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An empirical analysis of causal relationships among quality of work life factors in end user computing

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AN EMPIRICAL ANALYSIS OF CAUSAL RELATIONSHIPS AMONG QUALITY OF WORK LIFE FACTORS IN END USER COMPUTING

by

Shin Cheol Kang

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DISSERTATION TITLE

An Empirical Analysis of Causal Relationships Among QWL Factors in End User Computing

BY

Shin Cheol Kang

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GRADUATE COLLEGE
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AN EMPIRICAL ANALYSIS OF CAUSAL RELATIONSHIPS AMONG QWL FACTORS IN END USER COMPUTING

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Adviser: Sang M. Lee

End user computing is one of the most effective productivity enhancement tools available to knowledge workers. The principal advantage of end user computing lies in the harmony between people and technology that it is intended to engender. However, while the technical aspects of end user computing are relatively well understood, the behavioral and social aspects of end user computing continue to defy thorough comprehension. The lack of a theoretical perspective and reliable measurement instruments is often referred to as a major impediment in behavioral research in the field of management information systems.

In the present study, some conceptual difficulties in defining unobservable variables and complex relationships among quality of work life factors in end user computing were resolved and analyzed through a set of rigorous statistical techniques. Control theory was utilized to develop the study model in which variables were selected from a sociotechnical perspective. Variables included are user control, job control, stressors, job stress, user

satisfaction, and job satisfaction. A complete procedure for developing a new instrument for measuring user control increased the validity of the present study.

The empirical results of the present study provide many managerial implications to information system managers and policy makers in end user computing. Control constructs are no longer to be considered as mere users' dispositional characteristics; they have now become managerial variables which system managers can manipulate by changing the degree that end users influence the system development and implementation process.

Furthermore, it was found that job control in combination with user control helps ameliorate stressors in end user computing. Both user control and job control have a significant direct effect on job stress in a negative way. However, user control does not significantly mitigate stressors; rather, it increases role conflict. This role conflict is diminished by increasing job control, resulting in low job stress. This combinatorial effect results in high user satisfaction and job satisfaction.

-- To the memory of my father Younnam Kang

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CHAPTER 1

INTRODUCTION

End user computing (EUC) is one of the most effective productivity enhancement tools available to knowledge workers. The principal advantage of end user computing lies in the harmony between people and technology that it is intended to engender. The potential benefits of end user computing are enormous and its future promising. However, while the technical aspects of end user computing are relatively well understood, the behavioral and social aspects of EUC continue to defy thorough comprehension. Included among the behavioral constructs generally regarded as important to the implementation of end user computing are user control, job control, stressors, job stress, job satisfaction, and user satisfaction. Job stress and user control have received extensive attention from researchers in the field of occupational psychology. Many information systems researchers also appreciate their managerial importance, especially in the field of end user computing. However, only a few studies have explored combined effects of situational variables in end user computing. Furthermore, the existing studies exhibit many conceptual and methodological problems.

1.1 PURPOSE OF THE STUDY

The purposes of this study are: (1) to develop a new behavioral construct which manifests organizational culture and end user computing management policy, (2) to investigate the traditional quality of work life model in the end user computing environment, and (3) to investigate the impact of end user computing management on end users' quality of work life (QWL). The topics that will be addressed in the present study are relatively new, and some conceptual difficulties in defining unobservable variables and the complex relationships among constructs are to be resolved and analyzed through a new approach.

A review of the research in end user computing and quality of work life reveals at least three theoretical developments which are major concerns of the present study: (1) conceptual and operational refinement of user control; (2) sociotechnical relationships among computing environment variables and user psychological variables; and (3) causal relationships among quality of work life constructs.

A recent development in end user computing has been the identification of the close relationship between user control and user satisfaction (Rivard, 1987). Many researchers have stressed the importance of user control in end user computing (Hackathorn, 1988; McFarlan & McKenney, 1983; Davis & Olson, 1985; Rivard, 1987).

A substantial amount of research in occupational psychology provides a strong theoretical background for constructing a sociotechnical model relating the user control construct to other behavioral constructs in a computing environment (Coovert & Goldstein, 1980; Johansson & Aronsson, 1984; Smith, 1984; Johansson, 1984; Frese, 1987).

A useful theoretical framework describing the relationship between user control and job stress has been furnished by control theory (Averill, 1973). It is the contention of the present study that end users' technological and psychosocial variables are all closely associated with the construct of user control.

The lack of a theoretical perspective and reliable measurement instruments is often referred to as a major impediment in behavioral research in the field of management information systems (Ein-Dor & Segev, 1978; Ives & Olson, 1984; Huber, 1984). Such methodological problems as inappropriate operationalizations, inadequate evidence of reliability and validity, and inadequate causal modeling and subsequent statistical analysis were also found. The present study will attempt to deepen the conceptual and methodological arguments.

The relationship between user control and the problems inherent in end user computing is not well known (Benson, 1983; Keen & Woodman, 1984; Guimaraes & Vasudevan, 1985;

Leitheiser & Wetherbe, 1986; Hackathorn, 1988). In the present study, a rough picture of causal relationships among user control sub-dimensions and problems inherent in end user computing will be drawn.

1.2 OVERVIEW OF THE MODEL

A conceptual framework for the quality of work life factors in an end user computing environment is based on control theory. Based on this theory, the perceived control moderates the relationship between stressors and stress or influences stressors and their psychological effects.

In this study, the causal relationships among quality of work life factors in end user computing will be investigated from a sociotechnical perspective, in which users are assumed to possess an ability of self-regulation. Different conceptualizations accompanied by different operationalizations are also capable of changing the causal relationships among the constructs involved in the QWL factor model. Thus, this study will clarify the theoretical and methodological rationale for choosing a specific perspective on the QWL factor model. A more detailed discussion of the causal relationship among the QWL factors is provided in Chapters 2 and 3. In this section, the conceptual model to be explored in the present study will be briefly discussed.

Until recently, most researchers have followed the widely used and intuitive paradigm of the stimulus-response (S-R) model for explaining job stress and its outcomes (Bagozzi, 1981). The stressors are the stimuli, and mental strain and job satisfaction are the responses. This paradigm does not fully address the whys and hows of human behavior, thus falling short of complete explanation of the cognitive processes. The present study will try to explain why different users experience different levels of quality of work life in a similar work environment.

As shown in Figure 1, the typical stressors are role conflict and role ambiguity (Rizzo et al., 1970), quantitative work load, and underutilization of abilities (Caplan et al., 1975). Variations in these dimensions, as perceived by end users, are expected to affect levels of stress outcomes, being mediated by personal control (Averill, 1973). The personal control perceived by end users may be dichotomized into job control and user control. These forms of personal controls are assumed to be a manifestation of EUC management and organizational culture. In other words, users are assumed to perceive their degree of personal control commensurate with that which their managers intend to provide in a given organizational setting.

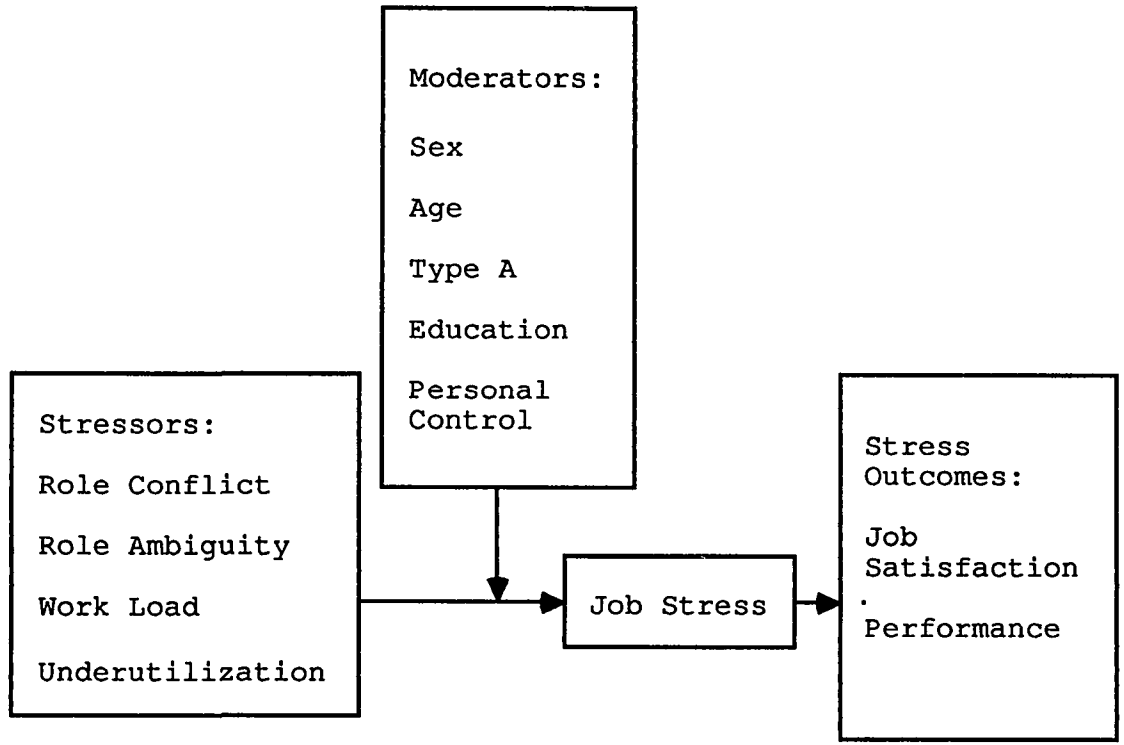

Figure 1

Traditional Stress Model

The different sources from which stress at work may arise include lack of control over work tasks, work pacing, work scheduling, the physical environment, decision making, interaction, and work resources (Ganster, 1989). These conditions are all determined by organizational limits and culture. On the other hand, user control will be characterized by the degree of participation and decision latitude allowed by system managers in various computing activities, such as system design and development, system resource management, system operation and maintenance, and decisions about development of intelligent skills.

These two variables, job control and user control, either moderate the traditional stress model or affect degree of job stress, user satisfaction, and job satisfaction. Job stress is represented by five dimensions of mental health: anxiety, depression, positive well-being, self-control, and general health (Ware et al., 1979). Job stress in turn affects the level of satisfaction perceived by users. The psychological outcomes of stress may be conceptualized into two separate constructs, job satisfaction and user satisfaction. Job satisfaction is indicated by levels of satisfaction in the following job dimensions: payment, job security, social relationship, supervision, and growth needs. User control is directly associated with computerized information systems, such as

quality of systems and their outputs in terms of content, accuracy, format, ease of use, and timeliness.

Job control will directly impact the level of job satisfaction and indirectly affect the level of user satisfaction. In contrast, user control will have a direct impact on the level of user satisfaction and an indirect impact on the level of job satisfaction.

The above causal relationships are moderated by such demographic variables as age, sex, computing knowledge, and Type A personality.

1.3 OVERVIEW OF THE DISSERTATION

The model of end user computing explored in this dissertation is composed of two personal control constructs, four stressors, and three responses. The two personal control constructs are job control and user control; the four stressors are role conflict, role ambiguity, underutilization of ability, and quantitative work demand; and the responses are degree of job stress, job satisfaction, and user satisfaction. Needless to say, these QWL constructs comprise neither an exhaustive nor definitive list. However, they represent the rudimental constructs that have received much attention in the field of management information systems and occupational psychology.

Chapter 2 presents a review and discussion of the research on the sociotechnical perspective and the quality of work life and end user computing as theoretical backgrounds. The links between variables will then be discussed. Finally, a research strategy will be presented to resolve some theoretical and methodological problems of the prior research.

In Chapter 3, a formally articulated discussion of the causal contexture among job stressors, job control, user control, job stress, job satisfaction, and user satisfaction will be provided. This chapter includes definitions of constructs, study models, and hypotheses drawing on the literature reviewed in Chapter 2.

Chapter 4 deals with the research methodology. It includes descriptions of the unit of analysis, sample respondents, data collection procedures, and measures of constructs. Some conceptual and methodological issues concerning construct operationalizations will also be discussed.

Chapter 5 describes the analytical procedures used to test the models and various hypotheses in this study, while presenting the test results from various analytic methods. Structural equation modeling will be used to assess the adequacy of the measurement and structural models. The descriptive characteristics of the respondents and the

results of tests of reliability and validity of the measures will also be provided.

Chapter 6 concludes the present study. It summarizes the test results, and provides several research implications for future studies concerning the causal relationships among QWL factors. Finally, managerial implications and the limitations of the present study will be discussed.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature concerning the research perspective and theoretical backgrounds of this study, focusing on quality of work life and end user computing. A critical review of quality of work life factor studies in end user computing identified several theoretical and methodological problems. A strategy for further research will also be presented.

2.1 THEORETICAL FRAMEWORK

In the broadest sense, an empirical study should be designed for the purpose of predicting or explaining a given phenomenon. Depending on the purpose of the study, the choice of variables and the analytic approach may differ. The purpose of the present study is to explain a phenomenon in a given work environment. Therefore, the choice of variables and the analytic procedure should be determined by a theoretical framework.

An information system is an integrated man-machine system. Any insights from studying information systems cannot be obtained without understanding their two basic components, people and computing technology. In particular,

end user computing highlights the importance of cohesion between these two system components. Emphasis on humanizing the work place in the highly technology-oriented post-industrial era led to the quality of work life movement in the field of organizational psychology. The concept of quality of work life originated from sociotechnical organizational theory. To grasp the fundamentals of the present study, a review of literature relevant to these three cohesive interdisciplinary areas is appropriate.

2.1.1 Sociotechnical Theory

Kling and Scacchi (1980) stated that the technical aspects of most computer systems are relatively well understood, while the behavioral and social aspects of computing have been inadequately investigated. This view has been shared by many MIS researchers (Strassman, 1985; Iacono & Kling, 1988; Clarke, 1988; Robertson, 1989). Strassman (1985) predicted that future research into information systems would put more emphasis on meticulous observation of people and organizations under conditions when information technology is applied.

When employees use an information system to support their decision making tasks, we can easily postulate that computer users' quality of work life and decision making performance will be influenced by both technological and social environments. Because the concept of end user

computing deals with these two perspectives simultaneously, one must study end user computing from the sociotechnical perspective.

Social Implications of Computing

The theoretical aspects of the social impact of computing in organizations may be divided into two major research perspectives (Kling, 1980): *systems rationalism* and *segmented institutionalism*. Systems rationalists typically emphasize the positive roles that computerized technologies play in social life, while segmented institutionalists examine the social problems that could result from haphazard, widespread automation. Kling's dichotomy is exemplified in the study of social impacts of office automation on the quality of work life by Hirschheim (1986). He used the terms "the optimist position" for systems rationalism and "the pessimist position" for segmented-institutionalism. He summarized supportive empirical evidence for both positions. The improvements in quality of work life anticipated by the systems rationalism view include:

(1) higher salaries in recognition of greater skills,

(2) better working conditions,

(3) better control over work and greater autonomy,

(4) improved prospects for career advancement and the opportunity to learn many new skills,

(5) greater participation through electronic message and conferencing systems,

(6) greater chance for constitutionalism through a better sharing of information,

(7) no negative effect on the social relevance of work life, and

(8) improved total life space through better control.

The pessimists take the opposite view, expressing concern over the prospect of job deskilling and lessening of job satisfaction. The pessimists also see office automation increasing alienation and leading to higher absenteeism, more errors, apathy, and a lack of community spirit between employees and the organization. For example, Gregory and Nussbaum (1982) maintained in their pessimistic view that the increasing introduction of computers would lead to more machine control, tighter supervision (increasingly by machines), social isolation, and little freedom of movement, as well as the deskilling of machine operators.

To summarize, when studying end user computing, we should consider both the positive and negative aspects of the social impact of computing in organizations.

Development of the Sociotechnical Approach

The sociotechnical approach arose in the early 1950's, in conjunction with the first of several field projects undertaken by the Tavistock Institute in the British coal

mining industry (Trist, 1981). The project was primarily concerned with the diffusion of innovative technology which promised to raise the productivity of the organization. This approach seeks joint optimization of the social and technical systems, which are independent of each other in nature (Davis, 1971). The two systems are coupled so that one requires the other for the transformation of an input into an output, which comprises the functional task of a work system.

The basic principles in the sociotechnical approach include several noteworthy points: (1) this principle values the *discretionary* rather than the prescribed part of work roles, (2) it treats the individual as *complementary* to the machine rather than as an extension of it, and (3) it is *variety-increasing* for both an individual and the organization, rather than variety-decreasing in the bureaucratic mode (Emery, 1978). These principles imply that the sociotechnical perspective puts more emphasis on humanization of the workplace than on economic efficiency of machine operation.

The sociotechnical theory of the efficacy of autonomous work groups provides much insight into the concept of "control" in end user computing. The autonomous work group approach is based on the cybernetic concept of self-regulation. Each member of an autonomous group has the ability of self-regulation and tries to affiliate to the

group goals, and beyond those to the organizational goals. This viewpoint is consistent with Simon's (1976) decision-making organizations, in which people are bounded in rationality. Bounded rationality implies that people do not have complete knowledge of the consequences of their acts, and either do not have complete knowledge of the alternative courses of action available to them or cannot afford to obtain that knowledge. As a result, group members adjust their decisions to conform with the organization's objectives.

According to Emery's concept of "participant design" (1974, 1977), the function of supervision is to manage the boundary conditions in a group's environment so that the group itself may be freed to manage its own activities. This is a very different concept from the bureaucratic theory of control. Following Perrow's definition of three types of control[1], "premise control" best fits the sociotechnical theory of the efficacy of autonomous work groups. This implies that to change individual behavior we do not have to change individuals, in the sense of altering their personalities or teaching them technical skills.

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1. Perrow (1986) labeled three types of controls: direct, fully obtrusive ones such as giving orders, direct surveillance, and rules and regulations; bureaucratic controls such as specialization and standardization and hierarchy, which are fairly unobtrusive; and fully unobtrusive ones, namely the control of the cognitive premises underlying action.

Instead, we change the *premises* of their decision. This *premise control* is a key concept in the sociotechnical approach.

Premise control presumes that individual workers are trusted in organizations. Failures or mistakes made by employees are considered a result of lack of organizational support rather than a failure of employees' self-regulation functions. The sociotechnical theory thus highlights psychological rewards and psychophysical health as major concerns, in particular as they relate to the quality of work life.

Sociotechnical Approach in MIS

Since the early 1970's, investigations into the human dimensions of MIS have been popular among MIS researchers (Whisler, 1970; Argyris, 1970; Dickson & Simmons, 1970; Mumford et al., 1972; Lucas, 1975; Mason & Mitroff, 1973; Swanson, 1974; Schewe, 1976). However, the lack of an in-depth study about the sociotechnical impact of information systems on organizations was recognized by Attewell and Rule (1984). The sociotechnical approach seems to have received little attention among MIS researchers until Bostrom and Heinen (1977) used the notion in system design. According to their study, a technical system is concerned with the processes, tasks, and technology needed to transform inputs into outputs, while a social system is concerned with the

attributes of people (e.g., attitudes, skills, values), the relationships among people, reward systems, and authority structures.

Recent studies put more emphasis on empirical research into MIS from the sociotechnical perspective (Hulin & Roznowski, 1985; Paddock, 1986; Er, 1987; Boland & Hirschheim, 1987). In the book *Critical Issues in Information Systems Research*, in particular, Boland and Hirschheim devoted more than half of their editorial collection to sociotechnical studies in MIS. Frese (1987) classified sociotechnical MIS studies according to the impact of computer use on (1) social relations, (2) control and skill utilizations, and (3) the organization. The major concern of the present study is the second category, control and skill utilizations.

2.1.2 Quality of Work Life

During the 1970's, the sociotechnical approach became linked to a wider movement concerned with the quality of work life (Trist, 1981). The importance of non-economic rewards (for example, challenging and interesting work) increased relative to the importance of economic ones, especially among white collar and highly educated workers in the post-industrial era (Suttle, 1977).

Certain early successful QWL programs, such as those at General Motors, Xerox, IBM, and many other large and small

organizations, drew much attention from the public (Copenhaver and Guest, 1982). However, the early emphasis on the improvement of blue collar and lower-level workers' quality of work life encountered unexpected problems (Walton & Schlesinger, 1979; Schlesinger & Oshry, 1984). Supervisory and white collar workers started to complain about a lack of control over their subordinates' actions as well as insufficient attention from their own superiors. White collar workers are more interested in psychological rewards than hygiene factors. At present, much attention is being given to the quality of work life of white collar workers, more specifically, of knowledge workers who are confronting masses of information and a turbulent decision making environment in the post-industrial era (Huber, 1984).

Studies have revealed that systems analysis techniques, when applied to operations research and computer information systems, can actually have a negative impact on productivity when they fail to take quality of work life into account (Wacker & Nadler, 1980). Kling (1980) argued that computer use does not profoundly alter the character of employee jobs; however, new technology does have an effect on the quality of work life. Turner (1984) agreed with Kling's view by stating that, rather than directly influencing outcomes such as job satisfaction, absenteeism, or performance, the use of computer systems creates a new work environment to which operators respond.

Definition of QWL

Since a series of national attitude surveys conducted at the University of Michigan in 1969 and 1973 drew attention to QWL, it has been studied from various perspectives and its conceptualization has expanded considerably. Substantial progress had been made in defining the field, and a wealth of information became available with the publication of Davis and Cherns' *Quality of Working Life: Problems, Prospects and the State of the Art* (1975) and Biderman and Drury's *Measuring Work Quality for Social Reporting* (1976). Depending on the researcher's perspective, QWL can be viewed as a variable, an approach to organizational development, a method for enhancing the work environment, a movement toward better relationships between workers and management, or even a panacea to solve all problems (Walton, 1973; Lupton, 1975; Suttle, 1977; Wacker & Nadler, 1980; Nadler & Lawler, 1983). Suttle's definition is worth noting:

> The degree to which members of a work organization are able to satisfy important personal needs through their experiences in the organization.

Dimensions of QWL

A huge body of literature addresses the various features of the quality of work life, ranging from fair pay and compensation to psychological rewards. Nadler & Lawler

(1983) identified four types of organizational activities related to QWL: participative problem solving, work restructuring, innovative reward systems, and improving the work environment. The components of QWL specified by various authors differ substantially, though most espouse a goal of humanizing the work place. The three major dimensions of QWL receiving increasing attention in the field of management information systems are job satisfaction, job stress, and worker control.

Job Satisfaction

Perhaps the most direct and immediate gain from an improved quality of work life is higher job satisfaction. Indeed, these two phenomena are so closely related that they are often assumed (incorrectly) to be one and the same. For the purpose of this study, it is important that a distinction be drawn between them. As used here, the term job satisfaction refers to an individual's affecting reactions or feelings toward his job, and the term quality of work life refers to the need satisfactions of the person. Therefore, quality of work life is a broader concept in which job satisfaction is included.

Wacker and Nadler (1980) argued that well-designed jobs should have healthy amounts of variety, challenge, autonomy, participation, learning, integrity of task, social interaction, equity, and opportunity for advancement.

Lupton (1975) also identified several advisable working conditions: 1) an interesting, challenging, and responsible job, 2) a variety of tools used and parts assembled, 3) autonomy, 4) responsibility, 5) interaction, and 6) control over work time.

Hackman and Oldham (1975) developed a job diagnostic inventory (JDI), in which the five job core dimensions are responsibility, autonomy, feedback, variety, and social interaction. They found that these dimensions are significantly related to job satisfaction. In their study, job satisfaction was characterized as the degree of satisfaction with both the job itself and five work conditions: payments, job security, supervision, growth needs, and social relationships.

Control in the Workplace

Personal control is essentially a psychological phenomenon that has both environmental and dispositional antecedents (Ganster, 1989). Therefore it can be viewed as an intrapersonal attribute or an interpersonal outcome. Van Maanen and Schein (1977) argued that human experience can be seen as a continuous stream of events in which the individual seeks to gain control over the immediate environment.

Averill (1973) analyzed research on control and proposed three types of control: behavioral, decisional,

and cognitive. Behavioral control refers to an individual's ability to act directly on the environment so as to produce desired outcomes or avoid negative ones; examples of such control include the ability to avoid glare from a video display terminal (VDT) screen. Decisional control refers to having a choice among several possible actions, outcomes, or tasks; selection of computer software and hardware is a good example of decisional control. Cognitive control refers to one's interpretation of the environment; users' feelings of independence from a central information systems department when setting system maintenance priorities could be an example of such cognitive control. Behavioral control is more relevant in ergonomics. The present study will focus on decisional and cognitive control.

