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**ATTITUDES TOWARDS END USER COMPUTING:
A COMPARATIVE ANALYSIS BY JOB CATEGORY**

by

KELLY A. S. HAYDON, B. COMM. (Honours)

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of

Master of Management Studies

School of Business

Carleton University

Ottawa, Ontario

August 29, 1990

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in partial fulfillment of the requirements for
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Thesis Supervisor

Director, School of Business

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ABSTRACT

This research was designed to investigate the phenomena known as "end user computing" (EUC) through a survey of 428 individuals at a large information intensive organization. The data gathered were used to describe the perceptions towards EUC of Information System (IS) personnel, senior managers and end users. The data were also used to examine perceptual differences amongst these three job categories.

The findings of this study indicate that members of all three job categories have strongly held perceptions about EUC. Consensus exists on many issues that affect end users. Within that consensus, senior managers are more enthusiastic than end users regarding the potential advantages of EUC. The consensus collapses when perceptions concerning the disadvantages of EUC are considered. Senior managers have a greater awareness than do end users of the potential disadvantages of EUC. Personnel in the IS department tend to perceive the least number of advantages and the greatest number of disadvantages of EUC. The relatively negative view of EUC held by IS personnel may be due to their special responsibility for computer technology, their concern that EUC may downgrade the relative importance of IS in the organization, and an uncertainty concerning their expertise in the new computing era of EUC.

The disparity in perceptions between the job categories, found in this study, may contain the seeds for organizational conflict between the end users and the IS department with senior management having an additional conflict management task as a result of an organization adopting EUC. For researchers, the results indicate that the three job categories (IS personnel, senior managers and end users) should be treated as separate entities in future research.

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INTRODUCTION

Davis (1984, p.4) defined end user computing (EUC) as:

"the organization of computing resources and design of information systems applications such that: (1) the application systems provide direct, immediate support for user activities, (2) information requirements are specified by the user and may be changed as the system is used; and (3) the development and use of the system is controlled by the user."

This definition is used for this study as it is the most comprehensive one found in the literature. Individuals who perform EUC are known as "end users".

Recent years have seen explosive growth in EUC. Rockart and Flannery (1983) found annual EUC growth rates of 50 to 90 percent and Benjamin (1982) predicted that end users will dominate the use of computing cycles. These estimates, from the literature, may be low as they were estimated in a time when few micro computers existed. It has since been found that end users who use micro computers develop almost twice as many applications as mainframe users (Benson, 1983). Not only has EUC experienced explosive growth but the facilitation and management of EUC has been ranked as the second most important of Information Systems (IS) managers (Dickson et al., 1984).

Despite the growth in EUC and the importance placed upon it by IS managers, research in this area is scarce and there exist few empirical studies (Amoroso, 1987). According to Rockart and Flannery (1983), EUC is still poorly understood and a need for research on end user computing exists (Cheney et al., 1986). Specifically, McKenney (1984, p.407) notes that a need exists for "comprehensive investigations of the impact of end user computing on individuals, work groups and organizations".

One way to assess the organizational impact of EUC is to measure individual's perceptions concerning the strengths and weaknesses of EUC. The literature suggests, however, that different groups within an organization will have different perceptions with respect to EUC (Beheshtian and VanWert, 1987; Bento, 1990; Leitheiser and Wetherbe, 1986; O'Donnell and Salvatore, 1987). Consequently, this study classifies personnel as

being either an end user, an employee of the IS department or a senior manager. Perceived advantages/disadvantages for each job category may then be examined and compared. This approach will provide a more complete picture of organizational impacts of EUC than will an examination of the aggregate group.

To address the research problem a survey which measured individuals' perceptions towards EUC was conducted at a large information intensive organization in the Ottawa area. This type of firm was chosen to ensure that the three employee categories (end users, senior management, IS personnel) were adequately represented.

The primary importance of the study is that it allows for a comprehensive empirical evaluation of the perceived advantages and disadvantages of EUC from a number of perspectives (IS personnel, end users, senior management). Although some advantages and disadvantages of EUC have been noted in the literature (Alavi, 1985; Davis, 1984; Guimaraes, 1984), most are not supported by empirical research. In addition, much of the empirical work done to date reflects only a single perspective (i.e., Alavi (1985) examined only views of the IS manager).

From a practitioner's standpoint, an examination of the benefits (tangible and intangible) of EUC as perceived by individuals in the three job categories will allow managers to objectively evaluate the impacts EUC will have within their organization. A comparison of what senior management, IS personnel, and end users perceive to be the costs of EUC could provide for the manager, responsible for EUC: (1) a better idea of the potential difficulties with EUC, and (2) a greater awareness of the problems faced within an organization which is implementing EUC. Such information may also allow management and IS personnel to make more efficient use of computing resources by solving or avoiding problems that have been identified, and by targeting training towards the solution of actual problems. Information from this study could also be used to inform end users of the problems senior management and IS personnel face when making decisions about EUC. Familiarity with these problems by the end users may reduce resistance to new policies

developed to manage EUC. Finally, by examining the differences in perceptions, managers may anticipate and understand potential conflicts rooted in these differences.

The thesis is divided into five sections. The first presents the background necessary for the study. A research framework used to guide the research is presented, followed by a discussion of each of its' components. The literature on the perceived advantages and disadvantages is then discussed followed by a review of the literature justifying the inclusion of the three groups. Finally, the the research questions are introduced in context of the shortcomings of the literature. The second section explains the methodology and includes such topics as the sample, measurement instrument, survey characteristics and data analysis. The results and the discussion of the results are presented in section three. Conclusions drawn from the results are presented in the next section. The thesis ends with a discussion of the limitations of the study and directions for future research.

BACKGROUND TO THE STUDY

Research Framework

A research framework (Figure 1) was developed to guide the questionnaire design and subsequent analysis.

Figure 1. Research Framework

The framework proposes that an individual's overall impression or perception of the advantages and disadvantages of EUC is a function of how they perceive EUC will affect the end user, the IS department and the organization. In turn, these perceptions may differ by an individual's job category. "Employee job category" in this study is defined to include three employee categories: (1) Information Systems group; (2) senior managers; and (3) end users.

The first component of an individual's overall perception ("Perceptions of End User Issues" (Figure 1)) encompasses those advantages/disadvantages which have a direct and clear impact on the end user. This construct includes such issues as productivity; job control; intrinsic motivation and employee roles. The second construct comprises those items which have a direct and clear impact on the IS department ("Perceptions of IS Departmental Issues"). Maintenance problems of user developed applications, the reduction of the IS department backlog, the threat to data integrity and the future necessity of the IS professional are included in this construct. The last construct is concerned with those items which have an affect on the organization as a whole and cannot be traced exclusively to an individual group or department. These items are labelled "Perceptions of Organizational Issues" in Figure 1. This construct consists of general topics such as the perceived effect of EUC on systems development, organizational costs, and management's function.

The framework in Figure 1 was also used to organize the literature review. The first section, reviews literature which pertains to those end user issues which constitute the construct "Perceptions of End user issues". The second and third sections summarize the literature which constitute the constructs "Perceptions of IS Departmental Issues" and "Perceptions of Organizational Issues", respectively. It should be noted that while the framework was developed from the literature review not all constructs and their respective issues have been examined in the literature to the same extent. Hence the review of some issues is longer than the review of others. The fourth section presents literature justifying examination of the three job categories. Finally, the shortcomings of the literature are

presented in justification for the research questions used in this study.

Perceptions of End User Issues

The literature suggests that four issues are associated with an individual's perception of EUC with respect to issues affecting the end user (see framework in Figure 1). These are the extent to which EUC is believed to impact: (1) productivity; (2) job control; (3) intrinsic motivation; and (4) employee roles. Literature justifying this view is reviewed below.

1. Productivity: Several studies suggest people who perceive that EUC will increase worker productivity should be more likely to have a positive perception of EUC. The literature indicates that increased productivity associated with EUC may occur through improved end user work methods. Alavi (1985), for example, found that 52% of IS managers thought that EUC improved end user work methods. Increased productivity may also result from increased professional and managerial effectiveness associated with EUC (Alavi and Weiss, 1986; Leitheiser and Wetherbe, 1986). Specifically, EUC may contribute to increased effectiveness of decision making by allowing for more timely information and making it possible to process more data than manual processes (Laudon and Laudon, 1988). It should be noted, however, that results from studies are far from conclusive and whether productivity is perceived as an advantage of EUC is unknown.

2. Job Control: Job control refers to the extent which an individual perceives that they are in control of their work. The literature suggests that people who believe EUC will increase job control are expected to have more positive perceptions of EUC. Two aspects of job control appear to be relevant to EUC: (1) the extent to which an end user's job is flexible and the extent to which it is autonomous from the IS department. The literature suggests that end users may gain more flexibility in their jobs (Leitheiser and Wetherbe, 1986). A

survey by Rockart and Flannery (1983) showed that two-thirds of the applications used by end users were run on an "as-needed" basis, demonstrating that end users took advantage of the flexibility provided by having control over their own computing. Davis (1984), Martin (1982), McLean (1979), Pyburn (1987) and Yaverbaum (1988) state that with EUC the end user is no longer totally dependent on the IS department. It could be postulated, from these articles, that EUC offers the individual more control over their operations.

3. Intrinsic Motivation: Individuals who believe EUC will increase intrinsic motivation are expected to have a more positive perception of EUC. One contributor to overall intrinsic motivation is job stimulation (Herzberg, Mausner, and Snyderman, 1959). The literature suggests that end users could perceive their jobs to be more stimulating due to the increase in their computer literacy levels (Leitheiser and Wetherbe, 1986). Because of this increase in job stimulation one may conclude that EUC makes employees jobs more meaningful. Yaverbaum (1988) put this contention to the test and surveyed 84 users across 15 companies. She found that clerical end users generally perceive their jobs to be more highly motivating than do most workers. However, manager/professional end users did not find their jobs to be more meaningful than the average manager. Aside from Yaverbaum's (1988) study of whether end users perceived their jobs as more motivating, management's viewpoint is still not understood. This is important as management decide whether EUC will be encouraged or discouraged in the organization.

4. Employee Roles: EUC can also affect employees' roles in the organization. One fear harboured by executives is that end users will essentially become programmers and neglect their main functions (Alavi and Weiss, 1986; Pyburn, 1987). Benson (1983) found that 10% of end users had, in fact, become programmers (spending over 50% of their time coding).

EUC may also make an individual's job more complex as much of the development burden associated with application development is transferred from IS to the end user (Guimares, 1984). The end user must now be responsible for data security, system design, documentation, and system implementation (Davis, 1984; Leitheiser and Wetherbe, 1986; Panko, 1988). Unfortunately, it is not clear whether the end users perceive this added job complexity to be a disadvantage.

EUC may also have an effect on an individual's career. Some managers have expressed concern that using a computer in one's job is a line function and that they would get stuck in this position (Benson, 1983). IS managers, on the other hand perceive that users who lack computer skills may feel their career paths are hindered (Alavi, 1985).

Perceptions of IS Departmental Issues

In this section of the literature review the perceived advantages/disadvantages of EUC which have implications for the IS department are discussed. The following topics, as laid out in Figure 1, are covered: (1) maintenance; (2) backlog; (3) data integrity; and (4) IS necessity.

1. Maintenance: System maintenance is the process of modifying existing systems to incorporate users' requests, to improve coding for computational efficiency and to incorporate different input sources (Martin, 1982). One of the major perceived risks of having users develop their own systems is that lack of documentation makes the system non-transferable and non-maintainable (Pyburn, 1987). For personal applications (where the program is used by only the individual (McLean, 1979)), maintainability may not be of a critical nature. On the other hand, maintenance of departmental systems may be crucial. When end users develop systems and then leave the organization, maintenance of the system is difficult as the developer usually is the only one that understands the program (Beheshtian and VanWert, 1987; Benson, 1983).

The literature suggests that maintenance problems of end user developed applications (UDAs) are a concern for IS managers as they believe that the IS department will be expected to solve them (Beheshtian and VanWert, 1987). Research on maintenance problems associated with EUC does not, however, make it clear whether maintenance is presently a concern of top management or end users.

2. Applications Backlog: One aspect of information systems development closely linked with EUC in the literature is the problem of the applications backlog. A backlog is the direct result of the gap between the number of user requests for information systems applications and the number which the IS department's resources can complete. In most organizations the number of user requests far exceeds the number which the IS departments can undertake (Guimares, 1984; Martin, 1982; McLean, 1979). While most corporations report a backlog of three to four years (McNurlin, 1981), Alloway and Quillard (1983) found that this known backlog is just the "tip of the iceberg". An invisible demand exists in organizations consisting of applications which managers do not submit because of the existing backlog. This invisible demand was found to be five times greater than the known backlog (Alloway and Quillard, 1983).

Reducing both the known and invisible backlog is one of the main perceived advantages of EUC cited in the literature. Alavi (1985) in a study of thirty-one IS managers from twelve different companies found that 59% of the managers believed that a smaller application development backlog was an advantage of EUC. In a case study conducted by Beheshtian and VanWert (1987), IS managers encouraged EUC primarily to relieve pressure on their department. Rivard and Huff (1984) found slightly different results. In a study of ten Canadian companies, four firms stated that backlog reduction was a benefit of importance to IS managers. These studies did not examine whether the other two job categories, namely senior management and end users, believe that EUC reduces the backlog, or is of any importance.

3. Data Integrity: Data integrity refers to the extent to which data in an organization is free from error and is one of the most discussed issues in EUC. Janson (1988) refers to data quality as the "Achilles heel of end user computing". EUC is perceived to threaten data integrity as: (1) end users are reluctant to test the programs they write as testing is difficult and time consuming (Davis, 1984; Leitheiser and Wetherbe, 1984; Alavi and Weiss, 1986); (2) user developed applications often do not validate input; (3) end users do not appreciate the need for audit trails and operating controls (Alavi and Weiss, 1986; Davis, 1984; Leitheiser and Wetherbe, 1986; Pyburn, 1987); and (4) a program based on a faulty model could be used and the erroneous results used in decision making (Alavi and Weiss, 1986; Davis, 1984; Leitheiser and Wetherbe, 1984).

Although possible threats to the integrity of data have been mentioned by IS professionals and academics as a drawback to EUC, only one study has elicited the opinions of end users on this issue. Guimares (1984) found that end users were not greatly concerned that algorithms may be wrong or the data may be inaccurate in user generated reports. This suggests there may be a difference of perceptions with respect to data integrity issues between the IS department and end users.

4. IS Necessity: IS necessity refers to the extent to which the IS department and its services are perceived to be needed in the organization. It is unclear from the literature how EUC impacts this issue. It may be that EUC increases the need for the IS department (personnel), but is equally possible that the necessity for IS personnel is reduced. This equivocality arises from several contentions in the literature: (1) EUC decreases overall demand for IS personnel; (2) the skill and knowledge of IS experts is devalued through EUC; and (3) EUC may indirectly undermine the IS professionals authority. These contentions are discussed below.

Advocates of EUC argue that having users do some of their own computing helps

relieve the shortage of technical people (Keen, 1983), thus reducing the overall need for IS personnel. Davis (1984), however, cautions that user developed systems may actually increase the demand for analyst services, data availability, and regular applications. In other words, he suggests that user developed applications may increase the overall demand for IS services.

Some IS professionals report concern that their skill and knowledge would be devalued with EUC as those skills are seen as less esoteric (Alavi, 1985). Martin (1982) suggested that the resistance of IS personnel towards fourth generation languages (4GLs) (often used by end users during systems development) occurs because 4GLs may make obsolete the knowledge that the programmers and systems analysts so laboriously acquired. He goes on to say that IS departments could be bypassed by end users finding ways to create their own applications.

The literature suggests the need for IS professionals could also be undermined as EUC may affect the authority of the IS professional. Although increased literacy due to EUC has its advantages, it may cause a loss of power and influence for the computer professionals (Lucas, 1986) as end users may challenge the authority of the IS department (Guimares, 1984). Martin (1982) also found that IS managers perceived that application creation by end users would erode IS managers' authority. In addition, IS managers believed that EUC reduced their control (Beheshtian and VanWert, 1987).

From these studies, it is not clear whether EUC is perceived as increasing or reducing the need for systems development personnel.

Perceptions of Organizational Issues

The literature suggests that an individual's perception of EUC will also be affected by how they perceive EUC will affect the organization as a whole as opposed to how they perceive EUC affects one particular department or individual. Literature justifying this construct is reviewed below under the following headings: (1) system development; (2)

cost concerns; (3) managerial aspects (see Figure 1).

1. System Development: IS development is all the activities involved in transforming a user's information needs into a computer based information system. This process includes such activities as user requirements definition, formal design, detail design, development and implementation (Laudon and Laudon, 1988). Beheshtian and Van Wert (1987) found that end users felt they were more capable of developing "high quality, responsive systems" than the IS department. This perception of "better systems development" is thought to arise because these systems are better defined and developed faster than traditional methods.

Better definition of user requirements is one of the major perceived advantages of EUC (McLean, 1979). Better system definitions are gained through EUC because elimination of the analyst or programmer allows the end user to define his/her IS requirements directly. In addition, misunderstandings about system specifications between the user and analyst are avoided (Davis, 1984; McLean, 1979). Better system definitions also result from greater user knowledge about computers, faster access to equipment, and the ability to quickly define their own information requirements (Guimares, 1984).

Better information systems may also be attained because system development is faster through EUC. Alavi (1985) reported that 78% of IS managers believed that faster response to user's needs was a major advantage of EUC. According to this view it occurs because end users can create and modify their programs as the need arises rather than adding the application to the backlog of the IS department (McLean, 1979). This decrease in turnaround time may be perceived to benefit the organization as many applications are needed immediately.

2. Cost Concerns: The literature suggests that people may perceive increased costs to be a major disadvantage of EUC. These costs are seen to arise from a number of issues

associated with EUC: (1) inefficient programming; (2) waste of company resources; and (3) duplication of employee effort.

Programs developed by end users are perceived to be inefficient and translate into increased organizational costs as they require more computing cycles (on a PC or mainframe) than their efficient IS counterparts. Guimares (1984) found that senior IS executives expect UDA to be technically deficient compared with systems developed by IS personnel. Alavi (1985) also reported that 59% of IS managers believed end users created inefficient applications. Beheshtian and VanWert (1987) found similar results. Although many IS managers believe that UDA are technically deficient, few end users are concerned about issues such as machine or operating inefficiencies (Guimares 1984).

