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What and Why of Technostress: Technology Antecedents and Implications

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WHAT AND WHY OF TECHNOSTRESS: TECHNOLOGY ANTECEDENTS AND IMPLICATIONS

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ABSTRACT

The Bureau of Labor Statistics (2002) reports that, on average, individuals worked seven hours per week from home in addition to regular work hours. This is made possible by advances in information and communication technologies (ICTs). While the increasing workload is not unusual, it has been related to stress, including the relatively new phenomenon of stress induced by technologies (technostress). Academic literature, popular press and anecdotal evidence suggest that ICTs are responsible for increased stress levels in individuals. However, it is not very clear as to *how or why ICTs create stress*.

Prior research on technostress has been largely descriptive. As ICTs become ubiquitous, their stressful impact can be felt at all levels of an organization. Stress related health costs are increasing dramatically and there is evidence of decreased productivity in stressed individuals (Chilton et al., 2005; Cooper et al., 2001; Jex, 1998). So, organizations have incentives to better understand stressful situations at workplace. Based on the literature from management information systems, psychology, organizational behavior, and occupational stress, a model of technostress is developed to address the question of "how and why information and communication technologies enable stress in individuals".

Person-Environment fit model (Edwards, 1996) is used as a theoretical lens to explain technostress. The research model proposes that certain technology characteristics exacerbate stressors identified in occupational stress literature leading to the manifestation of stress, referred to as strain. Specifically, technology characteristics - usability (usefulness, complexity, and reliability), intrusive (presenteeism, anonymity), and dynamic (pace of

change) are proposed to be related to stressors (work overload, role ambiguity, invasion of privacy, work-home conflict, and job insecurity).

Survey design methodology is used to test the proposed research model. Field data for 692 working professionals was obtained from a market research firm (Zoomerang®). In general, the results from structural equation modeling supported the hypotheses from the model. The results suggest that technostress is prevalent (and a significant predictor of overall job strain). Specifically, work overload and role ambiguity are found to be the two most dominant stressors, whereas intrusive technology characteristics are found to be the dominant predictors of stressors.

The results from this study have implications for both research and practice. It opens up new avenues for research by showing that ICTs are a source of stress – thereby addressing calls to understand the stressful impacts of ICTs (Nelson, 1990; Weber, 2004). To our knowledge, it is the first empirical study to address the phenomenon of technostress that is theoretically grounded in stress research. The implications of present research to other research streams such as resistance to technologies, value of technology investments are also highlighted. Based on research findings, this research proposes certain recommendations that can influence managerial action. Foremost among these, it brings attention to presence of technostress in organizations and also provides a framework which can be used to assess the extent to which technostress is prevalent.

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CHAPTER ONE
INTRODUCTION

1.1 Overview

Information and Communication technologies (ICTs) pervade organizational and individual life. With increasing uses of ICTs, how individuals interact with technology and its related consequences has gained importance. Consequently, research in the field of information systems (IS) has extensively studied the adoption, acceptance, self-efficacy and other related issues with respect to ICTs (Agarwal, 2000). Although this research stream has concentrated on how individuals can better utilize ICTs, there is also considerable interest about technology induced anxiety, stress etc. as these reduce the productivity of individuals (Brod, 1994; Igbaria and Ilvari, 1990; Weil and Rosen, 1997).

Advances in ICTs provide organizations opportunities for access to information and enable new work arrangements that were previously not possible. For example, ICTs have made it possible for individuals to work virtually i.e. without having to physically go to the office and made work-from-home a reality. Organizations expect productivity and efficiency increases as use of ICTs enhance timeliness and connectivity, and break down geographic and time barriers. It has become commonplace that organizations are dispersed, and consist of individuals working by means of ICTs in new organizational forms (Staples et al., 1999; Townsend, 1998). Even though ICTs might enhance the productivity of individuals and enable new forms of working, there are also concerns regarding negative consequences of ICTs advances in organizations and individuals' life.

ICTs are responsible for increased levels of stress at work and for blurring the divide between work and other aspects of life (Millard, 1999). Computerization of office work

environment is shown to have higher levels of stress among employees (Agervold, 1987; Kinman and Jones, 2005; Korunka and Vitouch, 1999; Wittbecker, 1986). Some have argued that this increase is due to increased workloads (Aborg and Billing, 2003, Sandblad et al., 2003; Wittbecker, 1986).

Use of ICTs has also produced a perpetual urgency as it facilitates ease in generating and transporting data/information and creates the expectations that people need, or are obligated to use, the data/information faster (Hind, 1998). Moreover, the focus on short-term benefits and shareholder's value – the dominant business perspective in Western nations – has produced increasingly lean organizations, encouraging cultures that reward people who work very hard, spend longer hours at work and are connected to the organization 24/7 via ICTs (Spruell, 1987; Kouzmin and Korac-Kakabadse, 2000). Individuals often complain about 'instant' expectations, as is evident in the following discourse – "People have to respond quicker now - with things like email etc. there is no time to think and reflect on your actions any more. Everything is instant (pp. 100 Kinman and Jones, 2005)."

The pervasiveness of ICTs and new work structures may contribute to 'technostress' (Weil and Rosen, 1997). Technostress refers to stress induced by information and communication technologies. In the present technological age, it is important to understand the antecedents to technostress, since stress in the work place is recognized as contributing to lower employee productivity and higher health costs for companies (Cooper et al., 1996; Sutherland and Cooper, 1990; Tennant, 2001). This argument is consistent with a special report in *InformationWeek* which argues that advances in technologies (i.e. virtual office technologies) contribute to increased burnout (McGee 1996). In the US, it is estimated that

stress-related ailments, including burnout cost as much as $300 billion a year (McGee, 1996), and by some estimates, as much as five to ten per cent of Gross National Product (Vernon, 1998). Further, there is empirical evidence which suggests that stress and job performance are negatively related (Burke, 1976; Chilton et al., 2005; Jex, 1998; Welford, 1973). In a study of software developers, it is shown that performance of software developers is severely affected when they are under strain (Chilton et al., 2005). Also, the negative relationship between stress and performance is underscored in a book that reviewed existing research between stress and job performance (Jex, 1998). Therefore, it is important from the management perspective to address the issue of technostress for two reasons - the health costs attributed to stress and the productivity losses of employees.

Although stress has been extensively studied, we lack a conceptual and theoretical understanding of the drivers of technostress. As identified in the next chapter, there is a gap in the literature in understanding what characteristics of technology induce stress. Further, there are calls for research in both the stress and IS literature to study the stressful impacts of (i) ICT use and (ii) new work arrangements that are enabled by ICTs (Cooper et al., 2001; Weber, 2004). Given the practical significance and research relevance, it is therefore important to understand if and how technology induces stress at workplace. The broad research goal of this study is

To investigate the stress induced by information and communication technologies on individuals in organizations.

1.2 Research Objectives and Model

Most of the existing literature on technostress is descriptive (Brod, 1994; Sami and Pangannaiah, 2006; Weil and Rosen, 1997) with conceptualizations implicitly referring to technostress as stress experienced by technology professionals, i.e. IT/IS professionals. However, with the ubiquity of present ICTs and their pervasiveness in organizations, individuals' interaction with technology is not limited to IT/IS personnel. Rather, it extends to any department and functional area utilizing ICTs to perform work.

Another limitation to existing descriptive studies on technostress is not explicitly identifying what technology characteristics induce stress in individuals. Making technology characteristics explicit has numerous advantages over the previous conceptualizations of technostress. For instance, in their descriptive account, Weil and Rosen (1997) argue that (un)reliability and 'space invasion' as sources of technology-enabled stress. Whereas the reliability issues are directly related to the predictability characteristic of technology and technological systems, the concept of 'space invasion' is not a characteristic of technology. 'Space invasion' relates to how technology enables individuals to be accessible and thereby invades on their space/time. The relevant technology characteristic of 'space invasion' seems to be the *connectivity* of technology. If technologies provide constant connectivity, the expectations to be available always could then create space invasion. As the example depicts, rather than treating technology as a surrogate for factors existing at various levels and unit of analysis, the present study delineates the technology characteristics that enable stress – thereby providing a better understanding of the phenomenon of technostress. Further, making technology characteristics explicit is in the spirit of the need to define the IT artifact in IS research (Orlikowski and Iacono, 2001).

Another advantage of making technology characteristics explicit is that the existing technologies could be profiled based on the individual's perceptions of technology characteristics. This could develop a cluster of technologies that have similar patterns in terms of their paths to stress. This cluster of related technologies could be a valuable diagnostic tool for human resource managers when developing appropriate strategies in coping with stress. Further, any new technology could be evaluated with respect to the technology characteristics identified in this study to assess through which path the technology in consideration will enable stress. In this way, the proposed model could be used as an evaluative tool. The proposed model as shown in Figure 1.1 explicitly identifies technology characteristics as antecedents to stressors identified in literature.

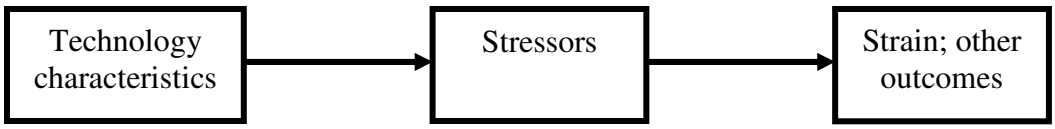

Figure 1.1: Research model in this study.

The current study seeks to contribute to the literature by focusing on technology characteristics in understanding phenomenon of technostress. The specific research objectives are

- To develop a model for technostress by integrating the literature from IS and stress research streams
- To empirically test the validity of the proposed model, and
- To identify the technology characteristics that have the greatest explanatory power in the model

1.3 Contribution

In general, acceptance and use of technology has been treated as voluntary and in a positive light. However, since individuals often have no option other than to use certain technologies for job related tasks and due also in fact to 'tragedy of commons' (everyone else is reachable through cell phone, so everyone expects you to be reachable too), use of technologies could be counterproductive. This study contributes by exploring the unintended effects of technology and provides an avenue for future research on technostress.

This study contributes by addressing calls for research on ICT induced stress (Cooper et al., 2001; Weber, 2004). Also, Nelson (1990) argues that many studies on individual adjustment to technologies treat technologies as undifferentiated and do not consider the specific features. For example, she argues that 'a computer may itself may not be a source of stress; rather, delayed response times may be stressful to the worker' (page 87). She has called for future research to consider specific features of technologies in understanding how individuals adjust to technologies. The present study contributes to the literature by explicitly proposing technology characteristics as antecedents to stressors in examining the phenomenon of technostress. Previous works on technostress provide a descriptive, undifferentiated view on technostress (Brod, 1994; Weil and Rosen, 1997).

There is a delicate balance between productivity benefits and productivity losses due to use of technologies. For example, enterprises like Cingular® are promoting the use of handheld mobile devices arguing increased productivity benefits. This study contributes by arguing that the expected productivity benefits may not occur and in some cases it could potentially lead to decrease in productivity. Mobile technologies are one aspect of ICTs that

will be included in this study along with other technologies. The profile of ICTs to be used in this study is discussed in Chapter 4.

In addition to the benefits offered by ICTs, recognition of the fact that ICTs create stress is necessary. This study contributes to practice by increasing awareness on technostress and providing certain managerial interventions to reduce technostress. Human resources are one of the most important organizational assets (Barney, 1991). Therefore, there is increasing burden on human resource managers to provide quality work arrangements in workplace and reduce negative reactions such as technostress. Further, there are concerns that keeping employees on virtual leashes using ICTs like laptops, Blackberrys and other devices could lead to lawsuits from employees who grow addicted to the technology (CNN, 2006a). Therefore, organizations have incentives in terms of health-cost benefits, and productivity benefits to alleviate technostress experienced by employees. Organizations and individuals can take initiatives in responding to technostress. Awareness of what technological factors lead to technology induced stress is the first step in this direction. This study also provides certain managerial interventions in terms of paying attention to the support structures (technical) and training issues to alleviate technology induced stress.

1.4 Outline of Dissertation

This chapter provided a brief description of the phenomenon 'technostress'. It also presented the broad research model and research objectives for this study. Chapter 2 provides a review on relevant stress and IS literature. The review section identifies gaps in the literature and presents insight germane to developing a model of technostress. Based on

finding from literature review, chapter 3 develops the research model and appropriate hypotheses are established. Chapter 4 discusses the proposed research design, sampling procedure, research instruments, and analysis to be used in this study. The results of the study are discussed in Chapter 5 and dissertation concludes by discussing the conclusions and implications from this study in Chapter 6.

CHAPTER TWO
LITERATURE REVIEW

To understand how ICTs induce stress, it is necessary to a) understand the conditions that create stress in general and, b) to conduct an IT-focused review of the literature on stress. In this chapter, relevant literature is synthesized to develop a theoretical understanding of technostress and identify gaps in existing research. This chapter unfolds as follows. First, it presents various definitions of stress concepts. Second, person-environment (P-E) fit model is identified as an appropriate theoretical lens through which to study stress. The next section identifies sources of stress (referred to as stressors). In the following section, a review of IT studies that examine stress and stressors is presented. Following, the concept and literature on technostress is discussed. Finally, the key points from synthesizing the literature are summarized to serve as theoretical underpinnings for the development of research model and hypotheses in chapter 3.

2.1 Stress terminology

2.1.1 Approaches to studying stress

Stress has been studied in many fields; studies related or similar to technostress appear in the psychology and organizational behavior literatures. Psychology studies focus on understanding the relationship between individual (within person) factors (i.e., dispositional traits & states, personality) and stress variables. Organizational behavior studies yield insight into the relationship among job characteristics, organizational factors, job-related roles and stress variables. In this study, insights from both streams of research are gleaned to understand technostress with a well-rounded perspective.

The broad application of the stress concept in multiple fields – medical, behavioral, and social science research has lead to numerous definitions. An analysis of articles published in six eminent journals in the field of organizational behavior has concluded that 'stress' is defined from different perspectives: 1) as a stimulus (stress as the independent variable), 2) a response (as a dependent variable) and, 3) as a transaction (stress as a process) (Cooper et al., 2001; Jex et al., 1992; Rees and Redfern, 2000). There is a growing consensus that stress results from a transaction between the individual and the environment (Lazarus, 1990). From the transactional view, no one component (i.e., stimulus or response) can be attributed as stress, because each must be understood within the context of the process.

2.1.1.1 Response-based definition of Stress

The response-based view identifies stress as a response to threatening stimuli. In this conceptualization, stress is viewed as a dependent variable and the focus is on the response. This view evolved from the early layman representations of stress – which typically involved the use of the phrase like "being-under-stress". This implies that it may not be possible to identify stress, only its consequences. Therefore, the main conceptual definition in the response-based approach is the manifestation of stress (Sutherland and Cooper, 1990). This view has its roots in medicine, a discipline typically dealing with symptoms but not necessarily their causes.

Due to the emphasis on manifestation of stress, early studies in the 20th century typically studied bodily reactions of individuals to life events and life experiences. This has lead to research typically referred to as 'psychosomatic medicine'. Examples of works include changes in stomach activity, increase in gastric secretion and acidity, changes in blood flow etc. in response to stress conditions (McLean, 1979).

Early works of Hans Selye marks the beginning of using response based approach to study stress in the medical field. The emphasis in this view is on the outcomes or consequences rather than the nature of stress (i.e. whatever the disease, all patients looked and felt sick). Because of its application in the medical field this view takes a physiological approach. Selye introduced the notion of stress-related illness in terms of the general adaptation syndrome (GAS). In this view, stress is viewed as a nonspecific response of the body to any demands made upon it (Selye, 1956). Responses to stress are considered invariant, and thought to follow a universal pattern.

GAS can be described in terms of three stages of response. In the presence of stimuli, the first stage consists of an alarm reaction. Here, the defense mechanisms are activated, forming the emergency reaction known as 'fight or flight' response. In this stage, typical physiological responses are increased heart rate and blood pressure in preparing the body for action. The second stage is resistance to the continued stimuli in which the alarm reaction is replaced by an adaptation response or return to equilibrium. However, because of the limited resources, if an alarm reaction occurs intensely or frequently over an extended period of time, the resources needed for adaptation become depleted, and exhaustion, collapse, or death could occur in the third stage (Selye, 1983).

This view is often criticized for its over-compassing definition in that stress is considered as a generic term that subsumes a large variety of manifestations (Pearlin et al., 1981). Also, medical research shows that responses to stimuli do not always follow the same pattern and could depend, for example, on hormonal secretion. Further, by ignoring the stimulus dimension of stress experiences, this view does not consider environmental factors in the stress process (Cooper et al., 2001).

2.1.1.2 Stimulus-based definition of Stress

This approach traces back to fifth century BC physicist Hippocrates and is based on the belief that characteristics of health and disease are conditioned by the external environment (Goodell et al., 1986). This approach views stress as an independent variable that elicits some response from the person. This view has roots in physics and engineering, comparing stress to force, which when present could lead to distortion (Cooper et al., 2001). It is assumed that both organic and inorganic substances have tolerance levels, and if these levels are exceeded, temporary or permanent damage occurs. In this view, the focus is on the stimulus side. Since stress is viewed as an independent variable eliciting some response in an individual, this view typically identifies various sources of stress in the work environment and is the principal idea of stimulus-based view of stress (Goodell et al., 1986).

Research related to this view is mainly involved in understanding the impact of industrialization on blue-collar workers. Different sources of stress are identified in order to provide optimal working conditions. In general, sources related to physical characteristics of the work environment e.g. heat, cold, noise, etc. are identified as sources of stress, and offer ways to improve the working conditions of blue-collar workers (Cooper and Smith, 1985). Typically, objective measures of work environment are identified as sources of stress. Therefore, this view does not explain why two individuals exposed to the same stimuli (i.e. sources of stress in terms of heat, noise, etc.) might respond differently. The inability to explain individual differences when exposed to the same situation is a drawback of this view. Not withstanding this limitation, this view is useful in identifying common patterns of work environment that might affect the majority of the workforce.

2.1.1.3 Limitations of Response and Stimulus definitions

The above definitions of stress are set within the simple stimulus-response paradigm. Since stimulus-response definitions each focus on a single component of the stress process, they say little about the process itself. Research attention is typically focused on one dimension of process (i.e. either response or stimulus). Therefore, it is only possible to conclude that an event has *the potential* to be stressful or that a response *may be* a stress response. The above definitions largely ignore the individual differences and their underlying perceptual processes (Cox, 1990; Sutherland and Cooper, 1990). There is little consideration of the context (e.g., levels of support, control) and the person's role in the organization (e.g., job attributes) which are likely to produce different responses for the same stimuli. Therefore, the above definitions may not explain why what is stressful for one individual is not stressful for another. To address these limitations, we turn to the transactional view of stress.

2.1.1.4 Stress as a Transaction

The transaction view takes into account individual and environmental factors. The emphasis is on understanding the nature or the process of stress. The transactional approach explores psychological mechanisms of appraisal and coping that highlight a stressful encounter. The transaction process discusses two types of appraisal – primary and secondary (Lazarus, 1966; 1991). Primary appraisal involves individuals' realization that something is at stake. In this process, the individual gives meaning to an encounter in terms of *harm*, the *threat* of harm, or *challenge*. Secondary appraisal begins after an encounter is appraised in some way as threat. This deals with identification and availability of coping resources to deal with the threat, harm, or challenge (Lazarus, 1991).

Therefore, stress is viewed as embedded in an ongoing process that involves individuals interacting with their environments, making appraisals of those interactions, and trying to cope with the situations that arise. As is evident in the name *transaction*, in this view, stress is neither viewed as a result of the individual or the environment, but in the relationship between the two (Lazarus, 1990). Stress arises when an individual appraises the demands placed by the environment to exceed the individuals' resources, thereby threatening individuals' well-being (Cooper et al., 2001; Lazarus, 1991). As will be discussed later, the transactional definition provides a framework for modeling stress.

The appraisal process places emphasis on the subjective experience (i.e. contingent upon the perception of the situation) rather than the objective situation. This view also acknowledges interpersonal influence that is the potential source of strain is not perceived in social vacuum. The presence of others could be a source of distraction, or they can provide support mechanisms, help to increase self-efficacy etc. This alludes to the use of support and self-efficacy variables as potential moderators. In this study, moderators based on these concepts are presented in the research model development section.

2.1.2 Stress definitions

A natural result of research on stress in different fields is the inconsistency in which related concepts of stress are addressed. Although they are shown to be conceptually distinct (Bussing and Glaser, 2000), there is still considerable ambiguity in the way different aspects of stress (i.e. stress, stressors, and strain) are described (Bussing and Glaser, 2000; O'Driscoll and Cooper, 1996). The main dissonance comes from how terms 'stress' and 'strain' are addressed. For example, in some studies 'stress' means the process and 'strain' is the outcome. In others, 'stress' is referred to as either a response or stimuli (Beehr and Newman,

1998). In other words, the problems of 'synonym' and 'homonym' exist in stress literature. By 'synonym', it is meant that same stress concept is referred to as 'stress' and 'strain' in different studies; and by 'homonym' it is meant that same term (i.e. stress, for example) is referred to mean different stress concepts. A recent review suggests that stress-related concepts have been used interchangeably (Rees and Redfern, 2000).

Previous researchers have shown concern over the vast number of definitions and descriptions for stress-related concepts. In a review of 51 stress studies, Jex et al. (1992) report that 41% used stimulus based definitions for stress, 22% used response based definitions for stress, 25% used stimulus-response definitions, and in 14% the usage was unclear. Further, as Nelson and Quick (1994) put it "Stress is one of the creatively ambiguous words in the English language, with as many interpretations as there are people who use the word. Even the stress experts do not agree on its definition" (p. 202). Concerning how related terms are used interchangeably, Beehr and Newman (1998) point out that "Job stress is an area with the potential to be plagued by confusion, at least partly because of the general, nontechnical, popular usage of the word stress. Even among researchers, stress had sometimes been used to mean an environmental "stressor" stimulus and sometimes to mean an individual's strain or distress reactions ... this is probably still true in the 1990s ..." (p. 842). This point is clear from some of the definitions and descriptions identified in previous literature, which are synthesized in the table 1.1.

Table 1.1: Select definitions of stress used in literature showing inconsistency.

Author(s)	Description	Comment
Aamodt (1999)	"Stress will be defined as the psychological and physical *reaction* to certain events or situations (called stressors) in your life.." (p. 569, emphasis added)	As defined here, stress overlaps with the concept of 'strain' – as a response to stressors.
Earnshaw and Cooper (1996)	"Stress is *any force* that puts a psychological or physical factor beyond its range of stability, producing strain within the individual" (p. 7, emphasis added).	As defined here, stress is referred to as a cause – similar to the concept of 'stressor'
Greenberg and Baron (2000)	"We define stress as a complex pattern of emotional states, physiological reactions, and related thoughts in *response* to external demands. These external demands are referred to as stressors" (p. 226, emphasis added)	As defined here, stress overlaps with the concept of 'strain' – as a response to stressors.
Hellriegel et al. (1992)	"Stress is *a consequence* of or a general *response* to an action or situation that places special physical or psychological demands, or both, on a person." (p. 280, emphasis added).	As defined here, stress overlaps with the concept of 'strain'.

Given these various interpretations, it is important to clarify the meanings of different terms in this study. Table 1.2 provides the description of stress related concepts used in this study (Cooper et al., 2001). Consistent with the 'transaction view' of stress discussed previously, the overall transaction process is referred to as 'stress'. 'Stressors' are referred to as the stimuli encountered by the individuals and 'strain' as the responses to these 'stressors'. The consequences of 'strain', for example, in terms of individuals' well-being or job performance are referred to as 'outcomes'.

Table 1.2: Description of stress related concepts.

Concept /Term	Description
Stress	the overall transaction process
Stressors	the events or properties of events (stimuli) encountered by individuals
Strain	the individual's psychological and behavioral responses to stressors
Outcomes	the consequences of strain at both the individual and the organizational level

Adapted from Cooper et al., 2001

In sum, there is considerable ambiguity among stress related terms. Further, stress has been defined in numerous ways. However, there is growing consensus on viewing stress as a transaction. Having looked at the basics of stress, the next section looks at theoretical approach to how stress is explained.

