefits. The perceived benefits in ten areas are developed for the present study by modifying the benefits criteria of the previously mentioned authors. The ten benefits used in the present study are presented in Table 1.

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**Table 1. Perceived Benefits**

1. Saves time
  2. Saves cost
  3. Directs you to more important issues
  4. Improves decision quality
  5. Helps you make timely decisions
  6. Helps you learn more about the external environment
  7. Helps you acquire more business experience
  8. Improves planning and control
  9. Deeper and wider exploration of alternatives
  10. Improves communication with others
- 

Earlier studies indicate that the benefits of computers is less profound on upper level management. Based on interviews with more than 100 upper level managers, Brady (1967) concluded that the impact of computers on upper level management on various benefit criteria is slight. In addition, the study predicted that the impact of computers would continue to be less at higher corporate levels than at lower organizational levels.

However, two recent studies found that upper level managers responded favorably to the concept of Decision Support Systems (DSS) (Alavi, 1982; Hough & Duffy, 1987), acknowledging the benefits in various dimensions such as information retrieval, evaluating the alternatives, "what if" analysis, etc. (Alavi, 1982). Another recent study on DSS (Guimaraes, Igarria, & Lu, 1992) found no relationship between the degree of perceived benefits and organizational level. Thus, it may be expected that there is presently not much difference in the perceived benefits of computers among various management levels.

## METHODOLOGY

A list of management personnel was obtained from 11 relatively large business organizations in diverse industries which include oil, transportation, insurance, etc. All companies in the sample had at least 4,000 employees, had large management information systems departments, and recruited new employees at a Midwestern university. A total of 375 questionnaires were mailed to the managers in these organizations. The most sent to any one organization was 60 and the smallest was 15. A total of 108 usable questionnaires were returned for a 29% response rate. Managers were from one of six functional areas: Accounting, Finance, Marketing/Sales, Personnel, Information Systems, and Operations Management. Since this study was primarily concerned with the relative impact of computers on three managerial levels, we included managers from all functional areas including information systems. Managers were asked to categorize themselves into one of three managerial levels: upper, middle, or lower. The number of managers within each managerial level is given in Table 2.

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**Table 2. Number of Managers within Each Managerial Level**

Managerial Level	No. of Managers
Strategic/Upper	21
Middle	50
Lower	37
Total	108

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Approximately 31 percent of the managers had worked in the same company for more than 20 years, while 53 percent had worked between 10 and 20 years with the present company. Only 16 percent reported less than 10 years with the current company. Thus, the majority of managers had worked in the same company in excess of 10 years.

The respondents were initially asked to self-rate their computer expertise at one of four levels: (1) do not use, (2) novice, (3) skilled, and (4) expert.

The respondents were also asked to indicate the primary software they used from a list of categories provided in the questionnaire. The categories of software included the following types: Office systems, spreadsheet or other financial systems, accounting systems, database systems, decision support software, expert systems software, 4th generation software, production planning systems, case software, and others. While a large number of managers utilized office systems, spreadsheet type systems, and database systems, only a few managers reported using one of the other categories as the primary software used. In order to conduct statistical analysis, similar types of software were grouped into 3 categories as follows: (1) decision support/spreadsheet type systems, (2) database type systems, and (3) office systems. The first category (financial

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systems, spreadsheet type systems, accounting systems, production planning systems, and decision support systems) all involve the use of quantitative modeling techniques to aid decision making. On the other hand, database software, 4th generation software, and case tools are all frequently involved in the use and manipulation of databases. Office systems include electronic mail, scheduling, word processing, etc. They are unique in the sense that they are designed to support various office works of individuals for their communication and everyday planning.

The respondents were also asked to indicate the task primarily supported by the software they utilized from a list of categories provided in the questionnaire. The types of tasks included the following: data retrieval, data analysis, investment/forecasting/planning, control/evaluation, report generation, communication. Again, for the statistical analysis, these tasks were categorized into three groups according to the similarities of the tasks. The three groups are: (1) data retrieval and report generation, (2) data analysis, investment/forecasting/planning tasks, and (3) control/evaluation, and communication.

Finally, the respondents were asked to rate each of the 10 potential benefits of IT listed in Table 1. The managers rated the possible benefits on a scale from 1 to 10, with a 10 indicating very beneficial. The research questions tested are stated as the following research hypotheses:

- H1: There is a relationship between the self-rated level of computer expertise and the level of management.
- H2: There is a relationship between the type of software used and the level of management.
- H3: There is a relationship between the types of tasks supported and the level of management.
- H4: The amount of perceived benefits of computers will be different among managerial levels.

## RESULTS AND DISCUSSION

*Computer use:* The relevant data for hypothesis 1 is summarized in Table 3. In the table, the managers who don't use a computer or consider themselves novices were combined, while those who rated themselves skilled or experts were also combined. The chi-square analysis on the data in Table 3 did not produce a significant result (chi-square = 0.368). Thus, there was no relationship between self-rated level of expertise and level of management. This result is consistent with some of the reports from earlier studies.



**Table 3. Computer Proficiency by Managerial Level**

Self-rating	Management Level		
	Upper	Middle	Lower
Novice user	6	18	11
Expert user	14	33	26

*Software Utilization:* Table 4 summarizes the results for hypothesis 2. The results of the chi-square test were significant (chi-square = 23.68,  $p < .001$ , 4 df). As can be seen in Table 4, upper level managers primarily use database type software and office systems. Middle managers primarily use office systems software, followed by decision support/spreadsheet type software. Lower level managers mainly use database type software.