Increased costs can also result from the waste of company resources through the ineffective use of computers. As EUC is not managed within the strict confines usually found with traditional data processing projects (Davis and Olson, 1985), ineffective use of resources may occur (Weber, 1986). Bergeron and Berube (1988) noted that it was important to avoid wasting resources on the development of less pertinent applications that are difficult to integrate into the overall system.

Furthermore, EUC is perceived to increase costs through duplication of employee effort. This is perceived to occur in one of two ways. First, the working programs developed by end users using a 4GL often have to be rewritten in a procedural language such as Cobol because IS management believes that IS staff cannot maintain the original program (Beheshtian and VanWert, 1987). Secondly, when end users develop their own applications in an organization it is difficult, if not impossible for one individual to know whether another is programming the same system. Thus, duplication of effort could occur. Some end users currently perceive a problem with duplication of system development (Guimares, 1984).

3. Managerial Aspects: The literature suggests that individuals may perceive that EUC

creates some problems for management. The most visible issues mentioned in this regard are hardware and software incompatibility and the over-taxation of computer resources (Alavi, 1985; Beheshtian and Van Wert, 1987; Bergeron and Berube, 1988).

The problem of hardware and software incompatibility is one of the most discussed perceived disadvantages of EUC in the literature. As the cost of Personal Computers (PCs) usually falls within the departmental budget, PCs proliferate throughout an organization in a piecemeal and incompatible manner (Leitheiser and Wetherbe, 1984). When hardware is incompatible, software portability becomes an issue (Weber, 1986) and the capability of standardizing software packages and applications decreases (Henderson and Treacy, 1986). Bergeron and Berube (1988, p.109) state that "the compatibility of equipment and software is vital". Alavi's (1985) empirical results support these observations. She found that 56% of IS managers believed computer (hardware and software) incompatibility to be a risk of EUC.

EUC may also cause an increase in computer consumption as more individuals utilize the hardware and software (Beheshtian and Van Wert, 1987). Since this extra load can overtax computer resources it is often perceived as a disadvantage of EUC. Alavi and Weiss (1986) suggest that this is of particular concern when end users utilize a mainframe.

Employee Job Category

The perceptions held by individuals in the three job categories (IS personnel, senior managers, and end users) towards EUC are examined in this study. These three job categories were chosen for the following reasons. First, a number of authors have noted the importance of these three categories (Beheshtian and VanWert, 1987; Bento, 1990; Leitheiser and Wetherbe, 1986; O'Donnell and Salvatore, 1987). Secondly, research on EUC that only incorporate one perspective seem to represent either individuals (both personnel and senior managers) from the IS department (Alavi, 1985) or the end user (Guimares, 1984; Yaverbaum, 1988). The fact that non IS department senior manager's

views are not portrayed singles them out as a separate grouping. Third, it would appear that these three categories also represent a natural division in organizations when concerned with issues related to IS. A list of book titles nicely illustrates this point. "Computers: The User Perspective (Hutchison and Sawyer, 1988); "Management Information Systems: The Managers View" (Schultheis & Sumner, 1989); "Principles of Information Systems for Management"; and "COBOL Programming: A Structured Approach" (Nickerson, 1977) (or any other technical reference guide for IS experts). In summary, there seems to be agreement that IS personnel, senior managers and end users are the key players with respect to EUC issues.

Not only does the literature suggests that this is an accurate segmentation but it also implies that the perceptions individuals hold towards EUC will differ by job category. For example, problems associated with controlling EUC are discussed in the literature (Rockart & Flannery, 1983) and such problems should not be a concern if all parties agreed on the same levels of control. Lack of senior management concern with the management of EUC in their organizations (Benson, 1983) compared with the zealous concern expressed by the IS department (Benjamin, 1982) also suggests a difference in perceptions between these two groups. Although not explicitly stated in the literature, there does seem to be reason to believe that differences in perceptions towards EUC do exist.

Research Questions

Although the existing literature suggests that perceptual differences exist by job category, it does not make clear how the three main personnel groups perceive the advantages and disadvantages of EUC. This can be attributed to a number of shortcomings in the literature. First, a lack of empirical research makes it difficult to form a complete picture of the perceptions towards EUC. This problem is exacerbated as many studies only reflect a single perspective such as that of the IS manager (Alavi, 1985). Finally, no empirical research has been conducted which systematically evaluates the different

perceptions of IS personnel, senior management, and the end user towards EUC.

This study represents, therefore, an initial effort to resolve some but not all of the above shortcomings. This study will develop a coherent picture of perceptions of the three job categories and the similarities and differences between these perceptions. This is facilitated through two research questions formulated to operationalize the purpose of the study:

Question One: What do IS personnel, end users, and senior managers perceive to be the advantages and disadvantages of EUC ?

Question Two: Do employees' perceptions of the advantages and disadvantages of EUC differ by employee job category ?

As this is an exploratory study the purpose is to gain as much insight as possible into the phenomena under study. A more in depth examination of observable job category differences is conducted to gain additional information with respect to how they differ. For this purpose, three research subquestions were formulated which correspond to each of the three constructs outlined in the research framework:

Question Two (i): How do employees' perceptions of the advantages and disadvantages of EUC differ on the "Perceptions of End user issues" construct ?

Question Two (ii): How do employees' perceptions of the advantages and disadvantages of EUC differ on the "Perceptions of IS Departmental issues" construct ?

Question Two (iii): How do employees' perceptions of the advantages and disadvantages of EUC differ on the "Perceptions of Organizational issues" construct ?

METHOD

Sample

The organization to be sampled had to meet the following criteria. It had to: (1) have over one thousand employees; (2) be in the technological forefront in information processing; and (3) be in the service sector. Criteria (1) and (2) were necessary to allow the sample to contain a large number of respondents in each of the three job categories. Criteria (3) was suggested from the EUC literature. Henderson and Treacy (1986) state that organizations where the service function is becoming increasingly important offer significant opportunities for the use of end user computing.

A judgement sample was used as financial constraints required that the organization be in proximity to the researcher. An organization which met all three criteria was selected for study. This organization was first contacted to ensure that they fit the sample criteria. The IS manager of the organization was then contacted to see if the organization would be willing to participate in the study. Once participation was confirmed a list of all personnel in the organization was requested to aid in survey distribution.

The study comprises a survey of the following three employee job categories: (1) senior management; (2) IS personnel; and (3) end users. The three job categories are operationally defined as follows:

- (i) the IS personnel job category (IS) includes all individuals in the IS department except clerical workers;
- (ii) the end users job category (EU) includes all non-IS individuals in the organization who use a computer in their jobs except clerical workers. Senior management is not included in this category.
- (iii) the senior management job category (SM) includes all executive managers except those managers in the IS department.

Clerical workers were not included in the survey to ensure that end users conformed to the definition in this study (have control over their computing). This

elimination was done to omit data entry clerks whose computer use is typically programmed by the company and thus out of their own control.

Senior managers from the IS department were not included in the senior management category but retained as part of the IS category to increase group homogeneity. The rationale behind the decision to include IS senior managers with the IS category was as follows. It was assumed that a senior manager in IS would have an extensive computing background and have more in common with the IS category than the senior manager category. The senior management group was assumed to be characterized by low computing experience, thus making them quite separate from IS senior managers with respect to IS issues. Details on how these groupings were operationalized can be found in Appendix 1.

Characteristics of the Respondents

Five hundred and thirty five (535) questionnaires were sent out and 428 responses were received for a response rate of 80%. The three job categories were represented as follows: (1) IS = 128 (30%); (2) SM = 60 (14%); (3) EU = 240 (56%).

Table 1 provides some background information on the respondents. IS group members tend to be younger and male (60%). They also have the highest number of college graduates. A substantial number of college degrees is not surprising as much of the computer labour force are drawn from colleges where more technical programs are given. As would be expected, senior managers were older, more highly educated and predominantly male. The majority of end users are female. Compared to the other two job categories, end users have the least amount of formal education.

Table 1 also contains information on the three job categories' use of computers. The IS group spend the most time on the computer, while senior managers spend the least. End users spend twice as much time on the computer as do senior managers.

Table 1. Characteristics of the Respondents

CHARACTERISTICS	IS	SM	EU
SEX male	62	87	40
female	38	13	60
AGE under 20	-	-	-
21 through 30	48	6	27
31 through 40	34	40	37
41 through 50	18	31	30
more than 51	-	21	7
EDUCATION			
high school	30	17	50
college	33	2	9
some university	6	15	8
university degree	31	46	31
post graduate	1	20	4
HOURS ON COMPUTER (per day)	5.49	1.78	3.64
GROUP SIZE	128	60	240
	(30%)	(14%)	(56%)

Note: sex, age and education are reported as percentages

Although an 80% response rate was attained in the survey, it is important to examine non response in case any bias effect may exist. Non respondents were evaluated on three criteria. First, the percentage of respondents in each of the three job categories was compared. Seventy three percent of end users and senior managers and 89% of IS responded to the survey. The fact that more of the IS category answered the survey may be attributed to the fact that the questionnaire was sanctioned by the IS department.

Non respondents were also evaluated by department. No systematic differences were observed. However, within one department a work area had a 22% response rate (only three of thirteen filled out the questionnaire). A follow up analysis showed that this group is known as the busiest section of the company. At the time of the survey they were exceptionally busy as they were working on a proposal for a multimillion dollar contract.

Non response was also evaluated in terms of an employee's position. No pattern seemed to exist. Non response was not associated with any specific position.

In addition to survey non response, individual question non response across the three groups was evaluated. This type of non response could occur in two ways: (1) the respondent did not answer the question; or (2) the respondent chose the option "doesn't concern me". No systematic differences exist with respect to the questions which were not answered, but a slight pattern did appear on the latter type of non response. On most questions respondents from the IS department answered "doesn't concern me", on average, 3.5 % of the time, whereas end users did so 8.0 % of the time. This difference between groups was, however, not statistically significant.

The pattern of non response on individual questions ("doesn't concern me") is deemed too small (4%) to have any effect on the outcome of the research (not significantly different from zero). Questionnaire non response, on the other hand, implies a slight bias. The questionnaire was championed from the IS department and possibly signalled to IS employees that their department saw the research as a worthwhile issue. Consequently, individuals from IS may have perceived that they had a larger responsibility to fill out the questionnaire.

Measurement Instrument

The following steps were followed during questionnaire design. First, the literature was used to identify the perceived advantages and disadvantages of EUC (see literature review). Second, the literature was examined for measurement instruments that have been used in previous studies. Measures of the perceived advantages and disadvantages of EUC that were found in the literature were not suitable for this study as they: (1) were designed for and could only be used in a personal interview; (2) were too general in nature; or (3) evaluated a single perspective, such as that of the IS manager's. In addition, no suitable instrument was found which contained all the elements to be evaluated. This necessitated

the custom design of an instrument for the study.

A structured questionnaire to measure the perceived advantages and disadvantages of EUC was developed following Dillman's (1977) guidelines. A closed format (choose one of a set of given answers) was used in the questionnaire in order to decrease complexity and the amount of time required to complete the questionnaire. This format also eliminates ambiguity often associated with open ended type instruments. Five point Likert type scales were developed to measure respondents' perceptions. The scale was anchored at "1" (strongly agree) and "5" (strongly disagree), thus responses of less than three indicate agreement with the posed statement. Scores greater than three show disagreement. Each statement either represents an advantage or a disadvantage. In most cases agreement with the statement indicates a perceived advantage of EUC. Some questions, however, were reverse coded so that agreement with such a statement indicates that a respondent perceives this to be a disadvantage of EUC. Questions that are reverse coded are marked on Tables 2 through 4 with an asterick. If a respondent disagrees with a statement representing an advantage then it does **not** become a disadvantage. Similarly, if a respondent disagrees with a statement representing a disadvantage then it does **not** become an advantage. In other words, the scales are not bipolar, but instead represent the degree of agreement/disagreement. The questionnaire used is in Appendix 2. The questionnaire is also presented in Tables two through four which place the questions within the research framework. Each table represents one of the three constructs from Figure 1 and variable names are assigned to each of the individual items. These variable names are used throughout the remainder of the thesis to increase readability.

Table 2 represents Construct One, Perceptions of End User Issues. Fourteen variables are included in this construct. Twelve of these represent advantages of EUC while two are disadvantages. The second construct, Perceptions of IS Departmental Issues, is presented in Table 3. Four measures were used for IS departmental issues; three represent disadvantages and one represents an advantage. The third construct, Perceptions of

Organizational Issues, is displayed in Table 4. Eleven variables were used to measure organizational impact of EUC. Seven of these represented disadvantages while four represented advantages.

Table 2. Questions Used to Measure Construct One: Perceptions of End User Issues

ISSUES	VARIABLE NAME	QUESTION
PRODUCTIVITY	productivity	. improves a person's productivity
	effectiveness	. makes a person more effective in their work
	efficiency	. makes a person more efficient in their work
	effective dm	. allows a user to analyze a larger number of variables for decision making
JOB CONTROL	pgm control	. increases the control people have over how a computer program will be used
	flexibility 1	. gives a person more flexibility in how they do their job
	flexibility 2	. makes it possible for workers to produce adhoc reports on demand
	autonomy	. reduces workers' dependence on the data processing department for reports/ information
INTRINSIC MOTIVATION	knowledge	. increases a worker's knowledge of computers
	stimulation	. makes a worker's job more interesting
	creativity	. allows people to be more creative
EMPLOYEE ROLES	neglect *	. will lead to users neglecting their normal job duties because they are spending too much time on the computer
	complexity *	. will increase the level of complexity of employee's job
	mobility *	. will make it difficult for an employee who does not use a computer to advance in his/her career

* perceived to be a disadvantage of EUC

Table 3. Questions Used to Measure Construct Two: Perceptions of IS Departmental Issues

ISSUES	VARIABLE NAME	QUESTION
MAINTENANCE	maintenance *	Having users fulfil some of their own computing requirements: . results in end user systems which are difficult to maintain
BACKLOG	backlog	. reduces the number of applications the IS department has to do
DATA INTEGRITY	data integrity *	. is a security risk as users can modify or change data with the programs they write
IS NECESSITY	IS necessity *	. will make the skills of programmers and analysts less required in the organization

* perceived to be a disadvantage of EUC

Table 4. Questions Used to Measure Construct Three: Perceptions of Organizational Issues

ISSUES	VARIABLE NAME	QUESTION
SYSTEMS DEVELOPMENT	needs	. results in programs/information systems which better reflect users needs
	response	. is faster than having the Information Systems department do it
COST CONCERNS	inefficient apps*	. results in inefficient applications and/or programs
	redundancy *	. leads to redundant work across the company
	waste *	. leads to a waste of computer resources
	economical	. is cheaper than having the IS department do it
	cost effect	. is cost effective for the organization
MANAGERIAL ASPECTS	hard-prolif *	. leads to the proliferation of incompatible Personal Computers
	soft-prolif *	. results in the proliferation of computer software
	overtax *	. will overtax computer resources
	manageability *	. is impossible to manage

* perceived to be a disadvantage of EUC

The questionnaire was first pretested on eight graduate and undergraduate students and two faculty members for clarity of concepts. The questionnaire was then taken to two managers at the participating company (one from IS, one from human resources) to customize the questionnaire to incorporate company idiosyncrasies and terminology. Six

individuals from the population representing the three job categories were asked to fill out the questionnaire. They were then interviewed to ensure that all key points were covered in the measurement instrument and to ensure that the questions were not misinterpreted. The information gained from these meetings was used to check the instrument for face validity.

To eliminate potential bias the individuals who pretested the questionnaire were not included in the survey. Bias could occur because respondents who have answered the questionnaire once may be sensitized to the questions.

Copies of the final version of the questionnaire were taken to a contact person at the participating company who then distributed them to the respondents through the company's internal mail system. Each questionnaire was accompanied by a cover letter from the researcher and another cover letter from the IS manager at the participating company (see Appendix 3 and 4). Each respondent was given half an hour off work to complete the questionnaire. To ensure confidentiality respondents placed the completed document in a sealed envelope and returned it to their supervisor who in turn passed it on to the researcher.

Data Analysis

Research Question One

To answer research question one frequencies were tabulated on each of the perception measures found in the questionnaire. These statistics were separately computed for each of the three employee job categories.

To determine a group's position on a particular question the frequencies were examined. First, the 5-point Likert scales were collapsed to three point scales to qualify respondents as being in agreement, neutral or in disagreement with an individual question. Response values of 1 or 2 were classified as "agree" (initially, 1=strongly agree 2=agree) and values of 4 or 5 were classified as "disagree" (4=disagree, 5=strongly disagree). A response value of three remained as "neutral". Second, to decide whether a job category as

a whole agreed or disagreed to a questionnaire item the following decision rules were applied: (1) if 50% or more of the respondents agreed with an item it was labelled "agree"; (2) if 50% or more of the respondents disagreed with an item it was labelled "disagree"; (3) if 50% or more of the respondents neither agreed nor disagreed then it was labelled as "neutral"; and (4) if no clear majority existed within any of the the three frequency cells the variable was labelled "indecipherable".

Conclusions were based on frequencies as opposed to means as it was felt that an analysis of the mean would not convey as much information. Use of frequencies would allow for a description of the distribution of responses within each job category. Means, on the other hand, would only produce a single summary measure of a category's position. The purpose of the first research question is to acquire as much information as possible in a descriptive sense about the phenomena under study. Means and standard deviations, however, are also reported for each variable as a summary statistic.

Research Question Two

To address research question two a series of analysis of variance (ANOVA) runs were done to determine whether the perception measures represented by individual questions differed on average across job categories (IS personnel, end users, senior management). Because the evaluation of differences is based on a more parsimonious measure (means) results from this section may seem to contradict those found in the previous section (results based on frequencies). For example, what was labelled in the analysis under research question one as "indecipherable" may be labelled as agree/disagree in this section. This situation, however, is not a contradiction as the two methods of analysis are used for different purposes. The first, an in depth description of groups perceptions and the second, an analysis to determine group differences.

When an ANOVA is conducted it is assumed that population variances for the groups are equal. Unfortunately, Bartlett's F-test (test for homogeneity) was significant for

a number of variables signalling that in a number of cases the assumption did not hold and that variances were unequal. A two step procedure was used to determine the effect of the variance homogeneity. As a result of this analysis (described in detail in Appendix 5), it was determined that statistical tests involving the variables "needs", "autonomy", "backlog", "response" and "knowledge" would be conservative (actual α < nominal α) (Type I error). The nominal α is the alpha level chosen by the researcher to test hypotheses. The actual alpha is the alpha level at which the test is actually conducted. A conservative test occurs when the actual alpha is less than the nominal alpha. To compensate for the conservativeness, tests where any of the above variables are used were evaluated at an increased nominal alpha level of 20% to maintain an overall α level of 15%.