2.2 Theoretical framework for studying job-related stress

Before discussing the theoretical approach, two broad theoretical paradigms that shed light on stress phenomenon are discussed. The first paradigm could be labeled as an epidemiological perspective (Fox et al., 1993). Researchers using this view typically link occupational conditions such as workload, vibration etc., to actual disease manifestations like coronary heart disease. In this view, how stressors are appraised by individuals has not received attention. The advocates of this view argue for the use of objective measures for measuring stressors and their outcomes. The other paradigm could be labeled as a cognitive perspective (Fox et al., 1993). The main emphasis of this view is that stressful outcomes are determined by how people cognitively interpret or appraise environmental demands. In accordance with the central tenet of subjective assessment, the outcomes studied in this

perspective are mainly psychological. The advocates of this view argue for the use of subjective measures, for example individual perceptions of occupational demands.

Consistent with the transaction view of stress, the cognitive perspective is used in reviewing the theoretical models. The emphasis on undertaking both person and environment factors in understanding the stress phenomenon makes the selection of person-environment (P-E) fit model appropriate. The person-environment fit model is the most contemporary view on stress and it acknowledges the transaction nature of stress i.e. it considers both the individual and environment factors. The next section provides an overview of person-environment fit model.

2.2.1 Person – Environment (P-E) fit model

The P-E fit model of stress is the one of the most widely used models in the literature (Edwards, 1991; Edwards and Cooper, 1988; Cooper et al. 2001). This model is based on the premise that there is equilibrium between a person and their environment. It proposes that when the relationship between the person and the environment is out of equilibrium, it results in strain. The lack of fit between the characteristics of the person and the environment could lead to unmet individual needs or unmet job demands. These unmet needs or demands result in strain (Cooper et al., 2001). This view emphasizes the subjective P-E fit, i.e., how the individuals perceive the encounter (see Figure 2.1). The misfit between person and environment could be further explored. In a review of person-environment fit literature, Edwards (1996) reports that this misfit could occur in two ways. First, a misfit could occur between the values of a person, and the environmental supplies available to fulfill those values (Edwards, 1996). Typically, values represent conscious desires held by the person and encompass preferences and interests (Edwards and Cooper, 1990; Edwards,

1996; French et al., 1982). Given the individuals preferences, a misfit in terms of subjective evaluation of supplies provided by the environment leads to strain. A typical application of this fit approach is used to assess the perceived discrepancy between what the individual wants and what the job provides (Cable and DeRue, 2002) or how well the needs of individuals are met by their jobs (Brkich et al., 2002; Cable and DeRue, 2002).

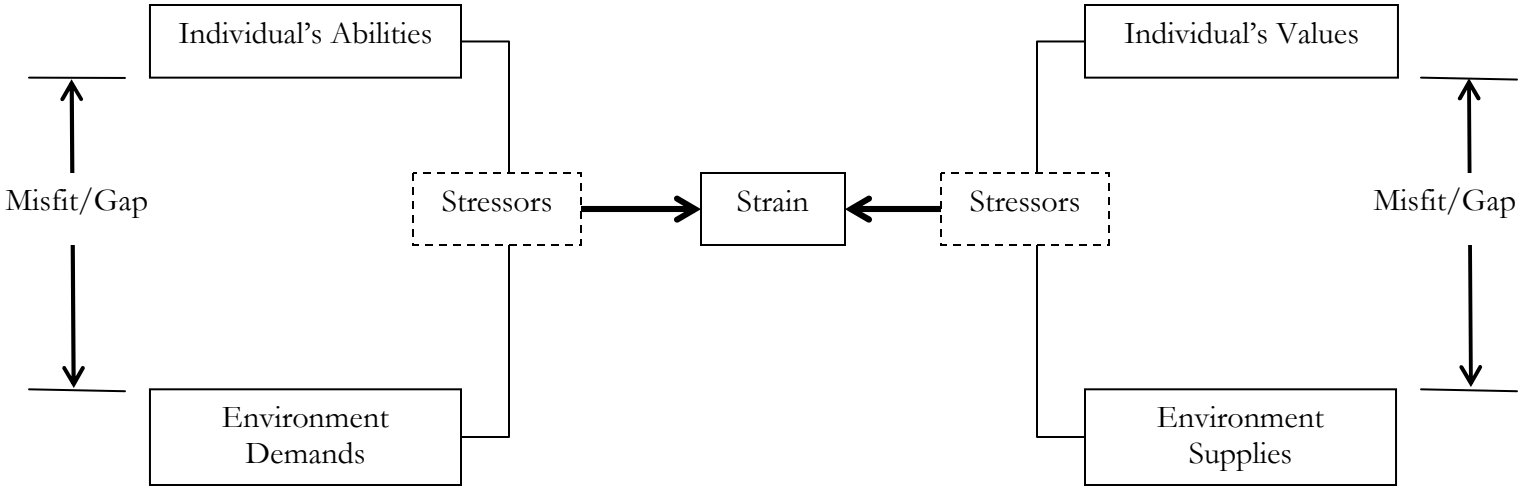

Figure 2.1: Pictorial depiction of person-environment fit.

A second type of misfit could occur between the abilities of the person, and the demands placed by the environment. Abilities could include the skills, knowledge, time and energy. Demands typically refer to the individuals' subjective evaluation of the requirements placed on the person. This implies that same requirements might be interpreted as different demands by different individuals. A typical application of this fit approach is used to assess the extent to which the demands of the job exceed individual's capabilities (Beehr et al., 1976, Chisholm et al., 1983) or to assess if individuals capabilities are insufficient for the job demands (Schaubroeck et al. 1989; Sutton and Rafaeli, 1987). It should be noted that values-supplies and demands-abilities fit form two complementary approaches (Kristof, 1996) and capture the degree to which the person and the environment each provide what the other requires (Edwards, 1991; Edwards et al., 2006).

In addition to being one of the widely used models (Cooper et al., 2001), the basic premise of person-environment fit is found to exist in various other models of stress (Cooper et al., 2001; Kahn and Byosiere, 1992). Because of its wide applicability and the synergy with the transactional view of stress, the person-environment fit model is used as a theoretical framework in this study.

Before the IS-stress literature is reviewed, the next section reviews various sources of strain i.e. stressors identified in the stress literature. Based on this review, stressors appropriate for the present study are derived from the identified list of stressors.

2.3. Identifying sources of strain i.e. stressors from job-stress literature

The job-stress literature identifies several factors that are sources of strain within the job environment. This stream has resulted in identification of numerous factors. This should

be expected as the concept of stress is studied in multiple fields through different perspectives. Due to the extensiveness of this type of research in different jobs or occupations, this stream is sometimes referred to as occupational stress research. Based on the review of literature a summary of often cited stressors is provided below. This is achieved by utilizing the widely used categorization proposed by Cooper and Marshall (1979). The categories identified are characteristics of job, role characteristics, organizational factors, career concerns, relationships within organization, and work-home interface. In addition to these, invasion of privacy is also discussed as a potential stressor. The present synopsis identifies several factors that are found to be significant sources of strain among different occupations.

Various stressors from above categories are described in the following sections. Based on this literature review, the most relevant stressors in the context of the present study are identified. The stressors included in the present study are chosen based on (i) the appropriateness of stressors to the phenomenon under study in the present work. For example, the physical characteristics of the job in terms of noise, temperature etc. might not be relevant when considering technostress (ii) if multiple pertinent stressors exist in each category, the dominant stressor from that category is selected to keep the present study to a manageable level.

As derived from the literature, the stressors included in the present study are work overload, role ambiguity, job insecurity, work-home conflict, and invasion of privacy. These stressors reflect the gap or misfit along abilities-demands and values-supplies, as discussed below in the following subsections. For example, the stressor work overload reflects the degree to which work requirements (environmental demands) exceed the individual's

abilities. Table 2.1 provides (i) a summary of the list of potential stressors identified in the literature, (ii) the stressors included in the present study and (iii) explanation as to why only certain stressors are selected.

2.3.1 Characteristics of Job

Factors related to physical demands and task requirements are placed in the job related factors category. Early research on blue-collar workers has identified several physical conditions that induce stress. Three physical characteristics of work environment, namely noise, vibration and temperature are discussed below. In terms of P-E fit model, these stressors could be viewed along the abilities-demands and values-supplies dimensions.

2.3.1.1 Physical Characteristics: Noise, Temperature, Vibration

Noise is typically defined as unwanted sound (Jones, 1983). Exposure to noise can hinder hearing ability and mask detection of wanted sounds, for example warning sounds. Smith et al. (1978) suggest that the impact of excessive noise is to reduce individuals' tolerance to other stressors. Noise has been reported as a stressor particularly in manufacturing industries. Similarly, Ivanicevich and Matteson (1980) argue that excessive and prolonged noise could be a source of strain.

Along with noise, vibration and temperature are also acknowledged as sources of strain affecting the physical and psychological well-being of individuals. Vibration is found to be problematic in occupations that use machinery such as pneumatic drills, aircraft propellers, helicopters, offshore drilling rigs etc (Sutherland and Cooper, 1986). Further, vibrations that transfer from objects to the body may adversely impact the performance and it can also be a nuisance factor.

Temperature is another physical characteristic of the work environment that can have significant impact on individuals. Jewell (1998) suggests that extreme temperatures can induce physiological responses that might have undesirable effects. This factor is especially stressful in work situations that demand critical decisions, fine discrimination, and performance of fast or skilled actions.

Table 2.1: Literature review of possible stressors.

Stressor Category	Possible Stressors	Stressors Included in the Present Study	Comments
Characteristics of Job	Physical Noise Temperature Vibration Task Related Work Overload Work Hours Exposure to Risk and Hazards	Work Overload	• Physical stressors (noise etc) are deemed inappropriate for studying the impact of information technologies. • Work Hours is somewhat related to Work Overload. • Shift work component of Work Hours and 'Exposure to Risk and Hazards' are controlled through sample.
Role Characteristics	Role Ambiguity Role Conflict Role Overload	Role Ambiguity	• As argued, Role Overload has considerable overlap with Work Overload. • Role ambiguity is a stronger predictor of strain than Role Conflict (Jackson and Schuler, 1985). Further, it is not clear how technology could affect Role Conflict.
Relationships within organization	Interpersonal relationships Leadership style	None	• Not dominant predictors of strain as compared to other stressors. Further, direct impacts of technology are not apparent.
Career Issues	Job Insecurity Career Advancement	Job Insecurity	• Job Insecurity is widely studied and dominant factor in this category.
Organizational Factors	Climate Structure	None	• Not dominant predictors of strain as compared to other stressors.
Work-Home Interface	Work-Home Conflict	Work-Home Conflict	• One of the new stressor fueled by telework phenomenon.
Invasion of Privacy	Invasion of Privacy	Invasion of Privacy	• Growing concern as a cause of strain fueled by advances in ICTs.

2.3.1.2 Task Characteristics: Work Hours, Exposure to Risks and Hazards, Work Overload

In addition to the above physical characteristics, task requirements of job that are found to be stressful are work hours, work overload, exposure to risks and hazards. In terms of the P-E fit model, these stressors can be viewed along the abilities-demands and values-supplies dimensions. These are discussed below.

Work hours could refer to both the sheer number of hours that a person works and/or also to the working hours or work schedule. Both these factors are shown to be significant sources of strain. Sparks et al. (1997) in their meta-analysis report that the sheer number of hours worked affects the overall health of individuals. As compared to their counterparts, individuals who worked excessive hours showed more symptoms of ill health. Another aspect of work hours refers to the actual work schedule hours of an individual. Most of the research on this aspect is related to shift work and changing pattern of work hours. Increasing demand for 24-hour service and ever-increasing competition are some of the factors that lead to increasing shift work. Organizations use shift work as an approach to improve their productivity and efficiency. Consequently, research efforts have tried to determine the effects of shift work on workers' job performance, overall psychological and physical well-being. Evidence suggests that shift work leads to various problems leading to a decline in physical health, satisfaction and overall subjective well-being (Folkard, 1996; Seymour and Buscherhof, 1991).

Another factor is the exposure to risks and hazards. Some occupations are inherently risky and hazardous. Individuals working in these occupations, for example, police officers, mine workers, soldiers, prison personnel, firefighters etc, need to be ready to react immediately. This constant state of arousal is related to muscle tension, respiration problems,

and could be a threat to long-term health (Cartwright and Cooper, 1997; Cooper et al., 2001; Davidson and Veno, 1980).

Finally, work overload is probably the most dominant factor identified in the literature. Two types of overload are identified in the literature – quantitative and qualitative. Quantitative overload refers to the sheer amount of work required and the time frame in which work must be completed (Cooper et al., 2001). The need to work under time pressure to meet deadlines is a major source of quantitative overload (Cooper et al., 2001; Narayanan et al., 1999). Qualitative overload occurs when individuals believe that they do not have necessary skills or abilities to perform job duties satisfactorily. It is apparent from the above descriptions that work overload presents a situation in which there is a misfit between the demands of work environment and the abilities of individuals. This misfit is shown to be a source of strain. The work overload construct is typically conceptualized as quantitative overload in stress and IS-stress literatures (see Ahuja and Thatcher, 2005 for exception). There is strong evidence that suggests that overload is related to high levels of strain, anxiety, depression and outcomes like job performance or innovation with technology (Ahuja and Thatcher 2005; Cooper and Roden, 1985; Kinman and Jones, 2005; Kushmir and Melamed, 1991; Westman and Eden, 1992).

2.3.2 Role Characteristics: Role Ambiguity, Role Conflict, Role Overload

Roles refer to the behaviors and demands that are associated with the job an individual performs. Kahn et al. (1964) proposed that individuals' roles in an organization could be a source of strain. The basic argument behind role variables (role ambiguity, role conflict, and role overload) being stressful is that role variables create situations of uncertainty. Therefore, in situations of uncertainty in an individual's work environment are

stressful if the individuals perceive it is beyond their ability to cope with uncertainty (misfit). The two primary ways in which strain can occur are through role ambiguity and role conflict.

Role conflict refers to incompatible demands on the individual (Kahn et al., 1964). This conflict occurs within a single role or between multiple roles held by an individual. Four different kinds of role conflict can exist (i) Intrasender role conflict: situation when expectations from an individual are mutually incompatible (ii) Intersender role conflict: situation when expectations from two or more people are incompatible (iii) Person-role conflict: situation when an individual's and organization's expectations and values conflict (iv) Inter-role conflict: situation when an individual occupies roles that have conflicting expectations or requirements (Quick and Quick 1984). Regardless of the type of conflict, evidence suggests that role conflict is a source of strain (Kahn and Byosiere, 1990; O'Driscoll and Beehr, 1994; Schaubroek et al., 1989).

Role ambiguity refers to unpredictability of the consequences of one's role performance and lack of information required to perform the role (Cooper et al., 2001). Role ambiguity captures unpredictability of consequences and information deficiency regarding expected role behaviors (Pearce, 1981). Kahn et al. (1964) suggest that lack of clarity about an individuals' role could be a source of strain. This factor is shown to be related to strain in numerous studies (Kinman and Jones, 2005; O'Driscoll and Beehr, 1994; Schaubroeck et al., 1989).

Role overload has been consistently found to influence job-related strain (Cooper, 1987; Narayanan et al., 1999). Role overload refers to the number of different roles a person has to fulfill. Considerable similarities exist between role overload and work overload at conceptual and measurement levels. It is possible that this overlap is due to the nature of

research in the field. The fragmented nature of the field has lead to research on 'role strain' – strain caused by role variables. To provide a holistic picture, role overload might have been used instead of work overload, along with role ambiguity and role conflict.

2.3.3 Relationships within the organization

The quality of interpersonal relationships at the workplace affects stress and strain. In terms of P-E fit model, this stressor (due to interpersonal relationships) could be viewed along the values-supplies dimension. Basically, negative interpersonal relationships at the workplace are a source of strain (Narayanan et al., 1999; Beehr and McGrath, 1992; Danna and Griffin, 1999). Levinson (1978) suggests that some individuals may ignore the feelings and sensibilities of others and dealing with these types of 'abrasive personalities' at the workplace can be a source of strain. Further, research has also looked into the relationship between supervisor and supervisee as a source of strain. Specifically, authoritarian and autocratic leadership styles of supervision are shown to be a source of strain (Ashour, 1982; Seltzer and Numerof, 1988).

2.3.4 Organizational factors

Organizational climate and structure are potential sources of strain. These factors have roots in the organization's culture and management style (Cooper and Cartwright, 1994). In terms of P-E fit model, these stressors could be viewed along the abilities-demands and values-supplies dimensions. Organizational climate studies (Guzley, 1992; O'Driscoll and Evans, 1988) typically place emphasis on communication processes within the organization. For example, organizations in which communications highlight employees in a negative way, or generate feelings of mistrust are suggested to be stressful (O'Driscoll and

Cooper, 1996). Also, hierarchical, bureaucratic structures can be stressful as they provide little opportunity for participation by employees.

2.3.5 Career Issues

Stressors in this category are career advancement and job insecurity. In terms of the P-E fit model, these stressors reflect the misfit along the values-supplies dimension. Issues related to promotion within the organization may be a source of dissatisfaction and psychological strain (Jewell, 1998). Another related issue is that of career plateauing (Osipow, 1973), which refers to individuals' leveling off in their skill development and advancement. In these situations, individuals feel less marketable and their career has limited opportunities for growth. Cooper et al. (2001) suggest that as individuals prefer continued development, any kind of plateau effect results in dissatisfaction and strain.

Job insecurity is the most widely studied stressor related to career issues. Job insecurity reflects the prospect or threat of job loss (Cooper et al., 2001). Evidence suggests that involuntary unemployment is on the rise (Latack et al., 1995) due to factors such as globalization and technological change among others. This factor also has received support as a source of strain (Kinman and Jones, 2005). Initially, research focused on the manufacturing industry, where jobs disappeared rapidly. However, job insecurity is now a source of strain in many industries and may be one of the dominant sources of strain in the new millennium (Cooper et al 2001), and its effects are experienced at all the levels in the organization. Individuals can be affected by job insecurity in many different ways. The individuals who actually suffer job loss have their general self-esteem affected, which is linked to well-being (Burke and Cooper, 2000). The surviving employees feel they might be next, and there is evidence which suggests it could lead to low employee morale (Luthans

and Sommer, 1999). Further, due to uncertainties in employment market, individuals may remain in jobs they dislike or which offer no future prospects. This perception of entrapment is shown to reduce psychological well-being of an individual (Sutherland and Cooper, 1986).

2.3.6 Work-Home Interface

Work-home conflict has assumed growing prominence in the job stress literature. The participation of women in the workforce and advances in technologies (especially, the telework phenomenon) are the major causes for recent interest in work-family conflict. Research on this topic examines an individuals' ability to manage the interface between responsibilities on and off the job, and is shown to be a source of strain (Frone et al., 1992; O'Driscoll et al., 1992; O'Driscoll, 1996). In terms of P-E fit model, this stressor can be viewed along the abilities-demands and values-supplies dimensions. As a contributing factor, the prevalence of ICTs allows people to work anywhere anytime. It is not surprising that work-home conflict has evolved as an important source of strain (Judge et al., 1994).

Work-home conflict may be examined using one of three approaches (Greenhaus and Beutell, 1985). First, it can be viewed from the perspective of resources. Since individuals have limited time and energy, the demands from different roles (work and home) tax these limited resources. In this view, conflict is imminent, as more time and energy is required to perform specific roles successfully, the greater the extent of conflict. A second perspective is referred to as behavior-based conflict. This refers to the situation in which individuals have to portray different personality characteristics at work and home. These opposing behavioral expectations create tension in individuals. The third perspective examines conflict between the roles induced by emotional interference between work and

home. For example, negative emotional reactions from home may be carried over to job roles and vice versa, resulting in irritability and lack of competence (Menaghan, 1991). In this study, we used the resource perspective (the first described), as this is where technological factors could arguably have greater impact over the other two perspectives.

2.3.7 Invasion of privacy

"Our future is becoming increasing dependent on a multiplicity of pervasive and invasive technological artifacts" – p. 133 Orlikowski and Iacono (2001)

As the way people approach performing their job duties change, there are bound to be new factors that need to be considered in exploring job-related stress. This is apparent from the inclusion of work-home conflict as a stressor. This factor evolved as a stressor as a result of the telework phenomenon, which produced a fundamental shift in how individuals worked. Further, there have been calls to include appropriate factors in accordance with changing job design (Cooper et al., 2001). Accordingly, the concept of 'invasion of privacy' enabled by the ability to use technology to monitor employees is gaining importance as a potential stressor (George, 1996). Invasion of privacy refers to the idea that individuals have the right to be left alone. It is well known that the behaviors of individuals' change when under supervision. The degree to which the individuals value their privacy, the perceptions of 'invasion of privacy' in the work environment leads to a misfit with individuals' values. It is shown that individuals' experience strain and their well-being is affected when they feel that they do not have privacy in their actions (Smith et al., 1992; DeTienne, 1993; Frey, 1993; Jenero and Mapes-Riordan, 1992; Parenti, 2001).

In summary, drawing on the stress literature this section highlighted list of prominent stressors and identified stressors to be included in the present study. The

definitions of the stressors included in the present study are provided in table 2.2. Having looked at the background literature, the next section (i) explores how stress related concepts are dealt in the IS literature, (ii) identifies potential gaps and, (iii) nomologically places the present study in the broader literature.

Table 2.2: Definitions of relevant stressors.

Stressor	Description
Work Overload	Perception that assigned work exceeds individual's capability or skill level.
Role Ambiguity	Refers to unpredictability of the consequences of one's role performance and lack of information needed to perform the role.
Invasion of Privacy	Perception that individuals' privacy has been compromised.
Work-home conflict	Individual's perceived conflict between the demands of work and family.
Job insecurity	Individual's perception of threat of job loss.

2.4 Stress related studies in IS literature

Research related to stress has received considerable attention within the IS literature. Two broad classifications are made to organize this section. The first involves studies exploring stress experienced by IS professionals while second involves studies exploring the impact of ICTs' introduction and use which includes issues related to computer anxiety, technophobia, and technostress.

2.4.1 Review of stress in IS professionals

The research studies in this stream could be referred to as occupation stress studies or stress experienced by IS/IT professionals. Understanding what contributes to stress in IT/IS professionals is especially important considering the lack of IT talent, as strain

experienced by individuals is related to turnover intentions (Moore, 2000). Further, evidence suggests that IT professionals experience higher levels of strain (Fox, 2002; Kalimo and Toppinen, 1995; McGee, 1996; Sethi et al., 2004). Therefore, it is important to effectively manage IT professionals. To this end, the studies identified in the Table 2.3 typically explore the relationship depicted in Figure 2.2.

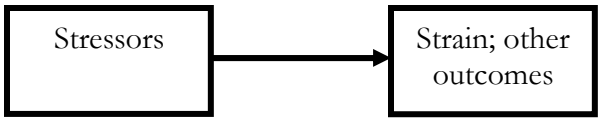

Figure 2.2: Past research models.

Since psychological well-being can be measured by different factors, the dependent variables in previous IS-stress studies are varied. However, the common theme in these studies is that they tend to identify the factors that lead an individual to an undesirable state. Some of the dependent variables studied are strain[1] (Ivancevich et al., 1983), work exhaustion and burnout – both considered as a special form of strain (Moore, 2000; Sethi et al., 2004).

Stressors identified in IS-related studies are largely consistent with previously identified stressors from the job-stress literature. Work overload is probably the most widely proposed and supported stressor among IS professionals (Bartol and Martin, 1982; Carayon et al., 2006; Chilton et al., 2005; Ivanicevich et al., 1983; Ivanicevich et al., 1985; Li and

[1] As mentioned previously the outcome of stress process is strain. However, most literature calls dependent variables as stress rather than strain, due to its intuitive appeal. The present study attempts to resolve this inconsistency as per the definitions provided before in Table 1.2.

Shani, 1991; Lim and Teo, 1999; Longenecker et al., 1999; Moore, 2000; Sethi et al., 2004; Salanova et al., 2002; Thong and Yap, 2000).

Similarly, role ambiguity is also posited as a stressor (Bostrom, 1981; Carayon et al., 2006; Goldstein and Rockart, 1984; Ivanicevich et al., 1983; Ivanicevich e al., 1985; Li and Shani, 1991; Lim and Teo, 1999; Sethi et al., 1999; Thong and Yap, 2000; Weiss, 1983). Ivanicevich et al. (1983) identify 'communication' job characteristic as an important stressor. However, this construct is similar in spirit to 'role ambiguity' as is evident from the sample items – "I never get the information I need" – indicating that the individual does not have enough information to perform his/her role effectively.