The concept of control underlies much of the theorizing which has occurred in occupational psychology. Ganster et al.'s (1989) statement is noteworthy:

> It is often hypothesized that individuals will be more committed to decisions that they have participated in, that they will be more satisfied and motivated in jobs that give them autonomy, that they will adopt more difficult goals if given a choice, and that they will react less negatively to stressful jobs if they have control.

Worker participation in decision making is viewed as a moral imperative and as a prerequisite to a high quality of working life (Ganster, 1989). Employee participation in decision making (Locke & Schweiger, 1979; Specter, 1986) is one form of personal control. It is regarded as an

important factor of QWL (Lawler, 1982; Mohrman, Ledford Jr., & Lawler, 1986). Walton's (1973) QWL categories also include the immediate opportunity to use and develop human capacities. Workers' control of their working environment is vital to a high quality of work life.

Job Stress

Another important component of QWL, which is most closely associated with the issue of control and job satisfaction, is job stress (Shamir & Salomon, 1985; Ganster et al., 1989). An empirical study (Ivancevich et al., 1983) found a significant relationship between stress level and user satisfaction. Normal fears and stress associated with information system implementation were addressed in a study of perceived control in the context of user involvement (Baronas & Louis, 1988). Job decision latitude (control), job satisfaction (user satisfaction), and mental strain (stress) were all found to be closely associated with one another (Karasek, 1979).

In addition, challenge of work (Levine et al., 1984), entrepreneurship (Sinetar, 1985), innovation (Walton & Schlesinger, 1979), and mistake-tolerating culture (Van Maanen & Schein, 1975; Wilkins & Ouchi, 1983; Smircich, 1983) have been determined to be important dimensions of QWL. However, it is difficult to find consistent results concerning causal relationships among these QWL factors.

Therefore, the present study will concentrate on the three major factors mentioned above: job stress, worker control, and job satisfaction.

Outcomes of QWL

The ultimate purpose of studying QWL factors in end user computing is to improve workers' quality of work life and their performance simultaneously. The benefits gained from various QWL programs differ substantially, but are generally of three types: increased productivity, increased organizational effectiveness, and increased job satisfaction. The first benefit, increased productivity, is often difficult to measure; in addition, the effects of QWL efforts on productivity are hard to distinguish from the effects of other events in the organization (Suttle, 1977). Measuring productivity in empirical studies is rather difficult, particularly in the MIS area (Hirschheim, 1986; Attewell & Rule, 1984). The second benefit, increased effectiveness of the organization, as measured by its profitability, goal accomplishment, shareholder wealth, or resource exchange, exhibits the same measurement problems. Consequently, a more positive attitude toward work or increased job satisfaction is perhaps the most direct benefit that can be separated from other events in order to facilitate measurement. User satisfaction, another version of job satisfaction in EUC, is believed to play the same

role in the present study. Two constructs, job satisfaction and user satisfaction, are endogenous variables in the model.

2.1.3 End User Computing

The term "end user computing" (EUC) has appeared in MIS literature since the late 1970's. McLean (1979) explained the increasing interest in end user computing as a reaction to the massive backlog in computer-based information systems. Decreases in hardware costs and user-friendly software have also contributed to the proliferation of EUC (Rivard & Huff, 1984; Rivard, 1987). The development of EUC is still in the infant stage and its future prospects are promising (Benjamin, 1982; Rockart & Flannery, 1983; Benson, 1983).

Definition of End User Computing

The capacity of users to have direct control over their own computing activities has come to be referred to as end-user computing (Davis & Olson, 1985). Hackathorn (1987) gives a more specific definition: EUC is an information processing activity in which the end user has direct personal control over all stages of the activity. End user computing was at first defined as programming by end users (Canning, 1981) or as user development of computer-based applications (McLean, 1979). The latter interpretation has

steadily gained favor over the former (Rivard & Huff, 1988). In this study, the "end users" referred to by the term end user computing will be assumed to:

(1) have direct control over computing activity and

(2) develop their own applications for the most part.

End users could be defined as those persons who interact with a computer as part of their job but are not programmers or analysts (Yaverbaum, 1988). More loosely, Rockart and Flannery (1983) identified six categories of end users: nonprogramming end users, command level end users, end-user programmers, functional support personnel, end-user computing support personnel, and data processing programmers. Depending on a researcher's study purpose and viewpoint, the type of knowledge worker considered an "end user" may vary. The present study will include the middle four of Rockart and Flannery's categories in the population.

Benefits from EUC

Reduction of the application project backlog and the application maintenance load has frequently been identified as a benefit to be derived from EUC (McLean, 1979; Rivard & Huff, 1984). Competitive advantage from implementing EUC (Henderson & Treacy, 1986; Gerrity & Rockart, 1986) has been found to be a rationale for adopting EUC. Increased individual performance, increased learning, improved internal organizational effectiveness, decreased fears, and

the resolution of myopia, among other factors, have also been identified as potential benefits of EUC (Gerrity & Rockart, 1986). Keen and Woodman (1984, p. 148) summarize the benefits derived by a commitment to EUC as follows:

1. Work eliminated
2. Costs avoided
3. Return on time
4. Improved decision making
5. Improved services
6. Competitive edge
7. Quality of work life
8. Spin-offs
9. Other

Risks from EUC

Although EUC may give substantial benefits to an organization, it also engenders a variety of problems. Improper documentation, data backup, data integrity, and security are worries amplified by adoption of EUC (Benson, 1983; Guimaraes, 1986). Alienation, dehumanization, lack of communication, and a decrease in social integration are to be expected (Rivard, 1984). Davis (1984) gave a good summary of the risks we may anticipate from implementation of end user computing.

Organizational Control and Support

In order to take advantage of the benefits while minimizing the risks of EUC, an appropriate level of organizational support and control is required (McKenney & McFarlan, 1982; Leitheiser & Wetherbe, 1986). For the purpose of this discussion, it is important that the distinction be drawn between organizational control and personal control. As used here, organizational control refers to the monitoring function at the organization level. The purpose of organizational control is to maintain consistency, data security, data integrity, effective distribution of resources, and so on. On the other hand, personal control refers to the ability to exert some influence over one's environment so that the environment becomes more rewarding or less threatening (Ganster et al., 1989).

From a sociotechnical perspective, *premise control* should be used as a means of regulating and monitoring end user computing activity. As the organizational control mechanism approaches completely unobtrusive control or premise control, users become self-regulating. Users who are involved in a system development project are not only participating in decision making processes, but are also taking risks and assuming responsibilities throughout all the stages of the system life cycle.

Accompanied by the appropriate level of control, technical and organizational support is also imperative for successful EUC. Information centers, training, and education are often suggested for supporting EUC (Benson 1983; Brancheau et al., 1985; Henderson & Treacy, 1986; Leitheiser & Wetherbe, 1986; Gerrity & Rockart, 1986; Sumner & Klepper, 1987). A positive relationship between the computer-related training an individual receives and his/her computer-related ability has been demonstrated (Nelson & Cheney, 1987). Top management support is also regarded as important for successful EUC (Benson, 1983).

2.2 QWL FACTORS IN END USER COMPUTING

Implementation of end user computing can be viewed as an organizational development effort. Stemming from humanistic organizational development theorists such as Elton Mayo, Chris Argyris, Douglas McGregor, and Rensis Likert, organizational development is defined as a people- and process-oriented approach to change whose objectives are the improvement of both organizational effectiveness and individual psychological success (Ouchi & Price, 1978). More specifically, planning, designing, and implementing end user computing constitute an integrated organizational effort to enhance both organizational effectiveness and workers' psychological status. It is therefore hard to

overemphasize the importance of a good fit between task, technology, people, and work environment to make the organization design consistent with organizational goals. In line with the sociotechnical perspective discussed above, user control, stress, and user satisfaction are the most conspicuous QWL factors relevant to the purpose of the present study.

2.2.1 User Control in End User Computing

Davis and Olson (1985) define end user computing as *the capability of users to have direct control of their own computing needs*. Frese (1987) states that it is useless to use expensive computers and deliver expensive training, if the company does not also provide a commensurately high degree of control to its workers. Control is a key attribute which distinguishes EUC from other information system implementation strategies.

The concept of control is not well-defined in MIS literature. Rivard (1987) used the term "independence from DP," which is a facet of control. He identified four aspects of independence in EUC: (1) the timeliness with which applications could be developed, (2) the avoidance of communication problems between users and IS professionals, (3) the increase in user control over the process of developing IS, and (4) the reduction of costs. He also found that user independence from a central IS department

contributes to user satisfaction; it was the variable with the highest correlation with user satisfaction in his study.

In the field of management information systems, user involvement in the system development process has received much attention (Ives & Olson, 1984). Users can participate in making decisions regarding all phases of IS development: end-user programming language selection (Meador & Mezger, 1984), information requirements definition phase for determining inputs, outputs, and other user-system interfaces (Robey & Farrow, 1982; Pliskin & Shoval, 1987), and system design and implementation stages (Olson & Ives, 1981; Franz & Robey, 1986).

As Gerrity and Rockart (1986) stated, computer users are free to act in their own interest. They may select and program their own applications, maintain personal files, and act as they see fit with regard to purchasing and using computer software and hardware. Allowing end users to retain as much control as possible over their own development and operation of computing has the greatest potential to increase quality of work life.

2.2.2 User Satisfaction in End User Computing

As Lorsch (1977) pointed out, the appropriateness of fit between the individual's psychological makeup, the nature of the task, and the organization will make it possible for individuals to gain a sense of competence,

which is an important psychological reward. Subsequently, as employees gain this sense of competence, they will perform their work more effectively and the organization will be more likely to achieve its goals.

Ghani and Al-meer (1989) reported a positive effect of the use of personal computers on job satisfaction. Rivard and Huff (1988) also found that user development of computer-based applications increases a user's independence from DP, which in turn improves user satisfaction.

2.2.3 Job Stress in End User Computing

The majority of the work in stress research in the field of management information systems is not specifically directed at end user computing. However, most of these studies are relevant to the theorizing involved in constructing the present model. Some will be briefly reviewed here.

Several studies found a negative influence of role ambiguity and role conflict on system designers' job satisfaction and user satisfaction (Goldstein & Rockart, 1984).

Baroudi (1984) surveyed 229 end users in sixteen organizations. He studied causal relationships among stressors and stress outcomes, using a path analysis technique. He found that a boundary role positively influenced role conflict and organizational commitment, role

ambiguity reduced organizational commitment, and organizational commitment negatively affected turnover intention. He also found that these causal relationships among QWL factors are moderated by individual differences and task differences.

2.3 CRITICAL REVIEW OF THE PRIOR RESEARCH

A review of the related literature reveals a number of methodological and theoretical weaknesses in prior studies. Included in methodological problems are measurement problems and research design problems. They will be enumerated in this section.

2.3.1 Theoretical Problems

The major portion of the research on end user computing is not founded on either a sound theoretical background or reliable and valid measures. Only a few researchers attempted to base their studies on theories, and even their research perspectives were rarely clear. As a result, the published literature neither fulfills practitioners' needs for plausible guidelines nor provides academic researchers with opportunities to develop a research base. As Keen (1980) argued, a strong research stream based on a theory must be developed for the accumulation of knowledge in a field. Most extant studies of management information

systems have not gone beyond the level of description of phenomena, avoiding the questions of why and how.

2.3.2 Methodological Problems

Measurement Problem

Highly reliable and rigorously validated measures for most QWL constructs are available in the literature. However, there is no proven measurement instrument for the control construct. As implied in the definition of end user computing, the principal advantage of EUC lies in the fact that it provides knowledge workers with personal control, which constitutes a technique for stress management. The conceptualization and assessment of the control construct is extremely important in studying end user computing. Lack of a reliable measurement instrument has continuously frustrated in-depth investigation into relationships between user control and other behavioral constructs concerning end user computing.

Research Design Problem

A major portion of QWL research on computerized information systems is descriptive, involving at best regression or correlational analysis.

Weiss (1983) surveyed 241 information system managers to investigate the relationships between various independent

variables and strain, using multiple regression analysis. His model was a simple stimulus-response (S-R) model, in which mental events (e.g., control) are viewed as fictional, untestable, and in any case unnecessary for explaining human behavior (Bagozzi, 1981). Bagozzi argued that the S-R model does not fully address the why and how of human behavior, thus falling short of explanation. Consequently, the S-R model fails to explain the more complex aspects of human action such as those found in purposeful behavior, information seeking, cognitive processes, social relationships, and in general the dynamic, creative side of human behavior.

When a researcher omits any important variable in his or her model (a misspecification error: this often occurs if the study is not based on a sound theory), he or she may find inconsistent results. For example, Weiss (1983) and Ivancevich et al. (1983) found several high job stressor scores, but did not find high mental strain among information system managers, while stress theory postulates a positive relationship between stressors and the degree of mental strain. This inconsistency may be explained by introducing an intervening variable or a moderating variable, as in Karasek's (1979) stress management model. Karasek attempted to explain the inconsistent relationship between stressors and stress outcomes. He found that high decision latitude, a type of personal control, can reduce

mental strain even if job demands are high. However, Karasek's study did not consider either the social relationships at work or individual differences. In general, only a few studies have examined the combined effects of situational factors in organizational settings.

2.4 A STRATEGY FOR FURTHER RESEARCH

Absence of reliable and valid measurement instruments for unobservable variables, measurement and misspecification errors due to lack of a theoretical background, and inappropriate research designs were identified as major problems of previous research in end user computing. In order to resolve these theoretical and methodological problems, the following research strategies were developed.

2.4.1 Control Theory

Control theory (Averill, 1973) explicitly depicts the causal relationships between stressor and control, and between control and stress outcomes. Averill viewed control as a moderator in the causal relationship between stressors and the level of stress. Control may also have a direct influence on the stressors (Frese, 1987).

A different perspective yields a different research model. From a sociotechnical perspective, users are believed to act in concordance with their superiors.

Therefore, the effectiveness of EUC management is represented by the degree of personal control perceived by end users. Consequently, a moderating effect and a causal effect of control on stressors and stress outcomes are of interest in the present study.

2.4.2 S-O-R model design

As discussed in the previous section, the stimulus-response (S-R) model is limited to the empirical representation of antecedent and consequent events. This approach has an advantage of ease in building, testing, and interpreting an intended model. However, it does not explain the why and how of a given relationship. Human behavior is more complicated than that represented by S-R approaches. To better capture the forces underlying human behavior, some researchers proposed intervening processes or structures between observable stimuli and the responses of individuals. This approach is referred to as a stimulus-organism-response (S-O-R) model (Bagozzi, 1981).

Simple correlational analysis or regression analysis does not suffice for the purpose of the present study, which involves explaining how QWL factors influence one another in the end user computing environment. In particular, stressors are assumed to be a cognitive process, in the sense that they are perceived by end users rather than exist by themselves. A control model can therefore be designed as

a stimulus-organism-response (S-O-R) model whose intervening variable is inferred from the behavior of the individual.

2.4.3 Composite Indices

Many of the most important QWL factors cannot be directly observed. As a consequence, they can be only be measured indirectly through the use of empirical indicators that represent the unmeasured variables (or constructs). The present study involves examining causal relationships among unobserved variables. The fundamental question with regard to measurement is how validly and reliably these indicators represent the unobservables. The structural inference for these unobservable variables will be performed by following a two-step procedure in which: (1) each set of measured variables is factor analyzed to obtain a single derived composite, and (2) these factor-generated composites then serve as variables in the causal modeling process.

There are several ways of obtaining a composite score for a construct. Once unidimensionality of a construct is proven through a confirmatory factor analysis, selection of a scoring procedure would not affect the size of structural coefficients in a model (Hayduk, 1987). If a construct is unidimensional, salient factor scores will be used as a way of composition; if a construct is multidimensional (possibly requiring a second order factor analysis), proper factor

scores will be used to maintain orthogonality among subdimensional composites.

2.4.4 Structural Equation Modeling Approach

The S-O-R model can be addressed by using a statistical technique which can handle both moderating and intervening effects. Baroudi (1984) and Robey and Farrow (1982) are among the few researchers who attempted to analyze intervening variables in the field of MIS, using causal analysis techniques. They used path analysis to investigate the causal relationship between stressors and stress outcomes. One of the main advantages of path analysis is that it enables one to measure the direct and indirect effects that one variable has upon another (Land, 1969; Asher, 1983). Path analysis makes it possible to analyze an intervening variable in an S-O-R model.

However, path analysis assumes that the variables used in a model are free of measurement error and all causal directions are one way (recursive model). As discussed in the previous section, quality of work life factors are invisible variables. The assumption of freedom from measurement error for these latent constructs is unrealistic. In addition, it is difficult to assume that all causality is unidirectional. Intuitively, it is possible that job stress may have a reciprocal causal relationship with job satisfaction. Unrealistic assumptions

about measurement errors and causal directions will be relaxed in the present study model by utilizing a structural equation model (LISREL).

2.4.5 LISREL

A structural equation model is used to specify the phenomenon under study in terms of cause-and-effect variables and their indicators (Jöreskog & Sörbom, 1982). Goldberger (1973) presented three situations in which the use of structural equations is more suitable than regression analysis: (1) when the observed variables contain measurement errors, (2) when there is a reciprocal causal relationship between constructs, and (3) when there is a misspecification error in a model.

The greatest difficulty in satisfying conditions for causal inference suggested by James et al. (1982)[2] lies in the fact that all variables are measured at the same time in such a survey-type empirical study. A longitudinal research design may resolve this problem (Nesselroade & Baltes,

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2. Seven conditions pertaining to the appropriateness of a theoretical model for causal inferences are:
   (1) formal statement of theory,
   (2) theoretical rationale for causal hypotheses,
   (3) specification of causal order,
   (4) specification of causal direction,
   (5) self-contained functional equations,
   (6) specification of boundaries, and
   (7) stability of the structural model.

1979). However, such a complex LISREL model requires a minimum sample size of 150, and the data collection procedure generally requires a tremendous effort and time commitment from the researcher (Bearden et al., 1982). As a result, it is almost impractical to collect such longitudinal data within a short period of time. The solution is to base a study model on a strong theory. A strong theory specifies the important variables and the temporal order of constructs; this in turn specifies the causal directions.

Once a model is built around a sound theory, the next question is how to solve methodological problems in assessing structural relationships among constructs in the model. As Jöreskog and Sörbom (1982) argued, to handle the two basic problems in social science (measurement and causal relationships), the LISREL model consists of two parts: the measurement model and the structural equation model. Both features of the LISREL model will be utilized to achieve the purpose of the present study.

CHAPTER 3

RESEARCH MODEL AND HYPOTHESES

This chapter presents one measurement model and two sociotechnical models, illustrating the detailed structural linkages which will be proposed to relate several key constructs. Following definitions of the variables utilized in this study, the hypotheses associated with each model will be listed. The first model is a measurement model which hypothesizes independence between user control and job control. The second model is called the "moderating" model, which hypothesizes a moderating effect of control constructs on the relationship between stressors and stress. The third model is called the "mediating" model, which hypothesizes that the control constructs have direct influence on stressors and indirect influence on stress-outcomes. In other words, stressors intervene in the relationship between the control constructs and stress-outcomes.

3.1 RESEARCH MODEL

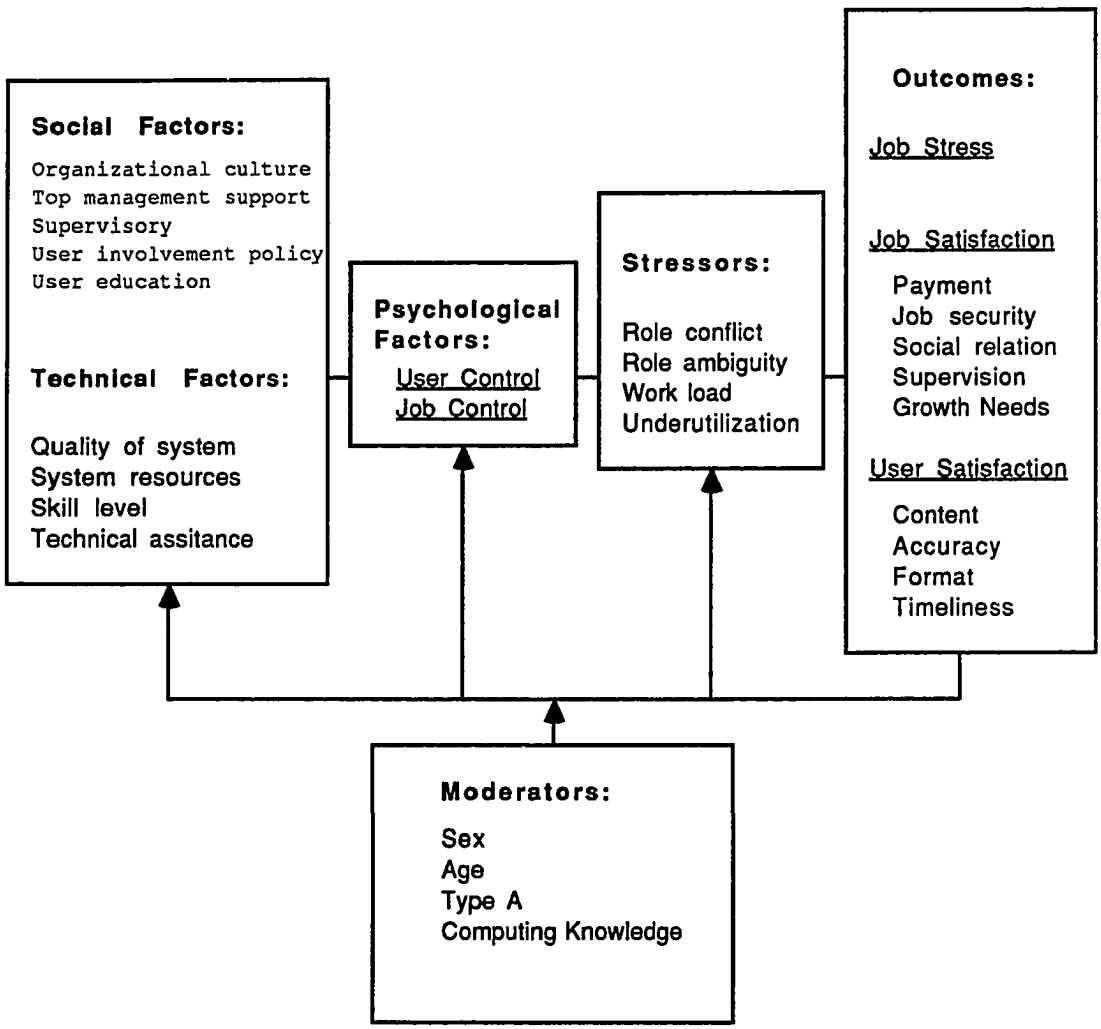
One measurement model and two structural equation models are proposed based on the literature review and research strategy discussed in Chapter 2. Figure 3.1a is a conceptual sociotechnical model, which shows the

relationships among social factors, technical factors, psychological factors, cognitive factors, outcome variables, and moderators. Figure 3.1b shows the relationships among studied variables. The model postulates a number of direct and indirect relationships.

Control may have a direct influence on the stressors or it may function as a moderator of the relationship between stressors and stress reactions (Frese, 1987). The direct effect on stressors is apparent when people can change those working conditions that they find stressful. The moderator effect has been consistently shown in experimental research as well as in field studies on the relationship between stress and health (Seligman, 1975; Weiss, 1983). The first structural equation model utilizes control constructs as moderators, while the second includes them as exogenous variables and stressors function as intervening variables. The causal directions and relationships between stress and satisfaction constructs are the same in both models.