The Bonferroni multiple comparison technique was used to determine significant differences between job categories. Individual tests were conducted at an alpha level of .005 (15/29)%, yielding a Bonferroni upper-bound of 15% (29 refers to the number of variables). In other words, if none of the means on any of the twenty-nine variables were different the probability of falsely rejecting at least one of the twenty-nine null hypotheses could not exceed 15%. An overall confidence level of 15% was used instead 5% as the study is exploratory in nature (Davies, 1961). Stevens (1986) also suggests maintaining an overall alpha of 15% when multiple univariate tests are conducted. For an in depth discussion of the Bonferroni inequality see Stevens (1986). When overall differences between the three job categories were found, an alpha level of 5% was used to determine which of the job categories were different.

Additional Analysis

Multivariate analysis of variance (MANOVA) runs were conducted to address the research subquestions two (i), (ii) and (iii). These questions were formulated to get a more detailed picture of how personnel in different job categories differed in their perceptions of

the three EUC constructs identified in the research framework (Figure 1). For each of the EUC constructs where a MANOVA was found to be significant, a descriptive discriminant analysis (DDA) was conducted to address the following questions: (1) is there a subset of the original response variables which produce nearly the same effects as the original set; (2) what is the ordering of the retained variables in terms of their relative contribution to the resulting effects; and (3) what is a substantive interpretation of the structure (or concept) underlying the resulting significant MANOVA effects (Huberty, 1984).

Discriminant analysis can be used to describe major differences among groups in MANOVA. It does so by breaking down the total between association into additive pieces, through the use of uncorrelated linear combinations of the original variables (these are the discriminant functions) (Stevens, 1986). The discriminant function which provides for a maximum separation on the groups is the best (first) discriminant function. The second discriminant function is the next best discriminator among the groups and is constructed to be uncorrelated with the first. A third discriminant function will be uncorrelated with the first and second discriminant functions, etc.. The number of possible discriminant functions in a given analysis is the minimum of either the number of groups minus one or the number of variables used in the analysis (Stevens, 1986).

Some controversy exists over how discriminant functions should be interpreted (Bray and Maxwell, 1985) but one method, proposed by Stevens (1986), seems to come close to a consensus view (Thomas, 1990). Stevens (1986) suggests that an examination of the standardized discriminant function coefficients (SDFCs) should be conducted in conjunction with an examination of the discriminant function structure coefficients (SCs). The standardized coefficients are obtained by multiplying the raw coefficient for each variable by the standard deviation for that variable. Structure coefficients, on the other hand, are the correlations between each discriminant function and each of the individual variables describing the discriminant function. Steven's (1986) two-step evaluation involves retaining variables having large (absolute) SCs and then discarding those variables

having a small (absolute) SDFCs. This method of interpreting discriminant functions, however, does not address the importance of the retained variables question associated with DDA (question 2 above) (Thomas, 1990). Thomas (1990) offers a technique which provides "a one-step implementation of Steven's approach" (Thomas, 1990, p. 6) and which also appears to provide an indicator of the 'relative importance' of individual variables to the discriminant function. Called parallel discriminant ratio coefficients (II DRCs), II DRC indicators are computed as the product of the corresponding SDFCs and the SCc. Thomas's (1990) technique, although justified via a mathematical analysis, has had little empirical use. Thus the two methods will be used in the analysis: Steven's (1986) method and Thomas' (1990) method.

To aid in the interpretation of results, Stevens (1986) suggests that a graphical representation of the groups in the discriminant plane is useful. This is especially true when there is more than one significant discriminant function. The horizontal axis corresponds to the first discriminant function and a lateral separation among groups indicates the extent to which they have diverged on this function. The second discriminant function is represented on the vertical axis and vertical separation shows which groups are being distinguished in a way unrelated to the way they were separated on the first discriminant function. When one or more discriminant function is found to be significant in this study the graphical technique will be used to illustrate directional differences among the groups.

When interpreting discriminant functions one must be sensitive to the possibility of instabilities in the discriminant function coefficients, causing interpretational difficulties (Campbell and Reymont, 1978). Instability, in the sense of large standard errors, can occur if some of the response variables are highly correlated. An initial examination of the data suggested that variable intercorrelation exists on construct one: end user issues. A four step procedure was used to: (1) highlight redundant response variables causing instabilities in the coefficients; (2) subject redundant variables to rigorous empirical and logical testing of the feasibility of combining variables; and (3) produce a data set with acceptable levels of

intercorrelations (see Appendix 6). This analysis resulted in the combination (via, simple summing) of the variables "productivity", "efficiency", and "effectiveness" and of the variables "stimulation" and "creativity" from the Perceptions of End User Issues construct. This aggregation resulted in the elimination of redundant variables and yielded an increase in the stability of the remaining coefficients. For the analysis of research subquestion two (i) the variables of construct one the variables were reformulated as follows: productivity = (productivity + effectiveness + efficiency); and intrinsic = (stimulation + creativity). All other variables are as defined in Table 2.

DISCUSSION AND RESULTS

The discussion of the study results is divided into three sections. The first analyzes the results of the first research question – What do IS personnel, end users, and senior managers perceive to be the advantages and disadvantages of EUC ? and provides a description of what each of three job categories perceive to be the advantages and disadvantages of EUC. Interpretation of the data and comparisons with the literature are done whenever possible. It should, however, be noted that no comparisons with the literature are possible with respect to many issues as little previous empirical work has been done in the area. In particular, studies depicting senior managers' and end users' views on EUC issues are sparse. The second section addresses the second research question – Do employees' perceptions of the advantages and disadvantages of EUC differ by employee category ? Differences between the groups are highlighted. No comparisons to previous studies are possible as no work in this area could be found. The final section of the discussion provides more insight into the group differences found in the previous section. This is done by examining the results from research subquestions two (i), (ii) and (iii).

The Advantages and Disadvantages of EUC

Job Category One: IS Department

Perceptions of End User Issues

Fourteen questions were used to measure perceptions of EUC with respect to how it impacts the end user. Respondents from the IS department agree with ten of the advantages and two of the disadvantages. The two remaining items were "indecipherable". Detailed results are presented in Table 5 and discussed in the sections below.

Table 5. Frequencies and Means – IS Job category – End User Issues

ISSUE	VARIABLE	AGREE %	NEUTRAL %	DISAGREE %	MEAN	VARIANCE	CONCLUSION
PRODUCTIVITY	productivity	61.7	24.3	14.0	2.36	1.062	A
	effectiveness	61.3	25.5	13.1	2.36	1.040	A
	efficiency	52.9	32.4	14.7	2.47	1.110	A
	effective dm	50.7	35.8	13.4	2.83	.792	A
JOB CONTROL	pgm control	43.0	29.6	27.4	1.96	1.262	I
	flexibility1	80.0	13.3	6.6	1.75	.759	A
	flexibility2	85.8	9.2	4.5	1.81	.668	A
	autonomy	81.9	9.4	8.6	1.97	.831	A
INTRINSIC MOTIVATION	knowledge	87.8	6.5	5.7	1.89	.75	A
	stimulation	75.2	19.0	5.9	1.87	.753	A
	creativity	80.1	18.4	1.4	2.54	.539	A
EMPLOYEE ROLES	neglect *	37.0	29.6	33.3	2.59	1.36	I
	complexity *	65.9	23.2	10.9	2.33	.91	A
	mobility *	57.2	26.1	16.6	2.41	1.07	A

* disadvantage

Conclusion Legend:

A=agree

D=disagree

I=indecipherable

N=neutral

Scale Legend: 1=strongly agree

3=neutral

5=strongly disagree

1. Productivity: Four questions were used to measure the extent to which people perceived increased productivity to be an advantage of EUC. Results are shown in Table 5. The results suggest that individuals in the IS department perceive increased productivity to be an advantage of EUC. The majority agree that EUC increases productivity (61.8%) effectiveness (61.3%) and efficiency (52.9%). There was, however, less consensus with respect to the perception that EUC increases the ability to make effective decisions (effective dm) as only half the people in IS agreed with this statement. This result suggests that respondents believe that EUC makes a person more effective in other aspects of their work than decision making. In general, these results are similar to Alavi's (1985) findings, where 52% of IS managers felt EUC improved user work methods.

2. Job Control: IS personnel also believe that EUC gives a person more flexibility (flexibility 1) in their job (80%). This perception is consistent with the fact that 86% of IS respondents perceive that EUC makes it possible for workers to produce ad hoc reports on demand (flexibility 2). Job control is also increased, according to 82% of IS personnel, as having users perform some of their own computing needs reduces workers' dependence on the data processing department for reports/information (autonomy). Although three of the variables in this subset produced conclusive results, the fourth, program control, was classified as "indecipherable". Although more of IS agree (43%) than disagree (27%) that EUC gives an individual more control over their computing (pgm control), there is no majority in any category.

In summary, the results tend to show that EUC is perceived by IS as increasing the worker's job control by increasing flexibility and autonomy. This result is similar to that found in the study conducted by Beheshtian and Van Wert (1987) whereby IS managers believed EUC reduced their control over end users.

3. Intrinsic Motivation: A large majority of the IS group believe that EUC increases an individual's knowledge of computers (knowledge-88%), makes their job more interesting (stimulation-75%) and allows people to be more creative (creativity-80%). Although some individuals were neutral on these issues, very few disagreed. This suggests that IS personnel feels that EUC makes a job more intrinsically motivating. Unfortunately, no previous studies exist which could be used for comparison.

4. Employee Roles: It is mentioned in the literature that EUC may lead to end users neglecting their main job duties and spending too much time on programming (Alavi and Weiss, 1986; Pyburn, 1987). This study neither supports nor contradicts this claim (from an IS perspective). Thirty seven percent of IS respondents do feel that end users will

neglect their jobs as a result of engaging in EUC (neglect). One third disagree with this contention, while 30% remain neutral. This finding may be explained by the possibility that subgroups exist within IS consisting of those individuals that have come in contact with or heard of neglect problems, and those who have not.

Much more conclusive results are found on the complexity and mobility variables where the data suggests that individuals from the IS department perceive two negative impacts of EUC on the end user. Individuals from the IS department perceive that EUC makes an employees' work more complex (66%) and will negatively effect their mobility within the company (57%). In other words, they perceive that individuals who do not use a computer will find upward mobility difficult. The latter disadvantage was noted in a previous study (Alavi, 1985).

Perceptions of IS Departmental Issues

Four questions were used to measure the perceived advantageous and disadvantageous impacts EUC may have on the IS department. Individuals from the IS department agree that one advantage and two of the disadvantages included in this construct do in fact exist. Results are discussed below and displayed in Table 6.

Table 6. Frequencies and Means – IS Job Category – IS Departmental Issues

ISSUE	VARIABLE	AGREE %	NEUTRAL %	DISAGREE %	MEAN	VARIANCE	CONCLUSION
MAINTENANCE	maintenance*	58.1	22.1	19.8	2.43	1.284	A
BACKLOG	backlog	50.7	25.7	23.5	2.63	1.30	A
DATA INTEGRITY	data integrity *	60.9	21.0	18.1	2.36	1.47	A
IS NECESSITY	IS necessity*	14.4	16.5	69.1	3.88	1.33	D

* disadvantage

Conclusion Legend:

A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

1. Maintenance: Fifty-eight percent of IS personnel believe that maintaining user developed applications (maintenance) is a problem. Approximately 20% each disagree or are neutral. Overall, IS see maintenance problems as a disadvantage of EUC. This result is supported in the literature (Benson, 1983; McLean, 1979; Pyburn, 1987) which suggests that IS managers believe that they will be responsible for fixing maintenance problems (Beheshtian and VanWert, 1987).

2. Backlog: Fifty-one percent of IS respondents perceive that EUC reduces the IS backlog (backlog), while 24% disagree. These results are similar to a study done by Alavi (1985) where it was found that 59% of IS managers believe that a smaller application development backlog was an advantage of EUC.

It is surprising that not more individuals in the IS department agree that EUC reduces the IS backlog. If users are completing some of their own computing, as opposed to submitting it to the IS department for completion, it follows that the number of applications the IS department has to do decreases. This discrepancy, however, may be explained by referring back to the findings obtained with respect to the "maintenance" variable (discussed above in the previous paragraph). Fifty-eight percent of the IS department believe that EUC results in non-maintainable programs for which they will be responsible (Beheshtian and VanWert, 1987). Fixing or rewriting such programs could therefore increase the overall workload to exceed the decrease in work gained through end users developing their own applications. Given this, it is not surprising that the majority of individuals in IS perceive that EUC will not reduce the backlog. Alternatively, IS respondents may be disinclined to admit that backlog reduction is an outcome of EUC as this could pose a threat to their job security.

3. Data Integrity: According to 61% of the IS group, EUC is perceived as a security risk as end users can modify data with the programs they write (data integrity). This finding is consistent with the views of researchers in the field (Davis, 1984; Leitheiser and Wetherbe, 1984; Alavi and Weiss, 1986). It should be noted, however, that these papers tend to focus on the sources of the threats to data integrity as opposed to individuals' perceptions.

It is not surprising, that individuals from the IS group perceive EUC as a threat to data integrity. It is likely that they have had extensive training in program testing and are probably aware that their EUC counterparts have no such background.

4. IS Necessity: Sixty nine percent of IS personnel in this study disagree that EUC will reduce the need for IS (IS necessity). This result contradicts that reported in the literature. Alavi (1985) mentions that IS managers believed that the careers of IS professionals may be threatened by EUC and that their skill and knowledge would be devalued as a result of EUC. Unfortunately, she did not report any numerical results for direct comparison.

The discrepancy between Alavi's (1985) study and this study could be a function of the four year lag between studies. At the onset of EUC, ambiguity with respect to the effects of EUC on an IS professional's career may have manifested itself in a negative perception. Through time, a better understanding of the implications of EUC may have been realized and reduced the fear of job insecurity.

Cognitive dissonance theory (Festinger, 1957) may also help explain why individuals from the IS department believe that their necessity to the organization is not threatened. Cognitive dissonance theory is concerned with the degree to which relevant "cognitive elements" are compatible. Examples of cognitive elements are attitudes, beliefs, items of knowledge and information. If two cognitive elements are not compatible, dissonance occurs which is psychologically uncomfortable. The theory suggests that an individual will attempt to reduce this dissonance by eliminating (adding) dissonant cognitions or by reducing (elevating) their importance (Wicklund and Brehm, 1976).

Individuals from the IS group may have initially believed that EUC would make them less required by the organization. However, this cognition is inconsistent with any feelings they may have of self worth and value to the company. To reduce the dissonance IS personnel may have inflated (changed) their belief that the IS function is necessary to the organization to be more in line with their perceptions of themselves.

Perceptions of Organizational Issues

Eleven measures were used to elicit individuals' perceptions of the advantages and disadvantages which EUC may have for the organization as a whole. Only three of these are perceived as disadvantages and one as an advantage by the IS department. The rest of the results are "indecipherable". Table 7 contains the results used in this section. A discussion is provided below.

1. System Development: A small majority of the IS department (56%) believe that UDAs (user developed applications) better reflect users' needs (needs). The remaining 40% is equally split between those who disagree and those who are neutral. This finding supports the argument, found in the literature, that better systems definitions are gained through EUC (Davis, 1984; Guimares, 1984; McLean, 1979).

It is difficult to discern whether faster response to user requests is perceived as an advantage or disadvantage by respondents from the IS department. Forty two percent agree while 31% disagree. Because these findings result in an "indecipherable" conclusion they neither support nor contradict the literature. Alavi (1985) found that 78% of IS managers mentioned faster response to user requests as an advantage of EUC. The different results of the two studies may be a function of the measurement instruments used. The item used in Alavi's (1985) study measured whether EUC was perceived to be faster. This study, however, used a finer measurement item stipulating that EUC is faster **than IS**.

Table 7. Frequencies and Means – IS Job Category – Organizational Issues

ISSUE	VARIABLE	AGREE	NEUTRAL	DISAGREE	MEAN	VARIANCE	CONCLUSION
		%	%	%			
SYSTEMS DEVELOPMENT	needs	56.2	21.2	22.6	2.52	1.35	A
	response	42.3	27.0	30.6	2.87	1.51	I
COST CONCERNS	inefficient apps	63.8	23.2	13.0	2.33	1.03	A
	redundancy*	70.5	13.7	15.9	2.25	1.27	A
	waste *	34.1	26.8	39.1	3.42	1.43	I
	economical	40.9	29.2	29.9	2.91	1.45	I
	cost effect	22.1	47.3	30.5	3.15	.925	I
MANAGERIAL ASPECTS	hard-prolif *	41.7	38.6	19.6	2.79	1.43	I
	soft-prolif *	59.7	29.1	11.2	2.35	.97	A
	overtax *	33.8	35.3	30.9	3.18	1.36	I
	manageability	30.4	29.0	40.6	3.45	1.33	I

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

2. *Cost Concerns*: The majority (63%) of IS personnel believe that UDAs are inefficient (inefficient apps). This finding supports previous work in the area. Alavi (1985) reported that 59% of IS managers believed UDAs to be inefficient. Other studies have reported similar results (Beheshtian and VanWert, 1987; Guimares, 1984).

Increased costs can also be incurred through redundant work efforts. IS personnel (71%) were quite strong in their belief that EUC leads to a redundant work effort (redundancy). These results support the assertion found in the literature (Beheshtian and VanWert, 1987) and are not surprising given that IS believe that UDA are non-maintainable, inefficient and that they will have to fix or rewrite these programs (Beheshtian and VanWert, 1987; Pyburn, 1987).

In this study individuals from the IS group are asked to what extent they agree or

disagree that EUC is cheaper than having the IS department do it (economical). Forty-one percent agree with this statement while 30% disagree. Similarly, the results from the scale used to measure the extent to which IS perceive EUC to be cost effective (cost effect) proves indecipherable (22% agree, 47% neutral, 31% disagree). Finally, 40% of the IS group disagree that EUC leads to a waste of computer resources (waste), whereas 34% agree making any inferences difficult with respect to this issue.

Of the five questions used to measure individuals' perceptions associated with cost issues only two proved conclusive. IS personnel believe that EUC leads to inefficient applications and redundant work efforts. Whether IS personnel perceive EUC to be more economical, wasteful or cost effective is unclear. A probable explanation is that inefficient applications and redundant work efforts are tangible and relatively visible/quantifiable items. The three indecipherable variables (waste, economical, cost effect), on the other hand, are less straightforward and thus may be more difficult to evaluate.