Other stressors identified before: job insecurity and work-home conflict have also received some support in IS literature (Carayon et al., 2006; Duxbury et al., 1992; Lim and Teo, 1999; Sethi et al., 2004; Thong and Yap, 2000; Vieitez et al., 2001).

As identified in Table 2.3, there is a gap in literature. As summarized in Table 2.3 (the last column) none of the previous studies have explicitly used technology characteristics. Previous attempts to develop an integrative framework for information systems and stress have also not made technology explicit (Thong and Yap, 2000). The technological characteristics that are sometimes referred to as causes for increased workload, work-home conflict etc. are never made overt in this literature. This study addresses this gap in literature.

Due to the nature of emphasis, the articles identified in Table 2.3 do not make the technological characteristics explicit (see Figure 2.2). It is interesting to note that, although technological characteristics are discussed implicitly as the source or enabling strain in individuals, the characteristics themselves are never brought to the foreground. The present

study makes the technology characteristics explicit, and proposes relationships on how technology induces stress. This is schematically depicted in Figure 2.3.

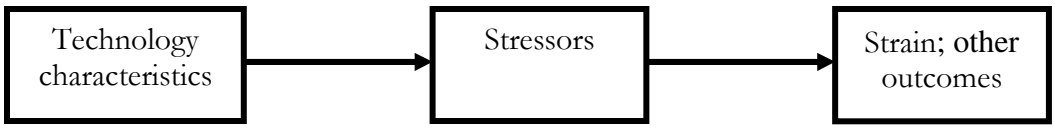

Figure 2.3: Research model in this study

In making the case for explicit technology characteristics, we ground our research in the general framework of stress identified in Kahn and Byosiere (1990) (See figure 2.4). They argue that typical stress researchers start their investigation with 'stressors'. As organizational psychologists, Kahn and Byosiere (1990) argue that "Organizational psychologists, however, must be concerned with the organizational and extra-organizational properties that are *antecedent to stressors in work settings*. In other words, we should think in terms of models in which *stressors are intervening variables*; we are interested not only in their effects but in their organizational causes" (Kahn and Byosiere, 1990 pp 580, emphasis added).

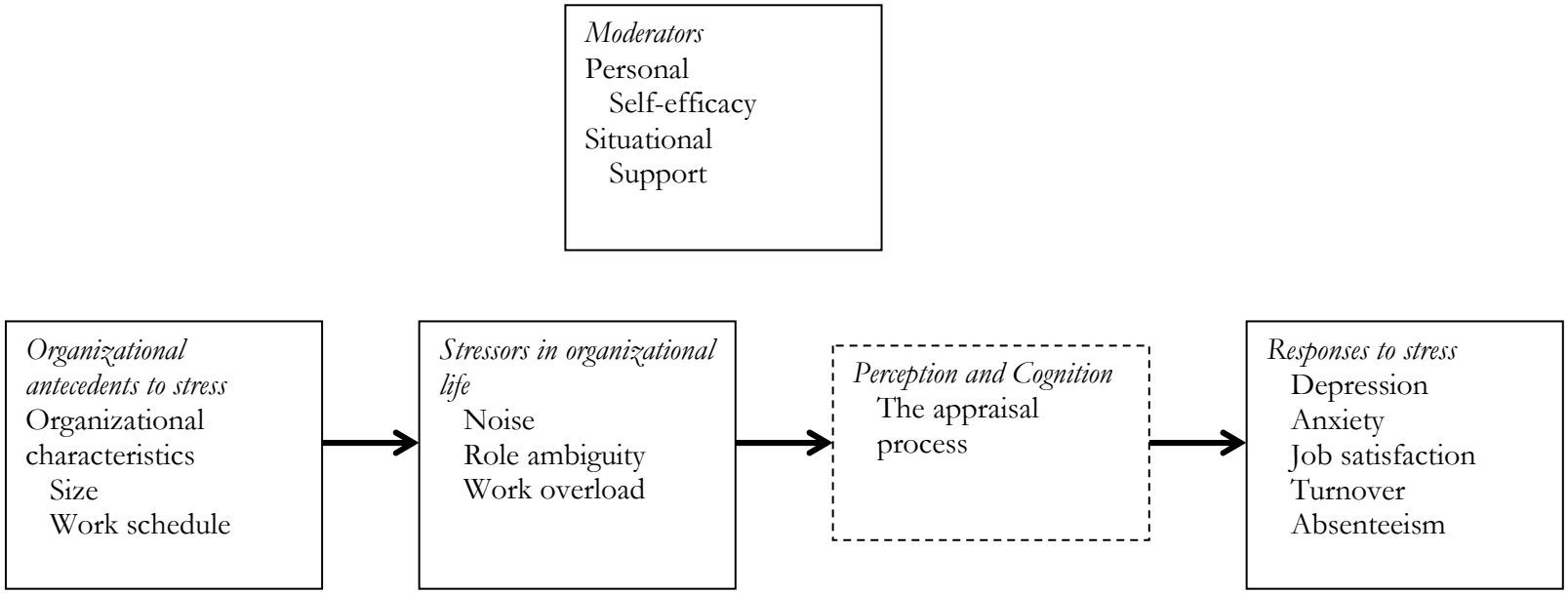

Figure 2.4. Conceptual framework proposed by kahn and byosiere (1990)

Similar to the views expressed above, we argue that as IS researchers, it is important to make technology characteristics explicit to understand the phenomenon of technostress. Therefore, the model proposed (figure 2.3) highlights technological characteristics as antecedents to dominant stressors in work settings.

In the context of this study it is important to distinguish between stressors due to ICTs and stressors due to other reasons. Technostress deals with stress due to ICTs, however, individuals' work situations could be stressful for a number of reasons (in addition to technostress). The figure 2.5 shown below delineates what is relevant to this study and how it fits into the overall stress process. Drawing on Frese (1987), who suggested that some of the well known stressors may be more pronounced with the use of computer technologies at work, we contend that the above identified stressors become pronounced due to use of ICTs. For example, the work overload stressor might have a component due to the use of ICTs and other components due to the nature of the job. Since the focus of this study is on technostress, it is important to only consider stressors due to ICTs. This provides tighter conceptualization between technology characteristics, stressors due to ICTs and strain due to ICTs. Also, this enhances the internal validity of the study by eliminating situations in which individuals use little or no technologies and still experience stressors and strain. Any stressful situation that is not directly attributed to ICTs falls outside the scope of the present study, and by focusing only on stressors due to ICTs and strain due to ICTs, the study address the issue of technostress. Consequently, references to stressors work overload, role ambiguity, invasion of privacy, job insecurity, and work-home conflict **refer to the components of these stressors due to ICTs** (e.g., work overload refers to work overload due to ICTs).

Chapter 3 provides hypotheses relating the technology characteristics, stressors due to ICTs and strain due to ICTs.

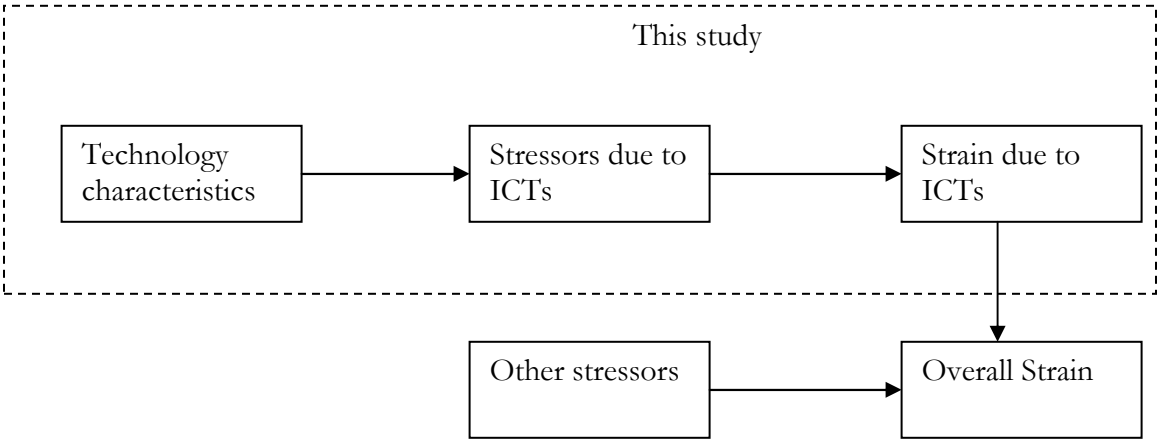

Figure 2.5. Boundaries of present study.

To conclude, this section reviewed the first part of 'stress related studies in IS literature' by reviewing works on stress experienced by IS professionals. Although stressors identified are largely consistent with previous literature, these studies have not made technology characteristics explicit. Also, the distinction between stressors due to ICTs and stressors in general is highlighted. The next section discusses the impacts of ICTs.

Table 2.3: Selected studies examining well-being issues of IS professionals.

Author(s)	Independent Variable(s)	Dependent Variable(s)	Comment(s)	Are technology characteristics explicit?
Bartol and Martin (1982)	-	-	Provides review of literature related to managing IS personnel, for example, job satisfaction.	No. Emphasis is on managing IS personnel.
Carayon et al. (2006)	-	-	A questionnaire is developed that evaluates the causes and consequences of turnover intentions in IT professionals.	No. Emphasis is on the retention of IT personnel.
Chilton et al. (2005)	Preferred cognitive style of software developers, perceived cognitive style required in job environment	Stress/strain, job performance	Stress/strain and job performance of software developers is studied. Basic premise is based on the person-environment fit concept. Specifically, misfit between the cognitive style of software developers and cognitive style required in job environment is shown to be related to stress/strain and job performance.	No. Emphasis is on the productivity of software developers.
Goldstein and Rockart (1984)	Role characteristics (role ambiguity, role conflict), leadership characteristics	Job satisfaction	Job satisfaction on programmers/analysts is shown to be related to role characteristics.	No. Emphasis is on the satisfaction of programmers/analysts.

Table 2.3: Selected studies examining well-being issues of IS professionals. (Continued)

Ivancevich et al. (1983)	Work environment stressors (work overload, role ambiguity, change, communication)	Stress outcomes (satisfaction, commitment, tension, doctor visits, absenteeism)	Provides an exploratory study on IT professionals. Little theoretical reasoning provided. Various job related factors (work overload, role ambiguity, communication etc) are found to be significant source of strain.	No. Emphasis is on developing an occupational model of stress for IT professionals.
Ivancevich et al. (1985)	Work attitude, Type A behavior	Stress outcomes	Alludes to person-environment fit. Emphasis is on extending the occupational stress research for IS profession.	No. Emphasis is on IS personnel.
Li and Shani (1991)	Organizational contextual factors, job satisfaction factors	Work stress factors	Theoretical reasoning unclear. Work overload is found to be a significant source of work stress.	No. Artifact is in the context, i.e. IS managers.
Lim and Teo (1999)	-	-	Key sources of stress in IT personnel are identified. These factors work demands, relationships with others, career concerns, systems maintenance, role ambiguity and administrative tasks.	No. Artifact is in the context, i.e. IT personnel in Singapore.

Table 2.3: Selected studies examining well-being issues of IS professionals. (Continued)

Longenecker et al. (1999)	Causes of IT job stress (Implicit) like poor communications, increased workload, conflicting goals, organizational change	Consequences of IT job stress (Implicit) like frustration, depression, turnover intentions, bad attitude, lack of motivation	Theoretical reasoning doesn't exist. The causes and consequences identified are based on the literature review. Based on the survey results the top 10 causes and consequences are reported.	No. Artifact is in the context, i.e. IT personnel
Moore (2000)	Perceived workload, role ambiguity, role conflict, autonomy, and fairness of rewards	Work exhaustion, turnover intention	Theoretical reasoning provided is based on the previous empirical results. Work overload is the strongest contributor to exhaustion. Technology professionals experiencing higher levels of exhaustion reported higher intentions to leave the job.	No. Artifact is in the context, i.e. IT personnel
Salanova and Schaufeli (2000)	Exposure to technology (frequency, time)	Burnout	The study investigates burnout among users of computer-aided technologies. In essence, if the technology is appraised positively, it will reduce the burnout levels.	No. Artifact is in the context, i.e. respondents were users of computer-aided technologies.

Table 2.3: Selected studies examining well-being issues of IS professionals. (Continued)

Salanova et al. (2002)	Job demands (quantitative overload), job control, self-efficacy (general and computer)	Burnout (exhaustion, cynicism)	Theoretical reasoning is based on Karasek's demands-control model. The more specific level of self-efficacy (i.e., computer self-efficacy) moderated the relationship between job demands and control and levels of burnout dimensions as expected.	No. Artifact is in the context, i.e. respondents were users of IT from different professions.
Sethi et al. (1999)	Work overload, Role ambiguity, role conflict	Burnout (lack of commitment)	Burnout in IS professionals is studied.	No. Emphasis is on IS personnel.
Sethi et al. (2004)	Stressor categories are – training, deadlines, coworkers, performance evaluation, job security, career development, user demands.	Burnout, job satisfaction and intention to quit.	No theoretical reasoning provided. 33 stressors are identified and classified into 7 stressor categories. The stressor categories are shown to be related to burnout, job satisfaction and intention to quit.	No. Artifact is in the context, i.e. IS personnel
Thong and Yap (2000)	-	-	Develops an occupational stress framework for IS professionals. Synthesizes different models and identifies key points that should be considered when studying occupational stress of IS professionals.	No. The emphasis is on the IS occupation, therefore typical stress models are applied to IS profession.

Table 2.3: Selected studies examining well-being issues of IS professionals. (Continued)

Weiss (1983)	Organizational stressors (like overload, role ambiguity, keeping up with rapid technological change, career development etc), and social support	Strain responses (like job dissatisfaction, psychological symptoms of strain)	Minimal theoretical reasoning. In general, stressors are positively related to strain. Among the stressors, role ambiguity has the greatest impact. Social support acts as a buffer, i.e. it moderates the relationship between stressors and strain.	No Artifact is in the context, i.e. IT managers

2.4.2 Review of ICTs adoption and use

The discussion on the impact of ICTs could again be broadly discussed under two themes: ICT-enabling and ICT-consequences themes. The ICT-enabling theme addresses issues of how IT enables individuals and organizations to be efficient and effective. In the words of Gutek (1983: p.163) this is succinctly expressed as "What can technology do *for* you?" Most studies explore how ICTs can improve individual and organizational productivity and address issues related to adoption, use of technology and business value of ICTs (e.g., Agarwal, 2000; Barua and Mukhopadhyay, 2000). Two primary research streams address the issue of individual's adoption and use of ICTs. The first stream based on Diffusion of Innovation (DOI) (Moore and Benbasat, 1991) consistently finds three characteristics of technology as significant predictors of adoption. These are compatibility, relative advantage and complexity. The second stream is based on Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989), which identifies two factors as significant predictors for an individuals' intention to adopt a technology. These factors are perceived usefulness and perceived ease of use. It is worth noting that considerable similarity exists between the two approaches. The concepts of 'relative advantage' and 'perceived usefulness', 'complexity' and 'perceived ease of use' are used interchangeably (Moore and Benbasat, 1991). This 'adoption and use' research stream identifies technology characteristics that facilitate the voluntary use of ICTs. Similarly, the lack of these characteristics makes the adoption and use of ICTs difficult. The degree to which the use of ICTs is perceived as involuntary and lacking these characteristics (e.g. usefulness, ease of use) makes the use of ICTs events stressful. Drawing similar reasoning, the 'adoption and use' characteristics discussed here would be useful in developing the theoretical model, as discussed later.

The second theme looks at the consequences of ICTs. In the words of Gutek (1983: p.163) this is better expressed as "What can technology do *to* you?" There is relatively little work done in this theme, however, this theme is growing in importance. This theme addresses issues related to the behavioral and psychological outcomes due to introduction or use of ICTs. Computer anxiety (Igbaria and Chakrabarti, 1990), technophobia (Rosen et al., 1987; Brosnan, 1998), and technostress (Tu et al., 2005) are some illustrative works in this stream. The proposed study fits into the second stream.

In summary, some of the dominant technology characteristics studied in literature are identified. Further, the present study is positioned in broader literature. The next section provides detailed analysis on technostress.

2.4.2.1 Technostress

As with the broader concept of stress, 'technostress' has also been used in many different ways. Technostress refers to the state of mental and physiological arousal, and consequent pressure, observed in employees who are dependent on technology in their work (Arntez and Wihlom, 1997). Some consider technostress to be a modern disease caused by the inability to cope with new technologies in a healthy manner (Brod, 1984). In this study, technostress refers to strain caused by individuals' interaction with ICTs. The concept of technostress[2] is discussed to an extent (Brod, 1984; Kakabadse et al., 2000; Sami and Pangannaiah, 2006; Tu et al., 2005; Weil and Rosen, 1997), as identified in Table 2.4. Although the individual studies discuss the process of how technology creates stress to some

[2] There are practitioner publications that discuss some aspects of technostress. These are not discussed here as they focus on anecdotal rather than a conceptual analysis of technostress.

extent, none of them systematically identify the technology factors that create stress. Further, they do not base their arguments on the rich theoretical base of job-stress literature.

It is interesting to note that Brod (1984), Kakabadse et al. (2000) and Weil and Rosen (1997) are books/book chapters that provide a descriptive treatment on technostress – often covering a broad range of issues related to ICTs (for example, technophobia).

There is a need for empirical studies on technostress, given its importance in present society. Tu et al.'s (2005) work is one of the few studies that provide an empirical conceptualization of technostress by developing a second order model for technostress with five dimensions of technostress. These are techno-overload, techno-invasion, techno-uncertainty, techno-complexity, and techno-insecurity. Although, this provides one way of conceptualizing technostress, this approach has several limitations. First, the causes of technostress are not identified. The above factors are identified as dimensions of technostress. Second, the conceptualization makes the boundaries and relationship between technology characteristics and stressors (like work overload) ambiguous. For example, the dimension of techno-overload asserts that there is greater workload and this is caused by technology. However, how this happens and what characteristics of technology cause this increase in workload is not clear. This paper contributes in this respect by making the technology characteristics explicit and proposing relationship between technology characteristics and stressors as depicted previously in Figure 2.3.

Table 2.4: Selected works on technostress.

Author(s)	Concept of technostress discussed?	Arguments grounded in stress lit.?	Type of work	Comment(s)
Brod (1984)	Yes	Not explicitly	Descriptive	These descriptive accounts generally describe how technology characteristics and the present technological environment could be stressful. For example, (i) References are made to how portability of technology and connectivity in technological environment could lead to invasion of privacy. (ii) The pace of change in technologies renders individuals' skills obsolete. This leads to concerns over job security.
Kakabadse et al. (2000)	Yes	Not explicitly	Descriptive	
Sami and Pangannaiah (2006)	Yes	Not explicitly	Descriptive	
Weil and Rosen (1997)	Yes	Not explicitly	Descriptive	
Tu et al. (2005)	Yes	Not explicitly	Empirical	This study proposes technostress as a second order construct consisting of techno-overload, techno-invasion, techno-uncertainty, techno-complexity, and techno-insecurity. This conceptualization lacks conceptual clarity on how technology enables stress. For example, it only asserts that technology causes greater workload, but how this exactly happens is unclear.
Present work	Yes	Yes	Empirical	The present work draws on above descriptive works on technostress, and stress and IS literatures to develop a model for technostress.

This is achieved by integrating the stress related studies of IS professionals (Table 2.3) and the above works on technostress (Table 2.4). The result is the development of a framework in which we use the descriptions provided in the technostress literature and base it on the theoretical foundations of job-stress literature. The result is a theoretically grounded framework which identifies technology characteristics explicitly, as shown previously in Figure 2.3.

2.5 Theoretical Framing of the Study

This section summarizes the key takeaways discussed in this chapter that are useful in developing the theoretical model in next chapter. These are

1. Contemporary views on stress focus on both the individual and environmental parts, i.e. stress cannot be attributed exclusively to either individual or environmental factors, but it exists in the relationship between the two.
2. Person – Environment fit model provides a framework for understanding the process of stress. In this model, fit could be evaluated along two dimensions: individual abilities - environment demands and individual values – environment supplies. Misfit along these dimensions is shown to be related to strain.
3. Review of existing stress literature has identified work overload, role ambiguity, job insecurity, work-home conflict, and invasion of privacy as potential stressors in the context of present study.
4. Review of existing IS literature identifies two main points
    a. Extensive stress literature in IS field indicates that previous research has mainly focused on stress in IS professionals rather than identifying what

characteristics of technology, if any, are stressful. This kind of research could be called occupational research as the emphasis is on IS occupation.

b. Technology adoption and use research stream could be used to identify some of the technology characteristics, which, if not present, make the use of ICTs frustrating and difficult.

5. Present works on technostress are mainly descriptive and do not consider the technology characteristics that are the source of technostress.

CHAPTER THREE
THEORETICAL DEVELOPMENT

Drawing on the insights from previous chapters, this chapter presents the research model and associated hypotheses. We propose that different aspects of technology produce varying levels of stress (Moreland, 1993). Based on the argument of the broad model in chapter 2, it is proposed that technology directly affect stressors which in turn create stress. This section explains how specific technology[3] characteristics influence stressors and strain. This chapter unfolds as follows: First, the theoretical premise of person-environment fit is discussed in more detail. Second, specific technology characteristics are identified based on previous works on technostress. Finally, hypotheses are developed for each technology characteristic, and also, hypothesis for potential moderators are discussed. Before looking into each of these sections, evidence of stressful impacts of ICTs is presented below.

There is empirical support which suggests that ICTs enhance stress in individuals. For example, it is argued that the initial productivity gains due to advances in ICTs enable higher expectations from management in terms of future productivity gains. This leads to employees facing significant work overloads (Karuppan, 1997). Further, Martin and Wall (1989) when referring to the manufacturing industry, note that advances in IT are changing the role of individuals in jobs. Present jobs are characterized by loss of control, lack of job security, and loss of privacy due to increased vigilance; all shown to be related to lack of well-being. Porter and Kakabadse (2006) suggest that the natural outgrowth of ICT use at work results in sources of pressure and challenge. In other words, ICT use could increase stress by impacting the stressors. Further, factors like increasing and unrealistic demands,

[3] References to technology imply the technology in the context of work-related activities.

expectations of connectivity and availability, blurring boundaries between work and life are reported in ICT users (Weil and Rosen, 1997). As discussed previously, all these factors are shown as contributing factors for strain.

3.1 Person-Environment fit

The person-environment fit literature underpins this study. The basic premise of this model is that misfit between person and his/her environment leads to strain. In essence, all the stressors result from a misfit or gap between the person and the environment. As discussed previously, misfit could occur along values-supplies, and abilities-demands. First, a misfit could occur between the values of a person, and the environmental resources available to fulfill those values (Edwards, 1996). For example, an individual may value his/her privacy or value job security. However, due to ICTs' intrusive and dynamic nature, =misfit could resulting in higher perceived insecurity. In these situations, individuals may be reluctant or even resist the adoption and use of ICTs.

Second type of misfit could occur between the abilities of the person, and the demands placed by the environment. An example of this misfit in the present study relates to the demands placed by ICTs on individuals' attention. The constant connectivity of ICTs demand individuals' time and energy, and the degree to which it taxes individuals' abilities leads to strain.

Since both types of misfits influence strain (Edwards, 1996), it is important to integrate values-supplies and abilities-demands misfits when integrating technology into the person-environment fit framework. It should be noted that when applied in the context of

this study, the misfit with environment implies the technological environment of an individual.

The basic premise of this study is an extension of the above arguments. We propose that ICTs may exacerbate the ability-demand and value-supply misfits. In other words, ICTs create additional demands, there by enhancing the ability-demand gap. Further, the gap between value-supply is intensified by creating situations which conflict with individual values (see Figure 3.1[4]). The following section identifies the technology characteristics used in this study and then develops hypothesis for each characteristic drawing upon the above premise.

3.2. Technology characteristics and hypotheses

To develop a model that is generalizable to various technologies poses a challenge in identifying appropriate technology characteristics. Further, since the introduction, adoption and impacts of ICTs are studied in multiple areas, different areas of research are considered for identifying these characteristics. The factors are identified from the three recurring themes that emerged from IS adoption and use, and technostress literatures.