Figure 3.1a

Sociotechnical Model in End User Computing



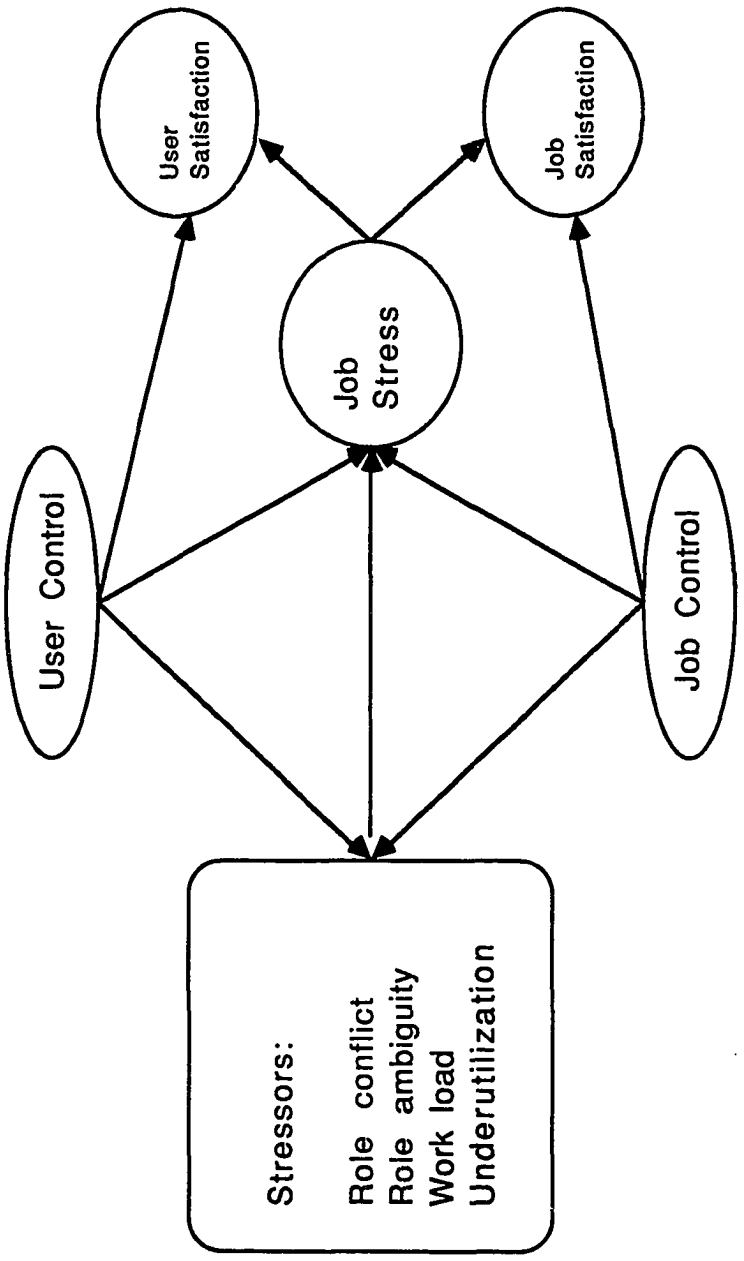


Figure 3.1b

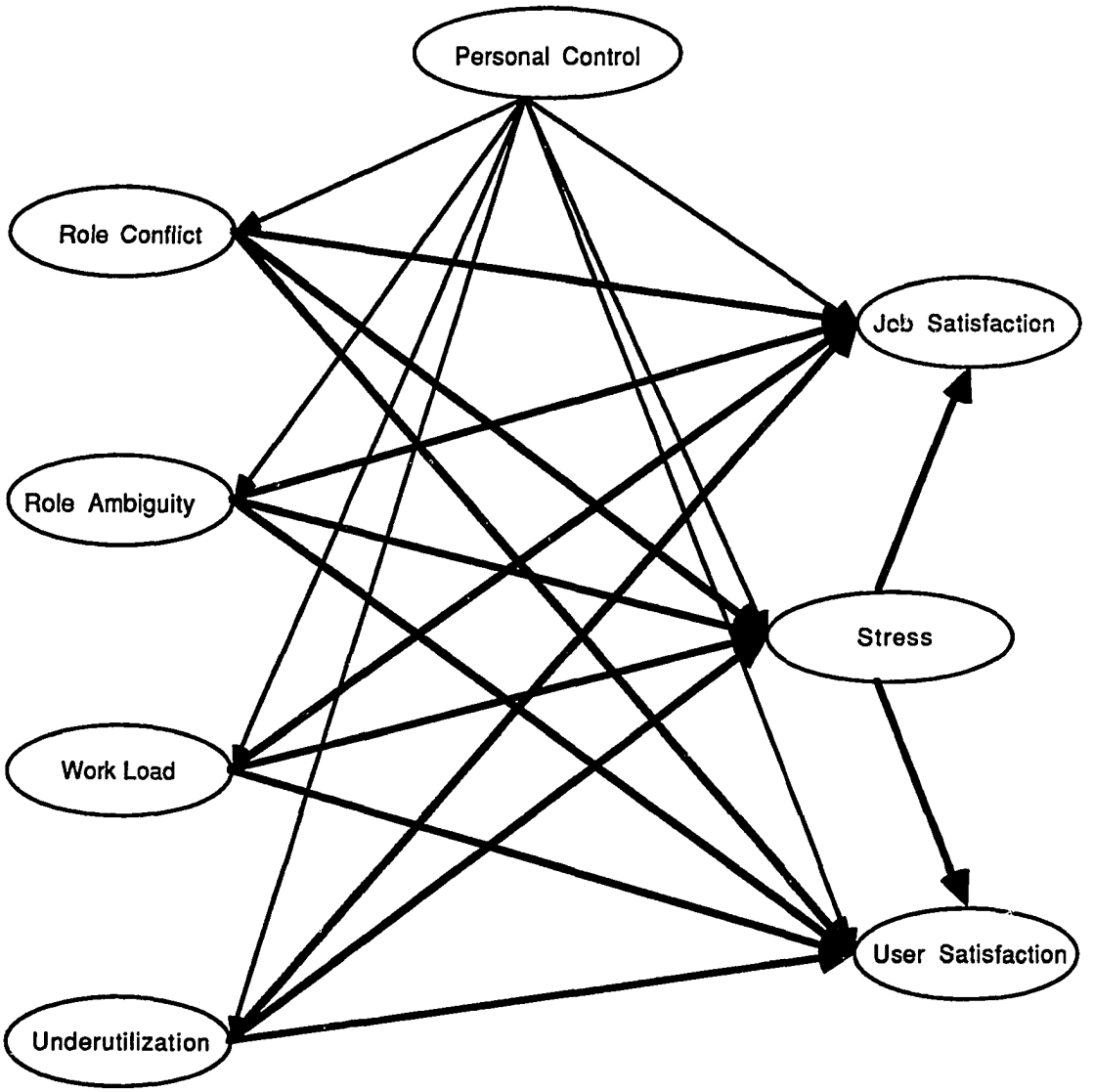
Studied Variables

3.1.1 The Moderating Model

In this model, the author is interested in testing the moderating effect of personal control on the relationship between stressor and job stress, user satisfaction, and job satisfaction. Structural parameter estimates among quality of work life factors are of no interest. The structural model is a traditional stress model, in which the causal direction goes from stressors to job stress, job satisfaction, and user satisfaction, as depicted in Figure 3.1c. Four stressors are role conflict, role ambiguity, work load, and underutilization of intelligent skills. Two moderators, user control and job control are not included in the model (they will be tested separately). These variables behave in a manner similar to dispositional variables (such as locus of control) or demographic variables (such as sex, age, or education). Therefore, user control and job control are assumed to be stable for a long period of time, and are not to be manipulated by changing environments. In many cases, moderating variables are out of the researchers' control and are thus taken as a given variable in a specific study scheme.

Figure 3.1c

Moderating Model



3.1.2 The Mediating Model (S-O-R Model)

As discussed in Chapter 2, a large portion of the prior research on QWL factors in management information systems utilized the S-R model, which cannot explain a force underlying the causal relationship between constructs. The S-O-R model attempts to explain why and how the relationship between stimuli and responses varies depending on individual differences or environmental factors. In this S-O-R model, job control and user control have direct influence on stressors and an indirect effect on stress; in other words, stressors intervene in the relationship between control (stimuli) and job stress (response), as shown in Figure 3.1d. Theoretically, individual control attenuates conception of stressors, resulting in a decrease in the level of stress.

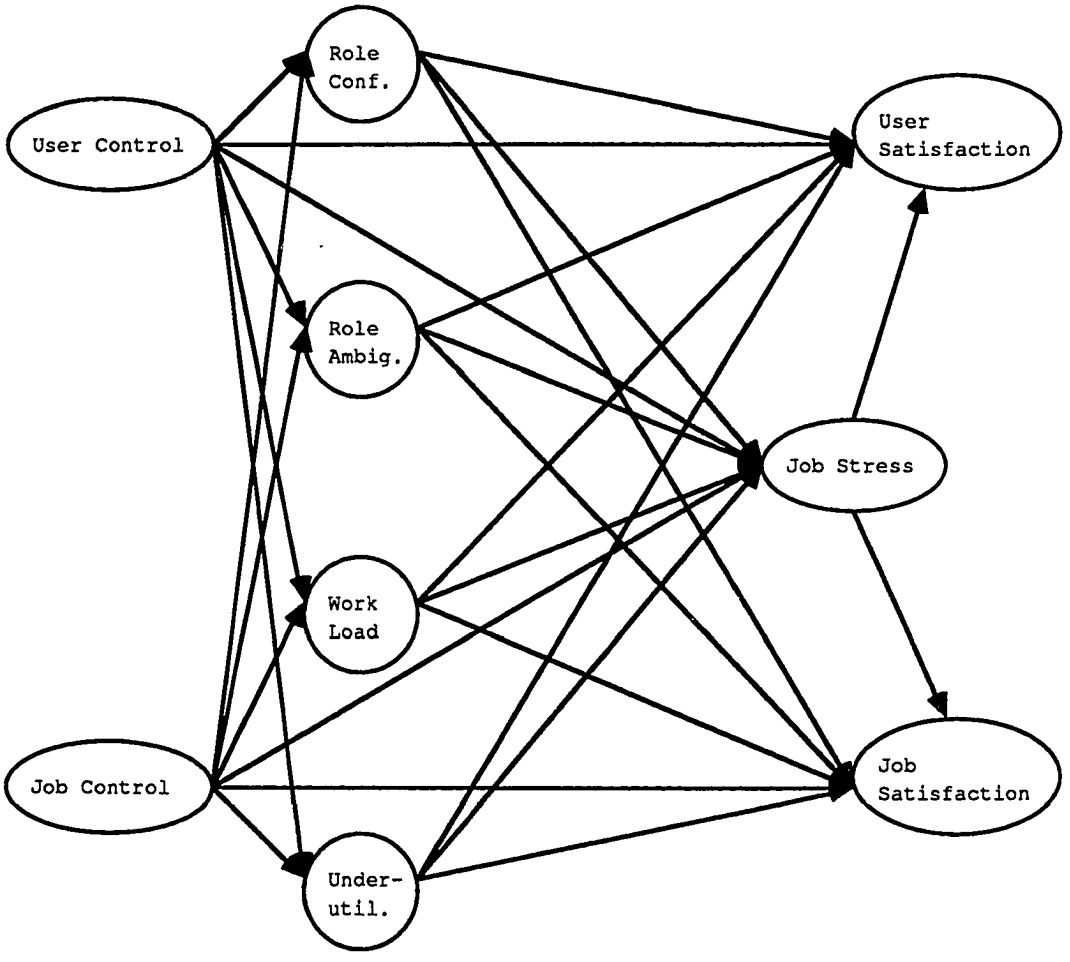
This model heavily emphasizes job control and user control as critical variables, because they may represent the degree of managerial effectiveness in an end user computing environment. Adopting the efficacy of QWL in attaining organizational goals, knowledge workers in an end user computing environment are believed to act as self regulatory agents in a sociotechnical work environment. Such organizational work environments as organizational culture and system managers' leadership are manifested in the degree of user control and job control perceived by end users. Therefore, the job control construct may represent

the goodness of organizational climate; the user control construct can be an indirect measure of successfulness of end user computing management. In the full model, the level of stress also functions as an intervening variable between stressor and the levels of job satisfaction and user satisfaction (Figure 3.1d).

For this S-O-R model, moderating variables are not shown nor used to explain potential individual differences in the magnitude of these variables and their relationships. Also, moderators will not be shown as interaction terms in structural equations; rather, they will be used to divide the whole samples into subgroups. Technically, a stacked model will be applied to investigate moderating effects (Hayduk, 1987). Moderators studied in this model are Type A personality, sex, age, and computing knowledge. Tests of equality on all individual variable means (t-test) and tests of the equality covariance structure among studied variables (test of equality of covariance matrices between subgroups) across different subgroups will be performed to uncover the moderating effects.

Figure 3.1d

Mediating Model



3.2 DEFINITIONS OF VARIABLES

3.2.1 Stressors

Job stressors are viewed as situational factors potentially capable of producing stress reactions. Following Parasuraman and Alutto (1984), stressors are defined conceptually as job demand, constraints (or opportunities), and job-related events or situations that may affect an individual's role fulfillment.

Four major types of stressors relevant to end user computing are employed as stimuli in the moderating model and as mediators in the intervening model: quantitative work load, role conflict, role ambiguity, and underutilization of ability.

Quantitative Work Load

Quantitative work load refers to the amount of work an end user has to do and the pace at which the end user must work. The work demands include supervising people, reporting to a number of superior persons, work overload, time pressures and deadlines, and keeping up with technology changes (Karasek, 1979).

Underutilization of Ability

When workers are required to use their skills and knowledge in completing work below their ability level, they

feel bored with their job, which causes stress (Caplan et al., 1975; Frankenhaeuser & Gardell, 1976; Smith et al., 1981). The variable "underutilization of ability" is defined as the degree to which end users underutilize their technical competence or task knowledge in completing their decision making tasks.

Role Conflict

Role conflict occurs when behaviors demanded by an individual's roles are incompatible (Rizzo et al., 1970). Here it is defined as the degree to which an end user believes that the demands of two or more of his/her role partners are incompatible and he/she can not simultaneously satisfy all the demands. In an EUC environment, role conflict may occur when knowledge workers are caught between two groups of people who demand different kinds of behavior. These two groups are typically technicians and computer-illiterate people.

Role Ambiguity

Role ambiguity refers to a lack of certainty regarding expected role behaviors and objectives (Rizzo et al., 1970). It is defined as the degree to which end users feel that they do not have the information necessary to perform their job adequately, as when they are uncertain about what their role partner expects of them, how to act to satisfy those

expectations, or how their ultimate performance will be evaluated.

3.2.2 Personal Control

The control construct most researched in recent years is the task characteristic of autonomy (Hackman & Oldham, 1975; Sims & Szilagyi, 1976; Brief & Aldag, 1978; McTavish & Pirro, 1984). Hackman and Oldham defined autonomy as the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out. Greenberger and Strasser (1986) defined personal control as the individual's beliefs, at a given point in time, about his or her ability to effect a change, in a desired direction, on the environment.

Job Control

Job control is a specific personal control in a job setting. Ganster (1989) identified seven subdomains of job control: task, work pace, scheduling, physical environment, decision making, interaction, and mobility. These seven aspects of job control may be defined as follows:

Control over Work Tasks: The degree to which an individual can determine the order, methods, and subjects, in completing her/his task.

Control over Work Pacing: The degree to which an individual determines the pace of work; for instance, duration of rest breaks. This type of control has a shorter time frame than work scheduling.

Control over Work Scheduling: The degree to which an individual determines his or her working hours so that non-work demands can be better coordinated with work demands; for example, duration of vacations or days off.

Control over Physical Environment: The degree to which an individual is able to modify, decorate, or otherwise personalize the work space. Control over lighting, temperature, noise, and privacy are included in this domain.

Control over Decision Making: The degree to which an individual has influence concerning organizational policies, goals, or procedures.

Control over Social Interaction: The degree to which an individual can control the amount and timing of contact with other people, such as coworkers or customers.

Control over Work Resources: The degree to which an individual has influence over work resources such as tools, materials, budgets, and personnel.

User Control

Many concepts similar to worker control have appeared in the organizational psychology literature. Examples include autonomy, decision latitude, worker participative

decision making, job pacing, and so forth (Ganster, 1989). However, in the field of MIS, the term autonomy or decision latitude has rarely been used. Instead, the term user control has been employed more frequently (McFarlan & McKenney, 1983; Rivard, 1987; Rivard & Huff, 1988; Gerrity & Rockart, 1986). McFarlan and McKenney argued that control by users has at least three important implications: getting a system up and running more quickly, being able to set maintenance priorities, and gaining control over day-to-day operations and becoming insulated from the unexpected changes of corporate computer scheduling. Gerrity and Rockart viewed user control as the degree to which end users can be trusted to make sound individual use of information systems.

User control is broadly defined as the degree to which end users can influence a variety of computing activities such as system design and development, computing resource allocation, hardware and software selection, and decisions about quality of system output.

3.2.3 Job Stress

McGrath (1970) defined stress as a perceived substantial imbalance between demand and response capability, under conditions where failure to meet demand has important perceived consequences. Schuler (1980) stated that stress occurs when an individual is either overwhelmed

by negative environmental factors or stressors or when the environment fails to supply the needs of the individual.

3.2.4 Job Satisfaction

Locke (1976) defined job satisfaction as a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences. As such, job satisfaction is presumed to be a global construct encompassing such specific facets of satisfaction as satisfaction with work, pay supervision, benefits, promotion opportunities, working conditions, coworkers, and organizational practices. Bell and Weaver (1987) confirmed the multidimensional nature of the job satisfaction construct. As used here, job satisfaction refers to the degree of end users' satisfaction with their general working conditions such as pay, job security, social relationship with workers, personal development, and supervision.

3.2.5 User Satisfaction

User satisfaction is the extent to which users believe the system meets their information needs (Liang, 1986). Information precision, system accuracy, output format, ease of use, and timeliness are included in measuring the EUC satisfaction (Turner, 1984; Liang, 1986; Montazemi, 1988). Doll and Torkzadeh (1988) defined EUC user satisfaction as

the affective attitude towards a specific computer system by someone who interacts with the system.

3.2.6 Moderating Variables and Others

Theoretically speaking, a variable z is a moderator if the relationship between two (or more) other variables, say, x and y, is a function of the level of z (James & Brett, 1984). The four individual differences described below represent moderating variables in the present study.

Type A Personality

The Type A behavior pattern, referred to as a coronary-prone type of personality, describes an end user as very involved in work, competitive, hard driving, and feeling a sense of time urgency.

Computing Knowledge

Length of system use and experience with IS use have been found to influence user satisfaction (Fuerst & Cheney, 1982; Sanders & Courtney, 1985).

Demographics and Others

Several demographic variables such as age, sex, and organizational tenure were reported to have a potential impact on user satisfaction (Culnan, 1983; Turner, 1984; Snitkin & King, 1986; Yaverbaum, 1988). The characteristics

measured in the current study are age, sex, work experience, job title, and type of end user.

Cognitive style has also been found to have an impact on IS success (Zmud, 1979; Snitkin & King, 1986; Liang, 1986). However, there is no consensus on the relationship between cognitive styles and user satisfaction or performance (Huber, 1983). Therefore, cognitive style is not included as a variable in this study.

Additionally, several EUC variables were measured to facilitate interpretation of the results and obtain some insights for future research. Appendix 2 illustrates the measures utilized to obtain values for social relationship with technical assistant, type of communication infrastructure, satisfaction with training program, frequency of data loss, degree of performance improvement, and top management support.

Top management support and user training have been found to be closely related to the success of IS (Sanders & Courtney, 1985). Information center service is regarded as critical for the success of EUC (Benson 1983; Leitheiser & Wetherbe, 1985 & 1986). User involvement has been positively related with user satisfaction when the problem is complex (Rockart & Flannery, 1983; Hirschheim, 1985; Montazemi, 1988; Doll & Torkzadeh, 1988). Organizational climate and organizational time frame have also been

proposed as potentially associated with EUC success (Cheney, Mann, & Amoroso, 1986).

3.3 HYPOTHESES

Based on the literature review and research model presented in the above section, four groups of hypotheses were derived: one hypothesis for the measurement model, several hypotheses concerning the moderating model, a third set of hypotheses for the intervening model, and several hypotheses for extra-model moderators.

3.3.1 Job Control and User Control

The concept of personal control in the field of MIS has developed independently from that in occupational psychology, even though they are conceptually in the same vein. Contemporary job control inventories, developed in the field of occupational psychology, do not include any items pertinent to computing activities. Furthermore, there is no measurement instrument for the control construct in the field of MIS. A new user control scale will be developed in the present study. Conceptual independence of the user control construct from the existing job control construct (construct validity) must be tested before its use in the study model may be justified. It is hypothesized

that job control is one thing and control over computing activity is another.

Hypothesis 1: End user control over computing activity is independent from job control.

3.3.2 Stressors and Personal Control

Personal control has been proven important in determining the stress of occupational experience (Averill, 1973; Ganster, 1989). Decision latitude, another form of personal control, is also known to be related to mental health (Karasek, 1979).

Establishing strict policies and procedures, as an attempt to minimize corporate risks in monitoring end-user computing, can actually cause discomfort to end users, resulting in work stress, which is an important indicator of low quality of work life. By providing end users with more opportunities to perceive control, information system managers can reduce this negative effect on mental strain.

The causal direction between stressors and personal control varies depending on hypotheses. When personal control is hypothesized as a moderator, personal control directly affects both stressor and stress, as shown in Figure 3.1c. If stressors intervene in the relationship between personal control and stress outcomes, then personal

control has both direct and indirect influences on the level of stress, as shown in Figure 3.1d.

Moderating Model

Hypothesis 2a: Job control moderates the structural relationships between stressors and stress-outcome variables (Averill, 1973).

Hypothesis 2b: User control moderates the structural relationships between stressors and stress-outcome variables (Frese, 1987).

Mediating Model

Hypothesis 3a: User control affects stressors negatively (Frese, 1987).

Hypothesis 3b: Job control affects stressors negatively (Averill, 1973; Ganster, 1989).

Hypothesis 3c: User control affects job stress negatively (Turner, 1984; Frese, 1987).

Hypothesis 3d: Job control affects job stress negatively (French & Caplan, 1972; Karasek, 1979).

3.3.3 Job Stress, Job (User) Satisfaction, and Job (User) Control

Kahn et al. (1964) found that men who suffered from role ambiguity experienced lower job satisfaction (r=-0.32). French and Caplan (1970) also found a close relationship between role ambiguity and job satisfaction. Kasl (1978)

found that indices based on somatic complaints and symptom checklists generally correlate with job satisfaction in the 0.10 to 0.30 range (p. 26).

A belief in personal control over one's environment has long been viewed as an intrinsic necessity of work life itself. Rivard (1987) surveyed 272 end users in 10 large organizations and found a positive correlation between user independence from the central DP department and user satisfaction. In general, the greater the perception of internal control, the greater the reported job satisfaction. It is postulated that job (user) control exhibits a direct influence on job (user) satisfaction.

Hypothesis 4a: Job control affects job satisfaction positively (French & Caplan, 1972; Karasek, 1979).

Hypothesis 4b: User control affects user satisfaction positively (Rivard, 1987; Rivard & Huff, 1988).

Hypothesis 4c: Job stress affects user satisfaction negatively (Ivancevich et al., 1983).

Hypothesis 4d: Job stress affects job satisfaction negatively (Kasl, 1978)

3.3.4 Moderating Effect of Individual Differences

The possible impact of individual differences on both control and stress outcome variables should be investigated before making any conclusion about the structural

relationships among QWL constructs. By and large, the variables frequently referred to as moderators in stress and control studies can be divided into three groups: dispositional variables, occupational ability, and demographic variables.

All three groups of individual difference variables are rather stable throughout a long period of time. Therefore, they are not easily changeable in contrast to beliefs or attitudes which are consistently changing even in a short period of time (Fishbein & Ajzen, 1975). In this study, Type A personality, computer literacy, sex, and age are used as moderators of the structural relationships among QWL constructs.

Type A Personality

Examples of dispositional variables are locus of control and Type A behavior. Studies of the relationship between locus of control and control exhibit inconsistent results (Ganster, 1989).

Another dispositional variable which is widely discussed in job stress and control studies has been the Type A versus Type B differentiation (Weiss, 1983). Cooper and Marshall (1984) called Type A "coronary-prone" behavioral syndrome or style of living, which can be characterized as "extremes of competitiveness, striving for achievement, aggressiveness, haste, impatience, restlessness

and feelings of being under pressure of time and under challenge of responsibility."

In general, Type A personality is believed to have a positive correlation with mental strain. However, Weiss (1983) surveyed 241 system managers and found a significant negative relationship between Type A personality and psychological job strain. Ivancevich et al. (1985) found a strong moderating effect of Type A behavior pattern between various job stressors, job related tension, and job satisfaction. Ganster (1987) reviewed studies on Type A behavior and occupational stress, then concluded that "the Type A behavior pattern would seem to be a likely candidate as a moderator of worker responses to control."

Hypothesis 5a: Type A behavior moderates the structural linkage among stressor, control, stress, and satisfaction constructs.

Sex, Age, and Computing Knowledge

Davidson and Cooper (1980, 1983) found significant differences between female and male managers. However, Weiss (1983) showed an insignificant correlation between sex and job stress. McGrath (1970) has proposed that prior experience, either in the form of familiarity with the situation due to past exposure or practice to cope with the situation can significantly alter the level of stress.

Intuitively, those who are competent in computer technology and have worked with a computer for a long time are conjectured to feel a greater need to be independent from external stimuli than their less experienced counterparts.