**Table 4. Software Utilization by Managerial Level**

Software	Management Level		
	Upper	Middle	Lower
Decision Support/Spreadsheet type software	4	21	11
Database type software	9	7	22
Office systems	7	23	4

*Tasks Supported by Software:* Table 5 summarizes the result for hypothesis 3. A chi-square test produced a significant result (chi-square = 10.47,  $p < .05$ , 4 df). As can be seen in Table 5, lower level managers are more likely to use the computer for data retrieval and report generation. As the primary software these low level managers use is data base type software, it looks like they use this software for data retrieval and report generation. On the other hand, the middle level managers are more likely to use the computers for analysis and planning. The primary software for the middle managers are office systems and decision support/spreadsheet type systems, and they use computers for analysis and planning mostly. Upper level managers use office systems and data base systems heavily and they use computers almost equally for data analysis/planning and control/communication.

**Table 5. Task by Managerial Level**

Task	Management Level		
	Upper	Middle	Lower
Data retrieval/report generation	5	16	22
Data analysis/planning	8	21	11
Control/communication	7	14	4

*Perceived Benefits of Computers:* To test hypothesis 4, a one-way analysis of variance between the three levels was performed on each of the ten benefits criteria. The results are summarized in Table 6. In general, lower level managers perceived greater benefits of using computers than middle and upper level managers. A Duncan's multiple-range test was conducted for pairwise comparisons among the means. The results indicated that lower level managers perceived greater benefits than upper level managers on items 1 (saves time), 3 (handle important issues), 6 (learn environment), and 7 (business experience). Lower level managers perceived greater benefits than middle managers on items 3 (handle important issues), 4 (complex decisions), and 5 (timely decision making). No significant differences were observed between upper and middle level managers.

**Table 6. Perceived Benefits Ranked by Overall Means**

Benefits	Management Level			F	p-value
	Upper	Middle	Lower		
1. Saves time	7.70	7.76	8.81a	3.19	0.045*
2. Cost efficiency	7.20	6.84	7.94	2.70	0.072
3. Handle important issues	6.95	7.03	8.32ab	4.73	0.011*
4. Complex decisions	6.65	5.86	7.11b	3.37	0.038*
5. Timely decision making	6.50	6.17	7.57b	4.18	0.018*
6. Learn environment	3.55	4.20	4.92a	2.25	0.110
7. Business experience	3.75	4.82	5.97a	5.71	0.004*
8. Control better	6.00	5.90	6.54	1.03	0.362
9. More alternatives	6.70	6.14	7.19	2.43	0.093
10. Better communication	6.35	6.41	7.35	2.11	0.126

\* - Overall ANOVA significant at the .05 level  
a - Lower level significantly higher than upper level (.05)  
b - Lower level significantly higher than middle managers (.05)

## SUMMARY AND CONCLUSION

In order to make appropriate decisions and to plan for the future, upper level managers must analyze data. Previous research has demonstrated that upper level management spends little time working directly with computers to accomplish these tasks (McCullough & Wooten, 1986). Contrary to the majority of previous studies, the results of this study indicate that all managers are using computers. That is, there was no significant difference in terms of self-rated computer expertise between the various management levels. This finding supports results from the other recent research (Guimaraes, Igarria, & Lu, 1992; Igarria, Pavri & Huff, 1989). This phenomena may be due to the recent advancement in IT, including office systems, executive support systems, and application packages, which are easy to use and to apply. This may also be due to recent increases in the emphasis on computer literacy education in business schools.

As to the computer software, upper level managers mostly used office systems and database type systems. For middle level management, office systems and decision support/spreadsheet type systems were the most frequently used software. On the other hand, database type systems were the most often used software by lower level management.

The present study found that computers primarily support lower level management in the areas of report generation and data retrieval. Computers are mostly used by middle level management in the area of analysis and planning, while upper level managers use the computer for a variety of tasks, including analysis, planning, communication, and control.

The impact of computers is still stronger on lower level managers on most benefit criteria. Lower level managers perceived greater impact in terms of saving time, handling important issues, making complex decisions, directing time to important issues, improving complex and timely decision making, learning about the business environment, and acquiring business experience. There were no differences in terms of the perceived benefits between middle and upper level managers. This finding supports the prediction (Brady, 1967) that the impact of the computer would remain stronger on lower level managers than on upper level management.

The results of the study suggests that the required computer skills for lower level managers are relatively uniform. Lower level managers primarily use database type software to assist them in report generation and data retrieval. Since the graduates of business schools most likely enter low level management first, the MIS education in business schools should emphasize some focus on teaching database concepts and skills. On the other hand, upper and middle level managers are engaged in analysis, planning, and a variety of other tasks including communication and decision making. The software required by higher level managers are diverse and may require careful and stringent procedures for selection and design of the systems. Upper level managers reported less benefits of using computers, possibly suggesting that either the necessary software to aid them in their jobs is still not adequate nor not enough education has been provided regarding their use.

There are some limitations of the study. There may be a response bias in the sense that the managers who rarely use computers might be less likely to respond to the survey. However, we

believe that active users can provide more accurate data on their perceptions on computer benefits and use. Additionally, the sample was not completely random. The study sample is from large corporations which utilize computers more than small corporations. A sample from smaller corporations or of other types may yield different results.

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