Since available studies on technostress are mainly descriptive, they do not explicitly identify stressful characteristics of technology. The procedure outlined below is followed to identify the technology characteristics that enhance the person-environment misfit. First, based on the review of available studies on technostress, the recurrent technology concepts that are proposed to be stressful are identified. Then, these concepts are mapped on to the

[4] The usability, dynamic and invasive characteristics of technology are discussed little later.

available constructs from IS literature based on their conceptual similarity. The resulting characteristics with their reference in IS and technostress literature are shown in table 3.1.

Since usefulness, complexity and reliability are related to the adoption and use of technologies, we categorize these as 'usability' characteristics. The 'pace of change' refers to the dynamic nature of ICTs, and therefore could be referred to as a 'dynamic' characteristic. Lastly, 'presenteeism' and 'anonymity' refer to the invasiveness of ICTs and therefore could be referred to as 'invasive' characteristics. These characteristics and the impact they have on stressors is depicted in figure 3.1. The next section develops hypotheses under each of these usability, dynamic and invasive characteristics of ICTs. The factors identified here, for the most part, cover the descriptive analysis of some of the previous studies on technostress (Kakabadse et al., 2000; Weil and Rosen, 1997).

The identified characteristics and their definitions are provided in Table 3.2. Each of these characteristics and how they affect the stressors previously identified are discussed in terms of hypothesis development in the following sections. The proposed research model is shown in figure 3.2.

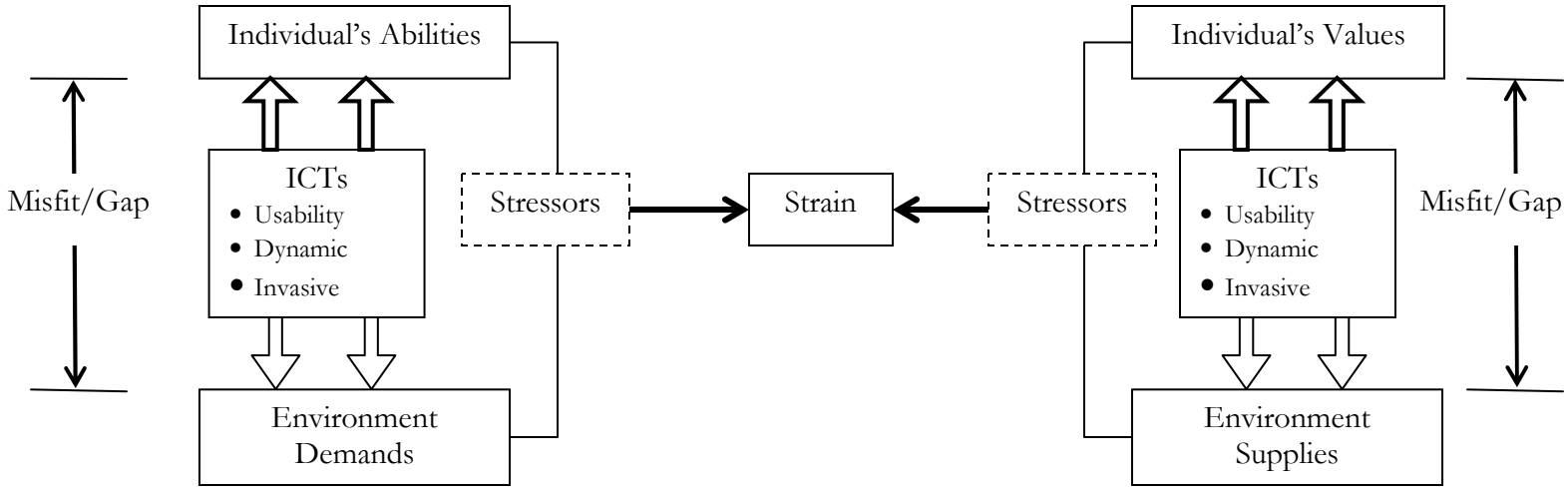

Figure 3.1: Impact of ICTs on person-environment fit.

Table 3.1: Technology characteristics identified from a review of studies.

		Review of existing studies on Technostress				
Technology Characteristics Identified	**Support for Identified Characteristics from Existing IS Literature**	**Brod (1984)**	**Kakabadse et al. (2000)**	**Sami and Panganna iah (2006)**	**Tu et al. (2005)**	**Weil and Rosen (1997)**
Usefulness	Moore and Benbasat (1991), Davis et al. (1989)	●	●	●		●
Complexity	Moore and Benbasat (1991)	●	●	●	●	●
Reliability	Delone and McLean (1992; 2003), Jiang et al. (2002)	●	●		●	●
Pace of Change	Weiss and Heide (1993), Heide and Weiss (1995)	●	●	●	●	●
Presenteeism			●		●	●
Anonymity	Pinsonneault and Hippel (1997)		●		●	●

Table 3.2: Technology characteristics and their definitions.

Technology Characteristic	Definition
Usefulness	The degree to which the characteristics of technology enhance job performance (Moore and Benbasat, 1991; Davis et al., 1989).
Complexity	The degree to which the use of technology is free of effort (Moore and Benbasat, 1991).
Pace of Change	The degree to which an individual perceives technological changes to be rapid (Weiss and Heide, 1993; Heide and Weiss, 1995).
Presenteeism	The degree to which technologies enable individuals to be reachable.
Reliability	The degree to which the features, capabilities provided by the technology are dependable (Delone and McLean, 1992; 2003; Jiang et al., 2002).
Anonymity	The degree to which the exact use of technology could be identifiable (Pinsonneault and Hippel, 1997).

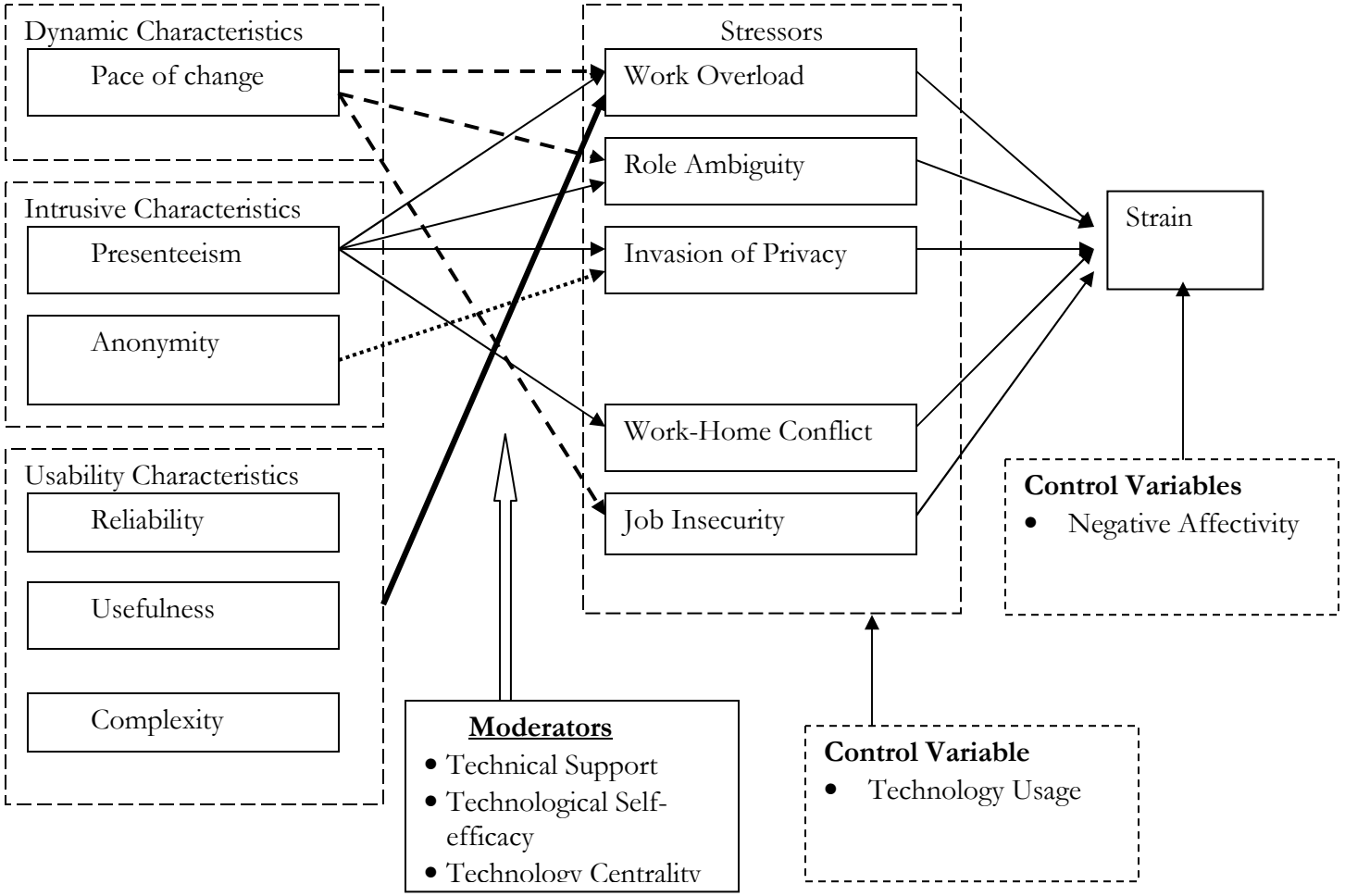

Figure 3.2: Proposed research model

3.2.1 Characteristics from 'usability' stream – usefulness, complexity and reliability

This section proposes how the three characteristics usefulness, complexity and reliability affect work overload. These three characteristics are loosely described under 'usability' umbrella because these factors have a common theme. Because of the confounding effects of relative advantage and compatibility (as argued in Moore and Benbasat, 1991), perceived usefulness is used as an innovation characteristic in innovation studies (Yetton et al., 1999). Accordingly, in the present study, perceived usefulness could be used instead of relative advantage and compatibility. These characteristics typically enable ICTs to be adopted and used. This implies that individuals value the characteristics of usefulness, complexity and reliability. Given that majority of individuals are not active adopters of technologies (Weil and Rosen, 1997), these characteristics take on heightened importance. Some individuals adopt technologies and technological aids enthusiastically, while others do it reluctantly. In fact, one study reports that 85 per cent of the population is in some respects uncomfortable or frustrated with technologies (Weil and Rosen, 1997). As regards individuals' attitude towards technology, Weil and Rosen (1997) identified that only 10-15 percent of population eagerly adopted technology, while 50-60 percent was hesitant, and the remaining resisted. They further report that 52% of individuals using the Internet, mobile phones are technophobic about using them, and shown to result in higher stress, lower productivity and lower efficiency.

The characteristics identified in the usability stream are based on the premise of voluntary adoption of ICTs. This implies that the usability characteristics discussed here (usefulness, complexity, and reliability) are useful in predicting the individual adoption and use of technologies, when the adoption and use of technologies is voluntary. However, for

the general technologies and the technological context at work place, there might not be a choice for adoption and use of ICTs. In other words, use of certain technologies at work place might not be voluntary due to the requirements of the job, and/or due to the implicit norms at work. For example, individuals might not have a choice to adopt e-mail technologies, or use mobile devices. This implies that individuals might have low perceptions of usability characteristics (which predict non-adoption) but still have to adopt and use technologies due to constraints in the work environment. In terms of P-E fit, the use of ICTs seems to enhance the misfit between the persons' values - environment supplies and between persons' abilities – environment demands. Evidence suggests that use of technologies based on compliance, rather than on voluntary adoption is stressful (Sami and Pangannaiah, 2006). Therefore, it is hypothesized that

H1: Individual perception of technology usability characteristics will be related to perceived work overload[5].

Since the majority of the individuals are not active adopters, they may not explore the ICTs. It is possible that the individuals who use ICTs reluctantly do not perceive the usefulness characteristic of the technology. These low perceptions of usefulness enhance the gap between person-environment by changing the perceptions of work overload. The perceptions of individuals' abilities are lowered as individuals actually perceive the technology to be not useful and believe that the work demands could be addressed in a better way. Further, the involuntary adoption of not so useful technology (as perceived) enhances the conflict between persons' values and environment supplies. Evidence supports

[5] Remember that stressors here reflect stressors due to ICTs, i.e. perceived work overload is actually perceived work overload due to ICTs.

that this type of conflict increase the demands on individuals, suggesting increased workload. Therefore, it is hypothesized that

H1a: Individual perception of technology usefulness will be negatively related to perceived work overload.

As ICTs become more complex, users may be frustrated with the number of features or confusing features as they might not find them useful. For example, some users are dissatisfied with the growing complexity of mobile devices (CNN, 2006b). Here, in accordance with adoption and use literature, the importance of 'ease of use' usefulness has been identified as essential, yet the present ICTs are still frustrating to use. One market researcher asks (regarding mobile devices) – 'Why is every user interface based on typing? When typing is the worst thing individuals do on mobile devices?'(CNN, 2006b) The above anecdotal evidence suggests that perceptions of complexity of technology could be stressful. These high perceptions of complexity (or low perceptions of ease of use) enhance the gap between person-environment by changing the perceptions of work overload. As individuals' perceive the use of technology to be difficult, any work demands placed by the use of that technology are perceived to be challenging. Further, the involuntary adoption of difficult technology (as perceived) enhances the conflict between persons' values and environment supplies. Evidence supports that this type of conflict increases the demands on individuals, suggesting increased workload. Therefore, it is hypothesized that

H1b: Individual perception of technology complexity will be positively related to perceived work overload.

Reliability is another characteristic that is discussed in the literature that generally refers to dependability and consistency of a system. Not surprisingly, researchers have recognized reliability as a factor in information system success models (DeLone and

McLean, 1992, 2003; Jiang et al., 2002). Although the importance of reliability may seem obvious, it is argued that many systems are not inherently reliable (Butler and Gray, 2006). This could in due be part of increasing complexity of today's systems, often containing unreliable components (Butler and Gray, 2006). Reliability problems in terms of software errors, quality problems, and failures are quite commonly discussed in literature (Abdel-Hamid, 1999; Austin, 2001; Ba et al., 2001). Consequently, we argue that unreliability or the threat of unreliability increases the perceived workload leading to strain. As individuals value reliable systems, any perceptions of unreliability not only enhance the conflict between the individuals' values and environment supplies (in terms of available systems) but also increase the perceptions of environment demands. First, individuals may have to do their tasks again in light of breakdowns. Second, individuals could have increased workloads due to the fear of breakdowns. It is not necessary that the actual technology be unreliable, but if an individual perceives it to be unreliable, then it causes increased workload, as the individual has to take precautions from the threat of breakdown.

Aborg and Billing (2003)'s work provides empirical evidence that suggests unreliability of ICTs is a source of strain. Respondents reported that, in the present work context, they were completely dependent on technologies and often feel captured. This situation changes the individuals' expectations about technologies, thereby creating new boundaries for what individuals' value. Given this technology dependence, any kind of unreliable performance in terms of disruptions, breakdowns, or unexpected long response times leads to frustration and increased stress levels. Further, anecdotal evidence support that individuals are frustrated when ICTs are unreliable (CNN, 2006b). Based on the above arguments it is hypothesized that,

H1c: Individual perception of technology reliability will be negatively related to perceived work overload.

3.2.2 Presenteeism

In the context of the present study, we define presenteeism as the degree to which the technology enables users to be reachable. The underlying premise of this concept is in connectivity i.e. different ICTs differ in their degree of connectivity. Anecdotal evidence suggests that IT can contribute to burnout by enabling employees to be connected to the office anytime and anywhere through laptops, e-mail, cell phones etc. (McGee, 1996). It is further reported that four out of five executives globally are always connected to work through mobile devices (CNN, 2006a).

Two factors need to be considered when presenteeism of a technology is considered. The first factor is how quickly the individual is accessible. Second, how well the services of individual can be rendered using the technology in question. For example, a cell phone may provide instant access to an individual, but limits the actions an individual can perform. On the other hand, an individual with a laptop may be less accessible, but may be able to perform more job activities. Presenteeism is one of the most widely discussed factors in the practitioner literature as well as the technostress literature. We contend that the ability to be accessible induces stress through four stressors – work overload, role ambiguity, work-home conflict, and invasion of privacy.

It could be argued that the development of work-home conflict as a stressor is due to the presenteeism characteristic of ICTs. Before the advances of ICTs over the last few decades, individuals' work life and home life were, for the most part, separate from each other. However, the advances in ICTs enabled organizations to offer flexible work environments as a benefit for individuals who wanted to cut commute time, and for those

who traveled a lot. Initial research concerns focused on how to design and organize the home-office; how to be an effective organizational member; and on the concerns of reward fairness as employees are 'out of sight'. With the proliferation in ICTs, what once was limited to some employees is now a common feature for most individuals in organizations. Now, it is not uncommon for individuals to bring work home and experience the presenteeism characteristic of ICTs working from home. Career oriented individuals are increasingly augmenting the time spent at the office with work done at home made possible by different ICT devices and applications.

While constant connectivity might have benefits for some, it also comes at the cost of blurring work-home boundaries, and invasion of privacy. There is growing evidence that the constant connectivity of ICTs is diminishing the quality of life to the extent that families are using 'instant messages' to communicate with each other, even when the individuals are in the same house (CBS, 2006). New technologies are seen as enabling blurring of boundaries between work and home (Mann and Holdsworth, 2003) and this factor has been shown to be a source of strain (Duxbury and Higgins, 1991).

Further, the meaning of the term 24-7 is changing in the way it is referred. Traditionally, it typically meant rigid 8 hour shifts for employees at workplaces that required round the clock service. However, with advances in technologies, it is now commonly referred to as the availability of individuals around the clock. Laptops, cell phones, broadband connections and other ICT advances, are blurring the boundaries of work-home by providing increased access to work and to individuals.

From the above arguments it is clear that presenteeism enhances work-home conflict. The prevalence of 'working from home' concept leads to an unspoken norm in

which individuals are expected to work from home. As individuals are limited in their abilities (resources), these increased demands enhance the gap between abilities-demands. Further, individuals' values and preferences in terms of not-to-work from home might not be fulfilled by the perceptions of environment supplies (expectation to work from home). Therefore, it is hypothesized that

H2: Individual perception of technology presenteeism will be positively related to perceived work-home conflict.

Related to work-home conflict, another path in which presenteeism is viewed as stressful is the invasion of individuals' privacy enabled by the constant connectivity. Present work pressures have often created an unspoken norm which appreciates individuals who are constantly available. Even on vacations, it is often reported that individuals are working to some extent made possible by presenteeism of ICTs. One of the popular ways in which individuals stay connected with work is through the use of Blackberry®'s. However, Blackberry®'s are often referred to as 'Crackberrys' due to the over-reliance of individuals on them. Popular press suggests that this type of over-identification with ICTs could lead to diminished well-being in individuals (CNN, 2006c). Individuals who are off-Blackberry®'s have reported being more effective. To this extent, some hotels are offering ingenious service by locking up guests' Blackberry®'s. This is expected to provide privacy and also real time-off without digital leashes. It is clear from the above discussion that this technology characteristic enhances the person-environment misfit along the values-supplies dimension. As individuals' value privacy, the present environmental context does not fulfill these expectations, leading to the following:

H3: Individual perception of technology presenteeism will be positively related to perceived invasion of privacy.

The presenteeism characteristic could also enhance the work overload and role ambiguity. Arguably, one of the major impacts of advances in ICTs is on the individuals' ability to stay 'connected'. The advances in connectivity increase the speed of workflow and heighten people's expectations for productivity (Clark and Kalin, 1996). The faster flow of work and heightened expectations from individuals often lead to jobs that require working under time pressures and strict deadlines. The need to work under time pressure and meet deadlines is shown as a source of work overload (Cooper et al., 2001; Narayanan et al., 1999). The applications/devices available to employees enable them to respond in-, or near-, real time (Vernon, 1998). This increases the demand on individuals to process information. It also creates the norm of 'real time' response in present day's information age society. This has lead Beeman (1996, p.3) to conclude that people are 'economically pressed, politically depressed and socially stressed'.

Most ICT innovations place demands on individuals in terms of new skills required, or expectations of faster turnaround times; and assumed availability around the clock. These increasing demands add to the perceived workload of individuals. In effect these increasing demands due to technology presenteeism enhance the misfit between individual abilities and environment demands. Given the constraints on abilities (resources) the increase in demands leads to greater perceived workload.

H4: Individual perception of technology presenteeism will be positively related to perceived work overload.

It should also be noted that ICTs create a constant demand for attention. It is not uncommon for individuals to leave their e-mail open, or create an alert on mobile phone whenever a new e-mail is received. The need to respond to these demands eventually takes 'time away' from work. The demands placed by these interruptions may create ambiguity on which task/job to perform. Further, the constant connectivity at work enables individual to multi-task, often creating ambiguity on what task an individual should perform. Although, it could be argued that some individuals have the choice to be 'disconnected', it may not always be possible. As alluded to before, the acts of certain highly motivated individuals create unspoken norm for the whole group/organization (for example, in terms of responding to emails quickly), commonly referred to as 'tragedy of commons'. To the extent that individuals value certainty in their work tasks, the supplies of the environment do not fulfill the individuals' expectations. In this regard, the technology presenteeism enhances the misfit along the individuals' value – environments' supply dimension. From the review of stress literature, the stressor that constitutes uncertainty in individuals' tasks is identified as role ambiguity. Therefore, it is hypothesized that

H5: Individual perception of technology presenteeism will be positively related to perceived role ambiguity.

3.2.3 Anonymity

In this study, anonymity refers to the degree to which an individual perceives that the use of ICT is identifiable, or the degree to which an individual perceives that individuals' actions are identifiable. The advances in technologies in the last two decades have enabled organizations to implement several processes that monitor employees' actions. In general, the invasiveness of technology has been recognized previously (Boyd, 1997), and evidence

suggests that individuals are apprehensive about the advances of ICTs at work due to the possibility of monitoring (George, 1996).

The anonymity characteristic of technology could lead to invasion of privacy by enhancing the misfit along the value-supply dimension. The anonymity or identifiability characteristic of technology enables monitoring. Therefore, the technological environment in which an individual works may be inconsistent with the individuals' values, (i.e. individual may value his/her privacy) and the availability and potential use of ICTs to monitor individuals' actions leads to misfit between individuals' values and supplies of the technological environment. From the review of stress literature, the stressor that constitutes concerns over individuals' privacy is identified as invasion of privacy.

As a society in general, there is an increasing loss of privacy as ICTs enable individuals, organizations and/or government to monitor the actions of individuals. It is not uncommon to find cameras in cities, malls, and other public places. Although these actions may potentially make for safer places, the price paid by the society is loss of privacy. Individuals feel that increasingly technologies are used to monitor individuals' behaviors and actions. Some have gone as far as installing speakers in addition to cameras, not only to monitor but to issue commands (Yahoo, 2006). Some even suggest that the society is moving in a direction where every action and even thoughts could be tracked and monitored (Mihelich, 2006). There is some evidence that this is technically feasible (Gandossy, 2006). In a similar vein, organizations could use ICTs to monitor the employees' actions with or without their knowledge, for security and productivity purposes. This has raised some ethical questions and researchers have explored the area of computer performance monitoring (CPM). Research in this area explored issues such as whether monitoring is ethical and,

whether employees have a right to know that they are monitored etc. Irrespective of what aspect of CPM was studied, there is consensus that computer monitoring is stressful on employees (Smith et al., 1992; DeTienne, 1993; Frey, 1993; Jenero and Mapes-Riordan, 1992; Parenti, 2001). It is a typical policy of organizations to monitor work related activities, notably e-mail. Doyle (1999) reports that in a survey of 1085 corporations, more than 40 percent engaged in some kind of intrusive employee monitoring including checking e-mail, telephone conversations, video recording, recording of computer activity, among others.

Not only are technologies like closed camera's used for monitoring, but the use of ICTs leave a trace which could easily be monitored. Further, the individual actions and behaviors using technology could be easily monitored and traced. Reports indicate that even after following the 'instructions' to delete all the episodes of ICT use, it was found that it is easy to retrieve the actions individuals' performed with ICTs. For example, after investigating only 10 mobile devices, sensitive corporate and personal information accounting to 27,000 pages was retrieved (CNN, 2006d). Other examples include, the ability to check who is logged on to the network, the ability to know the complete history of any file created (created, modified etc.) by employees and, the ability to know when email is delivered and when the email is read.

