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End user computing: A critique of the empirical literature

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ABSTRACT

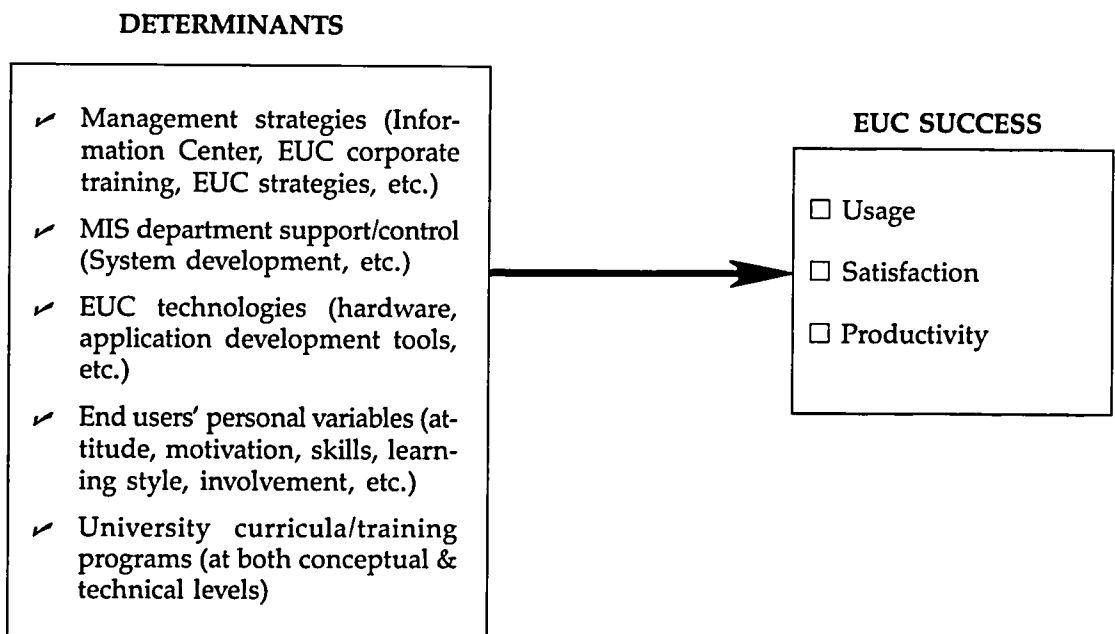
This manuscript is an attempt to provide the reader with synopses of relevant research pertaining to the EUC literature. References included in this paper for review address some of the most germane topics in IT management. With the recently increasing recognition that end users are a major player in the acquisition, use, and management of computer resources in business organizations, a host of researchers have examined diverse changes that have occurred in the computing environment in order to explore various issues associated with end-user computing (EUC). This paper suggests that past EUC research has extensively examined the effects of MIS department role, EUC technologies, and end users' personal variables, with insufficient emphasis upon the linkage of management strategies and of university training to EUC activities.

INTRODUCTION

The past decade saw tremendous changes in the computing environment, especially in the way end users used the information systems technology in an organization. As end user computing (EUC) has heavily grown in recent years (Henderson & Treacy, 1986; Rockart and Flannery, 1983), it emerged as one of the key issues in information technology management among researchers and practitioners. Therefore, it became imperative to take into consideration not only positive impacts but also potential risks associated with its growth (Alavi & Weiss, 1985). Such changes in the end-user computing environment presented a set of substantial challenges for IS managers necessitating them to make their utmost efforts to adequately manage end user computing. Accordingly, most research in end user computing has focused on the effective management of end user computing, exploring and addressing issues central to the new computing environment of business organizations. Managing does not necessarily mean controlling or limiting, but may partially imply facilitating. From a strategic standpoint, successful EUC management within a firm would presumably help a firm to gain a competitive advantage (Henderson & Treacy, 1986), and it drew much attention of today's IS managers.

The purpose of this paper is to review recent relevant literature in end user computing management and give a critique for the literature from the IT management perspective. This paper is intended to provide the reader with quick summaries of significant research (not intended as all inclusive) that is representative of the EUC literature. A majority of the references reviewed are exploratory or theoretical in nature, employing either field surveys or laboratory experiments, although there are a few argumentative articles. The survey of the literature leads us to construct Figure 1 that depicts a conceptual model of determinants of EUC success. The EUC research to date has predominantly focused on the determination of important factors for the success of EUC that can be broadly grouped into five categories, including management strategies, MIS department support/control, EUC technologies, end users' personal variables, and university training. Management strategies and the central MIS department's support/control role will play an important role in aligning EUC activities with the corporate strategy and minimizing EUC risks; EUC technologies will provide the critical computing resources for the end users; end users' personal variables will function to directly influence EUC at the individual level; and effective university training will lay for the future end user the key conceptual and technical foundation for understanding and utilizing EUC resources. These five categories of EUC-related variables will collectively determine the EUC success in terms of computer usage, satisfaction, and productivity. As we will notice in the Literature section of this paper, past EUC research has extensively examined such aspects as MIS department support/control, EUC technologies, and end users' personal variables, while giving little emphasis upon the effects of management strategies (Saaksiarvi, Heikkila, and Saarinen, 1988) and of university training/education. The aforementioned determinants will provide useful implications for the effective management of EUC, and the references addressing these factors are reviewed in this paper.