3. Managerial Aspects: Interesting results were found pertaining to the questions of proliferation. Respondents from the IS department perceive that software proliferation (soft-prolif) is a problem that is associated with EUC (60% agree) but not hardware proliferation (hard-prolif). In fact, it is difficult to discern how IS perceive the proliferation of hardware issue as no majority exists in any one cell (agree=41%, neutral=39%, disagree=20%). Both hardware and software proliferation have been considered disadvantages of EUC in the literature (Alavi, 1985; Henderson and Treacy, 1986; Weber, 1986). One explanation for the results obtained in this study may be that hardware proliferation is no longer perceived by IS to be a disadvantage as the company under study has developed PC purchasing standards which end users must adhere to. Although company policy also dictates what purchased software is to be used, it does not control for the proliferation of software resulting from individually created applications.

In this study, perceptions of two other managerial disadvantages associated with

EUC are measured. Unfortunately, both of these measures produce inconclusive results. First, it is not clear whether respondents from the IS department perceive that EUC will overtax computer resources as they are equally divided between agreement, neutrality and disagreement. Similarly, no consensus, among IS personnel, exists with respect to the claim that EUC is impossible to manage (30% agree, 29% neutral, 41% disagree).

In summary, one of the four items measuring the disadvantages of EUC which have an impact on the managerial policies of the organization provided conclusive results. This suggests that respondents from the IS department may not hold strong opinions with respect to these managerial issues (high neutral response) or alternatively, subgroups within the department who have conflicting views may exist (responses divided between agree and disagree indicates a high variability of responses).

Summary: Individuals from the IS department perceive a number of advantages to EUC. These advantages are summarized in Table 8 and are increased productivity; increased job control (flexibility, autonomy); and increased intrinsic motivation (knowledge, creativity and stimulation). In addition to these advantages, respondents from the IS department also perceive a number of drawbacks associated with EUC. IS personnel in general believe that EUC will have a negative impact on the end user's career but not on that of the programmers/analysts. Maintenance and security problems are also seen by individuals from the IS department to be associated with EUC. On the organizational side, IS respondents perceive that EUC is associated with the following disadvantages: leads to redundant work efforts; inefficient applications; and the proliferation of software. It would, however, appear that they perceive that EUC helps the end user rather than the organization or the IS department.

Table 8. Summary of Perceived Advantages and Disadvantages – IS Job Category

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> . increased productivity . increased job control . increased intrinsic motivation . backlog reduction 	<ul style="list-style-type: none"> . increased job complexity . mobility barrier . maintenance problems . threat to data integrity . inefficient applications . work redundancy . software proliferation

Job Category 2: Senior Management

Perceptions of End User Issues

Fourteen variables are included in construct one: perceptions of end user issues. Eleven of these represent ways that EUC is perceived to be an advantage for end users while three are perceived disadvantages. Senior managers perceive that EUC offers the end user eleven advantages and two disadvantages. One end user issue was deemed "indecipherable". Detailed results are exhibited in Table 9 and discussed below.

Productivity: The results suggest that senior managers see EUC as being associated with an increase in all aspects of productivity included in this study as they agree that effectiveness (79%), efficiency (75%), effective decision making (76%) and productivity (72%) increase with EUC. These findings indicate that the company's policy makers perceive that EUC will increase the end users' ability to do their jobs.

Table 9. Frequencies and Means – SM Job Category – End User Issue

ISSUE	VARIABLE	AGREE %	NEUTRAL %	DISAGREE %	MEAN	VARIANCE	CONCLUSION
PRODUCTIVITY	productivity	71.7	19.6	8.7	1.92	1.02	A
	effectiveness	78.7	12.8	8.5	1.92	.89	A
	efficiency	74.5	19.1	6.4	1.98	.93	A
	effective dm	76.1	23.9	-	2.34	.59	I
JOB CONTROL	pgm control	59.6	34.0	6.4	1.96	.88	A
	flexibility1	85.1	6.4	8.6	1.33	1.04	A
	flexibility2	89.2	8.7	2.1	1.81	.57	A
	autonomy	95.7	2.1	2.2	1.49	.43	A
INTRINSIC MOTIVATION	knowledge	97.8	2.2	-	1.89	.27	A
	stimulation	89.1	8.7	2.2	1.87	.64	A
	creativity	80.4	17.4	2.2	1.89	.59	A
EMPLOYEE ROLES	neglect *	34.0	29.8	36.1	2.59	1.30	I
	complexity *	58.7	23.9	17.4	2.33	1.23	A
	mobility *	63.8	21.3	14.9	2.41	.81	A

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

2. Job Control: Almost all senior managers believed that EUC gives an individual more flexibility in their jobs (flexibility 1-85%) and makes it possible for them to produce ad hoc reports (flexibility 2-89%). Senior managers also believe that EUC will increase end users' autonomy (96%) in their job. However, managers were less enthusiastic with the claim that having end users do their own computing increases the control they have over how a computer program will be used (pgm control-61%). These results suggest that senior management perceive that EUC increases an individual's job control through flexibility, autonomy and to a lesser extent program control.

3. Intrinsic Motivation: Senior management perceive that the intrinsic value of an end user's work will be increased with EUC. Almost all senior managers believe that EUC leads to increased computer literacy levels (knowledge-98%), makes a worker's job more interesting (stimulation-90%) and allows him/her to be more creative (80%). It is clear from the results that there is consensus among senior managers that one of the advantages of EUC is that it increases the intrinsic motivation of end users.

4. Employee Roles: Senior managers believe that EUC will have negative impacts on a worker's job and career. Fifty-eight percent of senior managers perceive that EUC will make a worker's job more complex (complexity) while two thirds felt that if EUC is present in an organization, individuals who do not engage in EUC will find their career paths hindered (mobility).

No consensus exists on whether end users neglecting their normal job duties (neglect) could be perceived as a disadvantage of EUC. Respondents were essentially equally split between agree (34%), disagree (36%), and neutral (30%).

Perceptions of IS Departmental Issues

Four measures were used to measure perceptions of EUC with respect to how it impacts the IS department. Respondents from the senior management job category agree with one advantage and one disadvantage. The two remaining items were "indecipherable".[†] These results are presented in Table 10 and discussed in the ensuing sections.

Table 10. Frequencies and Means – SM Job Category – IS Departmental Issues

ISSUE	VARIABLE	AGREE %	NEUTRAL %	DISAGREE %	MEAN	VARIANCE	CONCLUSION
MAINTENANCE	maintenance*	31.9	46.6	21.3	2.63	1.10	I
BACKLOG	backlog	76.1	19.6	4.4	1.63	.947	A
DATA INTEGRITY	data integrity	57.6	22.2	20.0	2.44	1.43	A
IS NECESSITY	IS necessity*	26.3	26.1	45.7	3.33	.807	I

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

1. Maintenance: The large number of neutral responses on the maintenance variable (47%) is worth noting. It would seem that managers have no strong feelings either way with respect to the extent to which EUC will reduce or increase application maintenance (maintenance). It is likely that senior managers are unconcerned with this issue as the responsibility lies with the end users, who must use such unmaintainable applications or IS personnel who may have to fix them.

2.Backlog: Senior management believes that EUC has the advantage of reducing the applications backlog (backlog)(76%). This suggests that senior management may perceive that EUC is beneficial to the IS department vis a vis backlog reduction.

3. Data Integrity: Data integrity (58%) is perceived by senior managers as a disadvantage. This result combined with that of "backlog" may suggest that senior managers perceive a trade-off exists between the perceived advantages and disadvantages of EUC with respect to IS departmental issues. Applications are more likely to be programmed but the data is also more likely to be inaccurate

4. *IS Necessity*: Although 46% of senior managers disagree that the skills of analysts/programmers will be less required by the organization (IS necessity), approximately 60% either agree or are neutral making the overall interpretation of these findings difficult.

Perceptions of Organizational Issues

Senior managers perceive three advantages and one disadvantage of EUC with respect to the organization as a whole. The remaining seven measures that were used for this construct (construct three) produced inconclusive results. A detailed discussion of the results follow and are summarized in Table 11.

Table 11. Frequencies and Means – SM Job Category – Organizational Issues

ISSUE	VARIABLE	AGREE	NEUTRAL	DISAGREE	MEAN	VARIANCE	CONCLUSION
		%	%	%			
SYSTEMS DEVELOPMENT	needs	70.2	25.5	4.3	2.04	.998	A
	response	80.4	17.4	2.2	1.74	.686	A
COST CONCERNS	inefficient apps	35.6	46.7	17.7	2.73	1.02	I
	redundancy*	48.9	31.1	20.0	2.60	1.01	I
	waste *	17.4	32.6	50.0	3.42	1.18	D
	economical	75.6	13.3	11.1	2.04	1.32	A
	cost effect	37.0	43.5	19.5	2.78	.929	I
MANAGERIAL ASPECTS	hard-prolif *	40.0	37.8	22.2	2.79	1.21	I
	soft-prolif *	71.1	20.0	8.9	2.09	.992	A
	overtax *	10.9	52.2	37.0	3.18	.914	N
	manageability*	13.0	34.8	52.2	3.45	1.07	D

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indiscipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

1. Systems Development: Approximately 70% of senior managers believe that EUC results in information systems which better reflect users needs (needs). Additionally, the majority of senior managers perceive that having users fulfil their own computing needs is faster than the IS department (response-80%). These results have very interesting implications for the IS department and the end users. Given that 80% of senior managers believe that EUC results in better system development and senior managers are responsible for resource allocation, the IS department may find itself in a precarious position.

2. Cost Concerns: Seventy six percent of senior managers believe that having end users fulfil some of their computing requirements is more economical than having the IS department do it (economical). However, when senior managers were asked to what extent they perceived EUC to be cost effective no conclusions could be drawn. In other words, some senior managers perceive EUC as being cost effective (37%) while others do not (20%). These results suggest that although EUC may be more economical than IS development it may not be overall cost effective for the organization. One possible explanation is that senior managers may be associating additional costs with EUC. According to the results of this study, these additional costs may arise from redundant work effort or inefficient application development but not from a waste of computer resources.

Results from this study suggest that senior managers do not perceive EUC to be a waste of computer resources (waste-50%). Whether costs are believed to be incurred through redundant work effort (redundancy) and inefficient applications (inefficient apps) cannot be determined from this study. Forty-nine percent of senior managers agree, while 20% disagree that EUC leads to work redundancy. The lack of consensus of senior managers on the inefficient application variable is caused mainly by a large percentage of respondents who neither agree nor disagree (47%) with this statement.

3. Managerial Aspects: The proliferation of software (soft-prolif) is perceived to be a disadvantage of EUC by 71% of senior managers. Although related, the proliferation of hardware (hard-prolif) is not perceived as a disadvantage (40% agree). As mentioned in the previous section one explanation for the discrepancy between hardware and software proliferation perceptions may be that hardware proliferation is no longer a problem in the sample organization as organizational policies exist to guide hardware purchases, whereas policies do not exist to control the proliferation of software developed by the end users..

Managers have no strong feelings either way with respect to the extent to which they perceive that EUC will overtax company computer resources (52% neutral). This may be a function of a lack of information with respect to this issue as the IS department typically maintains this type of information.

A measure was used to gain individuals' perceptions of the extent to which EUC was manageable. Fifty two percent of senior management perceive that EUC is not impossible to manage (manageability). This result suggests that despite the problems identified with the managerial aspects of EUC (software proliferation), managers have confidence that EUC can be managed.

Summary: In summary, senior managers are quite convinced that EUC has many advantages to the end user (increased productivity, job control, intrinsic motivation), the IS department (backlog) and the organization as a whole (better systems, economical)(See Table 12). Senior managers also associated a number of disadvantages with EUC . They perceive that EUC will have some negative impacts on: the end user (increased complexity, decreased mobility); the IS department (loss of data integrity); and the organization as a whole (proliferation of software).

Table 12. Summary of Perceived Advantages of Disadvantages – SM Job Category

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> . increased productivity . increased job control . increased intrinsic motivation . backlog reduction . user needs reflected . faster response . more economical than IS 	<ul style="list-style-type: none"> . increased job complexity . mobility barrier . threat to data integrity . software proliferation

Job Category Three: End Users

Perceptions of End User Issues

Fourteen variables were used to measure construct one: perceptions of end user issues. End users perceive that there are eleven advantages and two disadvantages for the end user associated with EUC. The results from one measure proved inconclusive. The findings are discussed below and presented in Table 13.

1. Productivity: Four questions were used to measure the extent to which end users perceived increased productivity to be an advantage of EUC. The results on these questions suggest that end users perceive increased productivity to be an advantage of EUC. Approximately 75% of end users believe that EUC increases productivity, effectiveness and efficiency and 65% perceive that EUC increases decision making effectiveness. These results seem to indicate that people who use this work arrangement see it as helping them with respect to their job performance.

Table 13. Frequencies and Means – EU Job Category – End User Issues

ISSUE	VARIABLE	AGREE	NEUTRAL	DISAGREE	MEAN	VARIANCE	CONCLUSION
		%	%	%			
PRODUCTIVITY	productivity	74.3	17.8	8.0	1.92	1.03	A
	effectiveness	79.0	14.6	6.4	1.92	.81	A
	efficiency	74.0	19.1	7.0	2.01	.88	A
	effective dm	64.7	30.4	4.9	2.26	.73	A
JOB CONTROL	pgm control	62.7	28.7	8.6	1.96	.96	A
	flexibility1	80.3	14.2	5.5	1.62	.79	A
	flexibility2	81.2	15.9	2.9	1.81	.68	A
	autonomy	81.7	15.5	2.8	1.78	.68	A
INTRINSIC MOTIVATION	knowledge	88.9	9.7	1.4	1.89	.51	A
	stimulation	85.5	12.1	2.3	1.87	.68	A
	creativity	83.6	12.6	3.8	2.22	.75	A
EMPLOYEE ROLES	neglect *	31.0	28.6	40.5	2.59	1.65	I
	complexity *	67.4	18.6	13.9	2.33	1.09	A
	mobility *	63.3	23.7	13.0	2.41	1.15	A

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

2. Job Control: End users also agree that EUC gives a user more job control. Sixty three percent agree that EUC gives them more control over how they use their computer (pgm control). In addition, 80% of this job category perceive that EUC gives a person more flexibility (flexibility 1) in their job, makes it possible to create ad hoc reports on demand (flexibility 2) and reduces a worker's dependence on the data processing department (autonomy). These results support non-empirically based assertions found in the literature (Davis, 1984; Leitheiser and Wetherbe, 1986). It is clear from these results that end users perceive increased job control to be an advantage of EUC.

3. Intrinsic Motivation: Three questions were used to measure the extent to which end users perceive that EUC increases intrinsic motivation. Over 80% of end users perceive that EUC allows an individual to be more creative (creativity), makes their job more interesting (stimulation) and increases their knowledge of computers (knowledge). These findings suggest that the end users in this study believe that EUC increases intrinsic motivation. These are interesting results as they contradict those found by Yaverbaum (1988). She found that managers and professionals who engaged in EUC did not find their jobs more motivating. This difference in results may be attributed to a slight difference in the comparison groups between studies. The group representing end users in this study may include more individuals at the supervisory level. The difference in results may also be attributed to a difference in measurement instruments used. Yaverbaum's (1988) measurement was comprised of an extensive number of questionnaire items based on standard instruments to assess motivation. The questions in this study were designed to assess intrinsic motivation issues that are specific to EUC (i.e., creativity, stimulation, knowledge). Alternatively, it would appear possible that the items used in this study, while interesting in themselves, are not a measure of intrinsic motivations.

4. Employee Roles: The results indicate that end users perceive that EUC may have negative impacts with respect to their work roles. Sixty-seven percent agree that EUC will increase the level of complexity of the employees' job. Likewise, 63% agree that having users fulfil some of their own computing requirements will make it difficult for an employee who does not use a computer to advance in his/her career (mobility).

This study is not conclusive with respect to whether EUC is perceived as leading to end users neglecting their job duties. Forty percent of end users disagree that they will neglect their normal job duties, while 31% agree and 29% remain neutral. Although no definitive conclusion can be reached with respect to this group's overall position, a comparison with the literature proves interesting. These results indirectly support Benson's

(1983) finding that 10% of end users had become programmers. The 31% who agree that EUC will lead to individuals neglecting their jobs may be representing a subset of end users who actually neglect their job duties and spend more programming. This is also in line with a study conducted by Rockart and Flannery (1983) where various degrees of end user involvement were found. One such type of end user is a "functional expert" who would be likely to neglect their regular job duties in order to service the department's computing.

Perceptions of IS Departmental Issues

Four questions were used to measure the extent to which end users perceived EUC impacted the IS department. Detailed results are presented in Table 14. Results on three of these items (maintenance, data integrity, IS necessity) are obscured by a large proportion of neutral individuals (30–40%).

1. Maintenance: Twenty nine percent agree that UDAs are difficult to maintain, while 28% disagree. These results may be reflecting the perceptions of different levels of end users. Rockart and Flannery (1983) found six different types of end users ranging from an end user who only utilizes a menu system to one who programs for other individuals in the organization. It may be that individuals who perceive a maintenance problem have either created a non-maintainable application or have attempted to fix one. To do this one would need to possess an advanced computer literacy level. On the other hand, individuals who disagree may have low computer skills and thus would never encounter such a situation.

Table 14. Frequencies and Means – EU Job Category – IS Departmental Issues

ISSUE	VARIABLE	AGREE %	NEUTRAL %	DISAGREE %	MEAN	VARIANCE	CONCLUSION
MAINTENANCE	maintenance	28.6	43.3	28.1	3.07	1.17	I
BACKLOG	backlog	75.9	19.2	4.9	1.94	.833	A
DATA INTEGRITY	data integrity	42.9	32.7	24.4	2.78	1.32	I
IS NECESSITY	IS necessity	23.7	32.2	44.1	3.36	1.15	I

* disadvantage

Conclusion Legend:

A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

2. *Backlog*: Although the majority of measures comprising construct three do not provide conclusive results, end users agree (76%) that EUC reduces the number of applications the IS department has to do (backlog). This is not surprising as they are incorporating what was traditionally done by the IS department into their own jobs and would, therefore, perceive that IS would have fewer applications to contend with.

3. *Data Integrity*: Forty-three percent of end users perceive that EUC is a threat to data integrity, while twenty-four percent disagree. These results suggest that end users are either unconcerned with the issue of data integrity or exhibiting views of different levels of end users. For example, high level end users may be aware of integrity problems as they could write programs that modify data. On the other hand, it is likely that low level end users are unaware of such problems .