It is clear from above arguments that the ability to monitor and the ability to trace the use of ICTs lead to concerns over loss of privacy. The degree to which an individual perceives the misfit between the values and supplies of present ICTs (in terms of anonymity characteristic) leads to perceptions of privacy invasion.

H6: Individual perception of technology anonymity will be negatively related to perceived invasion of privacy.

3.2.4 Pace of change

Pace of change refers to the degree to which an individual perceives the changes in his/her technological environment to be rapid. It is argued that pace of change enhances work overload, role ambiguity, and job insecurity by placing new learning demands on individuals, and by making the individuals' skills obsolete.

Typically, introduction of new technologies is argued to be a contributing factor to increased levels of job insecurity (Johansson, 1989; Korunka et al., 1995). However, Korunka et al. (1997) suggest that not only is the introduction of ICTs important, but continuous changes in ICTs is important in understanding individuals' stress responses. Further, Arnetz (1997) argues that constant development of new software tools, and rapidly changing technical and business environments result in high levels of stress. Empirical evidence suggests ICTs change faster than the ability of humans to adjust to the change (Pascarella, 1997). Vernon (1998), in a similar vein, notes that the speed of technology change means people have to spend more than usual hours to cope with innovation and work.

Employees are also pressured by the pace at which they have to adapt to new ICTs (Weil and Rosen, 1997). Even as they get accustomed to one particular tool or program, they often have to keep up with a 'better' tool or program which can 'do more'. This not only takes time to learn, but sometimes renders the skills of employees obsolete.

In words of Sami and Pangannaiah (2006), "Computer operating systems and software versions are changing so fast that by the time users get used to one version of the software, the next version gets released. This by itself brings with it a feeling of insecurity, the fear of not being able to keep up with these technological changes and a form of technology fatigue (page 430)".

The pace of change could be exemplified by either the changes to existing technologies, or the introduction of new technologies. These constant changes in ICTs create adaptational demands on individuals. It could be in terms of new learning demands, and in terms of demands placed by changes in functionality of ICTs (Korunka and Vitouch, 1999).

In addition to the demands of job, the constant changes place demands on individuals' attention to acquire new skills. As individuals have limited cognitive resources, the increased demands due to pace of change in ICTs lead to increased workload. Further, there is uncertainty as to whether an individual should expend his/her resources to perform the task requirements at work or to acquire new skills. These conflicting demands between the job and learning new skills also lead to role ambiguity. Further, there is empirical support which suggests that individuals when faced with learning technologies experience feelings of ambiguity and conflicting demands leading to role ambiguity (Rangarajan et al., 2005). Therefore it is argued that the degree to which there is a misfit in the ability of individuals' to deal with pace of change leads to increase in perceived workload and role ambiguity.

H7: Individual perception of technology pace of change will be positively related to perceived work overload.

H8: Individual perception of technology pace of change will be positively related to perceived role ambiguity.

The pace of change as exemplified by the introduction of new tools and services augment a supplementary pathway to stress in addition to the ones identified above, through job insecurity. Job insecurity and technology perceptions are related, as identified by previous research (Vieitez et al., 2001). Studies on resistance to technological change have

mainly identified fear of job loss as a source for resistance (Fernandez, 1990; Slem, 1986). The individuals' concerns often range from becoming obsolete, or the requirement to learn new or higher skills (Korunka et al., 1996). The constant changes and vast number of options available render individual skills obsolete. Further, due to limited cognitive resources, individuals often feel left out of the latest developments. These increased pressures due to pace of change of ICTs lead to job insecurity. As seen previously, job insecurity is identified as a factor in work stress literature. Therefore it is argued that the degree to which there is a misfit in the ability of individuals' to deal with pace of change leads to job insecurity.

H9: Individual perception of technology pace of change will be positively related to perceived job insecurity.

3.2.5 Moderator Hypothesis

Several variables are proposed as moderators to the stressor – stress relationship (Cooper et al., 2001). In particular, the variables which potentially affect the relationship between technological characteristics and stressors are considered in this study. Since the emphasis of this study is on technology characteristics, the moderators proposed for stressor-strain relationship are not examined. However, to get potential insights into possible moderators, stress literature is reviewed to identify moderators.

In general, moderators could be broadly classified into dispositional and contextual variables. Typical dispositional moderators include self-efficacy and type-A behavior. Type-A individuals are characterized as being ambitious, competitive, alert and aggressive. It is typically argued that individuals who take a more 'relaxed' approach to work will experience less psychological strain than those exhibiting type A characteristics. However, empirical

findings are inconsistent with many studies not finding support for the above contention (Burke, 1988; Edwards et al., 1990; Jamal, 1999). Self-efficacy refers to individual's beliefs about performing a task. It is proposed that individuals with higher self-efficacy have the confidence in their abilities to attend to job related demands and there by acts as buffer against stressful job conditions (Jex and Gundanowski, 1992; Schaubroeck and Merritt, 1997; Zellars et al., 1999). Because of the inconsistent findings of type A behavior and because of the applicability of self-efficacy concept in the technological area, self-efficacy is considered as a moderator. In keeping with the context of the study, technology self-efficacy might be more appropriate to be considered as a moderator.

Contextual variables considered in this study are support mechanism and technology centrality. It is proposed that having support from others will attenuate the relationship between stressors and strain because support might help individuals in coping with job demands. This is often referred to as stress-buffering hypothesis (Fenlason and Beehr, 1994; Winnubst and Schabracq, 1996). In keeping with the context of the study, technical support might be more appropriate to be considered as a moderator.

It should be noted that support and self-efficacy increase individuals coping ability or act as a buffer mechanism. Also, technologies may not be viewed as stressful if they play a central role in individuals' work context. Based on these insights, coupled with empirical evidence (Ivancevich et al, 2003; Lazars et al., 2005; Vieitez et al., 2001) technical support, technology centrality, and technological self-efficacy are hypothesized as moderators of technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).

As discussed above, support mechanisms are shown to enhance an individuals' coping abilities. Availability of technical support may alleviate some of the concerns and frustrations an individual faces when using ICTs. For example, dependable technical support may enhance individuals' perceptions of usefulness, and reliability of ICTs. An individual may not be frustrated with reliability concerns of ICTs if he/she has a support mechanism to depend on. Therefore, it is hypothesized that

H10a: Technical support moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).

Technology centrality is proposed as a moderator in this study. Technology centrality refers to the belief that technologies are integral to work tasks and are beneficial. Accordingly, technologies might not be viewed as stressful if the characteristics of technologies enable individuals to improve their performance. The degree to which the ICTs are viewed as central to work tasks might attenuate the stressful effects of technology. For example, a sales representative may find the 'presenteeism' characteristic of a technology to be very central for his/her job and thereby have low perceptions of stressful impacts of 'presenteeism' as discussed under the 'presenteeism' section. Therefore it is proposed that

H10b: Centrality moderates the relationship between technology characteristics (usability (except usefulness), dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).

Further, individuals differ in their technical capabilities, which to an extent is dependent on their technical skills and comfort level in using the technology (Rajeswari and Anatharaman, 2005) implying that individuals are at different maturity levels with respect to ICTs. Therefore, the same technology characteristics could have differential impacts on

individuals. To account for this factor, individuals' technological self-efficacy is considered. Agarwal et al. (2000) argue that that situation specific self-efficacy constructs are more appropriate than general self-efficacy. In a similar vein, this present study considers technological self-efficacy – which refers to individuals' belief about their ability and motivation to perform specific tasks with technologies. Based on the above arguments it is hypothesized that

H10c: Technological self-efficacy moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).

Finally, although it is not the main emphasis of this study, the relationship between stressors and strain is hypothesized. Drawing upon the extensive stress literature cited earlier, it is hypothesized that

H11: Stressors (work overload, role ambiguity, invasion of privacy, work-home conflict, and job insecurity) are positively related to strain.
H11a: Individuals' perception of work overload is positively related to perceptions of strain.
H11b: Individuals' perception of role ambiguity is positively related to perceptions of strain.
H11c: Individuals' perception of work-home conflict is positively related to perceptions of strain.
H11d: Individuals' perception of invasion of privacy is positively related to perceptions of strain.
H11e: Individuals' perception of job insecurity is positively related to perceptions of strain.

To conclude, this chapter identified several technology characteristics based on pervious literature (usefulness, complexity, reliability, pace of change, presenteeism, and anonymity). Applying the person-environment fit model, it is argued that the above characteristics exacerbate the stressors identified previously (work overload, role ambiguity, invasion of privacy, work-home conflict, and job insecurity). Based on these factors a research model for

technostress is proposed and several hypotheses were developed. Table 3.3 summarizes these hypotheses.

The next chapter discusses the research methodology deemed appropriate to test the proposed hypotheses. It discusses the issues of research design, sample design and provides information on measurement of various factors identified in the research model.

Table 3.3 Summary of hypotheses

Summary of proposed hypotheses
H1: Individual perception of technology usability characteristics will be related to perceived work overload. H1a: Individual perception of technology usefulness will be negatively related to perceived work overload. H1b: Individual perception of technology complexity will be positively related to perceived work overload. H1c: Individual perception of technology reliability will be negatively related to perceived work overload.
H2: Individual perception of technology presenteeism will be positively related to perceived work-home conflict.
H3: Individual perception of technology presenteeism will be positively related to perceived invasion of privacy.
H4: Individual perception of technology presenteeism will be positively related to perceived work overload.
H5: Individual perception of technology presenteeism will be positively related to perceived role ambiguity.
H6: Individual perception of technology anonymity will be negatively related to perceived invasion of privacy.
H7: Individual perception of technology pace of change will be positively related to perceived work overload.
H8: Individual perception of technology pace of change will be positively related to perceived role ambiguity.
H9: Individual perception of technology pace of change will be positively related to perceived job insecurity.
H10a: Technical support moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors. H10b: Centrality moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors. H10c: Technological self-efficacy moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors.
H11: Stressors (work overload, role ambiguity, invasion of privacy, work-home conflict, and job insecurity) are positively related to strain. H11a: Individuals' perception of work overload is positively related to perceptions of strain. H11b: Individuals' perception of role ambiguity is positively related to perceptions of strain. H11c: Individuals' perception of work-home conflict is positively related to perceptions of strain. H11d: Individuals' perception of invasion of privacy is positively related to perceptions of strain. H11e: Individuals' perception of job insecurity is positively related to perceptions of strain.

CHAPTER FOUR
METHODOLOGY

This chapter describes procedures and methods used in this study. This chapter is discussed in four parts. First, a brief overview of survey design is provided and rationale for selecting survey design is given. Second, the sample design is discussed. Then, the construction of research instrument is described. The final part discusses the methods used in data analysis.

4.1 Research Design

The aim of the present work is to develop a model for technostress and understand the relationship between technology characteristics and relevant stressors. Since the emphasis is on explaining the variance and in developing causal relationships, the survey methodology is used. It is the most widely used methodology for stress studies (Cooper et al., 2001).

The main purpose of survey research is to generalize from a sample to a population so that inferences can be made to the population (Creswell, 1994). The process of survey research typically involves identifying a sample, administering the survey to the members of the sample, then analyzing the data collected on the survey (Grover, 2007). Since the aim of the research is to make inferences to the population, it is important to obtain a representative sample so that any references made from sample to the population are valid. The next stage typically involves administering the survey. For this, appropriate and valid measures should be used for the variables of interest. Therefore, it is good practice to use established measures from previous studies, when available. If any new measures are

developed, it is necessary to validate the measures before they are used. Once the survey is administered and the data is collected, the next stage involves analyzing the data to study relationships between the variables.

Certain classifications about survey research could be made based on the nature of survey design. First, survey research could be either exploratory or explanatory. As the name suggests exploratory research aims to become familiar with a particular phenomenon. This type of research is used in areas where there is conceptual ambiguity and lack of theoretical models. In contrast, explanatory research aims at finding causal relationships among variables. This is accomplished by testing the theory-based conjectural statements made on how certain variables could be related (Grover, 2007). Second, survey research could be cross-sectional or longitudinal. Cross-sectional design implies that data is collected from the representative sample at one point in time where as longitudinal designs collect data from the representative sample at more than one point in time. Longitudinal designs are especially useful in establishing causality among variables but are very difficult to implement. The present study uses an explanatory approach as it tries to explain the relationship between technology characteristics, stressors due to ICTs and strain due to ICTs. Further, a cross-sectional design is used for data collection purposes. This design poses certain limitations regarding causality which is accepted and this issue will be addressed in future research works.

The next subsection discusses the unit of analysis in the present study and the variables that are used as statistical controls in this study.

4.1.1. Unit of analysis

The present study explores the impact of ICTs on individuals in their work settings. Therefore, the unit of analysis in this study is individual * ICT use * work tasks.

4.1.2 Control variables

Negative affectivity and technology usage are identified as two control variables. Negative affectivity (NA) is a dispositional factor that reflects a tendency to experience negative emotional states and low self-esteem (Watson and Clark, 1984). It is argued that individuals high on NA are inclined to experience higher levels of strain and other negative outcomes in work settings (Semmer, 1996). Consequently using self-reports of stressors and strains are advised to control for NA (Burke et al., 1993). Therefore, NA is statistically controlled in this study.

Also since the effects of technologies are only possible when the technologies are used and the degree to which they are used, it is necessary to control for technology usage. It is expected that individuals using ICTs all-the-time would have more opportunities to deal with ICTs as compared to individuals using ICTs occasionally. Therefore, technology usage could provide an alternate explanation to the stress experienced by individuals due to ICTs. Accordingly, technology usage is used as a control variable. Past research on technology usage has almost exclusively used self-report measures of technology usage (Speier and Venkatesh, 2002). Usage is typically measured by single item questionnaires measuring actual daily use i.e. amount of time spent (Anakwe et al., 2000; Igbaria, 1992, Kim et al., 2005, Lee, 1986) and, frequency of use (Anakwe et al., 2000; Igbaria, 1992, Kim et al., 2005). Although it is not possible to control for individual technology use in this study, the technology usage is controlled by asking the respondents their overall technology usage.

The next sections discuss the parameters of survey design, namely sample design (sample frame, sample selection and sample size), instrumentation and analysis.

4.2 Sample Design

Sample design involves three parts – sample frame, sample selection process and sample size (Churchill, 1991). These are discussed in the following sections.

4.2.1 Sample Frame

Sample frame identifies the target respondents from the population frame. Most of the previous stress works have used sample from a particular profession/occupation (nurses, machine operators etc). In a similar vein, in IS-stress studies, the sample frame consisted of IS/IT professionals. Since the present research studies the impact of ICTs on individuals', the sample frame is not constrained to any particular occupation. To truly understand the impact of ICTs on individuals in work settings, some key attributes of the population are desired i.e. individuals should be working full-time, they should use ICTs. Therefore, the population selected for this study is the working adult population who are business users of ICTs. A representative sample will be drawn from this population.

4.2.2 Sample Selection Process

The required sample will be obtained by using the services of a market research firm (Zoomerang). Zoomerang is a leading market research company that provides, among other services, respondents (Zoom-Panel) who participate in various research studies. Over 2.5 million members exist in this panel and these members are profiled over 500 attributes (http://www.zoomerang.com). Zoomerang reports that the profile of zoom-panel is representative of the U.S. population. This kind of data collection could provide greater

control (based on the attributes selected), and there is evidence that these type of data collection methods are used in academia (Piccolo and Colquitt, 2006). In order to use the service of zoom-panel, the survey had to be created on zoomerang. Once the survey was developed, representative at zoomerang was contacted to target the sample to 'business users of ICTs'. In discussions with a representative of Zoomerang, the researchers realized that although Zoomerang profiles its panel of respondents, the profile itself might be little outdated. For example, a respondents' profession/job responsibilities at the time of filling this survey might be different from the time he or she joined the zoompanel. Therefore, the researchers decided on using screening questions to get better control at the sample. According to the sample frame requirements, three screening questions were developed. These are "Do you work full time?", "Do you use any of these technologies?" (after providing the list of ICTs), and "Does your job mainly involve software or web programming?" In this way, it was possible to target full-time working business users of ICTs.

The common methods of questionnaire administration are through phone, mail, personnel interview and recently through the Internet. Due to the length of the survey, phone and personnel interview methods are not deemed appropriate. There is a growing interest in administering surveys through Internet. Internet surveys offer advantages of cost and data collection speed over other methods. Once the survey is set up, the marginal cost of conducting Internet survey is much lower than other traditional ways (Mehta and Sivadas, 1995). Also, Internet surveys greatly simplify the data analysis process as it is possible to directly transfer the collected data to analysis software. Another advantage of using Internet surveys is the speed of data collection process. None of the other survey techniques match

the speed at which Internet surveys collect data. The ability of Internet surveys to send surveys to a wide audience and get a quick response is acknowledged (Mehta and Sivadas, 1995; Simsek and Veiga, 2001; Swoboda et al., 1997).

Internet surveys can suffer from sampling bias since the survey respondents must have Internet access. However, since the study in context is about individuals' use of various ICTs, it is assumed that respondents to the survey will have access to Internet. In this regards, this provides a boundary condition to the present study. Due to the numerous advantages provided by the Internet surveys, this approach to collecting data is deemed appropriate for the present study.

One of the concerns with survey research is with non-response bias. As the name suggests, it typically deals with effects of nonresponses on survey estimates (Fowler, 1988). In other words, the concern is over whether the responses of nonrespondents would have significantly changed the results of the survey. One of the ways in which to address this problem is through wave analysis. In this procedure the responses of early and late respondents are compared to see if there are any significant differences among the variables of interest. As late respondents could almost be treated as nonrespondents, findings of insignificant differences between early and late respondents indicates lack of response bias.

4.2.3 Sample Size

Appropriate power analysis is conducted to calculate the sample size. Maxwell's (2000) procedure of calculating the sample size is used to calculate the appropriate sample size. The estimate is based on finding significant partial effect in the research model based on the estimates of average correlations between independent variables (IVs) and between independent-dependent variables (DVs). In this method, the criterion variable with most

number of predictor variables is identified from the research model and based on the correlation estimates, the sample size required to find the significant partial effect for each of the predictor variables is calculated. In this study, scenario analysis is conducted for two different estimates of correlations among IVs and DVs.

Scenario 1: If average correlations among IVs are 0.35, average correlation between IV-DV is 0.4 and for a power level of 0.8, the required sample size is 250.

Scenario 2: If average correlations among IVs are 0.3, average correlation between IV-DV is 0.3 and for a power level of 0.8, the required sample size is 420. Going with the more conservative estimate, the desired sample size is 420.

4.3. Research Instrument

The issues related to survey instrument are discussed in this section. First it provides a discussion on why subjective measures are used in this study. This choice raises a potential problem of common method bias, which is discussed next along with the proposed recommendations for controlling it. Finally, the section concludes by providing operationalizations of constructs used in this study.

4.3.1 Objective vs. Subjective Measures

Before discussing the scales for each construct, it is important to discuss why subjective measures were chosen over objective measures. The debate between the subjective versus objective measures in stress literature is well recognized (Frese and Zapf, 1999; Perrewe and Zellars, 1999; Schaubroeck, 1999; Spector, 1999). Proponents of objective measures argue that subjective measures suffer from common method bias (Frese and Zapf, 1999; Jex and Bheer, 1991; Schaubroeck, 1999) while proponents of subjective

measures argue that the process of stress itself is perceptual and therefore, only perceptual or subjective measures can do justice (Cooper et al., 2001; Jex and Bheer, 1991; Perrewe and Zellars, 1999). From the transaction view of stress, it is clear that the same situation could be appraised differently by individuals, and therefore, what is stressful for one individual may not be stressful for others. Objective measures cannot capture these individual differences to the same situation. Therefore, subjective measures are deemed appropriate for this study. However, the disadvantage of subjective measures, (i.e. common method bias) is addressed in this study by controlling for it, as discussed below.

4.3.2 Common Method Bias

Common method bias refers to the variance that is attributable to the measurement method rather than the construct of interest (Bagozzi and Yi, 1991; Podsakoff et al., 2003). Common method variance presents a problem as it offers an alternative explanation for the observed relationships between measured constructs that is independent of the one hypothesized. For example, let's assume that, based on theoretical reasoning, construct A is hypothesized to be correlated to construct B. If construct A and construct B are measured using the same method, then the method can contribute to the observed correlation between the constructs A and B. Thus, common method bias provides an alternative explanation to the proposed relationship between constructs A and B. Therefore, controlling for common method bias rules out alternate explanations to an extent and enhances the internal validity of the study.

In a critical review of common method bias in behavioral research, Podsakoff et al. (2003) provide recommendations to remedy common method bias. They recommend that for a study in which (i) the predictor and criterion variables are obtained from the same

source, and (ii) the predictor and criterion variables are measured in the same context, the remedies are as follows

- Use procedural remedies related to questionnaire design
- Statistically control by a single common method factor approach (discussed below)

Procedural remedies try to identify what is common in the measures of predictor and criterion variable and minimize this commonality through design of the study. One of the procedural remedies is to psychologically separate the measurements of criterion and predictor variables. This separation could be achieved by providing a cover story between the criterion and predictor measurement phases. Using this procedure should minimize the biases by reducing the respondent's ability to retain previous answers, and by reducing the perceived relevance of the previously recalled information in short-term memory. Biases can also be reduced by assuring respondents anonymity and informing respondents that there are no right or wrong answers. This should reduce respondent's apprehension on being evaluated on their responses. In this case, respondents are less likely to edit their responses to be more socially desirable or be consistent with how they think the researcher wants them to respond. Further, method biases can be reduced by paying careful attention to the scale items. Scales are improved by avoiding the use of ambiguous or unfamiliar terms, vague concepts, and double-barreled questions. Also, different scale endpoints and formats can be used for predictor and criterion variables, wherever possible. This reduces the biases due to similarities in scale endpoints and anchoring effects.

Statistically, method variance is assessed by using a single latent method factor. In this approach, widely used in literature (Podsakoff et al., 2003), items are allowed to load on their proposed constructs and also on a latent common methods variance factor. The

structural model is then tested for significance of parameters both with and without the latent methods factor. The variance of a specific measure can then be partitioned into trait, method and random error factors. One of the main advantages of this approach is that it does not require the researcher to specifically identify the factor responsible for method effects. A schematic for this approach with two constructs, A and B is shown in figure 4.1 below.

4.3.3 Construct Operationalization

Preexisting scales exist for most of the variables identified in the research model. Since making technology characteristics explicit is the novel part of this research, scales for some of the characteristics do not exist. In these cases, scales are adapted based on the descriptive accounts on technostress and from existing literature of related concepts. For example, presenteeism characteristic is described in the literature, but a scale doesn't exist. The following subsections provide information on the definition and measures for the variables used in the present study.

4.3.3.1 Work overload

It is defined as the perception that assigned work due to ICTs exceeds the individual's capability or skill level (Cooper et al., 2001, Moore, 2000). The measure of perceived work overload is derived from Moore (2000) which is also based on previous established scale from literature. This 4 item scale is shown to have a reliability of .80. The scale is shown in table 4.1.

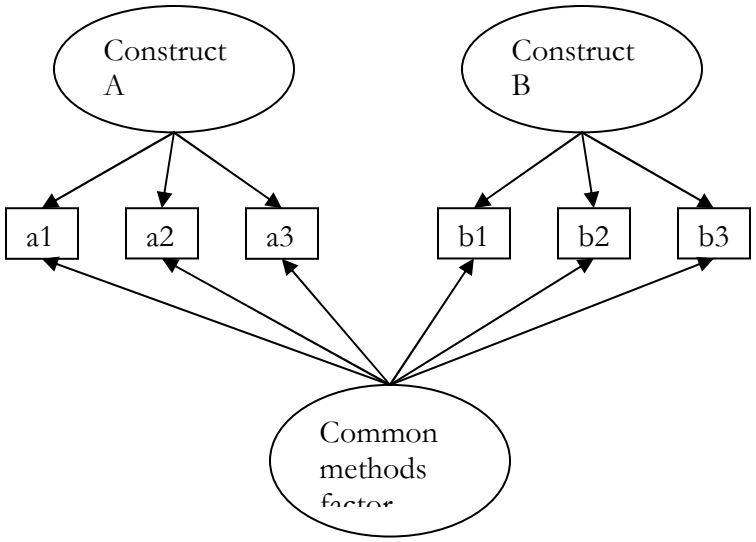

Figure 4.1. Single latent methods factor (Adapted from Podsakoff et al., 2003)

4.3.3.2 Role Ambiguity

It refers to unpredictability of the consequences of one's role performance and lack of information needed to perform the role (Cooper et al., 2001, Jex, 1998). The measure used is derived from Moore (2000) and Rizzo et al. (1970) and has an acceptable reliability of .83 in Moore (2000). The scale is shown in table 4.2.