From this author's unstructured interviews with end users, it was found that many naive users who are authorized to develop their own computer applications experience psychological pressure because they are unsure of what they are doing. This preliminary finding seems to indicate a potential correlation between control and stress, moderated by the user's technical competence and prior job experience.

The relationship among personal control, user satisfaction, and stress is assumed to be attenuated, or even reversed, if users have low computing knowledge. In most cases, age is highly correlated with longer prior experience and should have the same effects (Indik et al., 1964). Weiss (1983) found that age has a significant negative relationship with psychological and physiological strain among IS managers. However, there has been speculation about whether keeping up with new technology such as computers will be more stressful for older people than for younger ones (Bartol & Martin, 1982).

Hypothesis 5b: The level of a user's computing knowledge moderates the structural relationships among QWL constructs.

Hypothesis 5c: Sex moderates the structural relationships among QWL constructs.

Hypothesis 5d: Age moderates the structural relationships among QWL constructs.

CHAPTER 4

METHODOLOGY

This chapter describes the methods used by the researcher in data collection, measurement, and analysis. The rationale for the selection of the specific procedures and analysis techniques is described.

4.1 SAMPLE CHARACTERISTICS

The sample for the host companies for this study will be drawn from a population of large companies (where the number of employees is more than 300) in urban areas of the Midwest region in the United States. The information center (IC) managers in the host companies will be interviewed and asked to distribute questionnaires to end users in their organizations.

The sampling procedure involves the issue of internal and external validity of the study (Cook & Campbell, 1979). In such an empirical study, most researchers select internal validity at the expense of external validity (Pedhazur, 1982; Cook & Campbell, 1979). In other words, the greater the number of host companies, the higher the external validity or the generalizability; however, as the number of

companies included rises, it becomes more difficult to control unwanted factors in the research.

In a field setting, the two most common ways to exclude the influence of confounding variables, without interrupting normal operations, are to measure unwanted factors and exclude their effects from the relationship between variables under study (statistical control) or to collect homogeneous data. Both techniques will be employed to minimize unwanted factors from the sample characteristics.

In the process of contacting host companies, various organizational factors are controlled by choosing similar organizations in terms of size (more than 300 employees), industry type (service), area (urban), and region (Midwest). There is no evidence that such organizational differences affect the control-stress-satisfaction relationship; however, it is expected that controlling these variables will assure homogeneous data, which is a desirable condition in the use of LISREL (Jöreskog & Sörbom, 1988). Some environmental factors such as top management support and social relationship with information center personnel will be measured and, if they should exist, will be excluded from the first order correlation matrix, resulting in a partial correlation matrix (Nunnally, 1978, pp. 172-175).

A relatively large sample is required for the analysis of measurement model and structural equation model. The desirable sample size for the measurement model is 10 to 20

subjects per item (Nunnally, 1978); the minimum sample size for the structural model is 150 (Anderson & Gerbing, 1988).

4.2 UNIT OF ANALYSIS

There are three levels of sociotechnical analysis: the primary work system, the whole organization, and macro-social phenomena (Trist, 1981). The present model is targeted at the first level, the primary work system of end user computing. At the level of the primary work system, principles of work design and a method of work analysis become important. The question of motivation is related to individual differences and changing social values. Studies at this level consequently involve psychosocial problems. Even though the unit of analysis is the individual end user, the subjects' perceptions and attitudes are obtained from interaction with co-workers and superiors in an organizational context. Therefore, any results derived from this study will have important implications for the whole organization.

4.3 RESEARCH DESIGN

Three empirical research models will be investigated: first, the measurement model designed to confirm the existence of the new construct "user control"; and second,

the two linear structural equation models designed to examine the relationships among QWL variables in end user computing. Four stressor and five QWL latent variables are included in the model: role ambiguity, role conflict, underutilization of ability, and quantitative work load as stressors; job control, user control, job stress, job satisfaction, and user satisfaction as QWL factors.

The research will be conducted as a three-phased field study among large service organizations in the Midwest. In Phase I, the new construct "user control" will be developed and its construct validity tested. Because there exists no proven measure and this construct is important to the model, this research develops a measure for the user control construct. To operationalize the degree of EUC control, a somewhat abstract variable of activity level will be measured, and consequently the validity of the measure is open to question. Nunnally (1978) argued that the existence of a new variable itself should be questioned before the variable can be related to other variables in experiments. For statements of relationship to have any meaning, each measure must, in some sense, validly measure what it purports to measure. As mentioned above, the job control construct has already been developed, and its validity proven (Ganster, 1988 and 1989). Testing discriminant and convergent validity of the new construct against the existing variable job control is therefore a legitimate

procedure to examine the construct validity of the new variable.

In Phase II, an exploratory correlational study will be conducted to eliminate redundant and unwanted factors in the study model. In this phase, a pretest for extra-model moderating variables will also be conducted. Testing the moderating effect of a variable becomes meaningful only when the variable has substantial correlations with model constructs (James & Brett, 1984). Therefore, a superficial inspection of the first order correlation matrix would suffice for the purpose of identifying unqualified moderators.

In the final phase, the goodness of fit of two derived linear structural equation models will be tested. The data gathered through the survey process will be analyzed in order to examine the hypotheses introduced in Chapter 3.

4.4 DATA COLLECTION PROCEDURE

4.4.1 Questionnaire Development

The questionnaire development procedure follows the guidelines recommended by Belson (1981). Due to the strict requirements for data used in LISREL, only highly reliable and valid measurement instruments will be employed in the present study. Statistically proven measurement instruments are available for all QWL constructs except user control.

To assure content validity of these measures, the author modified the wording and phrasing of some of the questions. However, the original structure and format of the questionnaires were retained.

The initially developed questionnaire was reviewed by system managers in a service organization, graduate students majoring in MIS, and faculty specializing in MIS and psychometrics. The revised questionnaire was distributed to 100 end users in service organizations located in several Midwest urban areas in the United States. A total of 77 responses was collected. Following incorporation of some of the recommended changes, the second revised version of the questionnaire was used in the present study.

4.4.2 Interview

Service organizations were chosen based on the criteria mentioned earlier. Telephone calls were made to establish initial contact with IC managers, to explain the nature of the study and to offer them a summary of the analysis and results in appreciation for their time. An interview was scheduled upon their agreement to participate in the study.

A total of seventeen information center managers participated in the study. Each interview lasted thirty to forty minutes. Twenty structured questions were listed in the interview questionnaire, including several open-ended questions (see Appendix 1). The interviews were granted

based on strict confidentiality; the names of the institutions and persons may thus not be disclosed.

The objective of the interviews was to gather basic information on the host organizations such as organizational support and control, organizational structure, culture, size, and so forth, and to determine the number of potential participating subjects for the distribution of the user questionnaire.

4.4.3 Administration of Questionnaire

The information center managers in the host organizations were asked to briefly explain the nature of the study and to administer questionnaires to their end users. Each subject was requested to fill out the survey questionnaire within 30 minutes and to send it back to the researcher as soon as possible. A total of 435 questionnaires was distributed.

4.5 MEASUREMENT

In order to meet the requirement for highly reliable measurement for the use of LISREL, most constructs in this study are measured using statistically proven and widely-used scales. The measure of the user control construct is the only one developed specifically for this project. Each

scale is composed of multiple items (ranging from 3 to 22 items per scale).

4.5.1 Stressors

Four major types of stressors relevant to end user computing are quantitative work load, role conflict, role ambiguity, and underutilization of ability.

Role Conflict and Role Ambiguity (Rizzo et al., 1970)

These two scales are some of the most widely-used indicators of job stressors in the occupational literature. The mean score of items 3, 5, 7, 8, 10, 11, 12, and 14 in Table 4.1 measured role conflict. A reversed mean score of items 1, 2, 4, 6, 9, and 13 in Table 4.1 was used to represent role ambiguity. All these items are Likert-type scales with 7 anchors.

Quantitative Workload and Underutilization of Abilities (Caplan et al., 1975)

The quantitative workload scale is the "combined quantitative workload scale" from the survey conducted by Caplan et al. (1975). The workload measure is one of the most common in the job stress literature. Shown in Table 4.2 are the first four items included in the questionnaire. All items are scaled from 1 to 5 using a Likert-type scale.

Table 4.1

Role Conflict and Ambiguity Questionnaire Items

(Source: Rizzo, House, & Lirtzman, 1970)

Items

R1. I feel certain about how much authority I have.

R2. There are clear, planned goals and objectives for my job.

R3. I have to do things that should be done differently.

R4. I know that I have divided my time properly.

R5. I receive an assignment without the manpower to complete it.

R6. I know what my responsibilities are.

R7. I have to buck a rule or policy in order to carry out an assignment.

R8. I work with two or more groups who operate quite differently.

R9. I know exactly what is expected of me.

R10. I receive incompatible requests from two or more people.

R11. I do things that are apt to be accepted by one person and not accepted by others.

R12. I receive an assignment without adequate resources and material to execute it.

R13. Explanation is clear about what has to be done on my job.

R14. I work on unnecessary things.

Responses Scale

1. Very Inaccurate
2. Mostly Inaccurate
3. Slightly Inaccurate
4. Uncertain
5. Slightly Accurate
6. Mostly Accurate
7. Very Accurate

Underutilization of ability was also measured using Caplan et al.'s scale, which has a reported reliability of 0.85. A reversed mean score of items 5, 6, and 7 in Table 4.2 was used to measure underutilization of ability.

Table 4.2

Quantitative Workload and
Underutilization of Ability Questionnaire Items

(Source: Caplan, Cobb, French, Harrison, & Pinneau, 1975)

Items

R1. How often does your job require you to work very fast?

R2. How often does your job require you to work very hard?

R3. How often does your job leave you with little time to get things done?

R4. How often is there a great deal to be done?

R5. How often does your job let you use the skills and knowledge you learned in school?

R6. How often are you given a chance to do the things you do best?

R7. How often can you use the skills from your previous experience and training?

Responses Scale

How often do these things happen in your job?

1. Rarely
2. Occasionally
3. Sometimes
4. Fairly Often
5. Very Often

4.5.2 Job Control

A reliable and valid instrument is available for measuring the job control construct (Ganster, 1989). It consists of 7 subscales: work tasks, work pacing, work scheduling, physical environment, decision making, social interaction, and work resources (Table 4.3a). The scale showed a quite acceptable reliability with a coefficient alpha of 0.87. The item-total correlations range from 0.29 to 0.63, indicating that the scale could probably be shortened without a significant loss in reliability. A total of twenty items were employed to measure the job control construct, as shown in Table 4.3b. All items were scaled from 1 to 5 using a Likert-type scale.

Table 4.3a

Job Control Questionnaire Items
(Source: Ganster, 1989)

Items	
W1.	How much control do you have over the variety of methods you use in completing your work?
W2.	How much can you choose among a variety of tasks or projects to do?
W3.	How much control do you have personally over the quality of your work?
W4.	How much control do you have personally over how much work you get done?
W5.	How much control do you have over how fast or slowly you have to work?
W6.	How much control do you have over the scheduling and duration of your rest breaks?
W7.	How much control do you have over when you come to work and leave?
W8.	How much control do you have over when you take vacations or days off?
W9.	How much are you able to decorate, rearrange, or personalize your work area?
W10.	How much control do you have over the physical conditions of your work station (lighting, temperature, etc.)?
W11.	How much control do you have over how you do your work?
W12.	How much control do you have over your performance goals and objectives?
W13.	How much control do you have over the activities of other people at work?
W14.	How much control do you have over the amount and timing of your interaction with other people at work?
W15.	How much influence do you have over the policies and procedures in your work unit?

W16. How much control do you have over the sources of information you need to do your job?

W18. How much control do you have over the amount of resources (tools, materials, etc.) you get to do your work?

W19. How much control do you have over the number of times you are interrupted while you work?

W20. How much control do you have over the amount that you earn at your job?

W21. How much control do you have over how your work is evaluated?

W22. In general, how much control do you have over work and work-related matters?

Response Scales

1. Very Little
2. Little
3. Moderate Amount
4. Much
5. Very Much

Table 4.3b

Subdimensions of Job Control Construct

Dimensions	Item Numbers
Control over Work Tasks	1, 2, 3, 19, 20
Control over Work Pacing	4, 5, 6
Control over Work Scheduling	7, 8, 18
Control over Physical Environment	9, 10
Control over Decision Making	11, 12, 15
Control over Social Interaction	13, 14
Control over Work Resources	16, 17

4.5.3 Job Stress

The indicator of job stress is the Mental Health Index (MHI) measure (Ware et al., 1979) in the present study. As shown in Table 4.4, this fifteen-item instrument has four subscales, each of which has demonstrated substantial reliability and validity. The reported reliability of MHI is 0.93. The list of items included in the Mental Health Index is given in Appendix 2.

Table 4.4

Subscales of the Mental Health Index

Dimensions	Item Numbers
Anxiety	2, 5, 8, 11, 14
Depression	7, 12, 15
Self-Control	1, 4, 16, 18
Positive Well-Being	6, 10, 17

4.5.4 Job Satisfaction

The Job Diagnostic Survey (Hackman & Oldham, 1975) measures five facets of job satisfaction: job security, pay and other compensation, peers and co-workers, supervision, and opportunity for personal growth and development on the

job (Table 4.4a). As shown in Table 4.4b, fourteen items were used to assess the degree of job satisfaction in the five facets of a job, each of which showed acceptable reliability (ranging from 0.56 to 0.84). All items were scaled from 1 to 5 using a Likert-type scale.

Table 4.4a

Job Satisfaction Questionnaire Items

(Source: Hackman & Oldham, 1975)

Items	
J1.	The amount of job security I have.
J2.	The amount of pay and fringe benefits I receive.
J3.	The amount of personal growth and development I get in doing my job.
J4.	The people I talk to and work with on my job.
J5.	The degree of respect and fair treatment I receive from my job.
J6.	The feeling of worthwhile accomplishment I get from my supervisor.
J7.	The chance to get to know other people while on the job.
J8.	The amount of support and guidance I receive from my supervisor.
J9.	The degree to which I am fairly paid for what I contribute to this organization.
J10.	The amount of independent thought and action I can exercise in my job.
J11.	How secure things look for me in the future in this organization.
J12.	The chance to help other people while at work.

J13. The amount of challenge in my job.

J14. The overall quality of the supervision I receive in my work.

Response Scales

How satisfied are you with this aspect of your job?

1. Extremely Dissatisfied
2. Slightly Dissatisfied
3. Neutral
4. Slightly Satisfied
5. Extremely Satisfied

Table 4.4b

Job Satisfaction Scale

Dimensions	Items
Pay	2, 9
Job Security	1, 11
Social Relationship	4, 7, 12
Supervision	5, 8, 14
Growth Need	3, 6, 10, 13

4.5.5 User Satisfaction

In the present study, Doll and Torkzadeh's (1988) revised instrument was utilized. Their instrument consists of five subdimensions of end user satisfaction: content, accuracy, format, ease of use, and timeliness (Table 4.5a). Doll and Torkzadeh's instrument has a reported reliability of 0.92 and criterion-related validity of 0.76. In the

present study, eighteen items were used to measure user satisfaction, as shown in Table 4.5b. All items were scaled from 1 to 5 using a Likert-type scale.

Table 4.5a

Subscales of User Satisfaction

Subscales	Items
Content	1, 2, 3, 4, 5
Accuracy	6, 7, 8, 9
Format	10, 11, 12, 13
Timeliness	17, 18

Table 4.5b

User Satisfaction Questionnaire Items

(Source: Doll & Torkzadeh, 1988)

Items	
U1.	The system provides the precise information I need.
U2.	The information content meets my need.
U3.	The system provides reports that seem to be just about what I need.
U4.	The system provides sufficient information.
U5.	I found the output relevant to my task.
U6.	The system is accurate.
U7.	I am satisfied with the accuracy of the system.

U8. I feel the output is reliable.

U9. I find the system dependable.

U10. I think the output is presented in a useful format.

U11. The information I obtain from the system is unambiguous.

U12. I am happy with the layout of the output.

U13. The output is easy to understand.

U14. The system is user friendly.

U15. The system is easy to use.

U16. The system is efficient.

U17. I get the information I need in time.

U18. The system provides up-to-date information.

Response Scale

1. Strongly Disagree
2. Agree
3. Neutral
4. Agree
5. Strongly Agree

4.5.6 Moderating Variables

In this study, four individual difference variables were employed as moderators.

Type A Personality

The scale chosen here is the activity subscale of the Thurstone Temperament Schedule (Thurstone, 1953). Mayes et al. (1984) found that this scale had acceptable reliability. The scale is composed of twenty items, each with a 5-point response format ranging from "definitely false" to "definitely true," as shown in Table 4.5c.

Computing Knowledge

The degree of users' competence in computing technology was represented by composing three surrogate measures: computer experience, work experience, and computer training and education, each of which is a single item (Appendix 2). These surrogate measures assumed that users would be more competent if they worked with computers for a longer period of time and received more institutional education or training. The FATOR ANALYSIS in SPSSx was used to obtain the factor score of computing knowledge.[3]

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3. CKNOW = 0.5447*CEXP + 0.3227*CEDU + 0.4874*WEXP,
   where CKNOW: Computing knowledge,
   CEXP: Computer experiance,
   CEDU: Computer education & training,
   WEXP: Work experience.

Table 4.5c

Type A Personality Questionnaire Items

(Source: Thurstone, 1953)

Items
A1. I am more restless and fidgety than most people.
A2. I ordinarily work quickly and energetically.
A3. I am rather deliberate in telephone conversation.
A4. I am often in a hurry.
A5. In conversation I often gesture with hands and head.
A6. I rarely drive a car too fast.
A7. As a boy or girl I preferred work in which I could move around.
A8. I usually speak more softly than most people.
A9. People consider me to be rather quiet.
A10. My handwriting is rather fast.
A11. I often work slowly and leisurely.
A12. I prefer to linger over a meal and enjoy it.
A13. I like to drive a car rather fast when there is no speed limit.
A14. I like work that is slow and deliberate.
A15. I talk more slowly than most people.
A16. I often let a problem work itself out by waiting.
A17. I often try to persuade others to my point of view.
A18. I generally walk more slowly than most people.
A19. I eat rapidly even when there is plenty of time.
A20. I usually work quickly.

Demographics and Other Characteristics

The characteristics measured in the current study are age, sex, work experience, and type of end user, as illustrated in Appendix 2. In addition, other EUC variables were also measured to facilitate interpretation of the results and obtain some insights for future research. Described in Appendix 2 are social relationship with technical assistant, type of communication infrastructure, satisfaction with training program, frequency of data loss, degree of performance improvement, and top management support. All of these measures are single items.

4.6 THE DEVELOPMENT OF THE USER CONTROL MEASURE

Because there is no proven measure for user control, and due to its importance in the model, this research includes development of a measurement tool for this construct. The steps in developing a measure of user control are presented in this section. This procedure follows the guidelines recommended by Nunnally (1978).

4.6.1 Measurement Plan

The major part of this step is an outline of content for the instrument which is to be constructed. The domain of interest is a user's control over various types of computing activity in an end user computing environment.

Any discretion or autonomy given to end users other than decisions about information system use would not be considered to belong to this domain. Based on the literature review in Chapter 2, four subdimensions of user control were identified: system development, system operation and maintenance, user support with regard to training and technical assistance, and computing resource management.

System Development

System development includes planning, design, analysis, and programming of new applications and the maintenance of existing ones (Davis & Olson, 1985; Whitten et al., 1989). User involvement in the development of computer-based information systems has been one of the most enthusiastically studied fields in MIS (Ives & Olson, 1984). User involvement in the system design process is a way of increasing the level of control perceived by end users. Users may influence decisions regarding system planning, requirement assessment, quality of system output, and so forth.

System Operation and Maintenance

Zmud (1984) identified several important tasks of systems operation and maintenance activities: preparation and data entry, input and output control, machine operation,

hardware and software maintenance, and job scheduling. Users may influence or participate in every aspect of these computing activities.

Computing Resource Management

This domain of user control includes the administrative aspects of computing activities (Zmud, 1984; Davis & Olson, 1985). Users may be involved with some important tasks in this domain, such as hardware and software selection, chargeout management, budgeting, standards development, and capacity planning (Leitheiser & Wetherbe, 1986).

User Support

Davis and Olson (1985) stated that users receive organizational support such as training and technical assistance. This type of user support has in the past not been user-oriented, but rather was designed to fit users into the organization's schedule. Users should be able to influence decisions concerning their training schedule and the quality of technical assistance to which they have access (Benson, 1983; Leitheiser & Wetherbe, 1986).

4.6.2 Item Development

For each subdomain of user control, three to five items were developed. Initially, a pool of 25 items was constructed, based on the management information systems

literature. The items are of a Likert-type scale ranging from "very little" to "very much."

4.6.3 Assessment of Content Validity

The draft questionnaire was distributed to eighteen system analysts, thirty end users, and two MIS faculty members. They were all experts in either developing survey questionnaires or designing and operating computer based information systems, and were thus familiar with either question phrasing or selecting terminology and computer jargon. The average time to fill out all 25 questions was approximately three to five minutes.

The reviewers detected several instances of ambiguous wording, repeated items, and poor phrasing. These typographical errors, misphrasings, and miswordings were corrected, and five items were deleted from the original version while two items were added to it, resulting in twenty-two items (Table 4.6a).

Table 4.6a

User Control Questionnaire Items

Items
C1. How much control do you have over setting priority of developing information systems?
C2. How much control do you have over setting priority of running programs?
C3. How much control do you have over scheduling maintenance of your information system?
C4. How much control do you have over access to a computer terminal?
C5. How much control do you have over data base organization?
C6. How much control do you have over modification of computer programs?
C7. How independent are you from the DP department?
C8. How much control do you have over the selection of the software that you use?
C9. How much control do you have over the selection of the hardware that you use?
C10. How much control do you have over the input format design?
C11. How much control do you have over the selection of the programming languages which you use?
C12. How much control do you have over determination of information requirements for the system?
C13. How much control do you have over data security?
C14. How much control do you have over reducing information processing time?
C15. How much control do you have over reducing the information processing cost?
C16. To what extent can you fit the function of the information system to the organizational goals?

C17. How much control do you have over self-paced learning or building computer skills?

C18. How much control do you have over the accuracy of the computer output?

C19. How much control do you have over the computer output's relevancy to your task?

C20. How much control do you have over the volume of information system output?

C21. How much control do you have over the completeness of the information system output?

C22. How much can you control the timing of information system output?

Responses

1. Very Little
2. Little
3. Moderate Amount
4. Much
5. Very Much

4.6.4 Data Collection

Using the twenty-two items, one hundred questionnaires were distributed to end users in several educational institutions, insurance companies, and a communications company. Seventy seven responses were collected, of which two were invalid due to missing data. Included in the sample were 29 female and 46 male end users. Descriptive statistics concerning the subjects' age, computer education, computer experience, work experience, user type, primary communication channel, and primary data source are given in Table 4.6b.

Table 4.6b

Description of Respondents

Characteristics	Frequency	Percent
Age		
21-30	18	24.00
31-40	40	53.33
41-50	15	20.00
51-up	2	2.67
Sex		
Female	29	38.67
Male	46	61.33
Computer Experience (years)		
0 - 5	21	28.00
6 -10	35	46.67
11-15	14	18.67
16-up	5	6.67
Job Tenure (years)		
0 - 5	7	9.33
6 -10	21	28.00
11-15	17	22.67
16-20	18	24.00
21-25	8	10.67
26-30	2	2.67
31-up	2	2.67
Computer Education & Training		
No Education	16	21.33
Less than 1 year	25	33.33
Less than 2 year	11	14.67
More than 2 year	23	30.67

Table 4.6b (Continued)

Description of Respondents

Characteristics	Frequency	Percent
User Type		
Nonprogramming End User	17	22.67
Command Level User	18	24.00
End User Programmer	8	10.67
Functional Support	13	17.33
EUC Support (IC)	9	12.00
DP Programmer	6	8.00
Missing	4	5.33
Assistance Sources		
Colleagues	18	24.00
Department IC	4	5.33
Information Center	5	6.67
DP/MIS Department	20	26.67
Consultant/Vendor	2	2.67
Manual/Reference Book	26	34.67
Communication Types		
Stand-Alone	14	18.67
Unidirectional Transfer	15	20.00
Departmental LAN	11	14.67
Organizational Net.	24	32.00
Inter-Organizational Net.	11	14.67
Primary Data Sources		
Corporate Data	29	38.66
Department Data	25	33.33
Personal Data	16	21.33
Other Users' Data	4	5.33
External Data	1	1.33

4.6.5 Item Analysis

The item analysis procedure involves a test for both statistical assumptions of the overall data and requirements for individual items. Normality of the sample data was determined using the FREQUENCIES procedure in SPSSx (Statistical Package for the Social Sciences), which provides various statistics for testing the normality of sample data. As shown in Appendix 3, a superficial inspection of the histogram reveals that the sample data exhibits an approximate normal curve. This result coincides with the determination that both kurtosis (-.655) and skewness (.374) of the data are less than 1. Additional evidence for the normality of the sample is provided in the fact that all the cases fall within the ±1.96 standard residual range.