4. *IS Necessity*: Forty-four percent of end users do not perceive that EUC will devalue the skills of programmers and analysts while 24% do feel this way. No previous research exists to help explain these findings. Again, the diverse results may be a function of

various levels of end users.

Perceptions of Organizational Issues

Six of the eleven questions used to measure the third construct: Perceptions of Organizational Issues as perceived by the end users are not classifiable as advantages or disadvantages. This ambiguity can be attributed to the large number of neutral responses. Three advantages and two disadvantages to the organization are cited by the end users. The results for this construct are displayed in Table 15.

Table 15. Frequencies and Means – EU Job Category – Organizational Issues

ISSUE	VARIABLE	AGREE	NEUTRAL	DISAGREE	MEAN	VARIANCE	CONCLUSION
		%	%	%			
SYSTEMS DEVELOPMENT	needs	71.4	22.1	6.4	2.07	.815	A
	response	65.6	21.2	13.2	2.20	1.41	A
COST CONCERNS	inefficient * apps	36.5	31.7	31.8	3.01	1.19	I
	redundancy*	46.9	27.5	25.6	2.77	1.48	I
	waste *	16.6	34.6	48.8	3.42	1.29	I
	economical	54.1	32.9	12.9	2.42	1.26	A
	cost effect	46.8	38.4	14.8	2.59	1.09	I
MANAGERIAL ASPECTS	hard-prolif *	29.5	53.5	17.0	2.79	1.01	N
	soft-prolif *	37.0	50.0	13.0	2.71	.98	N
	overtax *	21.9	45.8	32.3	3.18	1.15	I
	manageability	14.9	38.5	46.6	3.45	1.24	I

* disadvantage

Conclusion Legend: A=agree
D=disagree
I=indecipherable
N=neutral

Scale Legend: 1=strongly agree
3=neutral
5=strongly disagree

1. System Development: End users perceive that EUC is associated with better systems development. Specifically, end users agree that better systems definition (needs-70%) and faster response to user needs (response-65%) are advantages of EUC. These results are

consistent with a study conducted by Beheshtian and VanWert (1987) who found that end users felt they were more capable of developing "high quality, responsive systems" than the IS department. The results tend to suggest that end users perceive EUC can benefit the organization as better systems (faster, needs) are produced.

2. Cost Concerns: Although this study attempts to evaluate end users' perceptions of the costs of EUC, high response variability made it difficult to do so. Only one of the five measures used to evaluate the extent to which end users perceive that EUC is related to costs (economical) proved conclusive. The rest of the results neither support nor contradict the three disadvantages of EUC and one advantage with respect to cost concerns found in the literature. These are: (1) EUC wastes company resources (waste); (2) EUC leads to duplication of employee effort (redundancy); (3) inefficient applications are a result of EUC (inefficient apps); and (4) EUC is cost effective (cost effect). It is surprising that some end users do not perceive that a redundant employee effort (redundancy) is a disadvantage of EUC as the literature suggests they do (Guimares, 1984). It is also surprising that some end users (37%) perceive that EUC results in inefficient applications (inefficient apps) as end users were not concerned about machine or operating inefficiencies according to a study by Guimares (1984).

Over half of the end users perceive that having end users fulfil their own computing needs is cheaper than having the IS department do it. Since end users perceive that EUC is more economical than having the IS department do it, it is surprising that they do not also perceive that EUC is cost effective. This suggests that end users may be associating additional costs with EUC not covered in this study.

3. Managerial Concerns: Of the four questions used to measure end user perceptions of the managerial disadvantages of EUC, two supplied inconclusive results. From this study it cannot be determined if users perceive that EUC overtaxes computer resources (overtax) or

is impossible to manage (manageability). The remaining two questions (hard-prolif, soft-prolif) exhibit surprising results. The data suggests that end users have no strong feelings either way with respect to the extent to which EUC leads to hardware and software proliferation (50% and 54% neutral, respectively). The lack of concern for software proliferation is not surprising as end users probably do not see it as their problem. As mentioned earlier this lack of concern for hardware proliferation may be a result of company policy.

Summary: End users perceive that many advantages to the end user are associated with EUC (Table 16). They also believe that two of three EUC disadvantages with respect to end user issues exist. However, of the remaining fifteen measures (IS dept and org issues) eleven of these are "neutral". Not surprisingly this group has a very focused view of EUC primarily being concerned with how it affects them rather than the IS department or the organization as a whole.

Table 16. Summary of Perceived Advantages and Disadvantages - EU Job Category

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> . increased productivity . increased job control . increased intrinsic motivation . backlog reduction . user needs reflected . faster response . more economical than IS 	<ul style="list-style-type: none"> . increased job complexity . mobility barrier

Job Category Differences on Perceptions of EUC

This section of the thesis deals with the different perceptions individuals in the three job categories have towards EUC. The variable names exhibited in Tables 2–4 in the methodology section are also used in this analysis. As the specific job category labels are frequently used in this section the following abbreviations will be used: (1) IS=IS department; (2) SM=senior managers; (3) EU=end users.

In this study, statistically significant differences vis a vis a particular issue may occur in six different ways:

- 1.All three job categories have different perceptions;
- 2.The IS job category has different perceptions from those in both the EU and SM categories;
- 3.The IS job category has different perceptions from those in the EU job category but not from those in the SM job category;
- 4.Individuals from the IS job category have different perceptions from those in the SM category but not from those in the EU category;
- 5.Individuals in the SM job category have different perceptions from both those in the IS and EU job categories;
- 6.Individuals from the EU job category hold different perceptions from both those in the IS and SM job categories.

It is also possible that none of the individuals from the three job categories will differ in their perceptions regarding a particular EUC issue.

The discussion of the results is divided in accordance with the research framework presented in the first section of the thesis. Three sections are used: Perceptions of End User Issues; Perceptions of IS Departmental Issues; Perceptions of Organizational Issues. Within each of these sections the results will be discussed in the order of differences set forth in the previous paragraph.

Perceptions of End User Issues

Fourteen variables were used to measure perceptions regarding end user issues. On one variable (effective dm) all groups have significantly different perceptions, while seven variables (flexibility 1, flexibility 2, creativity, stimulation, neglect, complexity, mobility) were identical for all three groups. Other significant differences in perceptions include four variables (productivity, effectiveness, efficiency, pgm control) where IS have different perceptions from both SM and EU, one instance (autonomy) where IS is different from SM but not EU and one (knowledge) where SM are different from IS and EU. Detailed results are discussed below and given in Table 17.

All categories hold different perceptions

All three groups (IS, Senior managers, end users) have significantly different perceptions regarding the extent to which EUC allows an end user to analyze a larger number of variables for decision making (effective dm). The groups do not differ in the direction of their opinions but in their degree of conviction. Senior managers agree most strongly that EUC allows users to analyze more variables. IS personnel were less convinced about this aspect of EUC, while end users fell in between. These results suggest that senior managers are more enthusiastic about EUC in the organization because of the advantages they perceive it can offer vis a vis decision making.

IS holds different perceptions from EU and SM

While individuals in all three job categories perceive that EUC increases productivity (productivity, efficiency, effectiveness), the degree to which they share these convictions differ significantly. IS personnel have different viewpoints from both senior managers and end users on the extent to which they perceive the advantages of EUC. IS were less confident that EUC improves a person's productivity (productivity) and makes an

individual more effective (effectiveness) and efficient (efficiency). They were also less convinced than senior managers and end users that EUC increases the control (control) people have over their computing. These results are not surprising, as it is usually the IS department who must answer to senior management for EUC. It is possible, therefore, that when IS evaluate EUC they use more rigorous, quantifiable criteria than the other groups. Alternatively, IS may be called upon to fix end users' mistakes and therefore, have a more negative view of the work style. It is interesting to note that EU and SM do not hold different perceptions from each other with respect to their perceptions of these advantages of EUC.

IS holds different perceptions from SM but not from EU

In the previous set of comparisons SM and EU held similar perceptions while the IS department was different. In this case IS is still different but only from senior managers. While all three categories perceive EUC leads to an increase in autonomy senior management tend to agree with this statement more than IS personnel. End users were not significantly different from either group. IS and end users may be less convinced than senior managers of the increase in end user autonomy as they have a more realistic picture of the EUC environment as they are both involved with it. On the other hand, senior managers may be slightly removed from the issue. It is also not surprising that the IS group is less likely to perceive that EUC leads to a decrease in dependency on IS as their self image and job security may depend to some extent on their being "needed".

Table 17. Job Category Differences – Perceptions of End User Issues

ISSUE	VARIABLE NAME	F	P-VALUE **	GROUP MEANS ***	SIGNIFICANT DIFFERENCES BETWEEN PAIRS
PRODUCTIVITY	productivity	5.26	.005	IS= 2.36 SM= 1.92 EU= 1.92	IS NE SM IS NE EU
	effectiveness	9.50	.0001	IS= 2.36 SM=1.92 EU= 1.92	IS NE SM IS NE EU
	efficiency	10.13	.0001	IS= 2.47 SM=1.98 EU= 2.01	IS NE SM IS NE EU
	effective dm	11.27	.0000	IS= 2.54 SM=1.89 EU= 2.22	IS NE SM IS NE EU SM NE EU
JOB CONTROL	pgm control	12.86	.0000	IS= 2.83 SM=2.34 EU= 2.26	IS NE SM IS NE EU
	flexibility1	1.02	.3621	1.96	NONE
	flexibility2	5.44	.0046	IS= 1.75 SM=1.33 EU= 1.62	SM NE IS SM NE EU
INTRINSIC MOTIVATION	autonomy	2.88	.0576	1.81	NONE
	knowledge	6.11	.0024	IS= 1.97 SM=1.49 EU= 1.78	IS NE SM
	stimulation	4.67	.0099	1.89	NONE
	creativity	1.63	.1982	1.87	NONE
EMPLOYEE ROLES	neglect *	1.23	.2949	2.59	NONE
	complexity *	.56	.5742	2.33	NONE
	mobility *	.56	.5720	2.41	NONE

* disadvantage

** tests are significant at p=.005

*** where a significant difference was not found the grand mean is reported

IS = Individuals from the IS department

SM = Senior managers

EU = End users

NE = Not Equal

SM holds different perceptions from both IS and EU

In the above results it was the IS respondents who were different from the other groups. This section examines differences between senior managers and the other two job categories. Senior managers are more convinced that EUC increases workers' knowledge (knowledge) of computers than do the IS personnel and end user groups. It is interesting that SM are more optimistic than end users themselves. This may be explained by the fact that the end users and IS personnel have first hand experience of the knowledge transfer and may be basing their answers on reality. Senior managers, on the other hand, may have less personal experiences in this area as they spend less time on the computer (see Table 1).

No differences in perceptions

All three job categories agree that EUC gives a person more flexibility in how they do their job (flexibility1, flexibility2). All categories also perceive that EUC allows people to be more creative in their jobs (creativity) and makes their jobs more interesting (stimulation). In addition, all three job categories perceive that with EUC: (1) end users will neglect their jobs (neglect); (2) complexity levels will increase (complexity); and (3) career advancement will be hindered for computer illiterates (mobility). It is surprising that all three groups agree on as many issues as they do as job roles, responsibilities and emotional involvement with EUC of the three categories are disparate.

Perceptions of IS Departmental Issues

Four variables were used to measure the Perceptions of IS Departmental Issues. In two cases (backlog, IS necessity) the perceptions IS hold are different from those held by both SM and EU, and two cases (maintenance, data integrity) where the perceptions held by IS are different from those held by EU but not from those held by SM. Detailed results are discussed below and given in Table 18.

Table 18. Job Category Differences – Perceptions of IS Departmental Issues

ISSUE	VARIABLE NAME	F	P-VALUE **	GROUP MEANS ***	SIGNIFICANT DIFFERENCES BETWEEN PAIRS
MAINTENANCE	maintenance *	13.98	.0000	IS= 2.43 SM= 2.83 EU= 3.07	IS NE EU
BACKLOG	backlog	22.56	.0000	IS= 2.63 SM=1.83 EU= 1.94	IS NE SM IS NE EU
DATA INTEGRITY	data integrity *	5.77	.0034	IS= 2.36 SM=2.44 EU= 2.78	IS NE EU
IS NECESSITY	IS necessity *	9.52	.0001	IS= 3.88 SM=3.33 EU= 3.36	IS NE SM IS NE EU

*

disadvantage

** tests are significant at $p=.005$

IS = Individuals from the IS department
 SM = Senior managers
 EU = End users
 NE = Not Equal

IS holds different perceptions from EU and SM

Individuals from the IS department are significantly less likely than both senior managers and end users to agree that EUC reduces the number of applications the IS department has to do (backlog). This result is not surprising as the IS department are more likely to have first hand knowledge of the backlog situation. In addition, by admitting that the backlog is reduced, they are indirectly acknowledging that there is less work for them to do.

Respondents from the IS department are also more likely to disagree than EU or SM that EUC will make the skills of programmers and analysts less required in the organization (IS necessity). These results are not surprising as IS has a vested interest in this issue, whereas the other two groups may not.

IS holds different perceptions from EU but not from SM

IS believes that EUC results in end user systems which are difficult to maintain (maintenance) but end users do not. This result suggests that end users may not be as aware of maintenance problems as are IS who have to fix them. It is also possible that end users do not wish to see these maintenance problems.

IS and end users are also not in accord with respect to their views on whether EUC is a security risk. IS are more predisposed than end users to believe that EUC is a security risk as end users can modify or change data with the programs they write (data integrity). End users only marginally agree with this item. This result validates past research (Leitheiser and Wetherbe, 1984; Guimares, 1984; Pyburn, 1987) and is not surprising if interpreted in terms of the group's referent points. IS has a technical background and are well aware of data integrity problems, whereas the end user may not (Davis, 1984; Guimares, 1984).

Perceptions of Organizational Issues

Eleven variables were used to measure the end user issues. In one case, (response) all groups have significantly different perceptions. Four other variables (hard-prolif, manageability, waste, overtax), on the other hand, were identical for all three job categories. Other significant differences in perceptions include two variables (needs, economical) where the IS job category holds different perceptions from those held by SM and EU, three instances (cost effective, redundant, inefficient apps) where perceptions held by IS are different from those held by EU but not SM. Finally, EU hold different perceptions from those of IS and SM on one variable (soft-prolif). Detailed results are discussed below and given in Table 19.

Table 19. Job Category Differences – Perceptions of Organizational Issues

ISSUE	VARIABLE NAME	F	P-VALUE **	GROUP MEANS	SIGNIFICANT DIFFERENCES BETWEEN PAIRS
SYSTEM DEVELOPMENT	needs	9.12	.0001	IS= 2.52 SM= 2.04 EU= 2.07	IS NE SM IS NE EU
	response	21.51	.0000	IS= 2.87 SM=1.74 EU= 2.20	IS NE SM IS NE EU SM NE EU
COST CONCERNS	inefficient apps *	16.30	.0000	IS= 2.33 SM=2.73 EU= 3.01	IS NE EU
	redundancy *	8.60	.0002	IS= 2.25 SM=2.60 EU= 2.77	IS NE EU
	waste *	5.55	.0042	3.42	NONE
	economical	12.16	.0000	IS= 2.91 SM=2.04 EU= 2.42	IS NE SM IS NE EU
	cost effect	12.30	.0000	IS= 3.15 SM=2.78 EU= 2.59	IS NE EU
MANAGERIAL ASPECTS	hard-prolif *	1.29	.2755	2.79	NONE
	soft-prolif *	9.76	.0001	IS= 2.35 SM=2.09 EU= 2.71	EU NE IS EU NE SM
	overtax *	2.84	.0599	3.18	NONE
	manageability *	4.70	.0096	3.45	NONE

* disadvantage

** tests are significant at $p=.005$

*** where a significant difference was not found the grand mean is reported

IS = Individuals from the IS department
 SM = Senior managers
 EU = End users
 NE = Not Equal

All categories hold different perceptions

All three job categories hold different opinions regarding whether EUC makes it faster to develop applications than is possible when the IS department does it (response). Senior management is more likely to perceive that this is a benefit of EUC while IS personnel tend to be neutral. End users are found in the middle. These are interesting results as one would imagine that end users would be more convinced that faster response is an advantage of EUC than senior managers. One explanation for this discrepancy may be that, initially end users may have perceived that a better response time was a benefit with the same conviction as SM, but once they engaged in EUC the reality of the situation (i.e., technical difficulties) may have changed their minds.

IS holds different perceptions from EU and SM

Perceptions towards EUC held by the IS department differed from those held by the other categories on two issues. First senior managers and end users perceive that EUC is cheaper (economical) than having the IS department do their computing. Individuals from the IS category are less convinced than the other two groups that EUC is more economical. This difference in groups may be explained by two premises. One, IS may be more knowledgeable with respect to the costs associated with computing and may have a better understanding of the hidden costs of EUC. Second, IS may be in a position where they cannot admit (publicly) that EUC is cheaper than development by IS as it may undermine their authority and necessity in the firm.

IS were also less convinced than senior management and end users that EUC results in information systems which better reflect users' needs (needs). An argument which is similar to that used to explain the differences in perceptions with respect to the economic aspect (economical) of EUC can be used to explain these results. Fear of reduced authority or usefulness may make IS more unwilling to admit that EUC leads to systems

which better reflect users needs. Alternatively, they may be able, because of their background, to evaluate more accurately how well a system reflects initial specifications.

IS holds different perceptions from EU but not from SM

The perceptions of end users and IS on the cost effectiveness (cost effect) of EUC differ significantly. End users assert that EUC is cost effective for the organization while IS takes the opposite stance. The fact that IS do not believe this contention is consistent with other results pertaining to cost concerns (economical) and may be interpreted as a defensive reaction by IS personnel to the perceived threat of EUC.

End users and IS personnel are also at odds with respect to two other issues. End users are less inclined than IS to agree that EUC leads to redundancy of programming effort (redundancy). Respondents from IS agree that EUC results in inefficient programs (inefficient apps) but end users do not. Both these results support what was found in the literature (Alavi, 1985; Beheshtian and VanWert, 1987; Guimares, 1984). Although redundancy was perceived as a disadvantage by both IS and end users in these studies, the difference in the degree of their convictions has not been previously evaluated. These results are significant in that if all groups agree that redundancy is a problem, albeit to a different degree, then it is quite likely that such a problem does in fact exist in an organization using EUC.

EU hold different perceptions from IS and SM

IS and senior management are more predisposed than the end users to the idea that EUC leads to the proliferation of computer software (soft-prolif). This result supports the argument that to protect their EUC privileges the end users will minimize the drawbacks of EUC.