Table 4.1. Work overload scale.

Scale Range: 1 = Strongly Disagree; 7 = Strongly Agree

1. ICTs create many more requests, problems, or complaints in my job than I would otherwise experience.
2. I feel that the time required to use ICTs interferes with fulfilling my work responsibilities.
3. I feel busy or rushed due to ICTs.
4. I feel pressured due to ICTs.

Table 4.2. Role ambiguity scale.

Scale Range: 1 = Strongly Disagree; 7 = Strongly Agree

1. ICTs cause constant interruptions, creating uncertainty in my work day.
2. I am unsure whether I have to deal with ICT problems or with my work activities.
3. I am unsure what to prioritize: dealing with ICT problems or my work activities.
4. I can NOT allocate time properly for my work activities because my time spent on ICTs-activities varies.
5. Time spent resolving ICT problems takes time away from fulfilling my work responsibilities.

4.3.3.3 Work-home conflict

It is defined as the individual's perceived conflict between the demands of work and family (Cooper et al., 2001; Kreiner, 2006). The five item scale is derived from the works of Kreiner (2006) and Netemeyer et al. (1996). The scale is reported to be reliable (alpha = 0.93, Kriener, 2006). The scale is shown in table 4.3.

Table 4.3. Work-home conflict scale.

Scale Range: 1 = Strongly Disagree; 5 = Strongly Agree

1. Using ICTs blurs boundaries between my job and my home life.
2. Using ICTs for work-related responsibilities creates conflicts with my home responsibilities.
3. I do not get everything done at home because I find myself completing job-related work due to ICTs.
4. I am not able to fulfill my family roles because I am doing ICT enabled-work activities from home.

4.3.3.4 Invasion of Privacy

It is the perception that an individuals' privacy has been compromised. The 3 item scale is derived from the works of Eddy et al. (1999) and Alge (2001). The reliability of the scale is reported to be 0.96 (Alge, 2001). The scale is shown in table 4.4.

Table 4.4. Invasion of privacy scale.

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. I feel uncomfortable that my use of ICTs can be easily monitored.
2. I feel my privacy can be compromised because my activities using ICTs can be traced.
3. I feel my employer could violate my privacy by tracking my activities using ICTs.
4. I feel that my use of ICTs makes it easier for my employer to monitor me.
5. I believe my organization can keep a digital leash on my ICTs-related activities.
6. I feel that my use of ICTs makes it easier to invade my privacy.

4.3.3.5 Job insecurity

It is defined as individual's perception of threat of job loss (Ashford et al., 1989; Cooper et al., 2001) and is based on the works of Ashford et al. (1989) who developed the scale for job insecurity. The scale is presented below in table 4.5.

4.3.3.6 Usefulness

It is defined as the degree to which the characteristics of technology enhance job performance (Moore and Benbasat, 1991; Davis et al., 1989). This scale is derived from Moore and Benbasat (1991). This scale is widely used and shown to have the required reliability. The scale is shown in table 4.6.

Table 4.5. Job insecurity scale.

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. I am under pressure to keep my ICT skill up-to-date to keep my job.
2. ICTs will advance to an extent where my present job can be performed by a less skilled individual.
3. I am worried that new ICTs may pose a threat to my job.
4. I believe new ICTs are in development that will effect how I would perform my job.
5. I believe that ICTs make it easier for other people to perform my work activities.
6. My inability to keep up with constant changes in ICTs will make me less valuable for my job.

Table 4.6. Usefulness scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. Use of ICTs enables me to accomplish tasks more quickly.
2. Use of ICTs improves the quality of my work.
3. Use of ICTs makes it easier to do my job.
4. Use of ICTs enhances my effectiveness on the job.

4.3.3.7 Complexity

It is defined as the degree to which the use of technology is free of effort (Moore and Benbasat, 1991). This scale, derived from Moore and Benbasat (1991), is widely used and shown to have required reliability. The scale is shown in table 4.7.

Table 4.7. Complexity scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. Learning to use ICTs is easy for me.
2. ICTs are easy to use.
3. It is easy to get results that I desire from ICTs.

4.3.3.8 Reliability

It is defined as the degree to which the features and capabilities provided by the technology are dependable (Delone and McLean, 1992; 2003; Jiang et al., 2002). The following three items are developed based on the descriptions of the above authors. The scale is shown in table 4.8.

Table 4.8. Reliability scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. The features provided by ICTs are dependable.
2. ICTs are free from breakdowns.
3. The capabilities provided by ICTs are reliable.
4. ICTs behave in a highly consistent way.

4.3.3.9 Pace of Change

It is defined as the degree to which an individual perceives technological changes to be rapid (Weiss and Heide, 1993; Heide and Weiss, 1995). The scale presented below is adapted from the works of Weiss and Heide (1993) and Heide and Weiss (1995). The scale is shown in table 4.9.

Table 4.9. Pace of change scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. I feel that there are frequent changes in the features of ICTs.
2. I feel that characteristics of ICTs change frequently.
3. I feel that the capabilities of ICTs change often.
4. I feel that there are frequent changes in how ICTs look.
5. I feel that the way ICTs work changes often.

4.3.3.10 Presenteeism

It is defined as the degree to which technologies enable individuals to be reachable. This scale is developed for this study. The three items developed are shown below. The scale is shown in table 4.10.

Table 4.10. Presenteeism scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. The use of ICTs enables others to have access to me.
2. ICTs make me accessible to others.
3. The use of ICTs enables me to be in touch with others.
4. ICTs enable me to access others.
5. ICTs enable others to contact me 24/7.
6. ICTs facilitate contact with coworkers 24/7.

4.3.3.11 Anonymity

It is defined as the degree to which the exact use of technology could be identifiable (Pinsonneault and Hippel, 1997). Anonymity is mentioned in the group decision support systems literature, and the items below are adapted to the present context. The scale is shown in table 4.11.

Table 4.11. Anonymity scale

Scale Range: 1 = strongly disagree; 7 = strongly agree

1. My use of ICTs can not be tracked.
2. It is easy for me to hide how I use ICTs.
3. I can remain anonymous when using ICTs.
4. It is easy for me to hide my ICT usage.
5. It is difficult for others to identify my use of ICTs.

4.3.3.12 Strain

It is defined as the individual's psychological response to the stressors (Cooper et al., 2001). The scale presented below is used from Moore (2000). The scale is shown in table 4.12[6].

Table 4.12. Strain scale

Scale Range: 1 = Never

2 = A few times a year or less, almost never

3 = Once a month or less, rarely

4 = A few times a month, sometimes

5 = Once a week, rather often

6 = A few times a week, nearly all the time

7 = Daily

1. I feel drained from activities that require me to use ICTs.
2. I feel exhausted at the end of the work day from using ICTs.
3. I feel tired from my ICT activities.
4. Working all day with ICTs is a strain for me.
5. I feel burned out from my ICT activities.

[6] An alternate measure of strain is also used. See Appendix E for more discussion.

4.3.3.13 Technological self-efficacy

It is defined as the individual's perceived capability to use information and communication technologies (Compeau and Higgins, 1995). The items are derived from the work of Thatcher and Perrewe (2002). The scale is shown in table 4.13.

Table 4.13. Technological self-efficacy scale

Scale Range: 1 = not confident to 10 = very confident

I could complete my work activities using ICTs if...

1. ... I had never used ICTs like it before.
2. ... I had only the manuals for reference.
3. ... there was no one around to tell me how to do it
4. ... I could call someone for help if I got stuck.
5. ... someone else helped me get started.
6. ... someone showed me how to do it first.

4.3.3.14 Technical Support

It is defined as the degree to which an individual perceives support regarding technology in their work environment. The items used are drawn from the work of Bergeron et al. (1990). The scale is shown in table 4.14.

Table 4.14. Technical support scale

1. The training provided is: complete/incomplete; sufficient/insufficient.
2. The documentation available is: complete/incomplete; simple/complicated.
3. The technical assistance provided is: simple/complex; adequate/inadequate
4. The troubleshooting provided is: complete/incomplete; sufficient/insufficient.
5. The advice and opinions provided are: relevant/irrelevant; rapid/slow
6. The time required to respond to service requests is: short/long; acceptable/unacceptable.

4.3.3.15 Technological centrality

It refers to the importance of ICTs in one's work activities. The scale is adapted from work centrality which refers to the general importance of work in one's life (Arvey et al., 2004). The scale is shown in table 4.15.

Table 4.15. Technological centrality scale

Scale Range: 1 = strongly disagree to 7 = strongly agree

1. Most of my work time involves the use of ICTs.
2. I find ICTs beneficial for my work tasks.
3. ICTs have positive impacts on my work tasks.
4. Important things required by my job involve using ICTs.
5. ICTs play a central role in my work activities.
6. ICT use is central to my job.
7. Without ICTs I can not do my job well.

4.3.3.16 Negative Affectivity

It is a mood-disposition that reflects a tendency to experience negative emotional states and low self-esteem (Watson and Clark, 1984). The items for this construct are obtained from Agho et al. (1992) and are shown in table 4.16.

4.3.3.17 Technology Usage

It refers to individuals' utilization of ICTs. Before providing the scale for usage, it is important to understand the profile of technologies that individuals use, so that their usage could be captured.

Technology profiles In conducting this study, it is useful to provide individuals' with a list of technologies against which an individual could assess the technology characteristics. The

presence of technology in the research model is schematically shown in figure 4.1 below. The challenge is to come up with a generalizable set of technologies that would be applicable to individuals' in different professions.

Table 4.16. Technological self-efficacy scale

Scale Range: 1 = strongly disagree to 7 = strongly agree

1. I often find myself worrying about something.
2. My feelings are hurt rather easily.
3. I suffer from nervousness.
4. My mood often goes up and down.
5. I sometimes feel 'just miserable' for no good reason.
6. I often lose sleep over my worries.

Typically, most of the studies that deal with these situations constrain their sample frame either by sample (i.e. by profession i.e. applicable to only IT professionals) or by technology (i.e. as in innovation studies, which focus on single innovation like EDI).

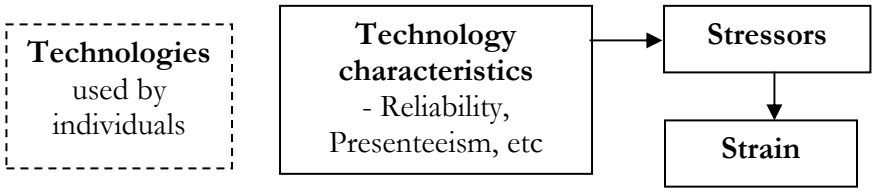

Figure 4.2: Technologies and research model.

There is a lack of any generalizable framework to generate technology profiles. The concern about the lack of an IT taxonomy was recently expressed on ISWORLD. If a list of technologies were provided, then the respondents would need to evaluate the research model for each technology selected. This would be a demanding and exhausting task.

Considering the lack of any particular taxonomy and due to the length of the instrument, respondents are requested to respond to the research variables when considering the following categories in their technological environment. Although the research model is not evaluated for each technology, providing the specific categories of technologies with examples provides some control over the individuals' technological environment. Due to the lack of any generalizable framework, the technology categories developed are based on their functionalities and their intuitive appeal. Also, due to the integration of voice and data technologies, the categorization of technologies in a discriminant fashion is unlikely. Since the goal of providing categories of technologies is to provide consistent reference to technological environment, this limitation is not severe. The categories are

- Mobile technologies (e.g., Cell phone, Pager, BlackBerry®, Laptop, PDA (Personal Digital Assistant)).
- Network technologies (e.g., Internet, Intranet, VPN)
- Communication technologies (e.g., Email, Voicemail)
- Enterprise and Database technologies (e.g. PeopleSoft®, SAP®, Oracle® applications).
- Generic application technologies (e.g., Word Processing, Spreadsheet, Presentation)
- Other work specific technologies

Based on the above categories and drawing on a scale adapted from Kim et al. (2005), the following items are proposed.

Consider the following ICTs when responding to the questions below.

- Mobile technologies (e.g., Cell phone, Pager, BlackBerry®, Laptop, PDA (Personal Digital Assistant)).

- Network technologies (e.g., Internet, Intranet, VPN)
- Communication technologies (e.g., Email, Voicemail)
- Enterprise and Database technologies (e.g. PeopleSoft®, SAP®, Oracle® applications).
- Generic application technologies (e.g., Word Processing, Spreadsheet, Presentation)
- Other work specific technologies

Table 4.17 Technology usage scale

1. On average, the number of hours you work in a week _____
2. From the above work hours, the average, number of hours spent using ICTs _____.
3. From the above hours spent using ICTs, please provide the **percentage** of time spent on each of the following. Note: the overall time spent using should add up to 100%

Technology Categories	Percentage of time used
1. Mobile technologies (e.g., Cell phone, Pager, BlackBerry®, Laptop, PDA (Personal Digital Assistant)).	
2. Network technologies (e.g., Internet, Intranet, VPN)	
3. Communication technologies (e.g., Email, Voicemail)	
4. Enterprise and Database technologies (e.g. PeopleSoft®, SAP®, Oracle® applications).	
5. Generic application technologies (e.g. Word Processing, Spreadsheet, Presentation)	
6. Other work specific technologies (Specify _____)	

4.4 Analysis

The analyses that will be undertaken in this study are discussed in this section. Figure 4.3 depicts the plan for the analyses to be conducted. It shows three phases – preparation, validation and results. The illustration of these phases in figure 4.3 is for descriptive and organization purposes only.

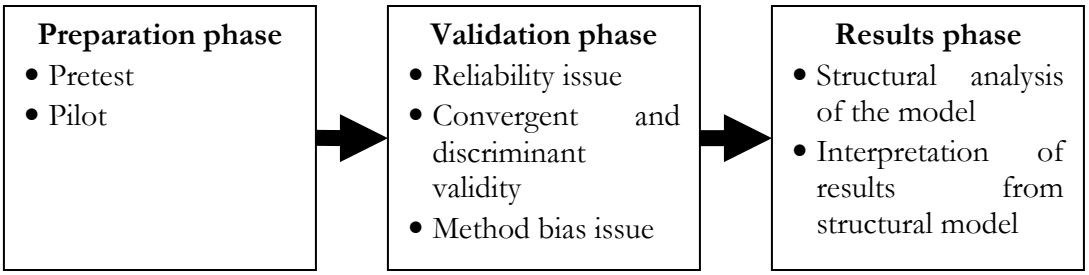

Figure 4.3. Analyses plan

Before discussing these phases, it should be pointed out that each of the constructs in the present study is represented by multiple items. Therefore, advanced statistical techniques like structural equation modeling will be used to take advantage of the information provided by multiple item scales. Specifically, EQS® statistical package will be used to conduct structural analysis.

The preparation phase mainly deals with all the analysis performed before the main data collection to ensure that there would be no costly mistakes. This includes going through many iterations of the survey instrument to ensure the readability and appropriateness of the survey. Even after the precautions and care taken towards developing the questionnaire, it is good practice and often necessary to get the questionnaire evaluated. This process includes

evaluating individual questions, the structure and sequencing of the questions, the question format and wording of the questions (Peterson, 2000). Some of the common approaches to questionnaire pretesting involve evaluation by experts and by convenience sample (Peterson, 2000). In this study, pretesting will be done by assessment of questionnaire by academicians (who have experience in this topic and research methodology) and by working professionals (who are the target sample frame). One of the most elaborate, sophisticated, and expensive pretesting methods is to conduct a pilot study. Pilot study is basically a small-scale study that simulates the desired research conditions. In this study, pilot study will be conducted by deploying the final survey on Internet (similar to final survey) and using a convenience sample of working professionals.

The validation phase mainly deals with analyses that provide confidence in the results obtained. This includes establishing the reliability of measures used in the study. Cronbach's alpha value, available through statistical packages like EQS will be used to check the reliabilities. Next, the validity of measures (i.e. both convergent and discriminant) will be checked by factor loadings, average variance extracted (AVE) and, pair-wise comparison between constructs. Common method bias will also be checked by various means. Common method bias poses a validity threat as it could provide an alternate explanation to the findings of the study. To check for the severity of this problem tests that will be conducted will include harman's single factor test, checking to see if adding a latent method factor will significantly improve the fit statistics of proposed model and, by checking the average loadings of items on method factor as compared to loadings on the construct that the items represent.

Finally in the results phase, the proposed hypotheses are tested. After establishing the goodness-of-fit statistics of the structural model, the path coefficients from the structural model will be used to test the proposed hypotheses. This concludes the discussion on this chapter and the next chapter provides results obtained in this study.

CHAPTER FIVE
RESULTS

This chapter describes the results obtained in this study. This is achieved by first discussing the insights obtained from the pretest analysis. The data collection procedures and descriptive statistics of the main sample are then discussed. The next section addresses psychometric properties of the proposed measurement model. The chapter concludes by presenting the results from the structural equation modeling analysis used to test the proposed hypotheses.

5.1 Pretest

As discussed in the previous chapter, the aim of pretest is to assess the quality of the questionnaire before the large scale study is conducted. Pretesting includes carefully examining the content of the questionnaire and preliminary analysis on representative pilot data. These two parts are discussed in the following paragraphs.

First, the questionnaire was developed after undergoing several iterations with faculty who have expertise in this field of study. As most of the scales are adapted from the literature to the present context, careful consideration was given to the content validity of the measures. This was achieved by ensuring that the items capture the meaning of the constructs. Also, for some items, alternatives were developed. For example, for a work-home conflict construct item - an option is provided between "Using ICTs blurs boundaries between my job and my home life" and "The access provided by ICTs blurs my work-home boundaries". The intention is to let the working individuals (who are the target sample) select the appropriate item from the available choices. Once a satisfactory questionnaire was

developed, it was subjected to further refinement. Eight doctoral students participated in carefully analyzing the wording of the items in the questionnaire. Overall, the feedback received suggested that the questionnaire was well developed. Minor changes were made to the wording and design of the questionnaire. Next, detailed interviews were conducted with three full-time working individuals. The questionnaire was sent to them electronically days before the actual interview. All the interviewees had a chance to review the questionnaire and had issues ready for discussion. Interviews lasted on an average 25 minutes each. Once again, the general feedback regarding the questionnaire was positive, however, some concerns were raised. First, the interviewees pointed out that they use instant messaging (IM) at work. Typically, each organization has its own bare-bone IM tools, as compared to popularly available ones. Therefore, a new category in technology profile, collaborative technologies, was added. Second, all minor wording issues were discussed and modified in the questionnaire. For example, based on the feedback, the role ambiguity item "I am unsure **which** to prioritize: dealing with ICT problems or my work activities" is changed to "I am unsure **what** to prioritize: dealing with ICT problems or my work activities". Finally, pretesting the questionnaire resolved the conflict between which of the alternative items were better. For example, for the work-home conflict construct, the item "Using ICTs blurs boundaries between my job and my home life" was deemed more appropriate than "The access provided by ICTs blurs my work-home boundaries". This process ensured a questionnaire that was tested rigorously by academicians and practitioners. The next section discusses the results of pilot study.

5.1.1 Pilot Test

One of the main goals of pilot study was to assess the validity of proposed model on a small sample before conducting the large scale study. Checking the reliability of constructs is one of the important steps in this process. Since the sample frame involved working individuals, it was difficult to get enough data to test the overall model. However, a convenient sample of working professionals known to the researcher was recruited with the main intention to check the reliability of constructs used in the research model. The survey was developed on surveymonkey.com and respondents were contacted by providing a web link to the survey. A total of 22 responses were collected out of 45 individuals contacted. Overall, the reliabilities and inter-item correlations among constructs indicated valid measures. All the constructs displayed reliabilities above the acceptable limit of alpha>0.7 with many above 0.9.

The items of constructs with lower reliabilities and inter-item correlations were checked for potential problems. Further, descriptive statistics of items were checked to ensure the items have good variability. Results from the pilot test suggested that one of the anonymity items had a negative correlation with other four items. A look at the item wording suggested that the one item was worded incorrectly. The item in question "The use of ICTs leaves clues which could be used to identify me" was opposite to other items such as "It is easy for me to hide my ICT usage". Therefore, the problematic item was changed to "My use of ICTs can **not** be tracked" to be consistent with other items. Also, negatively worded items exhibited lower inter-item correlations, these items were reworded. For example, reliability item "ICTs don't breakdown' is changed to "ICTs are free from breakdowns."

Overall, pretest analysis placed sufficient confidence in the scales to proceed with full sample testing. The results from full sample test are discussed next.

5.2 Sample characteristics

As mentioned before, the sample for this study was obtained through Zoomerang. A total of 1411 individuals accessed the survey developed on Zoomerang. Of these 1411, only 692 made it through the screening questions described in previous chapter (i.e. "Do you work full time?", "Do you use any of these technologies?" (after providing the list of ICTs), and "Does your job mainly involve software or web programming?"). The survey was designed such that all the items on the questionnaire were forced to be completed. Therefore, there was no missing data. However, preliminary analysis revealed that some of the data was invalid. For example, there were cases in which 'total number of ICT hours' were greater than 'total number of work hours' or in some cases invalid characters were entered for open ended questions. These cases were deleted. Also, initial screening for outliers was conducted resulting in a final sample size of 661. The demographic characteristics of the sample are discussed next.

Table 5.1 shows the demographic characteristics of the sample. Almost equal split is achieved with respect to gender (48% Female). Approximately thirty three percent of the respondents were single, fifty eight percent were married. Also, majority of respondents had at least graduated college. Respondents also represented a wide variety of industries. The top six industries represented are education, healthcare, government, finance, retail and manufacturing. On an average, the respondents were 49 years old, had 27.3 years of work experience, and 14.5 years of experience using various ICTs. Given the average years of

work experience and average years of experience with ICTs, the average age estimate seems reasonable. Previous stress studies in IS research have reported similar demographics (Moore, 2000).

Table 5.1 Demographics

Demographics, n=661	
Gender	48-52% Split, 48% Female
Age	Mean 49 years, Median 52 years
ICT Usage	Mean 22.25 hours, Median 20 hours
Work Experience	Mean 27.3 years, Median 29 years
ICT Experience	Mean 14.5 years, Median 15 years
Education	High School 7.2% Some College 17% Graduated College (2 and 4 year) 42.3% Graduate School 11% Postgraduate 22.3%
Marital Status	Single 33.4% Married 58.1% Other 8.4%
Industry	Education 16.9% Healthcare/Medical/Pharmaceutical 10.6% Government/Military 9.3% Finance/Banking/Insurance 7.1% Retail/Wholesale 6% Manufacturing 5.7%

It should be further noted that on an average, individuals used technologies 22.25 hours a week. The profile of their technology use in percentages is given below in Table 5.2. On an average, individuals used communication technologies the most (26%) which included email technologies. Following communication technologies, the next three major groups of technologies on which individuals' spent significant time on were generic application technologies (25%), network (16%) and mobile technologies (13%). It should be noted that the sum of percentages do not add up to 100% (adds to 93%). This is because of how technology use is measured. Respondents had to divide their time spent using

technologies into seven categories as shown in table 5.2. Although a lower number of categories would have been desired, there is no acceptable ICT taxonomy/typology that could have been used (discussed later in future research section). On average, respondents had difficulty dividing their time into seven categories that added up to 100%. Further, it was not possible to force the sum to match 100% through survey design as the survey design service provided by Zoomerang® did not check to see if the sum of all the categories adds up to 100 (this type of service is available through surveymonkey.com). The next section discusses the reliability and validity analysis.