Item trace analysis provides a tool for testing the linearity of an individual item in the relationship between an individual item and a construct (Nunnally, 1978). A trace is a diagram of the relationship between responses on a particular item and a construct. The construct is plotted on the horizontal axis and the item is plotted on the vertical axis. In the absence of a construct, it may be reasonably approximated by the sum of the scores on all the items in the scale (a total score). A monotonic item exhibits a linear relationship with the total score. All

twenty-two items were plotted against the total score. Only three items, C4, C7, and C17, were nonmonotonic.

The internal consistency of items was analyzed using the RELIABILITY procedure in SPSSx. The Chronbach's alpha for the user control construct is 0.93, which is much greater than the 0.70 norm for reliability in the social science literature. Inspection of the covariance matrix provided by the RELIABILITY program revealed that items C4 and C7 have a negative relationship with several other items. Normally, an item is retained if its item-total correlation is higher than 0.50. As shown in Appendix 4, corrected item-total correlations for the three items, C4, C7, and C17 were lower than 0.50.

Item 4 (access to a computer terminal), item 7 (independence from DP), and item 17 (self-paced learning), were excluded from the item pool due to their low communality with the construct. Cohen (1984) reported that computer users are unsatisfied with their job when they believe that there is an insufficient number of terminals. Accessibility to computer resources does not seem to be important in today's end user computing environment. With regard to item 7, the meaning of the question is problematic. End users seem to be unable to distinguish a data processing department (DP) from an information center (IC). Item 17 experienced a similar problem. The question asks about two different states, inducing ambiguity.

Predictive validity was tested by looking at the relationship between the newly developed construct and a criterion variable, the Mental Health Index (MHI). The procedure for testing predictive validity should employ a proven criterion variable. MHI has been proven statistically reliable and valid (Ware et al., 1979). The predictive validity of user control in this sample was 0.30 ($p < .01$). In other words, about 10 percent of the variance in the criterion variable, MHI, was accounted for by the independent variable, user control. The construct validity of this measure will be assessed more rigorously using the measurement model of LISREL.

4.7 ANALYTICAL PROCEDURES

One major shortcoming of past behavioral studies in MIS is the fact that the major portion of research has addressed relationships among theoretical constructs that are not directly observable (e.g., user satisfaction, user involvement, attitude toward IS, and computing knowledge). Two strategies commonly used to address this problem are the careful selection of one most representative item and the construction of an index formed from some combination of two or more observable indicator variables (Hughes et al., 1986). Although having multiple indicators for each construct is strongly advocated to handle such measurement

error problems, when a construct has good reliability and its unidimensionality is proven, Hughes et al.'s approach is appropriate.

The other concern of behavioral studies in MIS is discovering causal relationships among the variables and the relative explanatory power of such relationships. Lack of theories and reliable measurement instruments might inhibit the use of causal models in MIS. Only a few studies tested causal models using path analysis (Robey & Farrow, 1982; Bartol, 1983). The validity of the path model is predicated on a set of very restrictive assumptions, some of which are that: (1) the variables are measured without error; (2) the residuals are not intercorrelated; and (3) the causal flow is unidirectional (Pedhazur, 1982). Such assumptions are rarely, if ever, met in applied settings, particularly in non-experimental research. LISREL is a very versatile approach that may be used for the analysis of causal models with multiple indicators of latent variables, reciprocal causation, measurement errors, correlated errors, and correlated residuals, to name but a few (Pedhazur, 1982).

The LISREL model, in its most general form, consists of two parts: the measurement model and the structural equation model (Jöreskog & Sörbom, 1988). LISREL integrates measurement concerns with structural equation modeling by incorporating both latent theoretical concepts and observed

or measured indicator variables into a single structural equation model (Hayduk, 1987).

The first measurement model in this thesis, construct validity of user control, is analyzed using the LISREL submodel 1 (Jöreskog & Sörbom, 1988). Confirmatory factor analysis is used here because the model is based on *a priori* information about the data structure in the form of a given classificatory design for items or subsets according to objective features of content and format of the two scales. However, to some extent, the proposed measurement model also involves investigation of an exploratory nature. Model modification may be needed to exclude items which do not contribute to the discriminant validity or to merge two constructs into one unidimensional latent variable, which might be called user control.

The second structural equation model for the relationships among QWL variables is analyzed using the full LISREL model (Jöreskog & Sörbom, 1988). The goodness of fit of the control-stress-satisfaction model is measured using various indices: Chi-square (X^2), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Root Mean square Residual (RMR).

CHAPTER 5

RESULTS AND DISCUSSION

This chapter includes statistics describing the host companies, the respondents, and the results of data screening and reliability and validity tests of the measures. In addition, the results of the analyses for the measurement model and the structural equation models are presented.

5.1 DESCRIPTION OF THE HOST COMPANIES

A total of seventeen companies located in the Midwest area participated in the study. As shown in Table 5.1, most of these companies have been in the service industry for more than 30 years. The minimum number of employees in each company is 300, and their annual sales range from several hundred thousand dollars to several million dollars. Of the total of seventeen companies, only two did not have an independent information center (IC). In these two companies, end users receive technical assistance from data processing or management information system departments (DP/MIS).

Questions concerning benefits and disadvantages in implementing end user computing (EUC) were asked of

Table 5.1

Descriptive Statistics for Host Companies

Company Code	Products & Service	Number of Employees	Annual Sales	Company Age (Years)	DP/MIS Age (Years)	IC
01	Research	2	3	55	25	0
02	Communication	3	4	25	25	1
03	Research	1	2	30	12	1
04	Delivery	2	3	45	11	1
05	Computing	1	2	24	24	1
06	Bank	2	4	87	24	1
07	Communication	4	4	40	40	0
08	Finance	4	4	99	29	1
09	Finance	4	4	90	30	1
10	Utility	4	4	29	29	1
11	Insurance	4	4	43	43	1
12	Bank	2	4	82	30	1
13	Insurance	4	4	66	15	1
14	Mailing	2	4	45	15	1
15	Utility	1	4	30	20	1
16	Medical	2	4	75	22	1
17	Utility	4	4	44	25	1

Note: Number of Employees, 1: 300-500, 2: 500-1000, 3: 1000-2000, 4: more than 2000. Annual Sales, 1: less than 1 mil., 2: 1-5 million, 3: 5-10 million, 4: more than 10 million. IC, 0: not existing, 1: existing.

interviewees. Potential benefits examined in the interviews include overall EUC successfulness, DP time reduction, DP backlog reduction, user needs met, and improvement in decision making performance. The disadvantages include problems in important data loss, data compatibility, user privacy, and inefficient use of computing resources due to redundant data. The degree of top management support, social relationships between end users and information centers, and user training policy were also measured to

grasp a picture of the organizational cultures. Because the reliability of measurement scales for these variables is questionable and the sample size (n=17) is too small, a rigorous statistical test can not be made for these variables. However, they suffice for the purpose of outlining the host companies. The computer output for frequency data is attached in Appendix 5.

The degree of top management support for end user computing was very high in all companies. Their overall estimate of EUC success ranges from 3 to 5 on a 5-point Likert-type scale. The overall success of end user computing in the host companies was reaffirmed by the fact that eleven of seventeen companies agreed that information system development time in their DP department had been reduced since introducing end user computing, even though they were reluctant to say that the DP backlog had been reduced. About seventy percent of companies believed that user developed information systems better meet users' information requirements and more than eighty percent of the respondents agreed that decision making performance had been improved since implementing EUC.

With regard to disadvantages of EUC, most companies (83%) very rarely or never experienced data loss problems. Most respondents (94%) answered that they had a documentation problem, especially when there was a personnel reshuffle. Data incompatibility was also pointed to as a

minor problem in two companies. A user privacy problem was not found among the surveyed companies. Overall, the host companies had benefited rather than having problems by implementing end user computing.

5.2 DESCRIPTION OF THE RESPONDENTS

Of the 435 questionnaires which were distributed to end users in seventeen host companies, the total number of completed responses to the questionnaire was 302, a response rate of 69%. Thirty-one returned questionnaires were deemed invalid because too many values were missing. The total number of valid cases was 271.

Demographics

As outlined in Table 5.2a, the majority (96%) of respondents are normally distributed around the mean age of 36, ranging from 21 to 50. Two-thirds of respondents are male. The dominant respondents (74%) have less than 10 years of computing experience and less than 20 years of work experience. Among the surveyed people, 28% have not received regular computer education or training. Most of them learned with colleagues' help or by referencing hardware and software manuals. The majority (72%) of the respondents received institute education or participated in a training program provided either by their own company or

by an outside source. More than two-thirds of the respondents receive technical assistance from colleagues or reference manuals. Only 18% of the respondents are using a stand-alone system, while the majority (80%) communicate with other end users through a departmental LAN (Local Area Network) or connections to mainframes. The respondents' primary data sources are corporate data bases (38%), department data (31%), and personal data (20%).

Characteristics of End Users

Of the 271 respondents, 59 are non-programming end users and 16 are professional programmers. The remaining 196 people were categorized as end users in the present study. These three user groups are compared in Table 5.2b. Generally, end users feel that their working environment is more stressful than that of non-programming users, but less stressful than that of professional programmers. The level of end users' job control and user control is in the middle. Their user satisfaction and job satisfaction levels are moderate. On the other hand, non-programming end users have low user control and a moderate level of job control. They are satisfied with both their job and information system. Their role stress levels are relatively low.

Professional programmers work in the most stressful environment. They believe that they have less control over general work procedures, even though they have relatively

high control over computing activities. Their job satisfaction and user satisfaction are low, compared to the other groups.

Sample Size

The valid sample for various analytical procedures will vary because a set of preliminary data screening procedures such as the multinormality test, a linearity test, outlier analysis, etc., will eliminate unqualified cases, and a listwise deletion method will be used for dealing with partly missing values. All valid 271 cases were used for preliminary screening tests and comparison purpose. However, non-programming end users and professional programmers will be excluded from the sample for testing structural models.

Table 5.2a

Description of Respondents

Characteristics	Frequency	Percent
Age		
21-30	78	28.78
31-40	118	43.54
41-50	65	23.98
51-up	10	3.69
Sex		
Female	99	36.53
Male	172	63.47
Computer Experience (years)		
0- 5	84	31.00
6-10	119	43.91
11-15	39	14.39
16-20	15	5.54
21-25	11	4.06
26-up	3	1.11
Job Tenure (years)		
0-10	100	36.90
11-20	120	44.28
21-30	41	15.13
31-40	7	2.58
41-up	3	1.11
Computer Education & Training		
No Education	77	28.41
1 year	73	26.94
2 years	48	17.71
3 years	16	5.90
More than 4 years	57	21.03

Table 5.2a (Continued)

Description of Respondents

Characteristics	Frequency	Percent
User Type		
Non-programming End User	59	21.77
Command Level User	74	27.31
End User Programmer	64	23.62
Functional Support	37	13.65
EUC Support (IC)	21	7.75
DP Programmer	16	5.90
Assistance Sources		
Colleagues	98	36.16
Department IC	12	4.42
Information Center	14	5.17
DP/MIS Department	39	14.39
Consultant/Vendor	5	1.84
Manual/Reference Book	103	38.01
Communication Types		
Stand-Alone	49	18.08
Unidirectional Transfer	104	38.38
Departmental LAN	26	9.59
Organizational Net.	52	19.19
Inter-Organizational Net.	34	12.55
Missing (don't know)	6	2.21
Primary Data Sources		
Corporate Data	102	37.64
Department Data	83	30.63
Personal Data	56	20.66
Other Users' Data	14	5.17
External Data	6	2.21
Missing	10	3.69

Table 5.2b

Mean Difference by User Type

	Nonprogram-ming Users		End Users		Professional Programmers	
Constructs	MEAN	STD	MEAN	STD	MEAN	STD
Role Conflict	2.24	1.29	3.80	1.25	4.56	1.15
Role Ambiguity	1.63	1.12	2.37	1.31	2.48	1.59
Work Load	3.66	.77	3.67	.71	3.83	.82
Underutilization	3.71	.91	3.75	.92	3.31	1.04
MHI	2.22	.57	2.36	.62	2.50	.65
Job Control	3.12	.58	3.11	.56	2.51	.62
User Control	1.77	.71	2.57	.80	2.94	.75
Job Satisfaction	5.29	1.05	5.10	1.00	4.78	1.35
User Satisfaction	3.74	.67	3.71	.75	3.63	.77
Number of Respondents		59		196		16

5.3 DATA SCREENING

Prior to testing the reliability and validity of the scales, four stressor variables and five QWL constructs were examined through various SPSSx procedures for fit between their distributions and the assumptions of multivariate analysis. A total of 271 cases were examined.

5.3.1 Outlier Analysis

Outliers are cases whose extreme values on one variable or a combination of variables unduly influence statistics. There are two possible reasons for the existence of

outliers, provided that data is correctly entered and missing values are appropriately treated. The first is that the outlier is not a member of the population from which the study sample is drawn. The second is that the case is from the intended population but that the distribution for the variable in the population has more extreme values than a normal distribution. Cases with standardized scores in excess of ±1.96 were regarded as univariate outliers in this study. Descriptive statistics provided by the FREQUENCIES procedure in SPSSx were utilized to identify univariate outliers for each construct. A total of twelve univariate outliers were identified and excluded from the sample. Fifteen cases with the largest Mahalanobis' distance[4] were identified as multivariate outliers and excluded from the sample.

5.3.2 Linearity

Bivariate scatterplots were utilized to determine linearity between paired variables. Based on the structural linkage hypothesized in Chapter 3, all possible pairs were

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4. Mahalanobis' distance is a measure of the distance of cases from average values of the independent variables. In the case of a regression equation with a single independent variable, it is the square of the standardized value of X:

$$D_i = \left(\frac{X_i - \bar{X}}{S_X}\right)^2$$

formed and plotted against each other. Oval-shaped scatterplots evidence a linear relationship between the pair, while curved or round indicate a nonlinear relationship (Tabachnick & Fidell, 1989). No curved relationship was found for any pair of variables. However, a scatter plot between role conflict and user control appeared round before excluding outliers. Following exclusion of outliers, this relationship exhibited an oval shape.

5.3.3 Normality

The nine constructs were tested for satisfaction of the normality assumption using the HISTOGRAM and univariate statistics provided in SPSSx. A histogram contains a tally of the observed number of cases in each interval and the number expected in a normal distribution with the same mean and variance as the residuals (Norusis, 1985). A superficial inspection of the histogram overlapped by a normal curve facilitates determination of normality.

Additional quantitative analyses were made through analyzing skewness and kurtosis. Skewness has to do with the symmetry of the distribution; kurtosis deals with the peakedness of a distribution. Both statistics are indicators of the degree of normality of a distribution. Values greater than 1 are regarded as violating normality.

A summary of results from normality tests on the nine constructs is presented in Table 5.3. All constructs passed the criterion of skewness and kurtosis being less than 1. However, both skewness and kurtosis of the stress measure (MHI) are very close to one, indicating potential violation of the assumption of normality. Because this variable exhibited moderate positive skewness, a square-root transformation was made (Tabachnick & Fidell, 1989). Transformed data showed an approximate normal shape and a reasonable level of kurtosis and skewness (0.376 and 0.620, respectively).

Table 5.3

Summary of Normality Test Results

Construct	Histogram	Kurtosis	Skewness
Role Conflict	Approximate	-.806	.065
Role Ambiguity	Approximate	-.446	.049
Work Load	Approximate	.138	-.485
Underutilization	Approximate	-.403	.194
MHI	Skewed Right	.992	.984
Job Satisfaction	Approximate	.205	-.733
Job Control	Approximate	-.310	.055
User Satisfaction	Approximate	.214	-.486
User Control	Approximate	-.562	.262

The final sample after eliminating outliers and multinormality violators included 244 cases. The resulting distribution on the standardized residual scatterplot for the cleaned sample provided evidence that the variance of errors is the same at all levels of variable-homoscedasticity (Pedhazur, 1982; Tabachnick & Fidell, 1989).

5.4 RELIABILITY AND UNIDIMENSIONALITY OF CONSTRUCTS

Lack of unidimensionality in structural equation models often represents misspecification (Anderson & Gerbing, 1982). Interpretational difficulties may occur if the empirical meaning of an unobserved variable is other than the meaning assigned to it by a researcher.

Even though the present study employed widely-used scales, a set of statistical validation procedures is necessary to refine the reliability and unidimensionality of each construct. The analysis procedure includes (1) testing the reliability of each construct in the studied sample, (2) detecting any possibly bad items specific to this sample, and (3) finding the internal factor structure of each construct for the purpose of facilitating interpretation of the final results.

The reliability test does not assume the equality of the empirical score and the true construct value. In

particular, because only one composite indicator will be used for each construct in this study, assessment of the unidimensionality of each construct is critical to valid interpretation of the test results.

There are three common ways to assess the unidimensionality of a measure: (1) confirmatory factor analysis (Jöreskog & Sörbom, 1988), (2) similarity coefficients (Anderson & Gerbing, 1982), and (3) common factor analysis (Gorsuch, 1983). Confirmatory factor analysis is the most stringent technique, and was used here for testing the newly developed construct, user control. For the other existing constructs, common factor analysis will suffice for the purpose of identifying bad items to secure unidimensionality.

5.4.1 Reliability

Internal consistency via Cronbach's Alpha was utilized to measure the reliability of each construct using the final sample (244 cases). As shown in Table 5.4a, most constructs exhibited acceptable reliability. However, several items for some constructs had a low item-total correlation or a negative value in their corresponding covariance matrix. It is possible that an item may work very well in a particular sample, but fit poorly to its item pool in other samples (Nunnally, 1978). Therefore, each item should be closely scrutinized before obtaining a scale score to be used in a

rigorous statistical model. After eliminating bad items, item-total correlations and internal consistency improved, as shown in Table 5.4b.

Table 5.4a

Results from Reliability Tests

(Before)

Construct	Number of Items	Alpha	Item-Total Correlation	
			Minimum	Maximum
Role Conflict	8	.83	.31	.73
Role Ambiguity	6	.84	.25	.77
Work Load	4	.82	.58	.67
Underutilization	3	.76	.58	.62
Mental Health Index	15	.91	.46	.72
Job Satisfaction	14	.90	.37	.75
Job Control	20	.87	.27	.65
User Satisfaction	18	.95	.49	.74
User Control	19	.94	.51	.78

Table 5.4b

Results from Reliability Tests

(After)

Construct	Number of Items	Alpha	Item-Total Correlation	
			Minimum	Maximum
Role Conflict	6	.85	.55	.77
Role Ambiguity	5	.87	.61	.77
Work Load	4	.82	.58	.67
Underutilization	3	.76	.58	.62
Mental Health Index	15	.91	.46	.72
Job Satisfaction	10	.90	.49	.75
Job Control	15	.88	.47	.70
User Satisfaction	18	.95	.49	.74
User Control	19	.93	.51	.78

5.4.2 Unidimensionality (Common Factor Analysis)

The purpose of using common factor analysis was to find the pattern of factor loadings and to prove the unidimensionality of each construct. The criteria for selecting bad items will be both communality and factor loadings below 0.30. By definition, the communality of an item is that proportion of its variance that can be accounted for by the first common factor (Gorsuch, 1983). Therefore, the item's uniqueness is defined as that

proportion of the variance excluding the variance attributed to the common factor, that is, measurement error or bias. If all items exhibit reasonably high communality and factor loadings, the scale will be determined to be unidimensional.

The PAF (Principal Axis Factoring) option in the FACTOR program was applied to assess the unidimensionality of each construct, using SPSSx. The results are summarized in Table 5.4c. Both minimum communalities and factor loadings for all constructs are above the criterion of 0.30, and variance accounted for by the first factor ranges from 0.39 to 0.71, which are acceptable indications of unidimensionality.

Table 5.4c

Results from Common Factor Analysis

Construct	Minimum Communality	Minimum Factor Loading	First Factor Eigenvalue	Variance Accounted for
Role Conflict	.32	.56	3.4	0.57
Role Ambiguity	.41	.64	3.3	0.65
Work Load	.41	.65	2.2	0.54
Underutilization	.50	.71	2.1	0.71
MHI	.37	.52	6.9	0.46
Job Satisfaction	.35	.50	5.8	0.42
Job Control	.31	.52	5.9	0.29
User Satisfaction	.45	.54	10.1	0.56
User Control	.31	.51	9.7	0.44

5.4.3 Confirmatory Factor Analysis on User Control

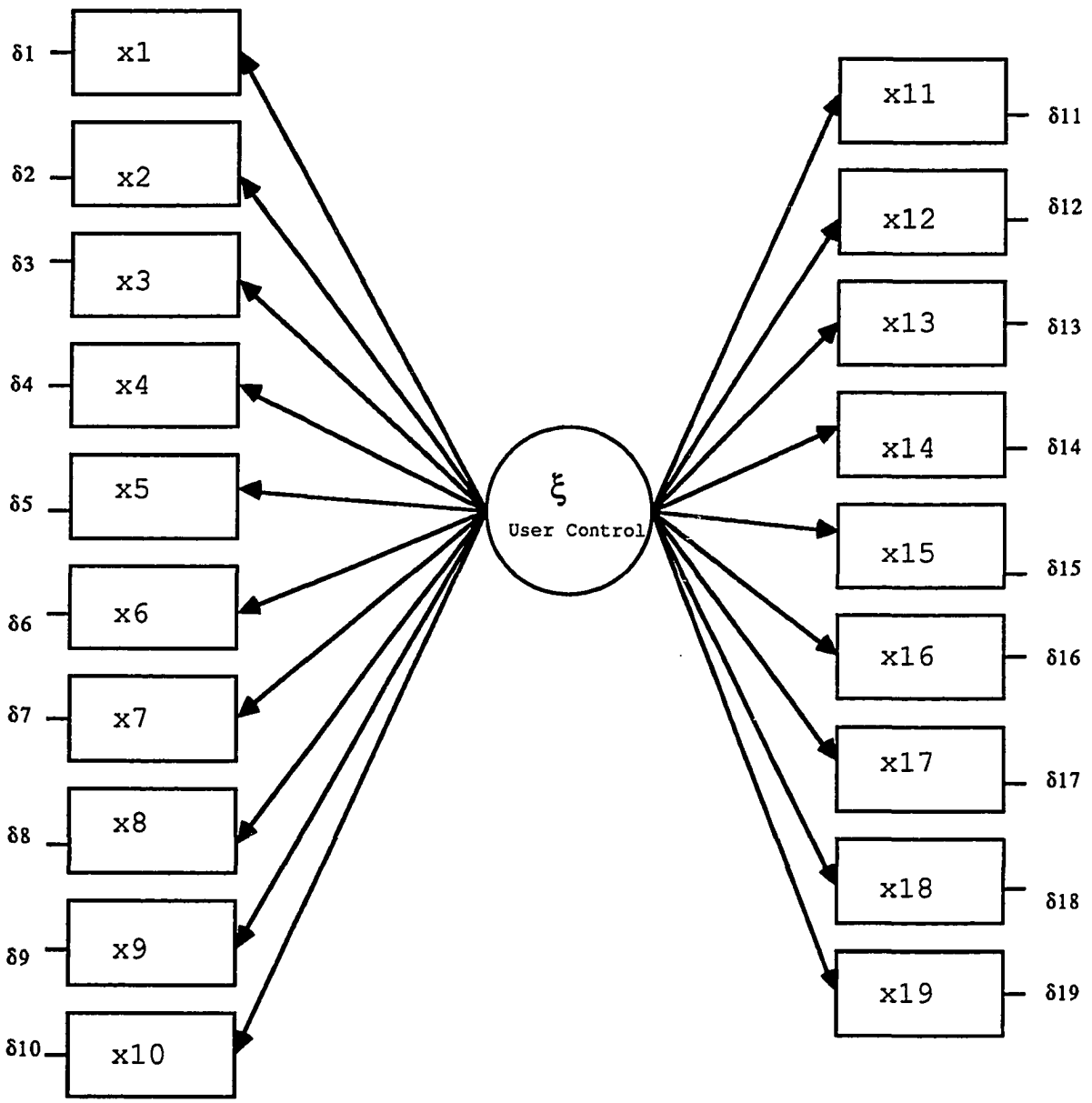
The purpose of a confirmatory factor measurement model is to describe how well the observed indicators serve as a measurement instrument for the construct or latent variable. As illustrated in Chapter 4, the user control construct exhibited good internal consistency (coefficient α=0.93). All nineteen items were entered into the confirmatory factor analysis in.LISREL.