No differences in perceptions

All three groups marginally agree that EUC leads to the proliferation of hardware (hard-prolif). The fact that this item is not perceived as a problem may be because technical advances of hardware have made compatibility less problematic. In addition, company policies have been developed to standardize hardware.

All three job categories disagree that EUC is impossible to manage (manageability) and will overtax and waste computer resources (overtax, waste). It is surprising that so few differences exist with respect to how the different job categories perceive that EUC affects these managerial aspects of EUC given their different areas of responsibility. These results tend to suggest that the three groups perceive EUC in a similar manner with respect to managerial issues.

Summary

Eighteen of twenty nine variables showed differences amongst the groups. These results are summarized in Table 20. The majority of these differences were in a matter of degree. Only with two variables was a directional change witnessed. IS believe end user systems are difficult to maintain, while end users disagree. The idea that EUC is cost effective to the organization is supported by the end user group but not IS. It may be argued that one other variable, inefficient applications, should be classified as a directional change as end users disagree ($X=3.01$) that EUC produces inefficient applications while, IS agree ($X=2.13$).

Of the twenty nine measures used in this study, eleven were associated with no differences between the groups. The majority of the variables (7) which all three groups had the same perceptions belonged to the end user issues. These results are surprising as one would think the degree of convictions would vary with the proximity of the effect on the individual. For example, end users should have the strongest views as they are directly affected by the issues, whereas IS are twice removed. IS are neither directly involved nor

do they supervise individuals that are directly involved (end users). This suggests the existence of a "common" or assumed perception that EUC benefits the end user. The rest of the measures where no differences were found belonged to the organization construct. All three job categories disagree that EUC will overtax or waste computer resources and that EUC is impossible to manage. All three job categories however, perceive that EUC results in hardware proliferation.

Table 20. Summary of Job Category Differences

TYPE OF DIFFERENCE	CONSTRUCT			TOTAL
	1	2	3	
All groups different	1		1	2
IS different from EU & SM	4	2	2	8
IS different from EU		2	3	5
IS different from SM	1			1
SM different from IS & EU				0
EU different from IS and SM	1		1	2
No differences	7		4	11
Total	14	4	11	29

Construct 1: Perceptions of End user issues

Construct 2: Perceptions of IS departmental issues

Construct 3: Perceptions of Organizational issues

Of the eighteen significant differences found, 45% were in the form of IS different from both end users and senior managers. Twenty eight percent were differences between IS and EU with senior managers caught in the middle (maintenance, data integrity, inefficient apps, redundancy and cost effect). These contentious issues seem to focus on the cost related items of the disadvantages of EUC. These results also suggest that individuals from the IS department perceive EUC more negatively than do the other two job categories. It is possible that respondents from the IS department are more aware of problems and are more apt to be negative to protect their jobs. End users, on the other hand, may be more positive towards EUC to protect their use of EUC.

In depth Examination of Differences

1. Research Question Two (i) – Differences in Perceptions of End User Issues

A MANOVA test was run on the fourteen variables representing construct one to determine if the three job categories exhibited differences on end user issues overall. The results of the test show multivariate significance (Wilk's lambda = .8391, $p=.000$) suggesting group differences exist with respect to End user issues. This test supports the results discussed in the previous section where 50% of the individual measures of construct one showed differences by job category.

In addition to a test for multivariate significance, a discriminant analysis was conducted on the end user variables. In the following discussion, group discrimination is discussed in terms of disagreement (agreement) with the different perceived advantages and disadvantages of EUC. For this section of the thesis, the terms agree/disagree are used as relative terms rather than absolute terms. The positions of the job categories are evaluated relative to each other along an agree/disagree continuum. For example, it is shown on the first discriminant function that IS disagree on the increase of productivity when in fact they agree in terms of their absolute response to this question (see research question 2). If we look at Figure 2 it suggests that IS are positioned at disagree, but it must be noted that the figure is showing the relative direction of the discrimination. In other words, IS tend to disagree more than the other two job categories, not in fact disagree in an absolute sense.

Two discriminant functions are significant on the end user issues. The first discriminant function will be discussed in terms of variable subset, ordering and substantive interpretation (the three DDA questions). The second discriminant function will then be discussed under the same terms and finally the simultaneous interpretation of the two functions presented.

Using Thomas' (1990) approach, an examination of the parallel DRCs of the first discriminant function indicates that three variables yield nearly the same effects. Steven's (1986) approach to the interpretation of discriminant functions, however, includes a fourth

variable (Table 21). These variables, in order of importance, are: (1) EUC is thought to increase the control people have over how a computer program will be used (pgm control); (2) EUC is thought to improve a person's productivity (productivity); (3) EUC is thought to allow a user to analyze a larger number of variables for decision making (effective dm); (4) EUC is thought to reduce a worker's dependence on the data processing department for its information (autonomy). These four variables are the major source of differences between the three job categories with respect to end user issues. Any other variable effects are either irrelevant to group discrimination or are redundant. Variables "pgm control" and "autonomy" are similar conceptually as they both refer to an increase in job control. For the remainder of this discussion the two variables will be treated as one and referred to as "control".

Table 21: First Discriminant Function - End User Issues

VARIABLE	SC	SDFC	II DRC	STEVEN'S METHOD	THOMAS' METHOD
productivity	.56	.45	.25	*	2
pgm control	.71	.60	.43	*	1
flexibility-1	.22	-.33	-.07		
knowledge	.38	.17	.06		
flexibility-2	.25	-.26	-.07		
autonomy	.46	.35	.16	*	
intrinsic motivation	.23	-.18	-.04		
effective dm	.63	.39	.25	*	2
neglect	.16	-.07	-.01		
complexity	.07	.10	.01		
mobility	-.18	-.19	.03		

Legend: * main contributors to group discrimination
 1 variable of primary importance
 2 variable of secondary importance

To maximize the discriminant function a respondent will disagree that EUC increases productivity, control and effective decision making. Job categories can be differentiated on the basis of the extent to which they agree or disagree with the belief that

EUC increases control, productivity and effective decision making. The horizontal axis in Figure 2 illustrates this differentiation represented by the first discriminant function.

Respondents seem to be discriminating on the degree to which they agree or disagree with the quantifiable benefits of EUC. A review of the variables that were included in the final subset suggests they represent more concrete and quantifiable concepts than the excluded variables. For example the statement "EUC allows a user to analyze a larger number of variables for decision making" is very specific in nature. On the other hand, variables, where no group differences exist, such as creativity, flexibility, interesting work and career development can be considered as subjective, qualitative elements relating to worker satisfaction and intrinsic motivation.

An examination of the SCs, SDFCs and parallel DRCs (Table 22) of the second discriminant function indicates that the item "EUC increases workers' knowledge of computers" (knowledge) is of primary importance and several variables are secondary. The secondary variables are "pgm control", "effective decision making (effective dm), intrinsic (stimulation and creativity), and "neglect". It, however, should be noted that the second discriminant function is relatively unimportant compared to the first. The first discriminant function explains 73% of the variation while the second only explains 27%.

To maximize job category discrimination (second discriminant function) an individual will tend to disagree that EUC increases computer knowledge and effective decision making and disagree that EUC decreases user pgm control, and disagree that EUC leads one to neglect their job.

Table 22. Second Discriminant Function – End User Issues

VARIABLE	SC	SDFC	II DRC	STEVEN'S METHOD	THOMAS' METHOD
productivity	-.18	-.21	.04		
pgm control	-.34	-.46	.16		2
flexibility-1	.05	.02	.001		
knowledge	.45	.50	.23	*	1
flexibility-2	.41	.26	.11		
autonomy	.38	.22	.08		
intrinsic motivation	-.22	-.46	.10		
effective dm	.33	.40	.13		
neglect	-.30	-.41	.12		2
complexity	.19	.22	.04		2
mobility	.04	.08	.003		

Legend: * main contributors to group discrimination
 1 variable of primary importance
 2 variable of secondary importance

Interesting results are obtained when the interpretation of the two functions are considered simultaneously. Figure 2 gives a graphical representation of the above analysis and the location of the three job categories on the discriminant function. The three job categories fall into three different quadrants of the discriminant plane. The IS category tends to disagree on the "quantitative" construct and tend to disagree with aspects of the second discriminant function (increased knowledge, effective dm, neglect and decrease in pgm control). End users, on the other hand, tend to agree on the first discriminant function and agree on the components of the second discriminant function. End users agree that EUC will increase productivity, control and effective decision making. With respect to the second discriminant function, end users agree that EUC will increase knowledge, effective analysis and neglect their jobs and agree that EUC will decrease job control. The position of senior management is most perplexing. They tend to agree with the quantitative benefits of EUC, but even more so than end users. This is surprising as EUC has been thought of as a bottom push phenomena and thus the users would be the most enthusiastic with respect to its benefits. They are, however, more similar to IS with respect to the second

discriminant function.

Figure 2. Job Categories on the Discriminant Function – End User Issues
Function 2

Function 1

productivity
pgm control
effective dm

Function 2

knowledge
effective dm
pgm control
neglect

IS	IS Personnel
SM	Senior managers
EU	End users

In summary, differences between the three job categories on the end user issues seem to stem mainly from five of the original fourteen variables. Of primary differentiating power is the contention that EUC increases the control people have over their computing. A secondary distinction concerns the associative increase in productivity and effective

analysis. A second discriminant function was significant and the differentiation seems to be based mainly on the perception of whether EUC increases an individual's knowledge of computers. Secondary contributors to the discrimination seem to involve the variables control, effective dm and neglect. Both the end users and the senior managers seem to be more positive than individuals from IS with respect to the quantitative benefits of EUC. The results suggest that IS are quite different from both end users and senior managers and the dissimilarity seems to stem from their less positive perceptions towards the quantitative aspects of end user issues.

2. Research Question Two (ii) – Differences in Perceptions of IS Departmental Issues

A MANOVA was used to test for differences between the groups on the IS departmental subset of variables. A significant Wilk's lambda (.78224, $p=.000$) indicates that the three job categories differ on the set of four variables.

The discriminant analysis of these group differences yields one significant discriminant function. An examination of the parallel DRCs (Table 23) reveal that the subset of original response variables, namely maintenance, backlog and IS necessity, yields nearly the same effects as the original set. In fact, it accounts for 96% of the 'length' of the discriminant function in the appropriate data space. The variable "backlog" (backlog reduction) has the greatest importance, with variables maintenance (no maintenance problem) and IS necessity (no de-skilling of IS) playing a secondary role. To maximize the distinction between the three job categories on the IS issues one would disagree that EUC reduces the backlog, disagree that EUC results in end user systems which are not difficult to maintain and disagree that deskilling of IS personnel will occur.

Table 23. First Discriminant Function – IS Departmental Issues

VARIABLE	SC	SDFC	II DRC	STEVEN'S METHOD	THOMAS' METHOD
maintenance	.49	.47	.23	*	2
backlog	.71	.69	.49	*	1
data integrity	.28	.15	.04		
IS necessity	-.44	-.53	.23	*	2

Legend: * main contributors to group discrimination
 1 variable of primary importance
 2 variable of secondary importance

One possible interpretation of the results is that the underlying construct differentiating the job categories with respect to their perception of IS issues is their perception of the necessity of the IS department. This can be justified as follows. First, a reduction of the IS backlog would translate into a work reduction overall for the department, and by definition a decrease in the need for IS. Second, if no maintenance problems are associated with user developed applications then IS workload would not increase, nor would the need for IS personnel. Finally, the necessity of the IS department is questioned from the perspective of the necessity of the particular skills set of IS departmental members.

Figure 3 delineates the relationship between the three groups and this underlying construct. Individuals from the IS department tend to disagree that IS is not needed, whereas end users and senior managers tend to agree. It is understandable that the vested interests of respondents in IS leads them to believe that their department's necessity is not threatened.

Figure 3. Job Categories in the Discriminant Plane – IS Departmental Issues
Function 1

3. Research Question Two (iii) – Differences in Perceptions of Organizational Issues

A multivariate analysis of variance shows that significant differences between the three job categories exist on this group of measures comprising the third perceptual construct (Wilk's lambda = .7570, $p=.000$). The discriminant analysis produced two significant discriminant functions. A consideration of the parallel DRCs of the first function (Table 24), indicates that two variables (response and inefficient apps) are of primary importance and two variables (needs and cost effect) are of secondary importance. To maximize the discriminant function the respondent will disagree (agree) that EUC is faster than IS; results in efficient programs; reflects user needs better; and is cost effective for the organization. It seems that the underlying construct may be one of better systems development. Each one of the variables is related to this construct as follows. First, the two most influential variables deal with the speed of end user programming and the efficiency of the resulting program. The secondary variable, that EUC reflects user needs much

better, would imply better systems development as the end product is better and more useful to the end user. Last, the cost effectiveness aspect would be a logical extension of better and more efficient programming.

Table 24. First Discriminant Function – Organizational Issues

VARIABLE	SC	SDFC	II DRC	STEVEN'S METHOD	THOMAS' METHOD
needs	.55	.26	.14		2
economical	.48	-.07	-.03		
response	.63	.49	.31	*	2
hard-prolif	.19	-.17	-.03		
soft-prolif	.33	.30	.09		
cost effect	.63	.28	.18		2
manageability	.35	.03	.01		
waste	.40	-.19	-.07		
redundancy	.50	-.08	-.04		
inefficient apps	.73	.67	.49	*	1
overtax	.28	-.12	-.04		

Legend: * main contributors to group discrimination
 1 variable of primary importance
 2 variable of secondary importance

The second discriminant function (Table 25) is strongly dominated by the notion that EUC results in the proliferation of software (soft-prolif). Of comparatively little discrimination power, the variables "economical" and "response" suggests a slight trade off between EUC being more economical and faster and software proliferation. To maximize the discriminant function individuals will agree that EUC is faster and more economical than having the IS department do it but will result in the proliferation of software. Because of the dominating presence of the soft-prolif variable it may be surmised that discriminant function two largely reflects perceptions on the proliferation issue.

Table 25. Second Discriminant Function – Organizational Issues

VARIABLE	SC	SDFC	II DRC	STEVEN'S METHOD	THOMAS' METHOD
needs	.08	-.05	-.00		
economical	.42	.43	.18	*	2
response	.56	.49	.27	*	2
hard-prolif	-.05	.60	-.03		
soft-prolif	-.55	-.94	.52	*	1
cost effect	-.09	-.64	.06		
manageability	.08	.07	.01		
waste	.00	-.00	.00		
redundancy	-.08	.02	.00		
inefficient apps	-.012	.07	-.01		
overtax	.10	.07	.01		

Legend: * main contributors to group discrimination
 1 variable of primary importance
 2 variable of secondary importance

The simultaneous evaluation of the two discriminant functions is depicted in Figure 4. The first discriminant function is represented by the horizontal axis, while the vertical axis correspond to the second discriminant function. The IS group tend to perceive that EUC is not associated with better systems development and marginally perceive that EUC is not associated with the proliferation of software. Conversely, senior management agree (rather strongly) that EUC does result in the proliferation of software, but perceive that EUC results in better systems development. End users are the strongest in their perceptions that EUC is associated with better systems development but, tend to side with IS on the issue of software proliferation.

Figure 4. Job Categories in the Discriminant Plane – Organizational Issues
Function 2

Function 1

faster (response)
 inefficient apps
 needs (better)
 cost effective

Function 2

soft-prolif
 faster
 more economical

Summary: This section of the thesis has discussed an analysis aimed at an in depth understanding of the perceptions of users in each of the job categories. The IS category differed from the other two job categories on the quantitative advantages to end users of

EUC. The job category differences pertaining to the perceived impact of EUC on the IS department were derived mainly from measures representing the necessity of the IS department. IS personnel tended to agree that they are needed by the organization whereas end users and senior managers tend to disagree. Group differences on the organizational issues tended to be associated with the concepts of better systems development and software proliferation. All three groups were found to be quite different. IS tended to disagree that EUC resulted in better systems development, while senior managers and end users tended to agree. Senior managers tended to perceive software proliferation as a problem. The other two categories did not.

CONCLUSIONS

The results of this study were surprising in that they draw quite a different picture of the key player's perceptions of EUC than that depicted in the literature. An examination of the literature led to the expectation that the three job categories would hold quite different perceptions of EUC (see literature review). First, individuals from the IS department were expected to perceive that EUC was associated with a number of disadvantages and few advantages associated with EUC. On the other hand, end users were expected to perceive EUC favourably. Although end users views are not represented in the literature, EUC is a bottom push phenomena (Davis and Olson, 1985) and it is unlikely that the end users would fight for such a thing unless substantial benefits would accrue to them. Finally, it was expected that senior managers perceive neither advantages nor disadvantages as they are unconcerned with EUC (Alavi, 1985; Benson, 1983).

The purpose of this study was to empirically describe the perceptions of the three job categories. The categories' perceptions are quite different from what was expected. Not only do senior managers have strong perceptions of the advantages and disadvantages of EUC, but the three job categories converge on many issues.

Individuals from all three job categories perceive that EUC is associated with advantages to the end user. This perception stems from the belief that EUC increases an individual's productivity, job control and intrinsic motivation. Increased job complexity and mobility barriers, however, are perceived as drawbacks of EUC for the end user. All individuals also perceive that EUC reduces the systems development backlog of the IS department. It is likely that the items registered positively by all three groups reflect the real advantages offered by EUC and where all three job categories express concern may be reflecting the actual problems associated with the phenomena.

Although respondents perceive some aspects of EUC similarly, there are many issues on which they vary in their strength of convictions. The positions of each of the

three groups are discussed. Senior managements position is quite surprising. They are more enthusiastic concerning the advantages of EUC than the end users themselves, but also perceive more disadvantages than the end users. It could be argued that senior managers may be more enthusiastic than the end users because they are "new" end users. As new end users, they are more enthusiastic than end users because they may have not dealt with many of the realities (negative) of computing which come to light over time. However, this explanation is discredited by the computer usage statistics presented in the section titled "survey characteristics". It is clear, from these results, that managers spend little time on the computer. In addition, studies have shown that executives only have fifteen minute blocks of time or less each workday that are uninterrupted (Mintzberg, 1971; 1973). It is therefore quite unlikely that they could engage in EUC.

A second explanation for management's enthusiasm may lie in the theory of cognitive dissonance. Management probably had to make large investments to support EUC in the organization. The decision to invest in EUC may not, however, have been completely within their control. It is likely that management were pressured by end users to support EUC as the literature suggests EUC is a bottom push phenomena (Davis and Olson, 1985). Consequently, managers may experience cognitive dissonance as they do not have their own rationale or justification for their decision. To reduce this dissonance, senior managers may have added consonant cognitions, particularly positive attitudes towards EUC.