Table 5.2 Profile of technology use

Technologies	Mean	Std. Deviation
Mobile	13.06	19.90
Network	16.38	20.90
Communication	25.87	20.19
Enterprise and Database	5.35	12.78
Application	24.97	24.81
Collaborative	3.04	5.91
Other	3.82	12.08

5.3 Reliability and Validity Analysis

The means and standard deviations for each of the construct are shown in Table 5.3. None of the constructs exhibited any serious problems, such as lack of sufficient variability.

Table 5.3 Descriptive Statistics

Construct	Anchor Points	Mean	Standard Deviation
Work Overload	1-Strongly Disagree 7-Strongly Agree	3.54	1.57
Work Home Conflict	1-Strongly Disagree 7-Strongly Agree	3.10	1.67
Invasion of Privacy	1-Strongly Disagree 7-Strongly Agree	4.14	1.74
Role Ambiguity	1-Strongly Disagree 7-Strongly Agree	3.19	1.47
Strain	1-Never 7-Daily	2.89	1.61
Usefulness	1-Strongly Disagree 7-Strongly Agree	5.35	1.21
Ease of Use	1-Strongly Disagree 7-Strongly Agree	5.10	1.25
Reliability	1-Strongly Disagree 7-Strongly Agree	4.58	1.26
Presenteeism	1-Strongly Disagree 7-Strongly Agree	5.69	1.07
Anonymity	1-Strongly Disagree 7-Strongly Agree	2.48	1.34
Pace of Change	1-Strongly Disagree 7-Strongly Agree	4.81	1.18
Job Insecurity	1-Strongly Disagree 7-Strongly Agree	3.12	1.52
Technology Centrality	1-Strongly Disagree 7-Strongly Agree	5.23	1.28
Internal Technical Self-efficacy	1-Not Confident 10-Very Confident	5.62	2.5
External Technical Self-efficacy	1-Not Confident 10-Very Confident	7.00	2.27
Technical Support	1-Relevent 7-Irrelevent 1-Adequate 7-Inadequate 1-Short 7-Long	3.52	1.57
Negative Affectivity	1-Strongly Disagree 7-Strongly Agree	3.34	1.63

Next, all the items were loaded on to their respective latent constructs. The factor loadings and reliabilities of the constructs used in this study are shown in Table 5.4. A detailed table with each item and their respective loadings is also provided in Appendix A.

Table 5.4. Factor loadings and Reliabilities

Construct	No. of Items	Confirmatory Factor Loadings Range	Reliability (alpha) α
Work Overload	3	0.73-0.88	0.88
Work Home Conflict	3	0.83-0.92	0.93
Invasion of Privacy	4	0.84-0.92	0.94
Role Ambiguity	4	0.82-0.90	0.93
Strain	4	0.91-0.97	0.97
Usefulness	4	0.87-0.93	0.94
Complexity	3	0.77-0.94	0.90
Reliability	3	0.85-0.90	0.86
Presenteeism	4	0.90-0.97	0.97
Anonymity	4	0.88-0.97	0.95
Pace of Change	4	0.80-0.93	0.94
Job Insecurity	3	0.71-0.89	0.84
Technology Centrality	5	0.75-0.92	0.91
Internal Technical Self-efficacy	3	0.72-0.91	0.91
External Technical Self-efficacy	3	0.77-0.92	0.93
Technical Support	3	0.76-0.84	0.91
Negative Affectivity	5	0.71-0.82	0.86

Further, the correlations among the constructs (after adjusting for method variance as explained later) and the average variance explained for each construct is shown in Table 5.5.

Table 5.5 Correlations among constructs.

Construct	wo	whc	inp	ra	s	pu	cm	rel	prs	ano	pc	ji	tc
Work Overload – wo	**0.70**												
Work Home Conflict – whc	0.54	**0.79**											
Invasion of Privacy – inp	0.30	0.24	**0.77**										
Role Ambiguity – ra	0.68	0.58	0.45	**0.74**									
Strain – s	0.58	0.51	0.31	0.59	**0.87**								
Usefulness – pu	-0.22	-0.08	-0.02	-0.08	-0.08	**0.82**							
Complexity – cm	-0.16	-0.16	-0.23	-0.16	-0.10	0.36	**0.74**						
Reliability – rel	-0.21	-0.11	-0.24	-0.19	-0.11	0.20	0.40	**0.76**					
Presenteeism – prs	0.19	0.12	0.13	0.14	0.21	-0.12	-0.07	0.01	**0.89**				
Anonymity – ano	-0.14	0.02	-0.32	-0.08	-0.11	0.12	0.18	0.31	-0.24	**0.85**			
Pace of Change – pc	0.20	0.14	0.16	0.25	0.25	-0.11	-0.08	-0.17	0.15	-0.18	**0.76**		
Job Insecurity – ji	0.13	0.20	0.20	0.19	0.21	0.18	0.08	0.24	0.04	0.08	0.17	**0.65**	
Technology Centrality – tc	0.12	0.14	0.13	0.24	0.34	0.35	0.12	-0.06	0.01	-0.01	0.03	0.27	**0.73**
Internal Technical Self-efficacy – ise	0.02	0.07	-0.02	0.04	0.04	-0.08	0.18	0.07	-0.09	0.18	-0.04	0.08	-0.06
External Technical Self-efficacy – ese	0.14	0.07	0.08	0.16	0.15	-0.20	-0.03	-0.08	0.02	-0.07	0.12	0.04	0.02
Technical Support – sup	0.16	0.10	0.18	0.25	0.14	-0.16	-0.19	-0.28	-0.09	-0.06	0.09	0.04	-0.01
Negative Affectivity – na	0.21	0.18	0.25	0.23	0.30	0.03	-0.10	-0.09	-0.01	-0.10	0.14	0.17	0.23

Diagonal elements represent Average Variance Extracted (AVE). For n=661, correlations above 0.09 and 0.11 are significant at 5 and 1% respectively.

Table 5.5 Correlations among constructs. (Continued)

Construct	Ise	Ese	Sup	NA
Internal Technical Self-efficacy – ISE	**0.72**			
External Technical Self-efficacy – ESE	0.56	**0.72**		
Technical Support – SUP	-0.03	-0.00	**0.66**	
Negative Affectivity – NA	-0.06	0.11	0.16	**0.56**

Diagonal elements represent Average Variance Extracted (AVE). For n=661, correlations above 0.09 and 0.11 are significant at 5 and 1% respectively.

Convergent validity and reliability of constructs used in this study are reflected through the measures of cronbach's alpha, factor loadings and average variance extracted (AVE). Results from confirmatory factor analysis, tabulated in table 5.4, indicate that the reliabilities for all the constructs exceed the recommended cutoff of 0.70. The reliabilities of constructs in the present study are similar to those reported by Ahuja et al. (2007), whose work used constructs that are similar in nature to the present work. Further, all the factor loadings are above the recommended value of 0.70 and AVE for each construct is above 0.50 indicating that the latent factors can explain at least 50 percent of the measured variance among items.

Discriminant validity among constructs was assessed in multiple ways. First, as suggested by Chin (1998) if the square-root of average variance extracted (AVE) for each construct is greater than all inter-construct correlations, it demonstrates significant discriminant validity. As shown in correlations table 5.5, the results indicate that all inter-construct correlations are less than the square-root of AVE – indicating discriminant validity among constructs.

Next, two models were compared to further assess discriminant validity. Model A is the measurement model consisting of all items loading on their respective factors with all the factors freely correlated. This model is compared with Model B which is similar to Model A with one significant difference; in Model B, all the factors are perfectly correlated i.e. fixed to 1. In essence Model B suggests that all the factors are not discriminant and in fact there is only one factor. This concept is pictorially depicted in figure 5.1 for a hypothetical three factor structure. Significant differences in Model A and Model B would indicate that it is not appropriate to model all factors into a single factor and actually, multiple factors exist. The

results obtained from this analysis are presented in table 5.6. Looking at the differences in fit indices, Model B fits the data much worse than Model A supporting that multiple factors exist rather than a single factor. This test could be considered as an omnibus test for checking the discriminant validity.

Table 5.6 Discriminant validity – Further evidence

Model	Chi-Square	CFI	RMSEA	Comment
Model A: All items load on respective factors. Factors are freely correlated.	1089 with 744 df	0.98	0.027	Discriminant validity exists if models A and B are significantly different. Results indicate that Model B is significantly worse – indicating evidence of discriminant validity.
Model B: All items load on respective factors. Factors are perfectly correlated.	11057 with 811 df	0.59	0.139	

To further provide evidence of discriminant validity among constructs, pair-wise comparisons among constructs were undertaken. The concept followed is similar to the above analysis. Only two constructs are analyzed at one time. First, the two chosen constructs are freely correlated and compared with a model in which they are perfectly correlated. The chi-square difference with one degree of freedom is used to test for presence of discriminant validity. This is a more stringent test and if any pair-wise comparison yields a non-significant chi-square, it would indicate lack of discriminant validity. Given that there are 17 total constructs, it would lead to 136 pair-wise comparisons. To keep the analysis to a meaningful level, pair-wise comparisons between the main constructs (among stressors and among technology constraints) was undertaken. The results from these analyses are tabulated in table 5.7. All the pair-wise comparisons are highly significant indicating discriminant validity among constructs.

In summary, the above analyses indicate that the measures are reliable and display sufficient convergent and discriminant validities. The next section assesses the threat of common method bias in this study.

Table 5.7 Pair-wise comparisons

Pair-wise comparison of constructs	Chi-square difference[1]
Stressors	
Work overload – Role ambiguity	20.51
Work overload – Work-home conflict	29.27
Work overload – Invasion of Privacy	24.70
Work overload – Job insecurity	49.00
Work-home conflict - Invasion of Privacy	137.44
Work-home conflict - Role ambiguity	41.78
Work-home conflict - Job insecurity	102.30
Invasion of Privacy - Role Ambiguity	65.39
Invasion of Privacy – Job insecurity	141.26
Role Ambiguity – Job Insecurity	189.95
Technology characteristics	
Usefulness - Complexity	312.58
Usefulness - Reliability	447.26
Usefulness – Presenteeism	117.49
Usefulness – Anonymity	134.13
Usefulness – Pace of change	230.79
Complexity - Reliability	5607.04
Complexity – Presenteeism	63.38
Complexity – Anonymity	136.00
Complexity – Pace of change	157.93
Reliability – Presenteeism	321.69
Reliability – Anonymity	324.89
Reliability – Pace of change	97.45
Presenteeism – Anonymity	352.10
Presenteeism – Pace of change	180.83
Anonymity – Pace of change	526.05

1 For 1df, chi-square differences of at least 3.84 are significantly different at 5% significance level

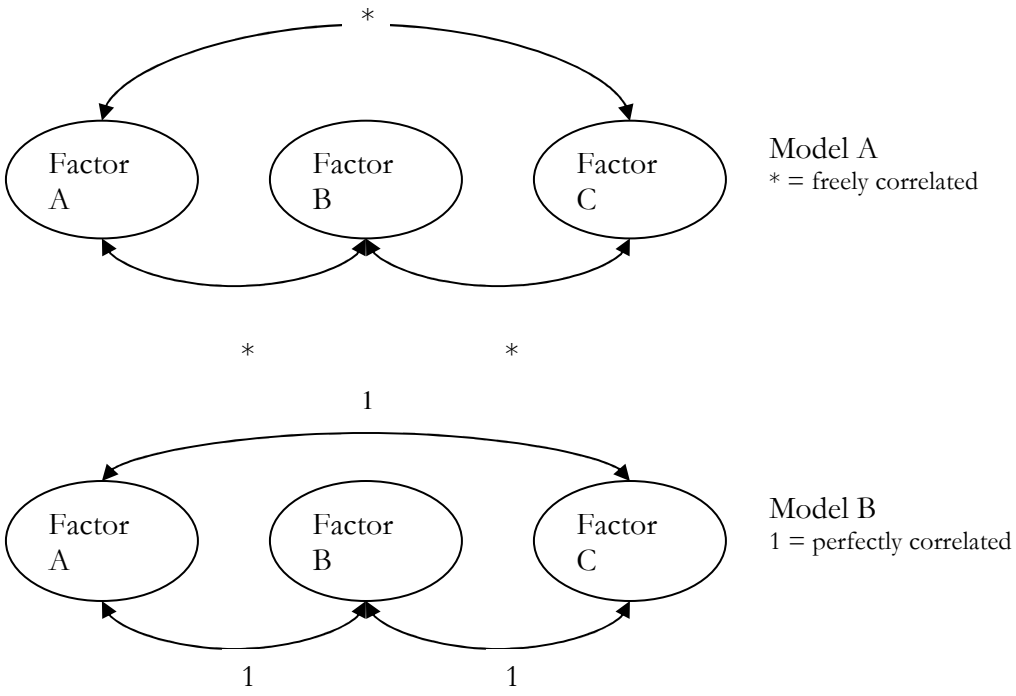

Figure 5.1. Test for discriminant analysis

5.4 Method bias analysis

Since common method bias posed a threat to the validity of this study, careful consideration was given to controlling bias due to the common method used for data collection. As discussed in the previous chapter, this bias is controlled (i) procedurally – through survey design; and (ii) statistically – by doing Harman's test of single method factor and by modeling a latent methods factor. The following paragraphs discuss the steps followed in this research to control the common method bias.

Podsakoff et al. (2003) promote the idea of separation of criterion and predictor variables as one of the potential procedural remedies to common method bias in cases where it is not possible to obtain data from different sources. Since the present research requires data be collected from the same source (individuals perceived stressors or strain), separation between predictor and criterion variables was introduced. This was achieved by providing material/facts appropriate for the respondents, which was not directly relevant to the research phenomenon. The statements introduced in the survey are shown in table 5.8. The next paragraphs discuss the statistical tests done to assess the severity of method bias.

Table 5.8. Procedural remedies for method bias

Separation introduced through following statements	Comments
Did you know? The Zip Code 12345 is assigned to Schenectady, New York.	Introduced between measures of Stressors and Strain
If you were wondering -- zip code 54321 does not exist.	Introduced between measures of Strain and Technology Characteristics
Did you know? Identical twins do not have identical fingerprints.	Introduced between measures of Technology Characteristics because the measures had similar anchor points.
You are more than half-way through the survey...*Thank You* for your patience as we research this important issue. You have almost finished 90% of the survey...Thank You for helping in this non-profit research. Last two pages...Thank YOU!! for helping us better understand the implications of technologies.	These statements are distributed in the survey to motivate the respondents and also to provide separation.

Harman's single factor test is one of the widely used tests to assess the gravity of common method bias (Podsakoff et al., 2003). The underlying argument of this test is that if a single factor emerges from the factor analysis and explains significant covariance among variables indicates the presence of common method bias. The commonly accepted standard

for *significant covariance* explained to be considered a potential problem is at least 25%. Accordingly, the variables involved in the present study were factor analyzed. The results of this test are shown in table 5.9. The results from the test did not yield a single dominant factor. The largest variance explained by a single factor in unrotated factor solution is 21% and is 9% in rotated factor solution, respectively. These results suggest that method bias might not pose a severe threat. It should however be noted that Harman's test is only a diagnostic test and it does not actually control for method bias. Based on the recommendations of researchers (Podsakoff et al., 2003) and a recent trend in IS articles (Ahuja et al., 2007; Liang et al., 2007) the unmeasured methods latent factor was modeled in this study. This technique not only tested for the severity of method bias, but also controlled for it by proportioning the observed variance for any construct into trait variance, method variance and error variance. The results from statistical tests performed with a latent methods factor are discussed next.

Two models are compared to assess the threat of method bias. Model A contained items loading on to their respective latent factors, and Model B contained all the items loading on to their respective latent factors and on to a common method factor. Model B makes intuitive sense because the same method was used to measure all the variables. Modeling a latent method factor significantly improves the fit of the model if common method bias accounts for most of the covariance observed in the variables. The results of this analysis are summarized in table 5.10. While comparing the fit indices between Models A and B, it should be noted that chi-square differences are sensitive to sample size. Therefore, in addition to the chi-square difference test, researchers have suggested to test for differences in CFI (Byrne, 2006; Cheung and Rensvold, 2002; Little, 1997) where the

difference in CFI should be less than 0.05 (Little, 1997) or according to Cheung and Rensvold (2002) less than 0.01. Although the difference in chi-square itself is significant, it should be noted that the ratio of chi-square difference per single degree of freedom is less than 3. Further, these results are similar to those reported by Ahuja et al. (2007) and within the recommendations of Hu and Bentler (1999). Additional evidence was obtained by comparing the differences in CFI. The results indicate that ΔCFI of 0.005 is less than the recommended values of 0.05 (Little, 1997) or 0.01 (Cheung and Rensvold, 2002). These results further provide support that common method bias was not a serious validity threat to this study.

Finally, following Liang et al. (2007), the loadings of each item on its latent trait factor and the latent method factor loadings were checked for the main variables in this research. The results obtained are similar to those reported by Liang et al. (2007). The average loading on the trait factor was 0.815 and the average loading on the common method factor was 0.035 as shown in table 5.11. However, this may not provide the true estimate of method factor as negative and positive method factor loadings of the items are canceled out. To get a better estimate, AVE for method factor is assessed based on the above method factor loadings. This is obtained by computing the average of squared loadings for method factor, which was found to be 0.13. Taking the square-root of AVE provides a measure of average method factor loading for the items in this model. This measure was found to be 0.36 which is very different from the arithmetic average method factor loading

Table 5.9. Harman's one factor test

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**17.381**	**21.196**	**21.196**	**17.381**	**21.196**	**21.196**	**7.729**	**9.425**	**9.425**
2	10.467	12.764	33.961	10.467	12.764	33.961	7.256	8.849	18.274
3	5.870	7.159	41.120	5.870	7.159	41.120	4.803	5.857	24.132
4	3.937	4.801	45.921	3.937	4.801	45.921	4.638	5.656	29.787
5	3.639	4.438	50.359	3.639	4.438	50.359	4.426	5.397	35.185
6	3.544	4.321	54.680	3.544	4.321	54.680	4.343	5.296	40.480
7	3.124	3.810	58.490	3.124	3.810	58.490	4.331	5.281	45.762
8	2.987	3.643	62.133	2.987	3.643	62.133	4.165	5.079	50.841
9	2.426	2.959	65.092	2.426	2.959	65.092	4.007	4.886	55.727
10	2.031	2.477	67.569	2.031	2.477	67.569	3.943	4.808	60.535
11	1.842	2.246	69.815	1.842	2.246	69.815	3.355	4.092	64.627
12	1.745	2.128	71.943	1.745	2.128	71.943	3.143	3.833	68.460
13	1.575	1.921	73.864	1.575	1.921	73.864	3.016	3.679	72.139
14	1.341	1.635	75.499	1.341	1.635	75.499	2.167	2.643	74.782
15	1.154	1.407	76.907	1.154	1.407	76.907	1.742	2.125	76.907

Extraction Method: Principal Component Analysis.

Table 5.10. Method bias test

Model	Chi-Square	CFI	RMSEA	Comment
Model A: All items load on respective factors.	1250 with 784 df	0.981	0.030	Significant method bias exists if Model B fits significantly better than Model A. Results indicate that ΔCFI is less than 0.01 indicating lack of method bias.
Model B: All items load on respective factors and also on a 'method factor'.	1089 with 744 df	0.986	0.027	

To summarize, procedural remedies were undertaken to reduce the severity of common method bias, and various statistical analyses illustrate that common method bias was not a serious threat to this study. Although, common method bias is not a serious validity threat, it still exists (for example, as pointed out by Harman's single factor test and average method factor loading value). The present-age statistical techniques, like structural equation modeling, enable researchers to partial out the method factor. Following the recommendations on common method bias issues (Poskadoff et al., 2003) and recent trend in IS research (Liang et al., 2007), the method factor is partitioned out by modeling a latent method factor. This approach enables researchers to test the relationships between constructs that are free of error and method variance. Therefore, a latent method factor is modeled in all subsequent analyses undertaken to test the proposed hypotheses of this present research. Before discussing the results for measurement and structural models, the assumptions required to run structural equation modeling were tested, which are presented next.

5.5 Testing structural equation modeling assumptions

Use of structural equation modeling requires that certain assumptions are met or appropriate adjustments are made for assumptions that are not perfectly met. The assumptions are that the data be ratio/interval, variables assume a minimum of four values, data is multivariate normal, the model is over identified (i.e. model has more information than there are unknown parameters), and sufficient sample size exists.

Table 5.11 Factor and method loadings

Construct	Items	Factor Loading	Method Loading
Work Overload	WRK_OL1, WRK_OL3, WRK_OL4	0.67. 0.90, 0.88	-0.26, -0.17, -0.18
Work Home Conflict	WHC1, WHC2, WHC3	0.85, 0.87, 0.89	-0.08, -0.24, -0.25
Invasion of Privacy	INPRIV1, INPRIV2, INPRIV3, INPRIV6	0.83, 0.90, 0.89, 0.86	-0.22, -0.18, -0.21, -0.06
Role Ambiguity	RA2, RA3, RA4, RA5	0.74, 0.73, 0.81, 0.79	-0.46, -0.48, -0.40, -0.28
Strain	S1, S3, S4, S5	0.90, 0.96, 0.92, 0.90	-0.16, -0.13, -0.19, -0.23
Usefulness	PU1, PU2, PU3, PU4	0.65, 0.76, 0.75, 0.78	0.58, 0.50, 0.56, 0.52
Complexity	EOU1, EOU2, EOU3	0.59, 0.68, 0.91	0.46, 0.46 0.41
Reliability	REL1, REL3, REL4	0.76, 0.86, 0.81	0.38, 0.30, 0.31
Presenteeism	PRSTSM1, PRSTSM2, PRSTSM3, PRSTSM4	0.78, 0.74 0.70, 0.75	0.61, 0.62, 0.66, 0.63
Anonymity	ANON2, ANON3, ANON4 ANON5	0.88, 0.87, 0.94, 0.86	-0.27, -0.29, -0.27, -0.25
Pace of Change	PCHANGE1, PCHANGE2, PCHANGE3, PCHANGE5	0.87, 0.93, 0.84, 0.81	0.27, 0.13, 0.23, 0.06
Job Insecurity	JINSEC2, JINSEC3, JINSEC5	0.85, 0.68, 0.74	-0.30, -0.48, -0.11
Average		**0.815**	**0.035**

Analysis based on correlation matrix is suggested if variables exhibit a range less than 4 categories for likert scale measures. All variables used in this study have at least 5 categories, so analysis based on the covariance matrix [ANALYSIS=COVARIANCE option in EQS program] was used. EQS reports Mardia's multivariate kurtosis normalized coefficient, which can be used as a statistic to check for multinormality. However, there is no accepted cutoff for this value, although, a value above 20 indicates that data might not be normal. According to Byrne (2006), presence of multivariate kurtosis could indicate that

distribution may be multivariately nonnormal, thereby violating the assumption required for use of maximum likelihood method of estimation. It is pointed out that in complex models, meeting this assumption might not be possible. In such situations, Satorra and Bentler (1998) have developed a statistic that incorporates a scaling correction for the chi-square based statistics. The resulting Satorra-Bentler (S-B) chi-square is shown to be the most reliable test statistic for various distributions and sample sizes. EQS provides a 'ROBUST' option which can be invoked with maximum likelihood (ML) estimation method to obtain corrected estimates. As Byrne (2006) points out, "Unquestionably, these robust statistics are worth their weight in gold when a researcher is faced with problems of non-normality in the data…these invaluable fit statistics were available only with the EQS program (pp. 138-139)." The present study had Mardia's estimate above 20, therefore ROBUST option was used with ML estimation technique [METHOD=ML, ROBUST in EQS program]. The structural model was also over-identified with positive degrees of freedom. Further, the sample size met the estimate calculated in chapter 4 as well as met the large sample size requirement necessary for complex models (Kline, 2005).

5.6 Measurement and structural models

The measurement model consisted of all the items loading on their respective factors and also on a single method factor simultaneously. This included all the constructs from the base research model i.e. all technology characteristics, stressors and strain measures. In the measurement model, all the constructs were freely correlated (except the method factor). The fit indices shown in table 5.12 suggest that the data fits the model well. The values were above the suggested cutoffs of 0.90 for CFI, 0.10 for SRMR and 0.10 for RMSEA (Kline,

2005). Further, in the structural model all the factor covariances were removed and structural paths were added reflecting the proposed hypotheses. This model also shows appropriate fit with the data, illustrated in Table 5.12. The results from the structural analysis shown in figure 5.2 and were used for hypotheses testing, which is discussed next.