Convergent Validity

Unidimensionality testing through confirmatory factor analysis is a way of achieving convergent validity. The most common type of measurement model for this purpose is the congeneric measurement model (Jöreskog & Sörbom, 1988). As shown in Figure 5.1, user control (XI) is represented by nineteen indicators (X_1 through X_{19}). The measurement errors in X_i are denoted by δ_i. The arrows do not represent direct causal influences in the usual sense, rather in the sense that if the latent variable were observed it would produce values of the corresponding observed variable Xi. The coefficients (LAMBDA 1 through LAMBDA 19) associated with the arrows emanating from XI represent regression coefficients in the relationships between each of the observed measures and the construct. It is assumed that the δ's are uncorrelated with XI and that the δ's are mutually uncorrelated among themselves and have zero means.

Figure 5.1

Congeneric Measurement Model



The covariance matrix for the nineteen indicators (Appendix 6) was entered as input for the LISREL measurement model. The valid sample for this procedure is 177. The Chi-square statistic (X^2 with 152 degrees of freedom = 171.93 (p=.128)) indicates that the hypothesized model fits the data very well and that the null model is significantly different from zero[5].

Discriminant Validity

A scale is invalidated if the variable is too highly correlated with some other construct purporting to measure a different thing (Campbell & Fiske, 1959). Although the multitrait-multimethod matrix model developed by Campbell and Fiske provides insights as to construct validity, a more intuitive and stringent test can be achieved in the measurement model in LISREL. The procedure of testing discriminant validity in LISREL involves two competing constructs which are very similar but purport to measure different concepts. In the present model, user control is very similar to job control, but their item sample domains are completely different; therefore, they must be distinct from each other (Hypothesis 1). Technically, the

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5. Note that smaller Chi-square values indicate better fitting models, and that an insignificant Chi-square is desirable, since it says the model's predicted matrix (Σ) is sufficiently close to the observed data matrix (S) for the remaining differences to be mere sampling fluctuations.

standardized parameter estimate (PHI_{ij}) linking the user control construct and the job control construct must be significantly less than one (Burnkrant & Page, 1982; Anderson & Gerbing, 1988). The X^2 value of the hypothesized measurement model is compared to that of the restricted model, where the structural parameter between the two constructs is set to 1. The significantly different X^2 with corresponding degrees of freedom indicate the discriminant validity[6]. The test result revealed that user control is a different concept from job control, supporting Hypothesis 1.

5.5 TESTS OF STRUCTURAL MODELS

Two structural equation models were tested using LISREL. The first model, henceforth called the moderating model, tested the moderating effect of user control and job control on the traditional stress model in an end user computing environment; the second model, called the mediating model, attempted to include user control and job control in the stress model as sources of job stress, user

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6. The difference between the two X^2's is also distributed as a X^2 with degrees of freedom equal to the difference between the degrees of freedom for the two models (Hayduk, 1987, p. 164).

	Chi-square	Degrees of freedom
Unrestricted model	1123.51	527
Restricted model	1677.63	528

X^2 = (1677.63-1123.51)/(528-527)=554.12 (P< 0.01)

satisfaction, and job satisfaction. The correlation matrix of QWL constructs is attached as Appendix 7.

5.5.1 Moderating Model

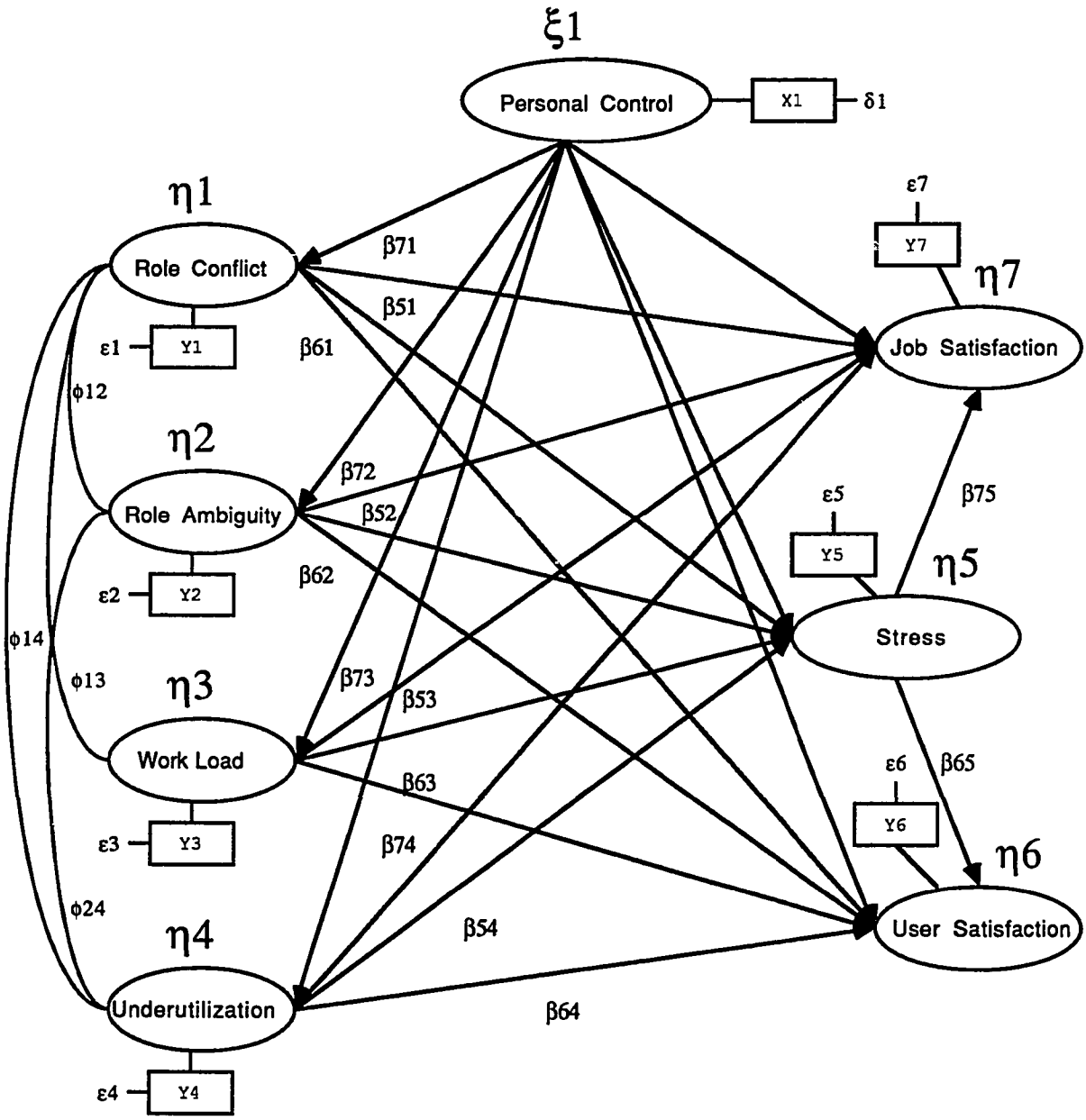
In the moderating model, the four stressors are exogenous variables. Job stress, user satisfaction, and job satisfaction are endogenous variables, which are hypothesized to be affected by the four stressors as shown in Figure 5.5a. The causal structure among stressors and the three QWL constructs was hypothesized to be moderated by the level of user control and job control in an end user computing environment.

Structural fit for the moderating models was tested through the LISREL procedure. The chi-square with 18 degrees of freedom was 7.12 (p=.086) for user control and 9.46 (p=.024) for job control. The results revealed that user control moderates the structural relationships between stressors and stress outcomes in end user computing environments, supporting Hypothesis 2a. However, the moderating effect of job control is not significant at the .05 level, thereby not supporting Hypothesis 2b.

Comparison of model structure between sub-groups which have different levels of user control was made to investigate the pattern of the moderating effect. The sample was divided into two extreme groups according to the

Figure 5.5a

Structural Equation Model I
(Moderating Model)



score of user control, while eliminating the middle group[7]. Simple correlation matrices (Appendix 8) for each group were entered as stacked model input in the LISREL program. The X^2 with 30 degrees of freedom was 59.01 ($p=.001$), indicating that the two groups are significantly different from each other. The parameter estimates shown in Table 5.5a experience both positive and negative changes, of widely varying magnitudes, when moving from the low user control group to the high control group. This indicates that the moderating effect of user control is complex. Positive relationships were found even between stressors and job satisfaction in the low control group.

5.5.2 Mediating Model

In the above moderating model, user control and job control were neither sources of distress nor causes of satisfaction. They were hypothesized to merely moderate the relationship between stressors and psychological stress outcomes. In other words, they were not included in the QWL model. However, as Frese (1987) stated, personal control

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7. As long as the number of cases minus the degrees of freedom exceeds 50, the structural equation model analysis holds its validity (Bearden et al., 1982). For the present model, minimum sample size for each group must be greater than the sum of degrees of freedom plus 50. The degrees of freedom for the stacked model is 30, so a sample of 80 is required for each group. Out of the 177 total sample size, the middle 17 respondents were eliminated.

may have direct influence on the stressors and indirect effect on stress-outcomes.

Table 5.5a

Parameter Estimates
(Comparison between Low & High User Control)

Parameter	Low User Control Parameter Estimates	Std Err	T Values	High User Control Parameter Estimates	Std Err	T Values
ß 51	-.077	.193	-.398	-.165	.176	-.935
ß 52	.246	.198	1.239	.172	.190	.908
ß 53	.070	.129	.544	.347	.155	2.237
ß 54	.234	.137	1.704	.194	.174	1.114
ß 61	.004	.134	.032	-.244	.154	-1.586
ß 62	-.762	.140	-5.447	-.201	.166	-1.215
ß 63	-.009	.089	-.107	-.058	.141	-.414
ß 64	-.112	.097	-1.157	-.266	.152	-1.750
ß 71	-.320	.164	-1.956	-.011	.173	-.066
ß 72	-.332	.170	-1.955	-.323	.186	-1.735
ß 73	.301	.110	2.741	-.075	.158	-.476
ß 74	.162	.119	1.359	-.158	.171	-.923
ß 65	-.085	.093	-.919	-.163	.117	-1.390
ß 75	.279	.115	2.431	.019	.131	.145
PSI 12	.586	.151	3.882	.383	.132	2.920
PSI 13	.108	.106	1.015	.475	.140	3.390
PSI 14	.123	.131	.942	.340	.129	2.630
PSI 24	.276	.136	2.026	.580	.152	3.821
X^2	1.52			4.72		
d.f.	3			3		
Probability	.677			.194		

The mediating model assumes that users' perceptions of personal control influence their feeling of the existence of stressors in their working environment; consequently, their psychological status obtained from their working environment is a result of personal control rather than stressors, as depicted in Figure 5.5b.

Theoretically speaking, the degree of personal control is determined by extra-model variables (e.g., organizational culture, supervising policy, or user involvement). This personal control influences users' perception of stressors positively or negatively. Certain levels of user control over computing activities and job control over normal work procedures may impose role conflict and role ambiguity on end users. It is also possible that end users with high levels of personal control perceive less than the actual work load. End users would thus feel less discomfort resulting from underutilization of intelligent skills if they have a sufficient level of user control or job control.

The correlation matrix (Appendix 8) for QWL constructs was entered as input into the LISREL structural model procedure. The summary statistics are shown in Table 5.5b. The X^2 value of the structural model was 11.14 with 5 degrees of freedom. The significance level was 0.049 and GFI (Goodness of Fit Index) was 0.987, which indicates that the hypothesized model moderately fit the data.

Figure 5.5b

Structural Equation Model II
(Mediating Model)

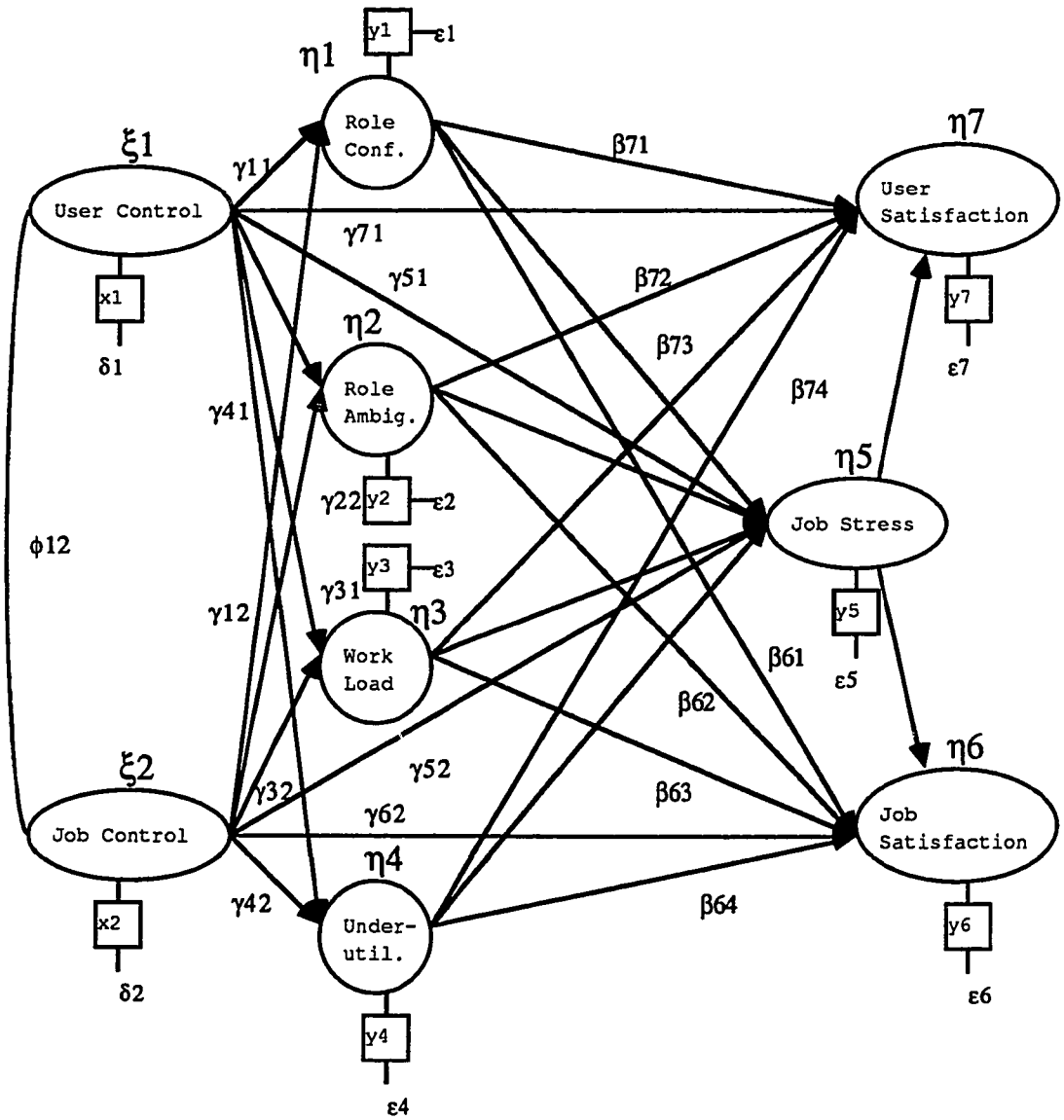

Table 5.5b

Parameter Estimates
(Mediating Model)

Parameter		Hypothesis	Parameter Estimates	Standard Errors	T Values
Γ	11	H3a	.272	.082	3.306
Γ	21	H3a	.124	.078	1.586
Γ	31	H3a	.117	.084	1.396
Γ	41	H3a	-.024	.073	-.324
Γ	51	H3c*	-.174	.079	-2.202
Γ	71	H4b*	.348	.074	4.735
Γ	12	H3b*	-.200	.080	-2.486
Γ	22	H3b*	-.412	.077	-5.381
Γ	32	H3b	-.094	.082	-1.137
Γ	42	H3b*	-.513	.071	-7.212
Γ	52	H3d*	-.191	.090	-2.124
Γ	62	H4a*	.299	.063	4.710
β	51		-.057	.107	-.534
β	52		.255	.110	2.329
β	53		.138	.076	1.811
β	54		.042	.087	.480
β	61		-.207	.076	-2.728
β	62		-.451	.081	-5.564
β	63		-.031	.055	-.555
β	64		-.087	.063	-1.378
β	71		-.264	.101	-2.610
β	72		-.325	.104	-3.315
β	73		.111	.073	1.517
β	74		.036	.077	.474
β	65	H4d	-.020	.055	-.356
β	75	H4c	.098	.073	1.338
ø	12		-	.080	4.480
PSI	12		.466	.074	6.287
PSI	13		.263	.065	4.038
PSI	14		.134	.061	2.180
PSI	24		.187	.062	3.038

X^2	11.14	GFI	0.986
d.f.	5	Adjusted GFI	0.877
Probability	.049	RMSR	0.031

* indicates that the hypothesis was supported
GFI: Goodness of Fit Index
RMSR: Root Mean Square Residuals

Hypotheses Testing

The t-values in LISREL provide the number of sampling distribution standard deviations that the estimate is away from zero and hence can be used to test the null hypothesis that the true parameter value is zero; if the t-value is greater than 2, the estimate is regarded as significant (Hayduk, 1987, p.173). The test results for Hypotheses 3a through 3d and Hypotheses 4a and 4b are summarized in Table 5.5b.

User control significantly affects role conflict and moderately affects role ambiguity and work load, but does not affect underutilization. The causal directions do not coincide with Hypothesis 3a, and therefore Hypothesis 3a is not supported.

Job control has a strong negative influence on role conflict, role ambiguity, and underutilization, and a moderate negative effect on work load. Hypothesis 3b is therefore supported.

Job stress is strongly affected by both user control and job control, supporting Hypotheses 3c and 3d. Their causal directions are all negative.

User control has a significant positive effect on user satisfaction, while job control has the same effect on job satisfaction. Consequently, both Hypotheses 4a and 4b hold true.

Trimmed Model

To clarify the picture of the structural linkage among QWL factors, a trimmed model was developed. The criterion for cutting paths was whether the t-value was less than 2. The trimmed model was entered into LISREL, and the X^2 with 10 degrees of freedom was 9.89 (p=0.45). By trimming insignificant paths, we obtained 6 degrees of freedom, while the p-value increased dramatically. The final model better fits the data and is shown in Figure 5.5c. In the trimmed model, underutilization and work load are not important factors. The interpretation of the model will be provided in Chapter 6.

Total Effects and Indirect Effects

The total effect can be decomposed into direct effect and indirect effect. As shown in Table 5.5c, user control had a weak negative indirect effect on both user satisfaction and job satisfaction. As a result, the total effect of user control on job satisfaction was negative (-0.038) and on user satisfaction was mitigated. Job control had a little negative indirect effect on job stress and a strong positive indirect effect (0.142) on user satisfaction. The resulting total effect of job control on job stress, user satisfaction, and job satisfaction became larger.

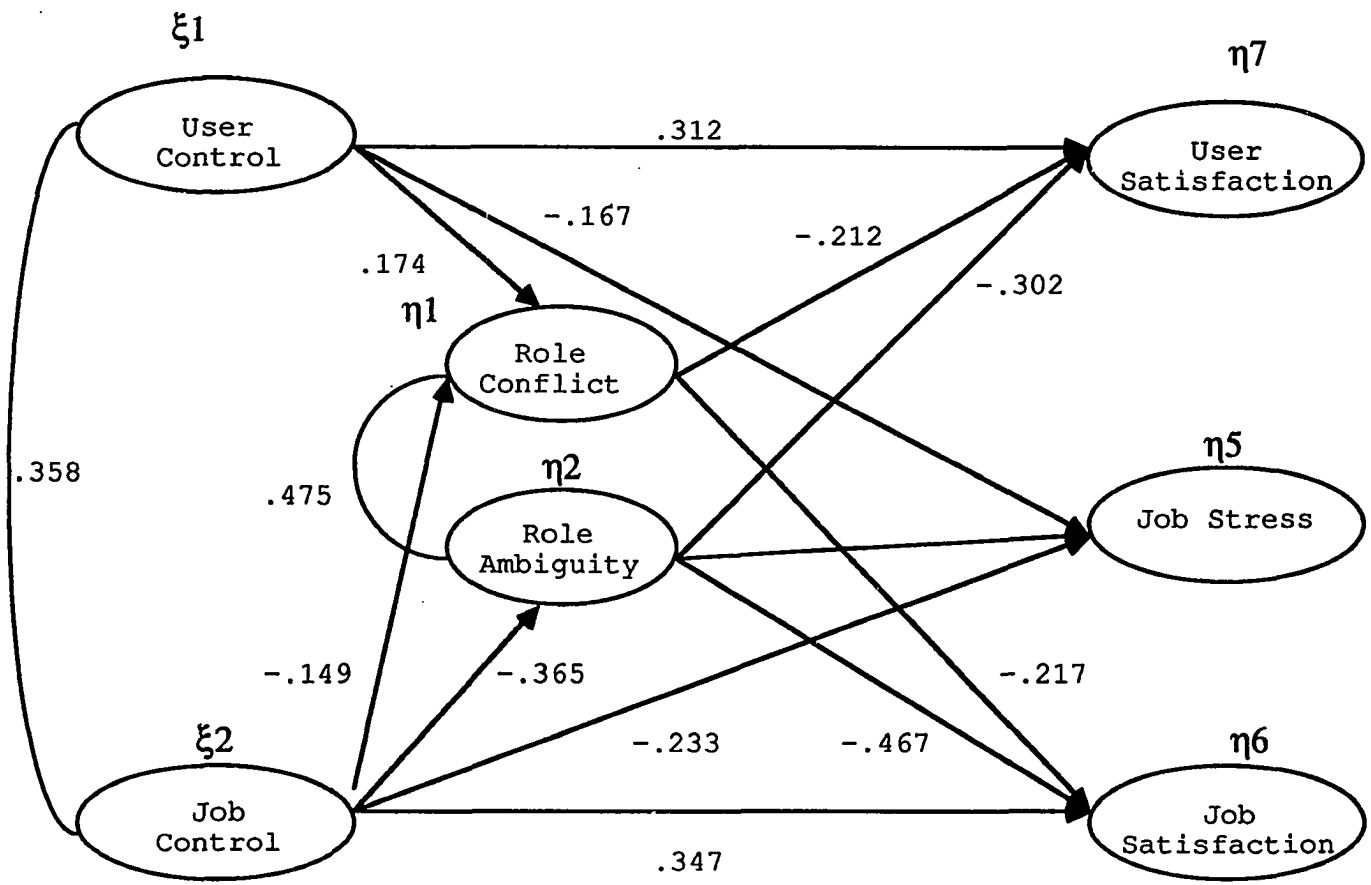

Figure 5.5c

Trimmed Model

Table 5.5c

Total Effects and Indirect Effects
(Trimmed Model)

Parameters	Direct Effect	Indirect Effect	Total Effect
Γ 11	.174		.174
Γ 51	-.167		-.167
Γ 61		-.038	-.038
Γ 71	.312	-.037	.275
Γ 12	-.149		-.149
Γ 22	-.365		-.365
Γ 42	-.523		-.523
Γ 52	-.233	-.081	-.314
Γ 62	.347	.203	.549
Γ 72		.142	.142
β 61	-.217		-.217
β 71	-.212		-.212
β 52	.222		.222
β 62	-.467		-.467
β 72	-.302		-.302

5.5.3 Moderating Effects

The purpose of moderating effects tests is to find dispositional variables which moderate the structural relationships among QWL variables. The variables tested in this case are sex, age, Type A personality, and computing knowledge.

If the level of measurement is categorical, such as sex, the sample can be divided into two groups without losing any of the sample during the split. However, if the variable is continuous, the sample group will be artificially classified into two extreme subgroups. Subjects in the middle of the range may be deemed

unclassifiable, and must be dropped. This may result in decreasing the sample size for both subgroups. However, as a rule of thumb, as long as the number of cases minus the degrees of freedom exceeds 50, the structural equation model analysis holds its validity (Bearden et al., 1982). Correlation matrices of divided samples are attached as Appendix 9.

The test results are summarized in Table 5.5d. The upper three rows present goodness of fit index statistics for the untrimmed model, and the lower part presents statistics for the structural difference with the trimmed model. With the untrimmed model, only age significantly moderates the model (at $p<.01$). However, with the trimmed model, age, computing knowledge and Type A personality moderate the structural relationships among QWL variables.