While this explains senior management's positive position, the question is still unresolved as to why senior managers perceive more disadvantages than the end users. Two possible explanations are proposed. First, management's perceptions of the advantages associated with EUC tend to pertain to either the IS department or the organization as a whole. Senior managers' job responsibilities necessitate that they take a broad view of issues affecting the organization. Consequently, they may have the opportunity to evaluate the organizational or IS departmental disadvantages of EUC. End

users, on the other hand, may not be in a position to perform such an evaluation.

The second possible explanation for senior management's partially negative perception of EUC may be political. Senior management may have deduced that the potential for conflict between IS and end users lies in the fact that these two job categories have quite different goals with respect to EUC. Managers may see one part of their jobs as managing or controlling this potential conflict. The results suggest that senior managers tend to see as many positive aspects of EUC as possible, while at the same time being sympathetic with the IS group and the problems they face with respect to EUC. This second supposition is supported by the finding in this study that differences of perceptions between the job categories were often between the IS group and the end users with senior management "caught in the middle".

Examination of the end user's position may also simultaneously help explain senior management's positive regard for EUC. Initially, end users may have been just as enthusiastic about EUC, as senior management, but may have adjusted their perceptions of EUC once the realities of the situation set in (i.e., technical problems, support problems). Another explanation for end users lack of enthusiasm (with respect to senior managers) may relate to a bottom push phenomena. To gain organizational (formal) support for EUC, end users may have espoused the benefits of EUC (i.e., increased productivity, creativity, etc...) to management without being sure of their existence. Once management support was attained they may have found themselves in a position where they are required to produce some results (i.e., increased productivity).

This study found that IS tended to be more negative towards EUC than the other two job categories. Three hypotheses are presented to explain why IS is relatively negative towards EUC. These three hypotheses are not necessarily mutually exclusive. It is quite possible that the perceptions measured are affected by a combination of the three explanations.

IS personnel perceive the least number of advantages and the largest number of

disadvantages to implementation of EUC. Upon closer examination, it seems that IS personnel perceive a number of advantages which benefit the individual worker but these are of a qualitative nature (i.e., stimulation). Advantages are perceived on the qualitative measures but not on the more quantitative variables (i.e., productivity). Thus, individuals from the IS department may tend to see EUC in a negative light more than the other job categories because they may base their judgements on more rigorous criteria but can only do so where possible (quantitative aspects). These results are not surprising as IS are responsible for computing and must justify their positions and actions.

IS's negative attitude (relative to SM and EU) may also be explained through self-perception theory. According to self-perception theory (Bem, 1967) people form their attitudes by watching and learning from their own and other people's behaviors. One recent set of studies suggests that people who express attitudes because of strategic concerns rather than as reflections of their actual feelings bias their own attitudes in the direction of strategically-expressed attitudes when their own attitudes are measured several days later (Higgins and McCann, 1984; Tetlock, 1983). It is possible that IS personnel initially based their attitudes on the strategic role of IS in the company (necessity) and now exhibit perceptions which have been biased in that direction. As EUC may be perceived as undermining the strategic primacy of IS, a negative perception towards EUC then becomes essential .

A third explanation for the relative negative perceptions of EUC may be that IS are applying old principles to a new computing phenomena. Traditionally the IS department's expertise is in large transaction processing systems which are based on routine tasks. EUC, on the other hand, is associated with less structured tasks and decisions requiring different tools and possibly different computing principles. IS personnel may be evaluating EUC from a traditional outlook (inappropriately) and this may result in negative perceptions. From principles better aligned with the type of computing, however, these disadvantages may be irrelevant.

This study indicates that the three job categories (IS personnel, senior managers and end users) do not perceive EUC in a similar manner. This conclusion has a number of implications for both academics and practitioners. First, it means that the literature depicting IS's perceptions of EUC does not apply to either end users or senior managers. Thus, one should not try to generalize results from a study on one category to another. Further, it is possible that these groups will differ on other issues concerned with EUC and researchers should be wary of studies which only treat the aggregate. Secondly, the disparity in perceptions between the three job categories may contain the seeds for organizational conflict between the end users and the IS department with senior management having an additional conflict management task as a result of an organization adopting EUC.

LIMITATIONS OF THE RESEARCH AND DIRECTIONS FOR FUTURE RESEARCH

This study has several limitations which are common to exploratory studies. Three of these limitations relate to weaknesses pertaining to the reliability and validity of the measures used. First, not all relevant variables may have been included in the study as the majority of the measures were drawn from the literature. Research in the area of EUC is immature and as it evolves more variables of importance may be found. Second, the importance of each of these measures in their contribution to the overall perception was assumed to be equal. It is quite possible that a weighting system should have been employed. These facts offer an excellent opportunity for future research. Third, the study relied heavily on perceptual measures and future research might well seek to develop objective measures.

In the research framework used in this study, perceptions were examined in light of job category. It is possible, however, that the perceptions of EUC may be modified by more than employees' job categories. Other constructs, such as computer literacy levels and past experiences with EUC may affect an individual's perception. A related factor is that subgroups within each of the job categories may exist to further explain overall perceptions to EUC. For example, within the end user group, different types of end users such as those found by Rockart and Flannery (1983) may hold different perceptions of EUC. Determining the effects of other constructs on individuals' perceptions would be a challenging research endeavour.

The study is further limited in that the perceptions measured in this study were done so in isolation. No indication of the effects of these perceptions on behaviour were studied and thus inferences are limited to descriptions. Determining the effects these perceptions will have on behaviour may have wide implications as this study suggests that organizational conflict may be a result of differences in perceptions of EUC. This limitation

offers a most promising research opportunity.

A number of characteristics of the study determine to what extent the results are generalizable. First, the applicability of the results over time may be limited as the computing environment is dynamic. The second limitation is due to the fact that all study data came from a single organization. The perceptions measured may be fundamentally related to EUC, and observed differences may endure across organizations. However, there may be some company characteristics confounded with differential perceptions, so that generalizations should not be made with certainty. Disentangling such possible confounds is beyond the scope of this study, but is an interesting topic for further research. Furthermore, results may be only applicable to firms who are relatively mature in EUC as the selection of the participating firm was based in part on the probability of their harbouring a large number of end users. Thus, the findings may represent the future, rather than the present for less mature firms if a reader were to believe the results were generalizable to other organizations.

REFERENCES

- Alloway, R. M., & Quillard, J. A. (1983). "User Managers' System Needs." MIS Quarterly, Vol. 7, No. 2, pp. 27-41.
- Amoroso, D. L. (1987). "Organizational Issues Of End-User Computing". Working Paper Series No. NC 87-13, School of Business Administration, The University of Western Ontario, London, Ont.
- Alavi, M. (1985). "End User Computing: The MIS Managers Perspective". Information & Management, Vol. 8, No. 3, pp. 171-178.
- Alavi, M., & Weiss, I. R. (1986). "Managing the Risks Associated with End-User Computing". Journal of Management Information Systems, Vol.2, No.3, pp. 5-20
- Beheshtian, M., & Van Wert, P. D. (1987). "Strategies for Managing User Developed Systems". Information & Management, Vol.12, No. 1, pp 1-7.
- Benjamin, R.I. (1982). "Information Technology in the 1990's: A Long Range Planning Scenario". MIS Quarterly, Vol.6, No.2, pp. 11-31.
- Bem, D. J. (1967). "Self-Perception: An Alternative Interpretation of Cognitive Dissonance Phenomena". Psychological Review, Vol. 74, No. 3, pp. 183-200.
- Benson, D.H. (1983). "A Field study of End-User Computing: Findings and Issues". MIS Quarterly, Vol.7, No.4, pp. 35-45.

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

Bento, A. M. (1990). "Policy Making for End-user Systems: A Model of Empirical Evidence". Journal of Information Technology Management, Vol. 1, No. 1, pp. 15-22.

Bergeron, F., & Berube, C. (1988). "The Management of the End-User Environment: An Empirical Investigation". Information & Management, Vol.14, No. 3, pp. 107-113.

Bray, J. H., & Maxwell, S. E. (1985). Multivariate Analysis of Variance. Beverly Hills, CA: SAGE Publications.

Campbell N. A. (1980). "Shrunken Estimators in Discriminant and Canonical Variate Analysis". Applied Statistics, Vol. 29, No. 1, pp. 5-14.

Campbell, N. A., & Reyment, R. A. (1978). "Discriminant Analysis of a Cretaceous Foraminifer Using Shrunken Estimators", Mathematical Geology, Vol. 10, No. 4, pp. 347-359.

Cheney, P. H., Mann, R. I., & Amoroso, D. L. (1986). "Organizational Factors Affecting the Success of End-User Computing". Journal of Management Information Systems, Vol. 3, No. 1, pp. 65-80.

Davies, O. L. (Ed.). (1961). Statistical Methods in Research and Production: With Special Reference to the Chemical Industry. (rev. 3rd. ed.). Hafner Publishing Company, New York, NY.

Davis, G. B. (1984). "Caution: User Developed Systems Can Be Dangerous to your Organization". Working Paper Series No. MISRC-WP-82-84, Management Information Systems Research Center, School of Management, University of Minnesota, Minn.

Davis, G. B. and Olson, M. H. (1985). Management Information Systems: Conceptual Foundations, Structure and Development (2nd ed.). McGraw-Hill Series In Management Information Systems.

Dickson, G. W., Leitheiser, R. L., Wetherbe, J. C., & Nechis, M. (1984). "Key Information Systems Issues for the 1980's". MIS Quarterly, Vol. 8, No. 3, pp. 135-158.

Dillman, D. A. (1977). Mail and Telephone Surveys: The Total Design Method. John Wiley and Sons, Toronto, Ont..

Festinger, L. (1957). A Theory of Cognitive Dissonance, Stanford University Press, Stanford, CA.

Guimares, T. (1984). "The Benefits and Problems of User Computing". Journal of Information Systems Management, Vol.1, No.4, Fall, pp. 3-9.

Henderson, J. C., & Treacy, M. E. (1986). "Managing End-User Computing for Competitive Advantage". Sloan Management Review, Winter, pp. 3-14.

Herzberg, F., Mausner, B., & Snyderman, B. (1959). The Motivation to Work. New York; John Wiley and Sons.

Higgins, E. R., & McCann, C. D. (1984). "Social Encoding and Subsequent Attitudes, Impressions and Memory: Context-Driven and Motivational Aspects of Processing". Journal of Personality and Social Psychology, Vol. 47, No. 1, pp. 26-39.

- Huberty, C. J. (1984). "Issues in the Use and Interpretation of Discriminant Analysis". Psychological Bulletin, Vol. 95, No. 1, pp. 156-171.
- Hutchison, S. E., & Sawyer, S. C. (1988). Computers: The User Perspective (2nd ed.). Irwin, Homewood, IL.
- Janson, M. A. (1988). "Data Quality: The Achilles Heel of End-User Computing". Omega: The International Journal of Management Science, Vol.16, No.5, pp. 491-502.
- Keen, P. G. W. (1983). "A Policy Statement For Managing Microcomputers". Computer World, In Depth, May, pp. 21-24.
- Laudon, K. C., & Laudon, J. P. (1988). Management Information Systems: A Contemporary Perspective, Macmillan Publishing Company, New York, NY..
- Leitheiser, R. L., & Wetherbe, J. C. (1986). "Service Support Levels: An Organized Approach to End-User Computing". MIS Quarterly, Vol. 10, No. 4, pp. 337-349.
- Leitheiser, R. L., & Wetherbe, J. C. (1984). "Avoiding the Pitfalls of End-User Computing". Working Paper Series MISCR-WP-85-09, Management Information Systems Research Center, School of Management, University of Minnesota, MINN..
- Lucas, H. C. (1986). "Utilizing Information Technology: Guidelines for Managers". Sloan Management Review, Fall, pp. 39-47
- Martin, J. (1982). Application Development Without Programmers. Prentice-Hall Inc., Englewood Cliffs, New Jersey.

McKenney, J. L. (1984) Conclusion to Part IV–The Information Systems Research Challenge–Proceedings. Ed. F.W. McFarlan . Harvard Business School Press, Boston, MA, pp. 403–410.

McLean, E. R. (1979). "End Users as Application Developers". MIS Quarterly, Vol. 3, No. 4, pp. 37–46.

McNurlin, B. (1981). "Supporting End User Programming". EDP Analyzer, Vol. 19, No. 6, pp. 1–12.

Mintzberg, H. (1971). "Managerial Work: Analysis From Observation". Management Science, Vol. 18, No. 2, pp. 97–110.

Mintzberg, H. (1973). The Nature of Managerial Work. Harper & Row, New York, NY.

Nickerson, R. C. (1977). Cobol Programming: A Structured Approach. Winthrop Publishers, Inc., Cambridge, MASS.

O'Donnell, D. J., & Salvatore, M. T. (1987). "End–User Computing Environments – Finding A Balance Between Productivity and Control". Information & Management, Vol. 13, No. 2, pp.77–84.

Panko, R. R. (1988). End User Computing Management, Applications & Technology. John Wiley and Sons, New York, NY.

Perreault, W. D. Jr., Behrman, D. N., & Armstrong, G. M. (1979). "Alternative Approaches for Interpretation of Multiple Discriminant Analysis in Marketing Research". The Journal of Business Research, Vol. 7, No. 3, pp. 151–173.

Pyburn, P. J. (1987). "Managing Personal Computer Use: The Role of Corporate Management Information Systems". Journal of Management Information Systems, Vol. 3, No. 3, 1987, pp. 49–70.

Rivard, S., & Huff, S. L. (1984). "User Developed Applications: Evaluation of Success From The DP Department Perspective". MIS Quarterly, Vol. 8, No. 1, pp.39–50.

Rockart, J.F., & Flannery, L. (1983). "The Management of End User Computing". Communications of the ACM, Vol.26, No.10, October, pp. 776–784.

Schultheis, R., & Sumner, M. (1989). Management Information Systems: The Manager's View. Irwin, Homewood, IL.

Stevens, J. (1986). Applied Multivariate Statistics For The Social Sciences. Lawrence Erlbaum Associates, Hillsdale, New Jersey.

Tetlock, P. E. (1983). "Accountability and Complexity of Thought". Journal of Personality and Social Psychology, Vol. 45, No. 1, pp. 74–83.

Thomas, R. D. (1990). "Interpreting Discriminant Functions: A Data Analytic Approach", Working Paper Series – WPS 90–96, School of Business, Carleton University, Ottawa, Ont.

Weber, R. (1986). "Planning and Control Issues in End-User Computing". The Australian Computer Journal, Vol. 18, No. 4, pp. 159-165.

Wicklund, R. & Brehm, J. (1976). Perspectives on Cognitive Dissonance. Erlbaum Hillsdale, NJ.

Yaverbaum, G. J. (1988). "Critical Factors in the User Environment: An Experimental Study of Users, Organizations and Tasks". MIS Quarterly, Vol. 12, No. 11, pp.75-88.

APPENDIX 1

OPERATIONALIZATION OF JOB CATEGORIES

To determine whether a respondent should be placed in the senior management job category question 4 (level) in section 1 of the questionnaire was used. The company uses a level scheme ranging from level 1 to level 19 (President) to classify employees. Based on interviews with a manager from human resources at the participating company it was determined that individuals in a level 13 or higher were considered a senior manager. A senior manager was defined as an individual who had an effect on the strategic decision making process of the company.

IS personnel include all individuals in the IS department less clerical workers. Respondents are assigned to this group based on their job title and the department they belong to. This information was attained from the respondent list supplied by the company.

End users were all individuals who did not work for the IS department, were a minimum level six and a maximum level twelve. This assignment was operationalized using question four of the questionnaire (level) and using the respondent list to determine which department they belonged to.

APPENDIX 2

QUESTIONNAIRE

SECTION 1 BACKGROUND INFORMATION

To analyze the questionnaire we first need to obtain some information about you, your job, and your computing background. Please answer all of the following questions.

- 1 Sex (CIRCLE one)
 - 1 Male
 - 2 Female
- 2 Age (CIRCLE one)
 - 1 Under 20
 - 2 20 to 30
 - 3 31 to 40
 - 4 41 to 50
 - 5 Over 50
- 3 Education (CIRCLE one)
 - 1 High School
 - 2 College Diploma
 - 3 Some University
 - 4 University Degree
 - 5 Post Graduate Degree
- 4 What is your present level

- 5 Your present work location is : (please CIRCLE response)
 - 1 Ottawa Head Office
 - 2 Ottawa Computer Centre
 - 3 Ottawa Service Centre
 - 4 Toronto
- 6 On average, how many hours do you work a week ? _____ HOURS
- 7 What type of computer equipment do you use ? (please CIRCLE as many responses as needed) Please also indicate, in the column provided, the number of HOURS you spend on each type of equipment on an average day.

	HOURS
1 Personal Computer - Standalone	_____
2 Personal Computer linked to mainframe	_____
3 Terminal linked to mainframe	_____
4 Other (please specify) _____	_____
- 8 Personal computers and terminals _____ may be dedicated to one user or shared. If you share, how often do you find your work is slowed down because you have to wait to use the computer ? (please CIRCLE response)
 - 1 Never
 - 2 Rarely
 - 3 About half the time
 - 4 Often
 - 5 Always
 - 6 Do not share
- 9 How long have you been using computers for work related activities ? _____ MONTHS _____ YEARS
- 10 How many computer or programming courses have you taken at the university or college level ? (please CIRCLE response)
 - 1 0
 - 2 1 to 3
 - 3 4 to 6
 - 4 more than 6
 - 5 degree was in Computer Science or Data Processing
- 11 What percentage of your computer knowledge was self taught ?
_____ PERCENT

SECTION 3 ATTITUDES TOWARDS END USER COMPUTING

In this section we are interested in how you feel about users doing their own computing (EUC) to help them do their jobs. End User Computing (EUC) is the use of computers for a variety of purposes by people who are not programmers or analysts from the IS department. These people are called "end users". Although you may be a programmer in the IS department we are still interested in how you feel about EUC.

EUC can have advantages and disadvantages for both employees and the organization. We would like to know what problems and benefits you think may occur from having people do their own computing. To do this, we would ask you to indicate how much you agree or disagree with the following statements by CIRCLING the appropriate number on the scale below.