Figure 1. A Conceptual Model of Determinants of EUC Success



THE LITERATURE

David H. Benson (1983). Benson reports on a series of interviews on end user computing carried out in twenty locations in St. Louis. Sixty-seven end users from all levels of management and nineteen IS professionals were interviewed in their work locations regarding the practices of interactive computing by non-DP professionals. The study explores the new phenomenon of microcomputers in the business office and examines some of the differences between those who use the mainframe environment and those who use microcomputers. Software used, the varieties of applications developed, as well as some of the problems encountered and some of the early results are examined. A prime objective of the study is accomplished in identifying end users' educational goals. Finally, five critical issues are identified which those interviewed saw as needing resolution in the near future.

John F. Rockart and Lauren S. Flannery (1983). Rockart and Flannery classify end users into six distinct types. Each type needs differentiated education, support, and control from the Information Systems function. To support a large number of their applications a new computing environment, "the third environment" must be developed by Information Systems (I/S) management. Close attention must also be paid by I/S management to the need to involve "functional support personnel" (end users in each functional area who spend most of their time programming and aiding other end users) in the I/S end user management process.

Paul Cheney, Bob Mann, and Don Amoroso (1986). Cheney, Mann, and Amoroso attempt to identify those variables that affect the success of end user computing within an organization. The variables are classified as controllable, partially controllable or uncontrollable. Previous research on end user computing is reviewed, and several propositions relating organizational variables to the success of end user computing are suggested.

Curt Hartog and Martin Herbert (1986). Hartog and Herbert identify the issues which MIS management rates as most important and most difficult to solve over the next two years. The results were obtained from a 1985 opinion survey of MIS managers in over 100 St. Louis area companies. The most important issues fall into three categories: Aligning MIS with corporate goals, software development, and end-user computing; the least important issues were narrowly focused or more technical. Comparison with prior research reveals that the alignment and end-user computing issues have increased in importance. The results indicate that MIS managers are more oriented to corporate than to technical issues.

Jeanne Wenzel Ross (1987). Ross presents a study to identify the factors related to end-user computing (EUC) and to note variances by industry. Data were collected through telephone interviews with a marketing manager and an ISD manager in 87 organizations in four industries. Marketing respondents were asked how they use microcomputers, how much influence ISD has over their microcomputer resource management decisions and what support they need from ISD. Analysis of the data indicates that ISD's control of a user department's end-user

computing, as perceived by marketing managers, is positively related to (a) its ability to cope with EUC uncertainties, (b) its nonsubstitutability, (c) the pervasiveness of the department's data needs, and (d) the importance of EUC to the department. Coping with uncertainty has the greatest predictive power of the four variables. Ross neither supports nor rejects the role of information intensity as a moderator of the strength of the relationships between the dependent and independent variables. Three measures of control—perceived influence, formal authority and demonstrated control—are interrelated. Ross proposes a model by which ISDs can gain EUC control and identifies future research which would contribute to an understanding of this topic.

Maryam Alavi, R. Ryan Nelson, and Ira R. Weiss (1988). Alavi, Nelson, and Weiss identified the rapid and widespread growth of end-user computing (EUC) technologies is transferring the power of computing resources from the management information systems department to end users. Because EUC is playing a more significant role in the overall performance of organizations, EUC and its related technologies should be considered as a set of value activities that contribute to an organization's competitive advantage. Three primary activities, or attributes, of EUC management are important in how EUC contributes to the overall success of the organization: 1. The direction attribute establishes the organizational agenda for EUC and involves issues related to EUC policy and planning. 2. EUC support involves provision of resources and training that enhances the development and growth of EUC in the organization. 3. Control processes ensure that plans are carried out effectively, efficiently, and in compliance with policies. Several styles of management strategies exist for the assimilation of EUC into the organization. For example, the marketing strategy attempts to build on prior positive user experiences to shape future successful directions for EUC.