Table 5.5d

Summary Results of Moderating Effect Test

		Gender	Age	Type A	Computing Knowledge
Un-	X^2	44.70	75.33	69.12	59.30
trimmed	d.f.	47	47	47	47
Model	P.	.568	.005	.019	.107
Trimmed	X^2	47.48	5538.25	5474.25	5530.18
Model	d.f.	47	47	47	47
	P.	.688	.000	.000	.000

Tables 5.5e through 5.5h present t-test results for comparing subgroups dichotomized by four moderating variables. Male end users have more role conflict but less work load than their female counter parts. Male respondents perceive more job control and user control, and report less stress than females. There is no significant difference in the level of user satisfaction and job satisfaction between men and women. Older people seem to perceive more role conflict than young end users. Older end users perceive significantly higher job control than young people, but there is no corresponding user control given to these older end user programmers. Type A patterned respondents perceive a heavier work load, but believe that they have a higher level of job control than do Type B people. Computer literates feel both a heavy work load and high role conflict, but their user control is higher than end users with low computing knowledge, resulting in a similar level of job satisfaction.

Table 5.5e

Results from t-test: Gender

	Female		Male			
Constructs	MEAN	STD	MEAN	STD	t	P
Role Conflict	3.22	1.20	4.01	1.29	-3.99	.000**
Role Ambiguity	2.01	1.32	2.26	1.27	1.27	.118
Work Load	3.84	.71	3.59	.76	2.14	.034*
Underutilization	3.72	.94	3.68	.95	.26	.792
MHI	2.50	.59	2.26	.55	2.59	.011*
Job Control	2.83	.50	3.02	.56	-2.33	.022*
User Control	1.90	.74	2.61	.80	-5.88	.000**
Job Satisfaction	4.96	1.01	4.94	1.10	.12	.908
User Satisfaction	3.71	.62	3.63	.85	.59	.556

significance level: *:.05 **:.01

Table 5.5f

Results from t-test: Age

	Young		Old			
Constructs	MEAN	STD	MEAN	STD	t	P
Role Conflict	3.42	1.25	3.88	1.38	-2.07	.041*
Role Ambiguity	2.03	1.17	2.13	1.24	-.49	.626
Work Load	3.57	.81	3.77	.71	-1.59	.115
Underutilization	3.72	1.03	3.66	.90	.36	.721
MHI	2.36	.62	2.35	.59	.02	.986
Job Control	2.88	.54	3.08	.56	-2.05	.042*
User Control	2.27	.85	2.44	.86	-1.13	.262
Job Satisfaction	5.04	1.00	4.92	1.16	.64	.526
User Satisfaction	3.75	.75	3.62	.82	.96	.338

significance level: *:.05 **:.01

Table 5.5g

Results from t-test: Personality Type

	Type B		Type A			
Constructs	MEAN	STD	MEAN	STD	t	P
Role Conflict	3.55	1.37	3.95	1.31	-1.62	.108
Role Ambiguity	2.16	1.29	2.09	1.24	.28	.777
Work Load	3.43	.78	3.87	.74	-3.10	.002**
Underutilization	3.83	.94	3.61	1.04	1.22	.223
MHI	2.27	.50	2.35	.64	-.70	.486
Job Control	2.87	.51	3.09	.59	-2.16	.033*
User Control	2.39	.88	2.45	.88	-.33	.744
Job Satisfaction	4.95	1.05	5.00	1.04	-.22	.825
User Satisfaction	3.63	.84	3.67	.76	-.24	.813

significance level: *:.05 **:.01

Table 5.5h

Results from t-test: Computing Knowledge

	Low comp. knowledge		High comp. knowledge			
Constructs	MEAN	STD	MEAN	STD	t	P
Role Conflict	3.62	1.24	4.14	1.36	-2.13	.035*
Role Ambiguity	2.14	1.30	2.38	1.44	-.92	.362
Work Load	3.55	.84	3.85	.72	-2.00	.048*
Underutilization	3.71	.97	3.66	.94	.30	.764
MHI	2.39	.62	2.36	.63	.28	.778
Job Control	2.86	.50	2.94	.52	-.91	.367
User Control	2.18	.78	2.68	.78	-3.40	.001**
Job Satisfaction	4.96	1.07	4.77	1.20	.93	.356
User Satisfaction	3.60	.80	3.62	.85	-.09	.926

significance level: *:.05 **:.01

CHAPTER 6

CONCLUSIONS

This chapter presents the study results and interpretations. Several research implications for further studies concerning the causal relationships among QWL factors are also provided. Finally, managerial implications and the limitations of the present study are included.

6.1 MAJOR FINDINGS AND CONTRIBUTION TO MIS RESEARCH

Unique Working Conditions of End User Computing

According to the sociotechnical theory and empirical studies concerning computer users' quality of work life, end users must perceive a higher level of stress than do normal office workers. An information system user in end user computing is playing a dual role, as a technician and as a decision maker. In the present study, end users were found to perceive a high level of role conflict and role ambiguity, and the majority of their supervisors believed that end user programmers' work load is always heavier than that of nonprogramming end users. It is natural to speculate that workers in this work environment should experience a high level of job stress and low level of job satisfaction or user satisfaction. However, end users in

our sample do not believe that they are working too much, and they do not perceive a high level of job stress. Neither job satisfaction level nor user satisfaction level was lower than those of other computing workers. These results are inconsistent with the previous stress studies (Baroudi, 1984; Goldstein & Rockart, 1984).

The question of such inconsistency may be answered by observing organizational culture in the host companies: they allow end users to actively participate throughout all stages of EUC implementation; the degree of top management support is relatively high; and the social relationship between end users and technical assistants is very favorable in those organizations. It is critical to find a construct which can manifest those environmental conditions. Averill(1973) argued that personal control moderates the causal linkage between stressors and stress-outcomes. In addition to the moderating effect of personal control, Frese (1987) suggested the possibility of user control as a source of distress.

User Control as an Independent Construct

Workers in an end user computing environment can have two types of personal control: job control and user control. End users were hypothesized to be able to conceptually distinguish control of computing activities from control of general job procedures.

The present study has proven that user control is an independent construct from job control, by testing convergent validity and discriminant validity via the LISREL measurement model. The construct validity of user control shed light on explaining user behaviors in an end user computing environment. User control could be a critical success factor as an antecedent of user satisfaction in EUC implementation.

User Control as a Moderator

A lack of control is almost invariably associated with feelings of distress, whereas being in control may prevent a person from experiencing distress. Thus, personal control may act as a buffer which serves to modulate the intensity of the stress reaction and may also decrease the risk of individuals developing discomfort.

Using two personal control constructs, user control and job control, a traditional stress model was tested to examine their moderating effects. The present study showed a strong moderating effect of user control on the structural linkage between stressors and their outcomes, but job control exhibited only a weak moderating effect on the stress model. Unlike in a normal work environment, user control may have more influence on the causal structure among QWL factors than does job control. This implies that

the traditional behavioral models are not well suited for application in a new working environment.

User Control as a Source of Distress

Control of the work process is a significant factor in the development of job stress. This has been demonstrated by several researchers (Karasek, 1979; Cooper and Marshall, 1984; Smith, 1981 & 1984) and appears to be one of the primary stressors imposed by computerized technology.

In the above moderating model, the size of the coefficients between controls and stress and stress-outcomes were of no interest; we were interested in only structural differences between groups artificially divided by the level of control. In other words, we could not find a specific causal linkage between personal control constructs and existing stress model variables, such as job stress and job satisfaction.

The present study found that the mediating model which incorporated personal control constructs fits the empirical data very well. Both user control and job control affect job stress, user satisfaction, and job satisfaction in various ways. User control has a negative impact on job stress and a positive influence on user satisfaction. User control tends to increase role conflict, an intervening variable, but role conflict does not significantly affect job stress. On the other hand, job control indirectly

influences job stress, user satisfaction, and job satisfaction via all four mediating variables (role conflict, role ambiguity, and underutilization of intelligent skills). It also has a direct negative impact on job stress and a positive effect on job satisfaction. Job control has no direct impact on user satisfaction, but does exhibit an indirect impact.

Moderators

User control and job control may interact with dispositional attributes such as decision making style or demographic factors such as gender, age, or level of computing knowledge. The present study revealed that Type A behavior pattern, age, and computing knowledge moderate the relationships among quality of work life factors.

Older workers have more job control and feel less job stress. They have less user control and lower job satisfaction and user satisfaction than younger end users. It is possible that as workers grow older, they may occupy higher positions in their organizations in order to achiever greater job control. However, it is obvious that job control alone, if not accompanied by user control, does not increase user satisfaction or job satisfaction in an end user computing environment.

Type A end users believe that they are working more than other user groups, but that they are utilizing their

full capacity in a challenging working environment; consequently, they feel higher job satisfaction and user satisfaction than B-typed end users.

End users with more computing knowledge are given more user control and job control. Too much control given to these sophisticated end users may cause high role conflict and feelings of overburden, lowering job satisfaction. End users having high technical competence would not feel job stress if their role is clarified.

6.2 OTHER FINDINGS

User Control and User Involvement

As Ganster et al. (1989) argued, personal control is essentially a psychological phenomenon that has both environmental and dispositional antecedents. Personal control itself is not an intra-personal attribute; rather, it is an inter-personal belief which is affected by one's environment. Manipulating user control in implementing end user computing is a topic of interest. In the process of interviews with information center managers, a structured questionnaire (Appendix 1) was used to measure system managers' user involvement policy. A comparison of user control score with user involvement policy was made for the seventeen host companies. A correlation of 0.34 ($p=0.01$) was obtained between system managers' user involvement

policy and the degree of user control. This implies that user control can be increased by allowing end users more participation in the system development procedure. Finding other ways of manipulating user control in end user computing constitutes a promising research avenue for the future.

User Support and Training

As revealed in Chapter 5, more than two thirds of respondents have received technical assistance from colleagues or manuals. There could be multiple reasons for this phenomenon. End users may prefer informal to formal assistance, or perhaps the information center is not functioning as it should be. From a sociotechnical perspective, this could be viewed as indicating that the self-regulatory mechanism is working very well, because all host companies are successfully implementing end user computing. However, in the long run, an appropriate level of organizational control will be necessary to prevent data incompatibility and redundant data holding problems. Even though self-paced learning and good social relationships among colleagues should be strongly advocated, there must be a unitary window for supporting end users in resolving technical problems or developing intelligent skills necessary for the successful EUC.

6.3 LIMITATIONS AND IMPLICATIONS FOR THE FUTURE STUDY

Range limit

In order to control for unwanted factors including industry type, organization size, region, and sales amount, only large service organizations located in Midwestern urban areas were included in the sample. This selective sampling procedure limits external validity or generalizability of the study. The same research variables should be tested in other types of industry and the research area should be geographically broadened. Of course, it is in order to test the moderating effect of those factors in the future study.

Comparison with Other User Groups

A rough comparison with other user groups was made to find end users' characteristics in the sample. Because the sample size was too small in non-end-user groups, rigorous statistical difference tests could not be performed. Future studies should gather more data on these groups and compare them to find end users' characteristics distinct from other computer users. Clarifying the target group will enhance interpretability of such behavioral studies in end user computing.

External Reliability of the User Control Construct

Internal validity of the user control construct has been tested rigorously through a reliability test and a stringent validity test. However, cross-sectional data would refine external validity of the measure. Again, geographical dispersion of research sites and various industry types would be a prerequisite for this purpose.

Longitudinal Design

The present study assumed that temporal orders of causal linkages follow exactly what theories depict. If possible, however, a longitudinal research design would be preferable for this type of causal analysis. A field experiment should be designed to manipulate EUC management style to see how users' feelings of personal control change, then correlate this with stress-outcome variables. Such a field experiment may have a range limit problem, but it will dramatically increase internal validity of the study. Accumulation of such statistically powerful studies will contribute to developing a theory in the field of management information systems.

6.4 MANAGERIAL IMPLICATIONS

Stress is inherent in every work environment where human beings are mentally operating. Identification of the

sources of stress may give managers opportunities to remove, or at least minimize, the stressors. Complete removal of stressors is almost never possible. For some people, an appropriate level of stress is even desirable for satisfying their growth needs in a challenging work environment. What is important is how to manage this stressful work environment.

As Trist (1981) argued in his exposition of sociotechnical system theory, in order to achieve high performance, technology and work organization need to complement each other. According to the social information processing model (Salancik & Pfeffer, 1978), individuals, as adaptive organisms, adapt attitudes, behavior, and beliefs to their social context and to the reality of their own past and present behavior and situation. The present study supported these theoretical frameworks. System managers' EUC implementation policy and organizational culture influence end users' feelings of personal control; in turn, users' perceptions of personal control will mitigate job stress, resulting in increased job satisfaction and user satisfaction. These factors are all critical components of high quality of work life.

The requirement of using intellectual skill or making decisions represents an opportunity to exercise judgement. This enhances the individual's feelings of efficacy and ability to cope with the environment; it can be a stress

manager rather than a cause of stress. This indicates that it may be possible to improve job-related mental health without sacrificing productivity. Changes in administrative structure would have to be made which improve end users' ability to make significant decisions about their task and computing resource management, increase their influence on organizational decisions, and allow them discretion over the use of existing and potential skills. It is also possible to increase user control by allowing greater decision making on how work gets done, and allowing alternative work procedures if they can be carried-out efficiently while not disrupting other users. Performance feedback can be used to enhance the user's control by feeding the information directly back to the user to let him/her know how he/she is doing.

It is very important for the successful implementation of end user computing and subsequent enhancement of quality of work life and performance that organizations have a transition policy that allows more worker participation in all stages of the information system development process as well as giving more decision latitude in system operation and maintenance. End users should be supported in terms of technical assistance, sufficient computing resources, and development of intelligent skills and knowledge. Those favorable working conditions should be built upon an

appropriate level of job control, which has a strong negating effect on role stresses.

The results of the present study provide many managerial implications to information system managers and policy makers in end user computing. Control constructs are no longer to be considered as mere users' dispositional characteristics; they have now become managerial variables which system managers can manipulate by changing the degree that end users influence the system development and implementation process.

Furthermore, it was found that job control in combination with user control helps ameliorate stressors in end user computing. Both user control and job control have a significant direct effect on job stress in a negative way. However, user control does not significantly mitigate stressors; rather, it increases role conflict. This role conflict is diminished by increasing job control, resulting in low job stress. This combinatorial effect results in high user satisfaction and job satisfaction.

In short, the dynamic interaction between user control and job control implies that an appropriate level of user control should be accompanied by sufficient job control to enhance end users' quality of work life in end user computing.

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APPENDIX 1

INTERVIEW QUESTIONS

INTERVIEW QUESTIONNAIRE

Date:_____ 1990
Time:__:__

Company Name: _____

Address:_____

Interviewee Name: _____

Job Title: _____

Phone No: _____

Computer Experience: ____ Year(s) ____ Months

Work Experience: ____ Year(s) ____ Months

Computer Education & Training: ____ Year(s) ____ Months

* This information is confidential

1. How long is the history of the following?

   1) Your organization _____ Year(s) ____ Months
   2) DP/MIS Department _____ Year(s) ____ Months
   3) End-User Computing _____ Year(s) ____ Months

2. Give the number of employees in each category.

   ____ Total Employees ____ Computer Users

   ____ DP Programmers ____ End User Programmers

3. Overall, how successful is EUC in your organization?

   1) Very successful
   2) Successful
   3) A moderate amount
   4) Unsuccessful
   5) Very unsuccessful

4. What is the most critical problem in implementing EUC?

5. What is the advantage of EUC?

6. Does your organization have a formal information center to support EUC?

   Yes ___ No ___

   If yes, what activities are they doing?

   How long has it been? _____ Year(s)

   Information Center Staffs are:

	When IC started	Today
1) from DP/MIS	____ %	____%
2) Functional department personnel	____ %	____%

7. Do you believe top management supports EUC?

1) Very supportive
2) Supportive
3) Moderate
4) Unsupportive
5) Resistant

8. How do EUC computers in your organization communicate with each other?

	Percentage
1) Stand alone	_____
2) Department-wide LAN	_____
3) Unidirectional transfer	_____
4) Organization-wide LAN	_____
5) Interorganizational network	_____
6) Other _____	_____

9. To what degree do end users participate when an information system is developed for the end user computing application?

	Degree of Involvement				
	Little		Moderate		Heavily
1) New system idea generation	1	2	3	4	5
2) System planning	1	2	3	4	5
3) Information system design					
Information requirement assess	1	2	3	4	5
Language selection	1	2	3	4	5
Data base organization	1	2	3	4	5
Input format design	1	2	3	4	5
Output format design	1	2	3	4	5
Presentation mode	1	2	3	4	5
Accuracy of output	1	2	3	4	5
Completeness of output	1	2	3	4	5
Quantity of output	1	2	3	4	5
4) EUC Software Selection	1	2	3	4	5
5) EUC Hardware Selection	1	2	3	4	5
6) Implementation (EUC Systems)					
Program running priority setting	1	2	3	4	5
Software maintenance	1	2	3	4	5
Modification or correction	1	2	3	4	5
System evaluation	1	2	3	4	5

10. Do you believe that information system development time in the DP department has become shorter since your organization implemented end user computing?

1) Strongly disagree
2) Disagree
3) Moderate amount
4) Agree
5) Strongly agree

11. Do you believe that, had EUC not been, the DP backlog would have increased?

1) Strongly agree
2) Agree
3) Neutral
4) Disagree
5) Strongly disagree

12. The information systems developed by users better meet their needs.

1) Strongly agree
2) Agree
3) Neutral
4) Disagree
5) Strongly disagree

13. How often does your organization have a difficulty due to loss of data?

1) Very often
2) Often
3) Sometimes
4) Seldom
5) Almost never

14. How often does your organization experience difficulty because user developed data files are not compatible with your company's data base?

1) Very often
2) Often
3) Sometimes
4) Seldom
5) Almost never

15. How is the social relationship between end user programmers and the central information systen department?

1) Very good
2) Good
3) Moderate
4) Poor
5) Very poor

16. Do you believe that users' decision making performance has improved since they began to develop their own systems?

    1) Strongly agree
    2) Agree
    3) A moderate amount
    4) Disagree
    5) Strongly disagree

17. How often do user-prepared documentations have problems? Especially, when there is a personnel reshuffle.

    1) Always
    2) Often
    3) Sometimes
    4) Seldom
    5) Almost never

18. Do you think that user privacy is not kept because users share a common data base in EUC?

    1) Strongly agree
    2) Agree
    3) A moderate amount
    4) Disagree
    5) Strongly disagree

19. Do you think end users are keeping too many redundant files, tapes, or diskettes?

    1) Strongly agree
    2) Agree
    3) A moderate amount
    4) Disagree
    5) Strongly disagree

20. Comments, Observations, Recommendations.....

Thank you very much! Do you want me to send you the final results of the study?

Yes ___ No ___

APPENDIX 2

SURVEY QUESTIONNAIRE

END USER COMPUTING AND QUALITY OF WORK LIFE SURVEY

This questionnaire asks you to describe the information system you use and how you perceive your computing work environment. The data you provide will be used as part of a doctoral dissertation at the University of Nebraska-Lincoln.

On the following pages you will find several different kinds of questions about your work environment. Specific instructions are given at the start of each section. Please read them carefully. It should take no more than 30 minutes to complete the entire questionnaire. Please move through it quickly.

The questions are designed to obtain **your** perceptions of **your** work environment and **your** feelings about it.

There are no "trick" questions. Your individual answers will be kept **completely confidential.** I encourage you to answer all questions to the best of your knowledge.

If you have any questions or comments, call or write me at the following address:

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University of Nebraska
Lincoln, NE 68588
(402) 472-6324

Thank you for your cooperation.

Shin C. Kang
Ph.D. Candidate

Biographical Information

1. Age _____ 2. Sex __ Female __ Male

3. Computer Experience ____ Year(s) ____ Months

4. Work Experience ____ Year(s) ____ Months

5. Computer Training & Education ____ Year(s) ____ Months

6. Job Title _____ 7. Dept. _____

8. Which type of end-user would characterize yourself as? (Check one)

___ **Nonprogramming end-user** (data entry, simple query, word processing)

___ **Command level user** (can specify, access, and manipulate information most often utilizing report generators and/or a limited set of commands in languages such as FOCUS, RAMIS II, EXPRESS, SQL, or SAS)

___ **End-user programmer** (develop applications primarily for your own personal information needs, using both command and procedural languages or fourth generation languages)

___ **Functional support specialist** (develop applications for other end-users within a functional area but is not a DP professional)

___ **End-user computing support personnel** (help end users or provide training, formal or informal; Information Center)

___ **DP programmer**

9. If you have any problem in using a computer, where do you get assistance?

	Percentage
1) Colleagues	____
2) Department Information Center	____
3) Information Center	____
4) DP or MIS Department	____
5) Outside Consultant or Vendor	____
6) Yourself (Manual or References)	____
7) Other	____
	100%

10. How is your relationship with the above assistant source?

Dissonant 1-----2-----3-----4-----5 Harmonious

11. Do you believe that your decision-making performance has improved since you began to use the computerized-information system?

1) No improvement at all
2) Almost no change
3) Neutral
4) Slightly improved
5) Definitely improved

12. How often do you lose your personal data?

1) Very often
2) Often
3) Sometimes
4) Seldom
5) Almost never

13. How satisfied are you with the training program provided by your organization?

1) Very little
2) Little
3) Moderate
4) Much
5) Very much

14. How does your computer communicate with other users' computers?

1) Stand alone (not connected)
2) Unidirectional transfer to mini or mainframe
3) Department-wide Local Area Network (LAN)
4) Organization-wide LAN
5) Inter-organizational network
Other. Specify_____

15. If you were to describe the sources of data for the applications you use, approximately what percentage would fall into each of the following categories?

_____ Data extracted from corporate data bases
_____ Data for department data bases
_____ Data for personal data bases
_____ Data from other end user systems
_____ Data from external data bases (e.g., Compuserve)
_____ Other:_____

16. How supportive is top management for end user computing?

1) Prohibitive
2) Unsupportive
3) Users are on their own
4) Supportive
5) Very supportive

Please circle the appropriate number for each question that best describes your *feelings during the past month*

1. How have you been feeling in general?

1 In excellent spirits
2 In very good spirits
3 In good spirits mostly
4 I have been up and down in spirits a lot
5 In low spirits mostly
6 In very low spirits

2. Have you been bothered by nervousness or your "nerves"?

1 Extremely so - to the point that I could not work or take care of things
2 Very much so
3 Quite a bit
4 Some - enough to bother me
5 A little
6 None of the time

3. How often were you bothered by any illness, bodily disorder, or pains?

1 Every day
2 Almost every day
3 About half the time
4 Now and then, but less than half of the time
5 Rarely
6 None of the time

4. How happy, satisfied, or pleased have you been with your personal life?

1 Extremely happy - could not have been more satisfied or pleased
2 Very happy most of the time
3 Generally satisfied - pleased
4 Sometimes fairly satisfied, sometimes fairly unhappy
5 Generally dissatisfied, unhappy
6 Very dissatisfied or unhappy most or all of the time

5. Have you been under or felt you were under any strain, stress, or pressure?

1 Yes - almost more than I could stand or bear
2 Yes - quite a bit of pressure
3 Yes - some, more than usual
4 Yes - some, but about normal
5 Yes - a little
6 Not at all

6. Have you been in firm control of your behavior, thoughts, emotions, or feelings?

1 Yes, definitely so
2 Yes, for the most part
3 Generally so
4 Not too well
5 No, and I am somewhat disturbed
6 No, and I am very disturbed

7. Did you feel depressed?

1 Yes - to the point that I felt like taking my life
2 Yes - to the point that I did not care about anything
3 Yes - very depressed almost every day
4 Yes - quite depressed several times
5 Yes - a little depressed now and then
6 No - never felt depressed at all

8. Have you been anxious, worried, or upset?

1 Extremely so - to the point of being sick or almost sick
2 Very much so
3 Quite a bit
4 Some - enough to bother me
5 A little bit
6 Not at all

9. Did you feel healthy enough to carry out the things you like to do or had to do?

1 Yes - definitely so
2 For the most part
3 Health problems limited me in some important ways
4 I was only healthy enough to take care of myself
5 I needed some help in taking care of myself
6 I needed someone to help me most or all of the time

10. Have you had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, feel, or of your memory?

1 Not at all
2 Only a little
3 Some - but not enough to be concerned or worried about
4 Some, and I have been a little concerned
5 Some, and I am quite concerned
6 Yes, very much so, and I am very concerned

11. Did you feel relaxed, at ease or high-strung, tight, or keyed-up?

1 Felt relaxed and at ease the whole month
2 Felt relaxed and at ease most of the time
3 Generally felt relaxed but at times felt fairly high strung
4 Generally felt high strung but at times felt fairly relaxed
5 Felt high strung, tight or keyed-up most of the time
6 Felt high strung, tight or keyed-up the whole month

12. Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile?