Having people perform some of their own computing requirements:

	COMPLETELY AGREE 1	2	NEITHER AGREE NOR DISAGREE 3	4	COMPLETELY DISAGREE 5	6	DOESN'T CONCERN ME 7
. improves a persons productivity	1	2	3	4	5	6	E
. makes a person more effective in their work	1	2	3	4	5	6	E
. makes a person more efficient in their work .	1	2	3	4	5	6	E
. results in end user systems which are difficult to maintain	1	2	3	4	5	6	I
. increases the control people have over how a computer program will be used .	1	2	3	4	5	6	E
. gives a person more flexibility in how they do their job	1	2	3	4	5	6	E
. results in programs/information systems which better reflect users needs	1	2	3	4	5	6	O

Having users fulfil some of their own computing requirements:

	COMPLETELY AGREE 1	2	NEITHER AGREE NOR DISAGREE 3	4	COMPLETELY DISAGREE 5	6	DOESN'T CONCERN ME 7
. is cheaper than having the Information Systems Department do it	1	2	3	4	5	6	O
. is faster than having the Information Systems Department do it	1	2	3	4	5	6	O
. reduces the number of applications the IS department has to do	1	2	3	4	5	6	I
. increases worker's knowledge of computers	1	2	3	4	5	6	E
. makes it possible for workers to produce ad hoc reports on demand	1	2	3	4	5	6	E
. reduces workers dependence on the data processing department for reports/information	1	2	3	4	5	6	E

Having users fulfil some of their own computing requirements:

	COMPLETELY AGREE 1	2	NEITHER AGREE NOR DISAGREE 3	4	COMPLETELY DISAGREE 5	6	DOESN'T CONCERN ME 7
. allows people to be more creative	1	2	3	4	5	6	E
. makes a worker's job more interesting	1	2	3	4	5	6	E
. leads to the proliferation of incompatible Personal Computers	1	2	3	4	5	6	O
. results in the proliferation of computer software	1	2	3	4	5	6	O
. is cost effective for the organization	1	2	3	4	5	6	O
. allows a user to analyze a larger number of variables for decision making	1	2	3	4	5	6	E
. is a security risk as users can modify or change data with the programs they write	1	2	3	4	5	6	I
. will lead to users neglecting their normal job duties because they are spending too much time on the computer	1	2	3	4	5	6	E

Having users fulfil some of their own computing requirements:

	COMPLETELY AGREE 1	2	NEITHER AGREE NOR DISAGREE 3	4	COMPLETELY DISAGREE 5	6	DOESN'T CONCERN ME 7
. will increase the level of complexity of the employees job	1	2	3	4	5	6	E
. will make skills of programmers and analysts less required in the organization	1	2	3	4	5	6	I
. will make it difficult for an employee who does not use a computer to advance in his/her career at Metropolitan Life	1	2	3	4	5	6	E
. is impossible to manage	1	2	3	4	5	6	O
. leads to a waste of computer resources	1	2	3	4	5	6	O
. leads to redundant work across the company (i.e 2 people writing the same program)	1	2	3	4	5	6	O
. results in inefficient applications and/or programs	1	2	3	4	5	6	O
. will overtax computer resources	1	2	3	4	5	6	O

APPENDIX 3
RESEARCHER'S COVER LETTER

withheld for confidentiality reasons

APPENDIX 4
COMPANY COVER LETTER

withheld for confidentiality reasons

APPENDIX 5

UNEQUAL VARIANCE ANALYSIS IN A THREE GROUP SITUATION

Univariate analysis of variance is based on the assumption that the population variances for the groups are equal (homogeneity of variance). For research question two (do group differences exist) an ANOVA was run for each variable accompanied by Bartlett's test for homogeneity. Unfortunately, Bartlett's F-test was significant for a number of variables signalling unequal variances. Table 26 lists these variables and the associated variances for each group. As long as group sizes are approximately equal (largest/smallest < 1.5), F is robust against heterogeneous variances (Stevens, 1986). Unfortunately, the ratio of largest to smallest, in this study, is much larger than 1.5.

When group sizes are sharply unequal and the population variances are different, it is necessary to determine what effect this will have on the F statistic (Stevens, 1986). Specifically we want to know whether the F statistic will be liberal or conservative. If the large sample variances are associated with the small group sizes, the F statistic is considered to be liberal (Stevens, 1986). A statistic being liberal (actual α > nominal α) means we are rejecting falsely too often (Type I error). When the large variances are associated with the large group, then the F statistic is conservative (actual α < nominal α) (Stevens, 1986). A statistic being conservative means we are not rejecting as often as we presume.

To compensate for these effects on the statistical test one can simply increase or decrease the actual α level depending on whether the variance effect will result in a liberal or conservative test. To illustrate, assume a test for differences between two groups on variable X and group variances are unequal. Specifically, the larger of the variances is associated with the smaller group. This will result in a liberal test. To compensate, tests for group differences should be conducted at an alpha level of .20 instead of the usual .15. With a nominal level of .20 we expect that the actual level is .15.

The above discussion used a two group case. For the three group case the same procedure is used except when the large variance is associated with the middle size group (as opposed to the large or small group). In this instance no procedure exists to redress the problem. Unfortunately, a number of variables in this study have unequal variances where the large variance is associated with the middle size group. To determine the overall effect of the variance, heterogeneity on a statistical test a two step procedure was used. First each pairwise combination of the three groups for each variable which had unequal variances were examined. Second, these results were interpreted in the light of the ratio of the group

sizes to determine whether the overall test was likely to be liberal or conservative. Table 26 contains the results at each step of the analysis.

Table 26. Analysis of Unequal Variances

COLUMN							
1	2			3			4
Variable	Group Variances			Pair Effects			Effect
	IS	SM	EU	IS & SM	SM & EU	IS & EU	
	N = 141	N = 48	N = 239	R=2.9 S	R=5.0 S	R=1.7 W	
needs	1.354	.998	.815	C	-	L	C
response	1.512	.686	1.411	C	C	-	C
backlog	1.301	.947	.833	C	-	L	C
knowledge	.75	.269	.514	C	C	L	C
autonomy	.831	.429	.682	C	C	-	C

Legend: Pair Effects C = conservative L = liberal
 Strength of Ratios S = strong W = weak

IS= Individuals from the IS department
 SM= Senior managers
 EU= End users

Step 1. Pairwise Examination of the Variances of the Three Job Categories

In the first step the variances (Table 26, column 2) with respect to group size were examined and each pair labelled as either being conservative or liberal (column 3). For example, variable "needs" for pairwise tests between groups IS and SM would be conservative as the large variance (1.354) is associated with the large size group (IS). On the other hand, between groups IS and SM a test would be liberal as the large variance (1.354) is associated with the small group (IS). In some cases, the pair in question has approximately equal variances, therefore, no evaluation was done. See, for example, variable needs, in Table 26, group SM (=.998) and group 3 (=.815).

Conclusions drawn in the first step were based on "eyeballing" the data. To increase the validity of these assertions, t-tests were run and the pooled and separate variance estimates were compared (Table 27). When t-tests are conducted, a pooled variance estimate is used when the population variances are equal, otherwise the separate estimate is used. Since we know, for the variables in question in this study, that the variances are unequal, but the ANOVA is based on pooled estimates (equal variances) we

simply compare the two values (pooled and separate) to determine heterogeneity effect. If the p-value of the test based on the pooled estimate (equal variances) is greater than the p-value based on a separate variance estimate (unequal variances) then the test is conservative. For the reverse situation, the test will be liberal. These tests supported the original conservative/liberal conclusions. To illustrate this point variable "needs" in Table 27 has a p-value (pooled) of .013 and a p-value (separate) of .008. Thus, the test will be conservative. Table 27 contains this conclusion and the conclusions for each of the other variables. "Indeterminable" labels were used when both the separate and pooled estimates were .000.

Table 27. Analysis of Unequal Variances – Pooled and Separate Estimates

t-test - p values						
Variable	IS & SM		SM & EU		IS & EU	
	Pooled	Separate	Pooled	Separate	Pooled	Separate
needs	.013	.008	-	-	.000	.000
response	.000	.000	.013	.002	-	-
backlog	.000	.000	-	-	.000	.000
knowledge	.002	.000	.008	.002	.138	.155
autonomy	.001	.000	.025	.011	-	-

t-test conclusions			
Variable	IS & SM	SM & EU	IS & EU
needs	conservative	-	indeterminable
response	indeterminable	conservative	-
backlog	indeterminable	-	indeterminable
knowledge	conservative	conservative	liberal
autonomy	conservative	conservative	-

IS= Individuals from the IS department

SM= Senior managers

EU= End users

Step 2. Examination of Pairwise Comparisons in Conjunction with Relative Strength of

Pairs

The first step of the analysis tells us the effect of the variance nonconformity on pairwise comparisons but does not evaluate the effect across the three groups. To evaluate whether the F statistic in the overall ANOVA was liberal or conservative, the pairwise evaluations have to be examined in conjunction with the relative strength of the pairs. As was mentioned earlier, heterogeneous variance is not a problem with relatively equal sample sizes, but as the ratio of sample sizes increases the effect on the F statistic also increases. Thus, the bigger the ratio of group sizes of a pair, the stronger the influence of that pair. In Table 26, the three sets of pairs have been labelled strong or weak based on their ratio of group size. An examination of variable needs (Table 26) will illustrate the evaluation technique. We see that between groups IS and SM the F test would be conservative (found in previous step). On the other hand, the F test would be liberal for the pair of group IS and EU. The overall effect on the F test would result in a conservative test because the first pair (conservative) has a much greater ratio (2.94) than the third pair (1.69). This evaluation technique was applied to all the variables in Table 26 and the overall effects can be found in column 4 labelled "effect".

The results from this analysis were not only used for the ANOVA, but for the multivariate tests as well. The findings presented in this section were applied whenever a statistical test based on a homogeneity assumption was used incorporating any of the heterogeneous variables.

APPENDIX 6

THE ANALYSIS OF UNSTABLE DISCRIMINANT COEFFICIENTS

When interpreting discriminant functions one must be sensitive to the possibility of instabilities of the coefficients, causing interpretational difficulties. Instability, in the sense of large standard errors, can occur if some of the response variables are highly correlated (Perreault, Behrman, Douglas, and Armstrong, 1979). An initial examination of the data suggested variable intercorrelation may exist on the end user issues. In the course of the data analysis it became evident that collinearity with respect to the measures constituting the end user issues did exist. The determinant of the variance covariance matrix was approaching zero (Table 28) suggesting high intercorrelatedness between variables (Stevens, 1986).

Table 28. Determinants of Variance-Covariance Matrix
Before and After Stabilization Process

GROUP	DETERMINANT BEFORE	DETERMINANT AFTER
IS	.00020	.00781
SM	.00000	.00020
EU	.00007	.00531

IS= Individuals from the IS department
SM= Senior managers
EU= End users

A four step procedure was developed to ensure instability actually existed, locate sources of high intercorrelations and to reduce variable interdependencies to an acceptable level.

Step 1

A cross validation study was conducted to assure that the instability was of a magnitude such that interpretation of analysis to be conducted would be misleading. The data set was randomly split into two and a discriminant analysis conducted on each half. This process was repeated three times creating six sets of data.

To determine the extent of the stability problem, results from the discriminant analyses on the six data sets were evaluated. Table 29 contains the parallel discriminant

ratio coefficients (II PDRCs) a product of standard discriminant function coefficients and the structure coefficients. This index reflects a variable's importance in the between groups discrimination. In essence, variables with large II DRCs are most important while small II DRCs suggest that the associated variables are redundant (Thomas, 1990).

Table 29. Cross Validation Results

VARIABLE	#	RUN 1		RUN 2		RUN 3	
		1ST HALF	2ND HALF	1ST HALF	2ND HALF	1ST HALF	2ND HALF
productivity	1	-.04	-.37	-.10	-.05	-.14	.03
effectiveness	2	.07	.26	.01	.23	.09	.20
efficiency	3	.05	.73	.66	.04	.25	.02
control	5	.21	.24	.15	.36	.33	.05
flexibility-1	6	-.01	-.09	-.06	-.02	-.05	.09
knowledge	11	.001	.04	.03	.07	.00	.09
flexibility-2	12	-.05	-.02	-.03	-.10	-.06	-.08
autonomy	13	.09	.09	.06	.14	.10	.13
stimulation	14	.08	.06	.08	.05	.12	.12
creativity	15	-.02	-.07	-.05	-.02	-.06	-.04
effective dm	19	.51	.05	.10	.27	.28	.32
neglect	21	.01	.03	.09	.00	.04	-.03
complexity	22	.06	.04	-.01	.02	.04	.00
mobility	24	.06	.05	.06	.02	.05	.06

From Table 29 it can be seen that the II DRCs of the variables "productivity" "effectiveness", and "efficiency" are quite unstable. In the first half of run 1 variable efficiency would be interpreted as redundant (II DRC =.01), whereas in the second half it would be considered as important (II DRC=.73). Similar patterns can be found on the second and third runs. Although the coefficients of variables control and effect dm showed some sign of instability, on the whole they seem quite stable.

The major conclusions drawn from this step of the analysis are: (1) serious instabilities exist; (2) the coefficients of the variables "productivity", "effectiveness" and "efficiency" are unstable and thus seem to be the main source of collinearity. It should, however, be noted that although these three seem to be the dominant variables they could very well be overshadowing other redundant variables.

Step 2

Campbell and Reymont (1978) and Campbell (1979) showed that if the within-groups correlation matrix has a small eigenvalue (evidence of collinearity of response variables), then instabilities will affect those variables that load heavily on the eigenvector corresponding to the small eigenvalue. In this case the variables "effectiveness" and

"efficiency" load heaviest (Table 30) on the smallest eigenvector (Table 31). These two variables were added together to see what effect it would have on the within-groups correlation matrix. Interestingly, the resulting smallest eigenvalue (.15) is less than the original (.16) (Table 31) suggesting that variables "effectiveness" and "efficiency" must be associated with still another variable. The eigenvector corresponding to the new "smallest" eigenvalue was examined and variables 2 (2+3) and 1 loaded heaviest (Table 30). Before adding these three variables together for the ensuing discriminant analysis, a number of other measures related to the compatibility of these variables must be examined.

Table 30. Eigenanalysis of Within Cells Correlation Matrix

ANALYSIS NUMBER

VARIABLE	#	1	2	3	4
productivity	1	-.08	.26		
effectiveness	2	.31		-.19	-.33
efficiency	3	-.23	-.29		
pgm control	5	.01	.02	.06	-.03
flexibility-1	6	-.01	.00	.17	.20
knowledge	11	-.00	-.03	-.12	-.17
flexibility-2	12	-.03	.02	-.01	-.24
autonomy	13	.00	.03	.05	.20
stimulation	14	-.01	-.01	-.30	.18
creativity	15	.00	.04	.33	
effective dm	19	.02	.01	.02	.17
neglect	21	.00	-.01	.02	.06
complexity	22	-.00	.01	.05	-.03
mobility	24	.01	-.01	-.01	.01

* after each analysis variables are summed and another eigenanalysis is conducted.
runs 1 through 4 were done consecutively

* boxed variables are added before next step

Step 3

The existence of high intercorrelations of variables 1, 2 and 3 ($> .75$) support the contention to sum the three variables. However, variables can only be summed if the means across groups are similar and are distributed similarly. An examination of the group means on the three variables verifies the existence of this necessary condition. The variables also belong together from a logical, as well as an empirical, perspective. Specific to EUC, productivity (variable 1) is related to both efficiency (variable 2) and effectiveness (variable 3) measures (see literature review). Lastly, a stepwise discriminant analysis left out variables 2 and 3, suggesting that once variable one is entered into the equation two and

three have little extra to contribute to overall group discrimination. Based on these findings and the eigenanalysis discussed above variables 1, 2 and 3 were summed together.

Table 31. Statistics on Stabilization Process

	ORIGINAL DATA SET			
		2+3		
SMALLEST EIGENVALUE	.16	.15	.29	.35
EIGENVALUE (ON DISC. FNC)	.1690	.1654	.1456	.1351
% DROP IN EIGENVALUE	0	2.6	13.8	20.1

STABLE 1: Statistics after variables 2 and 3 have been summed

STABLE 2: Statistics after variable 1, 2 and 3 have been summed

STABLE 3: Statistics after variables 1,2 and 3 have been summed
and variables 14 and 15

Step 4

Once variables are combined, it is important to evaluate their effect on the composition of the data set. First, the size of the smallest eigenvalue in the within-groups correlation matrix should be evaluated to ensure that the variable reduction actually relieved the collinearity problem. The smallest eigenvalue should be larger than that of the original data set. A trade off does, however, exist between an increase in stability and a loss in discriminatory power. In the above analysis the summing of the variables increased the "smallest" eigenvalue to .29 (increase in stability) but reduced the eigenvalue by 13.8% (discriminatory power). Table 31 contains the values of the small eigenvalues and the canonical root delineating the trade off. The values in the table reflect the changes after each iteration of the "collinearity reducing problem".

This process of eliminating variables causing instabilities in the correlation is an iterative one. Once the first set of variables are summed, the four steps are repeated until all instabilities are resolved. It should be noted that the process described so far in fact includes two iterations of the process, One, where variables 1 and 2 were summed and two, where variable 3 was added to the result of the previous iteration (2+3). On the third iteration, the eigenvector associated with the smallest eigenvalue of the within-groups correlation matrix was examined to see which factors load heavily. In this case, variables

14 (stimulation) and 15 (creativity) did (Table 30) (Step 2). These two variables also have similar means across groups, have logical semblance, are highly correlated (Table 32), and stepwise analysis entered one but not the other (Step 3). On summing 14 and 15 the smallest value in the within-groups correlation matrix was further raised to .35 costing discriminatory power of 6% more (Step 4).

Once 14 and 15 were joined, the ensuing eigenanalysis did not result in any other possible variable combinations.

Summary

A four step procedure was used to: (1) highlight redundant response variables causing instabilities in the coefficients; (2) subject redundant variables to rigorous empirical and logical testing of the feasibility of variable joinings; (3) produce a data set with acceptable levels of intercorrelations.

This analysis resulted in the summation of variables productivity, efficiency, and effectiveness and of variables stimulation and creativity from the Perceptions of EUC: End User Issues construct. This aggregation resulted in the elimination of redundant variables and translated to an increase in stability. For the analysis of research subquestion 2 (i) the variables of the End user Issue construct will be defined as variables: productivity (productivity + effectiveness + efficiency); control, flexibility-1, knowledge, flexibility-2, autonomy 1, intrinsic(stimulation + creativity), effective dm, neglect, complexity, mobility.

END

1|2|0|4|9|1

FIN