Evelyn S. Arkush and Steven A. Stanton (1988). With rising cost of end-user computing, Arkush and Stanton have examined that managers are demanding more and more data to determine its value. Two approaches can be taken: 1. Total value can be calculated by subtracting total cost from total benefit. 2. A sample value can be calculated which is equal to sample benefits less sample costs. While the former approach will prove more technically correct, the latter technique is more cost-effective. Using a representative sample, the values can be extrapolated from benefits not easily measured: customer satisfaction, for example, which can lead to high levels of competitive and financial advantage. Such benefits lie beyond the narrow view held by some managers that computing's value is defined solely by the number of people replaced. As end-user computing becomes more widespread, managers will come to terms with its value and approach management of computing resources as they approach asset management today.

Paul H. Cheney and R. Ryan Nelson (1988). Cheney and Nelson describe a questionnaire for measuring and analyzing end-user computing (EUC) abilities. The questionnaire measures EUC abilities using a self-report with Likert scales. It describes 11 computer-related abilities in terms of: 1. the importance of each ability as it affects the end user's willingness to use computer-based information systems (CBIS), and 2. the current skill level that the end users felt they had in each ability area. After 100 end users from 20 different organizations completed the questionnaire, its reliability was validated by assessing the degree of error in the measurement using the Cronbach alpha test applied to inter-item scores. The results show that the questionnaire's reliability is well within the limits of acceptability. A principle components factor analysis found that the items loaded on 3 factors: 1. primarily technical components, 2. modeling or problem analysis skills, and 3. application abilities.

William J. Doll and Gholamreza Torkzadeh (1988). Doll and Torkzadeh compare traditional versus end-user computing environments. A report is presented on the development of an instrument that merges ease of use and information product items to measure the satisfaction of users who interact with the computer for a specific application. A survey of 618 end users from 44 firms was used to conduct a factor analysis and to modify the instrument. A 12-item instrument that measures 5 components of end-user satisfaction (content, accuracy, format, ease of use, and timeliness) is suggested by the results. Evidence of the instrument's discriminant validity is given, and reliability and validity are assessed by nature and type of application. Standards for evaluating end-user applications are presented. The instrument's usefulness for achieving more precision in research questions is examined.

Janis Lee Gogan (1988). Gogan presents a natural experiment in the field which investigated the relationship of different levels of PC availability on usage, and open-ended interviews were conducted to explore the social context of computing, in order to further explain usage differences. Substantial support was found for the hypothesis that high information technology (IT) tool availability is associated with greater amount and variety of IT tool usage. Questions were generated for future studies of technology assimilation in organizations. The research contributes to theories of information processing tool availability and the diffusion of innovations in organizations. This study represents an important first step toward identifying effective approaches for managing end-user technologies.

Francis Neville Pavri (1988). Pavri proposes that information technology—computers, communication networks and the like—has assumed a role of growing importance in both private and public sector organizations during the 1980s. The purpose of this research is to develop and test a model of the relationships between a variety of external variables, and the managers' usage of computers. Data was collected from a cross-sectional survey of 519 managers, drawn from managers of 54 corporations in Ontario. The results provided support for 11 of the 16 propositions in the model. Using LISREL as the data analysis technique, it was found that positive attitudes towards computer usage, and subjective norms that supported usage led to higher levels of usage. In turn, attitudes were affected by computer anxiety, computer skills, the quality of the system and management support. Subjective norms were affected by management support, and usage by upper level managers and peer managers in the organizations.

Markku Saaksjarvi, Jukka Heikkila, and Timo Saarinen (1988). Saaksjarvi, Heikkila, and Saarinen examined the impact of different management strategies on the success of end-user computing (EUC). The assessment is based on an empirical investigation of 16 Finnish organizations with 151 end users. The analysis shows that accelerating management strategies resulted in significantly better success than controlling strategies; however, there seems to be no clear connection between the existence of a formal information center (IC) and the success of EUC. An IC seems to play a dual role. If organizations with an IC are managed by accelerating growth strategies, success measures are significantly higher than if managed by controlling growth policies. In the organizations with controlling growth policies and an IC, success measures are even lower than in organizations without an IC. It is recommended that IS managers critically reevaluate and adjust their EUC strategies because an IC alone does not guarantee success.

Steven A. Stanton (1988). Stanton identified a growing need for integration of business technology and information technology for end-users. Business end users need tools for gathering and sorting information and for making decisions. An organization should have a well-defined and well-communicated end-user computing strategy. End-user computing should be considered as a complementary and integral part of information systems (IS). Both end-user activities and IS activities should be linked to the overall business strategy of the organization. IS will have a crucial role in teaching users about managing technology and about administrative functions, such as documentation, backup, security, and disaster recovery. IS will remain as the centralized network manager and will coordinate the development of data architecture.