1 Extremely so - to the point that I have just about given up
2 Very much so
3 Quite a bit
4 Some - enough to bother me
5 A little bit
6 Not at all

13. Have you been concerned, worried, or had any fears about your health?

1 Extremely so
2 Very much so
3 Quite a bit
4 Some, but not a lot
5 Practically never
6 Not at all

14. Were you generally tense or did you feel any tension?

1 Yes - extremely tense, most or all of the time
2 Yes - very tense most of the time
3 Not generally tense, but did feel fairly tense several times
4 I felt a little tense a few times
5 My general tension level was quite low
6 I never felt tense or any tension at all

15. Have you felt downhearted and blue?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

16. Has your daily life been full of things that were interesting to you?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

17. Have you been feeling emotionally stable and sure of yourself?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

18. Have you felt cheerful, lighthearted?

1 All of the time
2 Most of the time
3 A good bit of the time
4 Some of the time
5 A little of the time
6 None of the time

Please write a number in the blank for each statement, based on this scale:

1	2	3	4	5
Very Little	Little	Moderate Amount	Much	Very Much

___ 1. How much control do you have over the variety of methods you use in completing your work?

___ 2. How much can you choose among a variety of tasks or projects to do?

___ 3. How much control do you have personally over the quality of your work?

___ 4. How much control do you have personally over how much work you get done?

___ 5. How much control do you have over how fast or slowly you have to work?

___ 6. How much control do you have over the scheduling and duration of your rest breaks?

___ 7. How much control do you have over when you come to work and leave?

___ 8. How much control do you have over when you take vacations or days off?

___ 9. How much are you able to decorate, rearrange, or personalize your work area?

___ 10. How much control do you have over the physical conditions of your work station (lighting, temperature, etc.)?

___ 11. How much control do you have over how you do your work?

___ 12. How much control do you have over your performance goals and objectives?

___ 13. How much control do you have over the activities of other people at work?

___ 14. How much control do you have over the amount and timing of your interaction with other people at work?

___ 15. How much influence do you have over the policies and procedures in your work unit?

___ 16. How much control do you have over the sources of information you need to do your job?

___ 17. How much control do you have over the amount of resources (tools, materials, etc.) you get to do your work?

___ 18. How much control do you have over the number of times you are interrupted while you work?

___ 19. How much control do you have over the amount that you earn at your job?

___ 20. How much control do you have over how your work is evaluated?

___ 21. In general, how much control do you have over work and work-related matters?

Control over computing activity

1	2	3	4	5
Very little	Little	Moderate	Much	Very much

__1. How much control do you have over setting priority of developing information systems?

__2. How much control do you have over setting priority of running programs?

__3. How much control do you have over scheduling maintenance of your information system?

__4. How much control do you have over access to a computer terminal?

__5. How much control do you have over data base organization?

__6. How much control do you have over modification of computer programs?

__7. How independent are you from the DP department?

__8. How much control do you have over the selection of the software that you use?

__9. How much control do you have over the selection of the hardware that you use?

__10. How much control do you have over the input format design?

__11. How much control do you have over the selection of the programming languages which you use?

__12. How much control do you have over determination of information requirements for the system?

__13. How much control do you have over data security?

__14. How much control do you have over reducing information processing time?

__15. How much control do you have over reducing the information processing cost?

__16. To what extent can you fit the function of the information system to the organizational goals?

__17. How much control do you have over self-paced learning or building computer skills?

__18. How much control do you have over the accuracy of the computer output?

__19. How much control do you have over the computer output's relevancy to your task?

__20. How much control do you have over the volume of information system output?

__21. How much control do you have over the completeness of the information system output?

__22. How much can you control the timing of information system output?

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very Inaccurate	Mostly Inaccurate	Slightly Inaccurate	Uncertain	Slightly Accurate	Mostly Accurate	Very Accurate

___ 1. I feel certain about how much authority I have.

___ 2. There are clear, planned goals and objectives for my job.

___ 3. I have to do things that should be done differently.

___ 4. I know that I have divided my time properly.

___ 5. I receive an assignment without the manpower to complete it.

___ 6. I know what my responsibilities are.

___ 7. I have to buck a rule or policy in order to carry out an assignment.

___ 8. I work with two or more groups who operate quite differently.

___ 9. I know exactly what is expected of me.

___10. I receive incompatible requests from two or more people.

___11. I do things that are apt to be accepted by one person and not accepted by others.

___12. I receive an assignment without adequate resources and material to execute it.

___13. Explanation is clear about what has to be done on my job.

___14. I work on unnecessary things.

How often do these things happen in your job?

Rarely	Occasionally	Sometimes	Fairly Often	Very Often
1	2	3	4	5

___ 1. How often does your job require you to work very fast?

___ 2. How often does your job require you to work very hard?

___ 3. How often does your job leave you with little time to get things done?

___ 4. How often is there a great deal to be done?

___ 5. How often does your job let you use the skills and knowledge you learned in school?

___ 6. How often are you given a chance to do the things you do best?

___ 7. How often can you use the skills from your previous experience and training?

This portion of the questionnaire contains items that are related to your feelings regarding the information system you are working with.

Write a number in the space next to the each statement based on the following scale:

1	2	3	4	5
Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree

___ 1. The output information of the system is precise.

___ 2. The information content meets my task need.

___ 3. The system provides reports that are just about what I need.

___ 4. The system provides sufficient information.

___ 5. I find the output relevant to my task.

___ 6. The output information is accurate and correct.

___ 7. I am satisfied with the accuracy of the system.

___ 8. I feel the output is reliable.

___ 9. I find the system dependable.

___ 10. I think the output is presented in a useful format.

___ 11. The information I obtain from the system is unambiguous.

___ 12. I am happy with the layout of the output.

___ 13. The output is easy to understand.

___ 14. The system is user friendly.

___ 15. The system is easy to use.

___ 16. The system is efficient.

___ 17. I get the information I need in time.

___ 18. The system provides up-to-date information.

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

1	2	3	4	5	6	7
Extremely Dissatisfied	Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Satisfied	Extremely Satisfied

__ 1. The amount of job security I have.

__ 2. The amount of pay and fringe benefits I receive.

__ 3. The amount of personal growth and development I get in doing my job.

__ 4. The people I talk to and work with on my job.

__ 5. The degree of respect and fair treatment I receive from my job.

__ 6. The feeling of worthwhile accomplishment I get from my supervisor.

__ 7. The chance to get to know other people while on the job.

__ 8. The amount of support and guidance I receive from my supervisor.

__ 9. The degree to which I am fairly paid for what I contribute to this organization.

__ 10. The amount of independent thought and action I can exercise in my job.

__ 11. How secure things look for me in the future in this organization.

__ 12. The chance to help other people while at work.

__ 13. The amount of challenge in my job.

__ 14. The overall quality of the supervision I receive in my work.

The following statements reflect common characteristics of people that may or may not apply to you. Please indicate whether you feel these statements are true or false as they apply to you personally.

Write a number in the space next to each item based on the following scale:

1	2	3	4	5
Definitely False	Mostly False	Don't Know	Mostly True	Definitely True

__ 1. I am more restless and fidgety than most people.

__ 2. I ordinarily work quickly and energetically.

__ 3. I am rather deliberate in telephone conversation.

__ 4. I am often in a hurry.

__ 5. In conversation I often gesture with hands and head.

__ 6. I rarely drive a car too fast.

__ 7. As a boy or girl I preferred work in which I could move around.

__ 8. I usually speak more softly than most people.

__ 9. People consider me to be rather quiet.

__ 10. My handwriting is rather fast.

__ 11. I often work slowly and leisurely.

__ 12. I prefer to linger over a meal and enjoy it.

__ 13. I like to drive a car rather fast when there is no speed limit.

__ 14. I like work that is slow and deliberate.

__ 15. I talk more slowly than most people.

__ 16. I often let a problem work itself out by waiting.

__ 17. I often try to persuade others to my point of view.

__ 18. I generally walk more slowly than most people.

__ 19. I eat rapidly even when there is plenty of time.

__ 20. I usually work quickly.

APPENDIX 3

HISTOGRAM OF USER CONTROL SCORE

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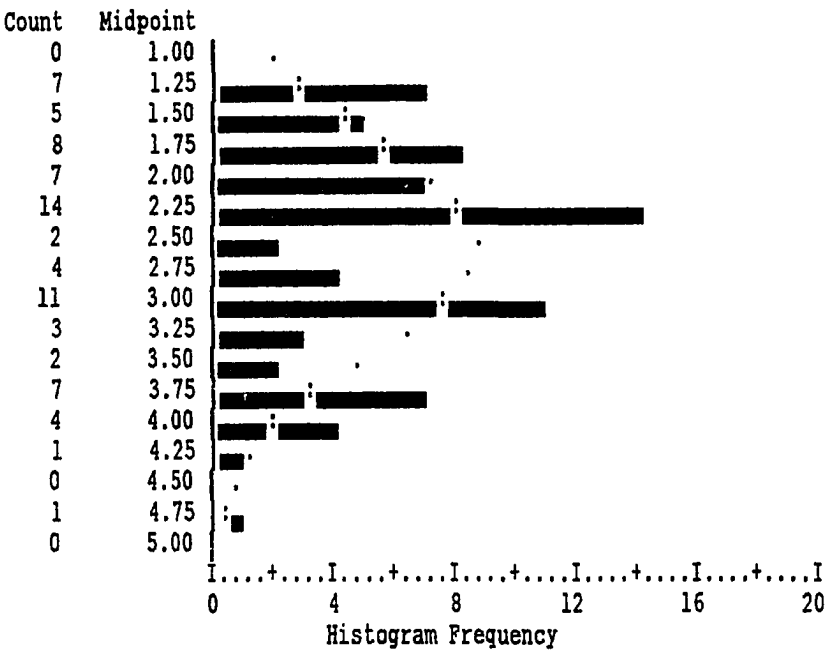
CC



Valid Cases 76 Missing Cases 1

APPENDIX 4

RELIABILITY TEST

(USER CONTROL)

OF CASES = 75.0

ITEM-TOTAL STATISTICS

	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM-TOTAL CORR.	SQUARED MULTIPLE CORR.	ALPHA IF ITEM DELETED
C1	56.65	281.39	.62	.70	.93
C2	56.75	277.16	.70	.59	.93
C3	56.91	279.25	.72	.71	.93
C4	54.84	298.08	.21	.46	.93
C5	56.35	277.26	.65	.56	.93
C6	55.93	276.17	.65	.72	.93
C7	55.81	306.07	.00	.49	.94
C8	56.35	281.77	.56	.73	.93
C9	56.85	287.58	.52	.63	.93
C10	56.08	276.72	.71	.77	.93
C11	56.71	271.02	.77	.78	.92
C12	56.48	272.20	.80	.77	.92
C13	56.59	275.11	.73	.70	.93
C14	56.87	278.93	.74	.80	.93
C15	56.93	278.57	.78	.79	.92
C16	56.39	282.99	.61	.53	.93
C17	55.73	292.44	.35	.31	.93
C18	55.44	285.17	.50	.64	.93
C19	55.51	286.44	.51	.64	.93
C20	56.20	279.13	.63	.80	.93
C21	56.08	279.37	.63	.81	.93
C22	56.44	274.69	.80	.79	.92

RELIABILITY COEFFICIENTS 22 ITEMS

ALPHA = .9308 STANDARDIZED ITEM ALPHA = .9324

APPENDIX 5

FREQUENCY DISTRIBUTION

(EUC ADVANTAGES & DISADVANTAGES)

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X1 EUC SUCCESS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
MODERATE	3	7	41.2	41.2	41.2
SUCCESSFUL	4	7	41.2	41.2	82.4
VERY SUCCESSFUL	5	3	17.6	17.6	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y1 DP TIME REDUCTION

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
STRONGLY DISAGREE	1	2	11.8	11.8	11.8
DISAGREE	2	3	17.6	17.6	29.4
NEUTRAL	3	7	41.2	41.2	70.6
AGREE	4	4	23.5	23.5	94.1
STRONGLY AGREE	5	1	5.9	5.9	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y2 DP BACKLOG REDUCTION

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
DISAGREE	2	4	23.5	23.5	23.5
NEUTRAL	3	3	17.6	17.6	41.2
AGREE	4	7	41.2	41.2	82.4
STRONGLY AGREE	5	3	17.6	17.6	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y3 MEET USER NEEDS

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NEUTRAL	3	4	23.5	23.5	23.5
AGREE	4	8	47.1	47.1	70.6
STRONGLY AGREE	5	5	29.4	29.4	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y7 DM PERFORMANCE

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
NEUTRAL	3	3	17.6	17.6	17.6
AGREE	4	13	76.5	76.5	94.1
STRONGLY AGREE	5	1	5.9	5.9	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y4 DATA LOSS FREQUENCY

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SOMETIMES	3	3	17.6	17.6	17.6
SELDOM	4	4	23.5	23.5	41.2
ALMOST NEVER	5	10	58.8	58.8	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y5 DATA COMPATIBILITY PROBLEM

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
OFTEN	2	2	11.8	11.8	11.8
SOMETIMES	3	8	47.1	47.1	58.8
SELDOM	4	4	23.5	23.5	82.4
ALMOST NEVER	5	3	17.6	17.6	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y8 DOCUMENTATION PROBLEM

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
OFTEN	2	5	29.4	29.4	29.4
SOMETIMES	3	11	64.7	64.7	94.1
SELDOM	4	1	5.9	5.9	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y9 USER PRIVACY PROBLEM

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
SOMETIMES	3	4	23.5	23.5	23.5
SELDOM	4	11	64.7	64.7	88.2
ALMOST NEVER	5	2	11.8	11.8	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y10 REDUNDANT DATA PROBLEM

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
VERY OFTEN	1	3	17.6	17.6	17.6
OFTEN	2	3	17.6	17.6	35.3
SOMETIMES	3	6	35.3	35.3	70.6
SELDOM	4	5	29.4	29.4	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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X3 TOP MANAGEMENT SUPPORT

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
MODERATE	3	3	17.6	17.6	17.6
SUPPORTIVE	4	7	41.2	41.2	58.8
VERY SUPPORTIVE	5	7	41.2	41.2	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

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Y6 USER-IC RELATIONSHIP

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
MODERATE	3	2	11.8	11.8	11.8
GOOD	4	14	82.4	82.4	94.1
VERY GOOD	5	1	5.9	5.9	100.0
	TOTAL	17	100.0	100.0	

Valid Cases 17 Missing Cases 0

APPENDIX 6

COVARIANCE MATRIX (USER CONTROL ITEMS)

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CONVERGENT VALIDITY OF USER CONTROL CONSTRUCT
DA NI=19 NO=177
CM
1.300
 .688 1.476
 .728  .597 1.302
 .709  .616  .806 1.753
 .763  .700  .719  .929 1.752
 .531  .522  .649  .666  .576 1.609
 .500  .486  .551  .540  .499  .548 1.137
 .636  .655  .725  .905  .807  .656  .591 1.677
 .628  .594  .689  .835  .868  .776  .572  .889 1.623
 .818  .725  .838  .992  .966  .853  .644  .872  .945 1.603
 .719  .676  .805  .926  .771  .687  .464  .831  .832  .908
1.723
 .629  .660  .752  .641  .718  .599  .413  .707  .649  .798
 .826 1.199
 .594  .518  .567  .590  .583  .564  .493  .584  .567  .689
 .721  .638 1.030
 .551  .551  .642  .761  .666  .513  .352  .613  .568  .763
 .746  .568  .596 1.300
 .655  .638  .688  .649  .877  .688  .476  .749  .676  .881
 .664  .661  .519  .579 1.540
 .528  .647  .652  .622  .756  .522  .617  .658  .690  .901
 .666  .706  .619  .611  .650 1.471
 .546  .591  .549  .703  .760  .631  .485  .797  .771  .870
 .757  .765  .653  .652  .716  .761 1.607
 .565  .604  .706  .803  .898  .664  .651  .851  .816  .884
 .785  .716  .588  .738  .743  .741  .788 1.627
 .630  .701  .686  .795  .833  .576  .519  .835  .838  .958
 .802  .800  .634  .670  .759  .803  .734  .885 1.395
MO NX=19 NK=1 LX=FR PH=ST
OU ML RS
```

APPENDIX 7

CORRELATION MATRIX - WHOLE MODEL

	ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
ROLC	1.000								
ROLAM	.524	1.000							
LOAD	.273	.005	1.000						
UTIL	.134	.373	-.149	1.000					
JCON	-.098	-.359	-.052	-.513	1.000				
UCON	.189	-.030	.079	-.206	.358	1.000			
MHI	.111	.294	.109	.242	-.366	-.252	1.000		
JSAT	-.474	-.664	-.093	-.433	.531	.086	-.309	1.000	
USAT	-.297	-.395	.068	-.184	.260	.270	-.095	.388	1.000

N=177

APPENDIX 8

CORRELATION MATRIX - MODERATING MODEL

User Control = Low

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.593	.151	.111	-.170	.174	.112	-.472	-.394
.593	1.000	.064	.276	-.419	.165	.248	-.748	-.365
.151	.064	1.000	-.114	-.018	-.098	.045	-.042	.221
.111	.276	-.114	1.000	-.556	-.067	.275	-.339	.071
-.170	-.419	-.018	-.556	1.000	.015	-.226	.594	.204
.174	.165	-.098	-.067	.015	1.000	-.142	-.085	-.256
.112	.248	.045	.275	-.226	-.142	1.000	-.303	.214
-.472	-.748	-.042	-.339	.594	-.085	-.303	1.000	.222
-.394	-.365	.221	.071	.204	-.256	.214	.222	1.000

User Control = High

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.311	.389	.226	-.044	-.101	.084	-.383	-.172
.311	1.000	-.154	.580	-.295	-.243	.167	-.429	-.373
.389	-.154	1.000	-.241	-.125	.135	.202	-.092	.012
.226	.580	-.241	1.000	-.357	-.304	.167	-.439	-.318
-.044	-.295	-.125	-.357	1.000	.174	-.391	.511	.034
-.101	-.243	.135	-.304	.174	1.000	-.278	.198	.256
.084	.167	.202	.167	-.391	-.278	1.000	-.271	-.078
-.383	-.429	-.092	-.439	.511	.198	-.271	1.000	.321
-.172	-.373	.012	-.318	.034	.256	-.078	.321	1.000

APPENDIX 9

CORRELATION MATRICES

Correlation Matrix - Gender

SEX = Female

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.569	.336	.064	-.059	.143	.257	-.385	-.167
.569	1.000	.069	.286	-.223	.050	.338	-.711	-.344
.336	.069	1.000	-.227	.048	.063	.025	-.024	.256
.064	.286	-.227	1.000	-.653	-.317	.286	-.440	-.085
-.059	-.223	.048	-.653	1.000	.347	-.294	.486	.108
.143	.050	.063	-.317	.347	1.000	-.231	.029	.098
.257	.338	.025	.286	-.294	-.231	1.000	-.305	.045
-.385	-.711	-.024	-.440	.486	.029	-.305	1.000	.364
-.167	-.344	.256	-.085	.108	.098	.045	.364	1.000

SEX = Male

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.486	.396	.203	-.113	.116	.151	-.505	-.312
.486	1.000	.025	.478	-.425	-.088	.237	-.643	-.423
.396	.025	1.000	-.103	-.069	.187	.108	-.174	-.001
.203	.478	-.103	1.000	-.453	-.231	.232	-.429	-.254
-.113	-.425	-.069	-.453	1.000	.419	-.380	.542	.326
.116	-.088	.187	-.231	.419	1.000	-.154	.110	.373
.151	.237	.108	.232	-.380	-.154	1.000	-.302	-.143
-.505	-.643	-.174	-.429	.542	.110	-.302	1.000	.385
-.312	-.423	-.001	-.254	.326	.373	-.143	.385	1.000

Correlation Matrix - Age

AGE = Young

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.566	.176	.120	-.247	.079	.128	-.395	-.324
.566	1.000	-.121	.342	-.438	.014	.282	-.617	-.470
.176	-.121	1.000	-.097	.009	-.024	.022	.057	.101
.120	.342	-.097	1.000	-.560	-.316	.298	-.349	-.088
-.247	-.438	.009	-.560	1.000	.403	-.396	.669	.335
.079	.014	-.024	-.316	.403	1.000	-.267	.273	.266
.128	.282	.022	.298	-.396	-.267	1.000	-.213	-.116
-.395	-.617	.057	-.349	.669	.273	-.213	1.000	.572
-.324	-.470	.101	-.088	.335	.266	-.116	.572	1.000

AGE = Old

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.326	.467	.044	.189	.504	.025	-.408	-.079
.326	1.000	.079	.502	-.433	.058	.278	-.759	-.400
.467	.079	1.000	-.222	-.164	.299	.131	-.302	.163
.044	.502	-.222	1.000	-.511	-.190	.249	-.441	-.291
.189	-.433	-.164	-.511	1.000	.441	-.370	.435	.243
.504	.058	.299	-.190	.441	1.000	-.156	-.113	.203
.025	.278	.131	.249	-.370	-.156	1.000	-.410	-.066
-.408	-.759	-.302	-.441	.435	-.113	-.410	1.000	.352
-.079	-.400	.163	-.291	.243	.203	-.066	.352	1.000

Correlation Matrix - Personality Type

TYPE B

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.680	.153	.185	-.077	.295	.176	-.597	-.336
.680	1.000	.108	.356	-.152	.185	.352	-.612	-.377
.153	.108	1.000	-.117	-.085	.078	.158	-.143	.031
.185	.356	-.117	1.000	-.340	-.207	.352	-.407	-.281
-.077	-.152	-.085	-.340	1.000	.392	-.523	.416	.270
.295	.185	.078	-.207	.392	1.000	-.168	-.039	.237
.176	.352	.158	.352	-.523	-.168	1.000	-.345	-.030
-.597	-.612	-.143	-.407	.416	-.039	-.345	1.000	.525
-.336	-.377	.031	-.281	.270	.237	-.030	.525	1.000

TYPE A

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.408	.446	.247	-.194	.047	-.046	-.536	-.280
.408	1.000	.014	.562	-.427	-.172	.131	-.684	-.492
.446	.014	1.000	-.135	-.125	-.050	.016	-.233	.135
.247	.562	-.135	1.000	-.633	-.409	.208	-.482	-.263
-.194	-.427	-.125	-.633	1.000	.598	-.336	.537	.273
.047	-.172	-.050	-.409	.598	1.000	-.386	.176	.191
-.046	.131	.016	.208	-.336	-.386	1.000	-.146	-.168
-.536	-.684	-.233	-.482	.537	.176	-.146	1.000	.422
-.280	-.492	.135	-.263	.273	.191	-.168	.422	1.000

Correlation Matrix - Computing Knowledge

Computing Knowledge = Low

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.491	.175	.116	-.315	.038	.013	-.364	-.349
.491	1.000	-.028	.344	-.469	.002	.311	-.624	-.517
.175	-.028	1.000	-.010	-.042	-.175	.092	.045	.101
.116	.344	-.010	1.000	-.542	-.147	.370	-.335	-.127
-.315	-.469	-.042	-.542	1.000	.197	-.339	.595	.374
.038	.002	-.175	-.147	.197	1.000	-.310	.251	.305
.013	.311	.092	.370	-.339	-.310	1.000	-.274	-.094
-.364	-.624	.045	-.335	.595	.251	-.274	1.000	.508
-.349	-.517	.101	-.127	.374	.305	-.094	.508	1.000

Computing Knowledge = High

ROLC	ROLAM	LOAD	UTIL	JCON	UCON	MHI	JSAT	USAT
1.000	.519	.512	.239	.095	.222	.102	-.468	-.090
.519	1.000	.122	.525	-.412	-.116	.189	-.712	-.436
.512	.122	1.000	-.192	.086	.404	-.011	-.178	.251
.239	.525	-.192	1.000	-.615	-.365	.199	-.524	-.360
.095	-.412	.086	-.615	1.000	.446	-.292	.534	.223
.222	-.116	.404	-.365	.446	1.000	-.215	.015	.404
.102	.189	-.011	.199	-.292	-.215	1.000	-.282	-.087
-.468	-.712	-.178	-.524	.534	.015	-.282	1.000	.295
-.090	-.436	.251	-.360	.223	.404	-.087	.295	1.000