Jean Steele and Dick Bottomley (1988). Steele and Bottomley conducted an end-user survey at the Federal Home Loan Mortgage Corp. (Freddie Mac), which is owned by US savings institutions and operated to increase the availability of mortgage money for home loans. A project team was formed to define end-user computing and to comment on its needs and costs. The team defined end-user computing as any automated procedure created by users to support the routine execution of their corporate functions. End-user applications were developed to provide control and volume processing functions, but users would have preferred that the functions be provided by the information systems department. The survey concluded that end-user computing was meeting the need for quickly developed and easily modified applications, but that standards and organized support for end-user developers needed to be improved.

William J. Doll and Gholamreza Torkzadeh (1989). Doll and Torkzadeh proposed that end-user computing is characterized by substantial differences between individuals in skill and motivation. The unique aspects of this dynamic end-user environment are identified, and an end-user involvement construct is described. A model of end-user involvement based on Alutto and Belasco's (1972) discrepancy concept of participation is presented. Focusing on individual differences, this model hypothesizes a contingency relationship between perceived involvement, desired involvement, and satisfaction of the end-user. Three intervening psychological mechanisms are used to provide a theoretical rationale for the linkage between involvement and end-user satisfaction. The model is examined empirically using a sample of 618 respondents from 44 companies, and the results generally support the contingency hypotheses.

Jawaid Abdul Ghani and Abdul Rahim Al-Meer (1989). Ghani and Al-Meer presented an examination of the effect of the use of computers on job satisfaction. According to a survey of 85 professionals in Saudi Arabia, the use of personal computers (PC) had a positive effect on job satisfaction, particularly when the individual was working on high scope tasks, i.e., tasks with high variety, identity, autonomy, and feedback. The study also found that the use of manframe computers had no significant effect on job satisfaction. The significant positive effect on job satisfaction that comes from using a PC is consistent with the (largely anecdotal) findings of researchers in end-user computing.

Mukul Sanwal (1989). Sanwal examined the implementation process for the successful introduction of microcomputers in developing countries. This implementation process requires a methodology, both at the practical and the conceptual level, for integrating information technology into administrative functions. Sanwal makes a comparison between the experience in developed countries and efforts in developing countries, including the effect of industrial and information technology innovation and of change at the local level with end-user computing. The criteria for the setting of priorities is identified. It is shown that strategic use of end-user computing requires a conceptual analysis of decisions that must be taken at various levels in development administration. This results in the development of a process of planning to match this strategy with the information technology strategy.

Janice C. Sipior and G. Lawrence Sanders (1989). Sipior and Sanders state that research has addressed the impact, implications, and expectations of end-user computing (EUC); such research generally has been exploratory in nature. Definitions in this area are inconsistent; consequently, they are unclear. Furthermore, the main focus has been on individuals, with little emphasis on the understanding of group dynamics in EUC activities. A more explicit definition of EUC is advanced, recognizing both development and use activities performed either individually or in groups. Previous research is charted according to these distinctions, allowing the identification of areas in need of further study. Issues facing organizations in integrating EUC are discussed, and a framework for EUC in groups is presented, with the intention of advancing an understanding of the implications that group dynamics have for the management of EUC activities.

Bob Bostrom, Lorne Olfman, and Maung Sein (1990). Bostrom, Olfman, and Sein report the findings of a series of studies that examined the influence of a novice's learning style in learning of typical EUC tools such as spreadsheets and electronic mail. A consistent pattern of findings emerged that indicates that learning style is an important predictor of learning performance, both by itself and in interaction with training methods. The findings suggest that in the design of training, it is essential to match training methods to individual difference variables. Based on these findings, guidelines are recommended for IS professionals involved in EUC training. Further research directions are suggested.

SUMMARY AND CONCLUDING REMARKS

This literature critique has been an attempt to provide the reader with synopses of relevant research pertaining to the EUC literature. References included in this paper for review address some of the most germane topics in IT management. With the recently increasing recognition that end users are a major player in the acquisition, use, and management of computing resources in business organizations, a host of researchers have examined diverse changes that have occurred in the computing environment in order to explore various issues associated with EUC. A majority of references highlight the positive side of EUC trends and promulgate the opportunities that EUC provides.

Albeit, a heavy emphasis exists in the literature on the impact of EUC upon management practices, only a limited number of references have concentrated on the normative aspects of EUC management that are chiefly concerned with identifying a set of critical success factors for implementing successful technological change (Regan, 1992). As mentioned earlier in the introduction, future end-user computing research should increasingly explore the effects of management strategies and university training/education upon EUC success, thereby generating strategically important implications that would be useful for practitioners. Given the availability of new end-user tools and the advances in telecommunications, as well as the growing base of skilled users, perhaps a specialty/concentration at the undergraduate level (i.e., End User Computing Support) needs to be implemented that will address not only technical but also conceptual/human factor issues surrounding EUC. As we approach the next millennium and as user organizations, information systems vendors, and academicians become more aware of the field and its potential, perhaps the appropriate level of skills and preparation for the new IS professional will be investigated.

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