5.12 Fit Statistics

Model	SRMR	CFI	RMSEA	Chi-square
Measurement Model	0.036	0.986	0.027	1089 with 744 df
Structural Model	0.072	0.917	0.037	1986 with 1044 df

5.7 Hypotheses testing

Before discussing the results from hypotheses testing, the results of the control variable analysis are presented. In the proposed research model it was argued that stressors due to ICTs (i.e. work overload, role ambiguity, work-home conflict, invasion of privacy, and job insecurity) should control for technology usage, and strain due to ICTs should be controlled for with the dispositional variable negative affectivity. The results from the structural model support this argument. The detailed results of control variables and appropriate discussion are presented in Appendix II.

5.7.1 Testing 'usability' characteristics hypothesis – H1

As presented in Chapter 3, technology characteristics from the 'usability' stream (i.e. usefulness, complexity, and reliability) were hypothesized to be related to work overload. Restating the hypothesis,

H1: Individual perception of technology usability characteristics will be related to perceived work overload.
Specifically,

H1a: Individual perception of technology usefulness will be negatively related to perceived work overload.
H1b: Individual perception of technology complexity will be positively related to perceived work overload.
H1c: Individual perception of technology reliability will be negatively related to perceived work overload.

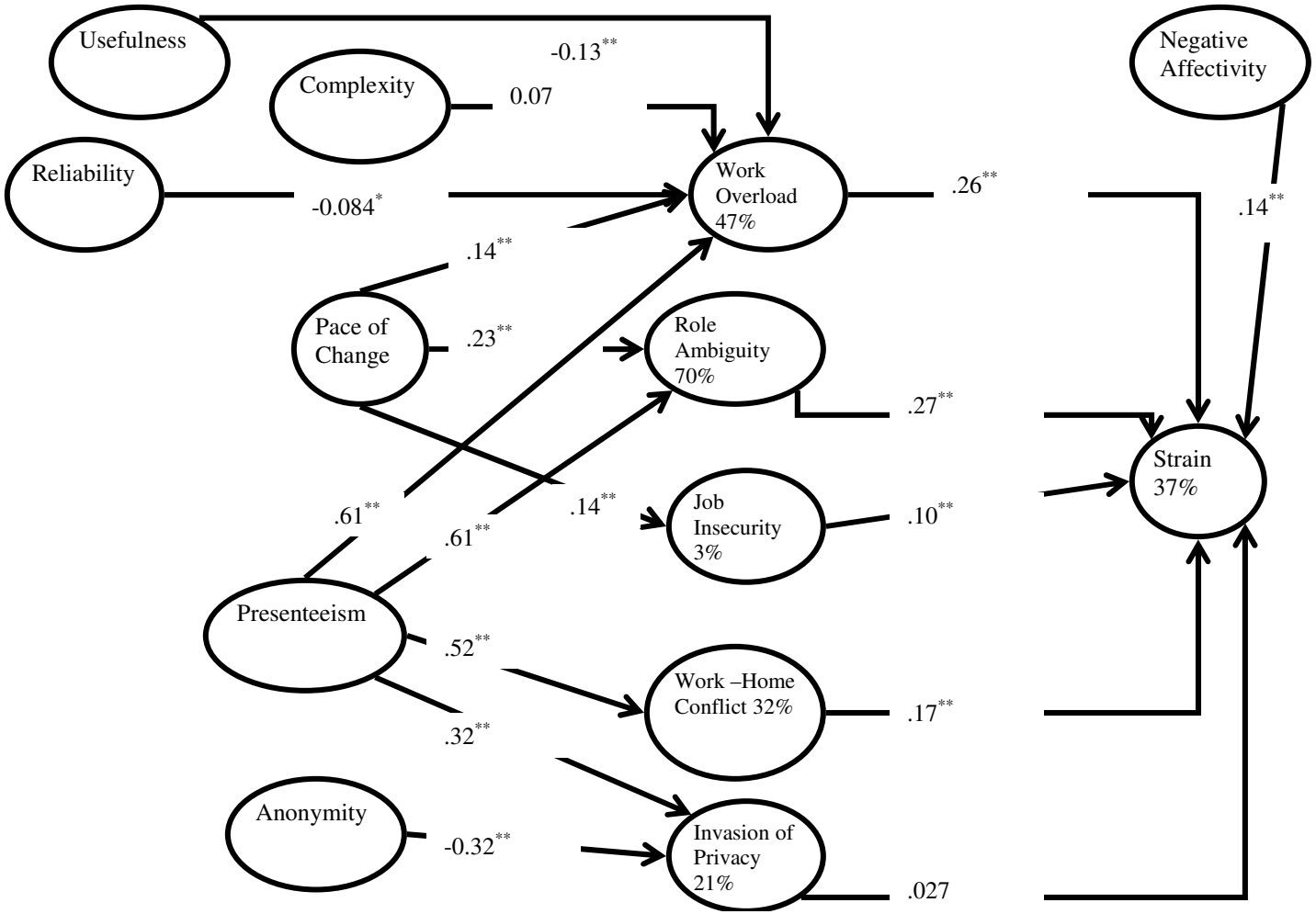

Figure 5.2 Structural model with results

Results from the structural analysis yield support for H1a and H1c, but not to H1b. Therefore, hypothesis H1 is partially supported. Results indicate that the usefulness – work overload link is significant (b= -.13, $p<0.01$), and the link between reliability – work overload is also significant (b= -.0.08, $p<0.05$) supporting H1a and H1c. The link between complexity – work overload is insignificant (b=0.07, $p>0.05$), indicating lack of support for hypothesis H1b. Therefore, results from the structural analysis find partial support for hypothesis H1.

5.7.2 Testing 'intrusive' characteristics hypotheses – H2 to H6

As discussed previously, intrusive characteristics are identified as 'presenteeism' and 'anonymity'. The results pertaining to 'presenteeism' are presented first, followed by 'anonymity' hypotheses.

It was hypothesized that 'presenteeism' characteristic of technology would be related to work-home conflict, invasion of privacy, work overload and role ambiguity. Each of these hypotheses is recounted here, and the results from the structural model for the same are presented.

Hypothesis H2 proposes a relationship between presenteeism and work-home conflict. Specifically,

H2: Individual perception of technology presenteeism will be positively related to perceived work-home conflict.

Results from the structural model provide support for this contention. The standardized regression coefficient for this link is found to be significant at $p<0.01$ (β= .52), supporting H2. Hypothesis H3 relates presenteeism to invasion of privacy. Specifically,

H3: Individual perception of technology presenteeism will be positively related to perceived invasion of privacy.

Results indicate support for this hypothesis H3 with a regression coefficient of β=0.32, significant at 1%. H4 and H5 hypothesized a relationship between presenteeism and work overload and role ambiguity, respectively. Recounting,

H4: Individual perception of technology presenteeism will be positively related to perceived work overload.
H5: Individual perception of technology presenteeism will be positively related to perceived role ambiguity.

To address hypothesis H4, path coefficients between presenteeism and work overload were examined. The standardized coefficient of 0.61 ($p<0.01$) suggests that presenteeism is a strong predictor of work overload, thereby supporting H4.

In addition, data supports the contention that presenteeism and role ambiguity are positively related. Specifically, results indicate β=0.61 ($p<0.01$), supporting H5.

Hypothesis H6 relates anonymity to individuals' perception of invasion of privacy. Restating the hypothesis

H6: Individual perception of technology anonymity will be negatively related to perceived invasion of privacy.

Results from the structural model suggest that anonymity is negatively related to invasion of privacy. This relationship is significant (β= -.32, $p<0.01$) supporting H6.

5.7.3 Testing 'dynamic' characteristic hypotheses – H7 to H9

The dynamic characteristic of technology included in this model, as discussed in previous chapters is 'pace of change'. Chapter 3 argues that technology pace of change is

related to work overload, role ambiguity and job insecurity. These arguments are conjectured, and restated for convenience as

H7: Individual perception of technology pace of change will be positively related to perceived work overload.
H8: Individual perception of technology pace of change will be positively related to perceived role ambiguity.
H9: Individual perception of technology pace of change will be positively related to perceived job insecurity.

Path coefficients from the structural model provide support for all three hypotheses. Specifically, the link between pace of change – work overload has a standardized coefficient of .14 ($p<.01$), supporting H7. Also, data supported the contention that pace of change is a predictor of role ambiguity $\beta=.23$ ($p<0.01$), supporting H8. Finally, evidence in terms of standardized coefficient $\beta=0.14$ significant at 1% provides support for the premise that pace of change and job insecurity are related, supporting H9.

5.7.4 Testing relationship between 'stressors' and 'strain' – H11

As argued in Chapter 3, H11 relates stressors (due to ICTs) to strain (due to ICTs). Restated here as

H11: Stressors (work overload, role ambiguity, work-home conflict, invasion of privacy and job insecurity) are positively related to strain.
- H11a: Individuals' perception of work overload is positively related to perceptions of strain.
- H11b: Individuals' perception of role ambiguity is positively related to perceptions of strain.
- H11c: Individuals' perception of work-home conflict is positively related to perceptions of strain.
- H11d: Individuals' perception of invasion of privacy is positively related to perceptions of strain.
- H11e: Individuals' perception of job insecurity is positively related to perceptions of strain.

Results from the structural model provide partial support for this hypothesis H11. The link between work overload – strain is statistically significant with a standardized coefficient of $\beta=0.26$ ($p<0.01$), supporting H11a. Support for H11b is found in terms of significant relationship between role ambiguity and strain ($\beta=0.27$, $p<0.01$). Also, the relationship between work-home conflict and strain is confirmed by data ($\beta=0.17$, $p<0.01$), supporting H11c. Data didn't support that invasion of privacy is related to strain ($\beta=0.027$, $p>0.05$) – lending no support for H11d. Finally, the link between job insecurity and strain is statistically significant ($\beta=0.10$, $p<0.01$), lending support for H11e. In summary, four of the five hypotheses for H11 are supported. Therefore, hypothesis H11 is partially supported.

5.7.5 Testing moderator relationships – H10

The three moderators discussed previously in this research work are technological self-efficacy, technical support and technological centrality. It was hypothesized that

H10a: Technical support moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).
H10b: Centrality moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).
H10c: Technological self-efficacy moderates the relationship between technology characteristics (usability, dynamism, intrusive) and stressors (work overload, role ambiguity, work-home conflict, and job insecurity).

In order to test the moderation effects in structural equation modeling, the approach proposed by Marsh et al. (2004) was followed. This approach suggests mean centering the indicators and then creating interaction terms by taking the product of mean-centered indicators. So, to test the moderation effect of centrality on technology characteristics-stressors link, product terms have to be created between centrality and each technology

characteristic (presenteeism, anonymity, usefulness etc.). This procedure has to be repeated for other two moderators - technical support and technological self-efficacy. Given the total number of moderator relationships, each is tested separately and only the significant relationships are reported. The results indicated that technology support and self-efficacy do not moderate any of the relationships between technology characteristics and stressors. Therefore hypothesis H10a and H10c are not supported.

The results for technology centrality are presented in table 5.13. The results in general provide support that technology centrality moderates the relationships between technology characteristics and stressors, supporting H10b. Specifically, for the same levels of technology characteristics, higher levels of technology centrality result in lower levels of stressors. For example, for the same level of presenteeism, increasing centrality by one standard deviation (S.D)reduces the perceptions of work overload (by .14 S.Ds), role ambiguity (by .19 S.Ds) and invasion of privacy (by .12 S.Ds). These results indicate that technology centrality could be used as a lever to reduce stressful impacts of ICTs to an extent.

Table 5.13. Interaction results for technology centrality

Predictor variables	Criterion variable	Standardized coefficient
Presenteeism	Work overload	.53*
Centrality		.22*
Presenteeism * Centrality		**-.14***
Presenteeism	Role ambiguity	.60*
Centrality		.37*
Presenteeism * Centrality		**-.19***
Presenteeism	Invasion of	.23*
Centrality	privacy	.16*
Presenteeism * Centrality		**-.12***
Anonymity	Invasion of	-.29*
Centrality	privacy	.04
Anonymity * Centrality		**-.08****
Usefulness	Work overload	-.13*
Centrality		.07
Usefulness * Centrality		**-.13***
Pace of change	Work overload	.18*
Centrality		.04
Pace of change * Centrality		**-.09****
Pace of change	Role ambiguity	.31*
Centrality		.02
Pace of change * Centrality		**-.16***

* significant at 1%
** significant at 5%

Overall, strong support has been found for the proposed hypotheses. Table 5.14 provides the summary of results.

Table 5.14 Summary of the proposed hypotheses

Hypotheses	Supported?
H1a: Individual perception of technology usefulness will be negatively related to perceived work overload.	Yes
H1b: Individual perception of technology complexity will be positively related to perceived work overload.	No
H1c: Individual perception of technology reliability will be negatively related to perceived work overload.	Yes
H2: Individual perception of technology presenteeism will be positively related to perceived work-home conflict.	Yes
H3: Individual perception of technology presenteeism will be positively related to perceived invasion of privacy.	Yes
H4: Individual perception of technology presenteeism will be positively related to perceived work overload.	Yes
H5: Individual perception of technology presenteeism will be positively related to perceived role ambiguity.	Yes
H6: Individual perception of technology anonymity will be negatively related to perceived invasion of privacy.	Yes
H7: Individual perception of technology pace of change will be positively related to perceived work overload.	Yes
H8: Individual perception of technology pace of change will be positively related to perceived role ambiguity.	Yes
H9: Individual perception of technology pace of change will be positively related to perceived job insecurity.	Yes
H10a: Technical support moderates the relationship between technology characteristics and stressors.	No
H10b: Centrality moderates the relationship between technology characteristics and stressors.	Partial
H10c: Technological self-efficacy moderates the relationship between technology characteristics and stressors.	No
H11: Stressors (work overload, role ambiguity, work-home conflict, invasion of privacy and job insecurity) are positively related to strain.	Partial
H11a: Individuals' perception of work overload is positively related to perceptions of strain.	Yes
H11b: Individuals' perception of role ambiguity is positively related to perceptions of strain.	Yes
H11c: Individuals' perception of work-home conflict is positively related to perceptions of strain.	Yes
H11d: Individuals' perception of invasion of privacy is positively related to perceptions of strain.	No
H11e: Individuals' perception of job insecurity is positively related to perceptions of strain.	Yes

5.8 Post-hoc / exploratory analysis:

Various exploratory analyses were performed to gain further insights which are presented next. First, analyses were performed to see if the strength of proposed relationships varied across gender, age. If so, it would inform practice to be sensitive to these differences. Accordingly, a multi-group analysis was performed. The results for gender are discussed first followed by results for age. Second, the importance of technostress was established by evaluating the relationship between technology induced strain to the overall job strain. Finally, cluster analysis was performed on technology usage to create technology profiles. Analysis were performed on these profiles to see if differences exist in the proposed model.

5.8.1 Group analysis: Gender

First the data was split into two groups along gender. Then, the proposed research model was run for each group to see if the data fit the model well. Results suggested that the model fit the data well in both the groups. Now, all the structural paths (i.e. hypotheses in the model) were constrained to be equal for both males and females. Running the Lagrange Multiplier Test (LM Test) in EQS identifies the paths that are significantly different in both the models (Byrne, 2006; Kline, 2005). It was found that H2 and H11b are significantly different at 10% significance level. Specifically, it was found that the relationship between presenteeism and work-home conflict (H2) is stronger in females (β_{female}=.58, β_{male}=.45). Also, it was found that relationship between role ambiguity and strain (H11b) is stronger in females (β_{female}=.35, β_{male}=.17).

5.8.2 Group analysis: Age [Group1: Age less than or equal to 42; Group2 > Age 42]

The frequencies of 'age' were checked to create two groups. Age of 42 provided a break in the data pattern and also considering the mean age of the sample, age of 42 was used as the cutoff to create two groups. First group consisted of individuals till the age of 42 years, and the second consisted individuals who are older than 42 years. Similar to the group analyses for gender, the structural model was first checked in both the age groups and then all the structural paths in both the groups were constrained to be equal. LM test indicated that three paths were significantly different. Results indicated that the relationship between 'work-home conflict' and 'strain' (H11c) was stronger (at 1%) in the younger age group (β_{group1}=.34, β_{group2}=.11). Also, H6 which posited relationship between 'anonymity' to 'invasion of privacy' was significantly different at 5%, with the relationship being stronger in older age group (β_{group1}= -.21, β_{group2}= -.35). Finally, H9 which proposed a link between 'pace of change' to 'job insecurity' was also found to be different at 10%, with relationship stronger in the younger age group (β_{group1}=.30, β_{group2}=.08).

5.8.3 Relationship between strain due to ICTs and job strain

Since most of the stress research focuses on job strain, and consequences of job strain are widely established (turnover intentions, job dissatisfaction), we explored whether strain due to ICTs contributes to job strain for an individual. In chapter 2, the boundary condition of this study suggested that strain due to ICTs could be a component of overall strain an individual experiences for which there could be other stressors in the job environment. To establish and prove that strain due to ICTs was an important component of job strain, the structural model shown in figure 5.2 was modified by proposing strain due to ICTs as an antecedent to job strain. The scale for job strain was obtained from the widely

used measure of House and Rizzo (1972) is presented in the appendix c. The results from the structural analysis suggest that the link between strain due to ICTs and job strain is significant at 1% with a standardized coefficient of β=0.26. As might be expected, as strain due to ICTs increases, the overall job strain an individual experiences also increases.

5.8.4 Cluster analysis results – technology profiles

To better understand the nuances of technology profiles as applied to the present model, cluster analysis on technology usage was performed. Cluster analysis identifies homogenous subgroups of cases in the population. Groups are formed such that with-in group variation is minimized and between-group variation is maximized. SPSS® 13.0 was used to perform the cluster analysis on technology usage variables. SPSS offers three approaches to cluster analysis – hierarchical, k-means and two-step. Hierarchical clustering is appropriate for small sample sizes as it is very intensive and k-means clustering requires the researcher to specify number of clusters in advance. Considering the exploratory nature of this analysis and relatively large sample size, two-step clustering approach was used. The clustering of seven technology usage variables resulted in four clusters[7]. Cluster 1 consisted of individuals who used mobile and 'work specific' technologies. This could represent individuals who, to an extent, work outside the typical office or whose work requires them to use mobile ICTs. Cluster 2 consisted of individuals who mainly used the enterprise and database technologies. Individuals who used network technologies extensively were part of cluster 3, and cluster 4 was formed by individuals who used the communication and generic application technologies the most. It should be noted that all clusters have some degree of

[7] The solution with four clusters provided more interpretable results than 3 or 5 clusters.

communication and generic technology usage, because of the nature of technologies in consideration. The cluster information is shown in table 5.15 below.

Table 5.15. Cluster analysis – technology profiles

		Mobile		Network		Communication		Ent. and DB		Application		Collaborative		Other	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Cluster	1	41.43	31.50	8.93	14.56	17.03	12.54	.38	1.52	16.60	16.80	1.37	2.64	17.14	24.06
	2	10.52	10.49	10.40	9.85	23.09	12.27	20.32	21.46	24.08	17.23	9.31	9.43	1.38	4.42
	3	6.61	8.66	45.88	19.50	22.19	11.83	2.41	4.69	16.50	13.29	2.52	3.65	.91	3.83
	4	6.09	8.13	5.12	7.74	33.62	26.69	1.37	3.55	34.21	32.29	.68	1.82	1.02	3.41

According to the above cluster information, the data set was divided into four files – each representing a cluster. The proposed structural model was run on each of these data sets. Any differences in the significance of structural relationships (as compared to the original model) would provide preliminary support for the contention that different type of technologies have different pathways to stressful reactions. The table 5.16 reports some interesting exploratory findings from executing the original structural model on these four different clusters (i.e. technology usage profiles). The fit indices for these four models are also reported in table 5.16. The idea here is to present some initial evidence on the sensitivity of technology profiles on the proposed model which could be explored in detail in future studies.

5.16. Finding from cluster analysis

Cluster	Some key patterns identified
Cluster 1 – Mobile technology intensive (CFI = 0.9, SRMR= 0.1, RMSEA=0.07)	• Invasion of privacy – strain link becomes significant at 5%. • In general, 'pace of change' and 'presenteeism' relationships are stronger. • Usability characteristics become less significant (i.e. become weaker)
Cluster 2 – Enterprise and database technology intensive (CFI = 0.9, SRMR=0.08, RMSEA=0.07)	• Usefulness-work overload link becomes stronger. • Invasion of privacy – strain link is not significant and job insecurity – strain link is significant (similar to base model)
Cluster 3 – Network technology intensive (CFI = 0.93, SRMR=0.09, RMSEA=0.06)	• Work overload and role ambiguity stressors become stronger predictors of strain. • Links between work-home conflict, job insecurity, and invasion of privacy to strain are insignificant
Cluster 4 – Communication and generic application technology intensive (CFI = 0.95, SRMR=0.08, RMSEA=0.05)	• Work-home conflict (as compared to work overload) and role ambiguity become dominant stressors predicting strain. • 'Reliability' becomes more important than 'Usefulness' with respect to usability-work overload relationships.

The results from cluster analysis identify some interesting trends. Only for mobile technology cluster (cluster 1) does 'invasion of privacy' become a significant predictor of strain. Also, the general trend in this cluster implies that the strength of links involving either presenteeism or pace of change become stronger. For cluster 2, the usefulness – work overload link becomes much stronger and, as in original model, invasion of privacy to strain link becomes insignificant. For network technology cluster (cluster 3), the links between work overload, role ambiguity stressors and strain became stronger. However, contrary to the original model, work-home conflict and job insecurity stressors were not significantly related to strain. For cluster 4 (communication and generic application technology cluster), work-home conflict (instead of work overload) and role ambiguity were stronger predictors of strain. Also, for this cluster, among usability characteristics, reliability had stronger relationship with work overload than usefulness.

The results of these exploratory analyses provide several insights that can be explored deeper in future research. Detailed analyses and discussion of these new findings is beyond the scope of this dissertation.

To conclude, this chapter provided a discussion on the results obtained in this study. The next chapter discusses the interpretations of these findings, their implications for research and managerial practice. Further the limitations of this study are acknowledged and also future research opportunities are identified.

CHAPTER 6
CONCLUSIONS AND IMPLICATIONS

The broad research goal of this study was to investigate the stressful impacts of ICTs on individuals in organizations. Specifically, the goals of this study were to (i) develop a model for technostress by integrating stress and IS literatures, (ii) empirically test the overall validity of the model, and (iii) identify technology characteristics that are significant predictors of stressors in the model.

The developed research model argued that technology characteristics induce stress by enhancing the misfits between individuals' abilities – environments' demands and between individuals' supplies – environments' values. The misfits are characterized in terms of stressors due to ICTs. That is, technology characteristics are proposed as antecedents to stressors, which in turn are predictors of strain (due to ICTs). The following sections present a discussion, conclusion and implications of the research findings. First, the results of the hypotheses testing are discussed. Next, contributions in terms of implications for research and implications for practice are presented. Also, limitations of this present study and future research opportunities are also pointed out. The chapter ends by providing conclusions from this study.

6.1 Discussion of Results

The results of hypotheses testing found that out of 11 hypotheses, all the hypotheses are supported –three of them partially. The presentation of findings from these results is organized as follows. First, the relations between stressors and strain are discussed, followed by relations between technology characteristics and stressors. Here, it is worth reiterating

that stressors and strain discussed here are components that are directly attributed due to ICTs. This section concludes by discussing the moderator hypothesis and some exploratory analysis performed in Chapter 5.

6.1.1 Predictors of Strain

The terminology presented in Chapter 2 argues that 'stress' is the overall process and 'strain' as a response to stressors. Therefore, it is critical that in a study of 'technostress', evidence of existence of 'strain due to ICTs' be found. The results of the present study suggest that technostress is real, and deserves attention in the present environment. The results indicate that approximately 37% of the variance in strain is explained by proposed stressors i.e. work overload, role ambiguity, work-home conflict, job insecurity and invasion of privacy (H11). The strongest contributors to strain in this sample were role ambiguity and work overload, which exhibited similar path coefficients. The next strongest predictor was work-home conflict, followed by job insecurity. Contrary to expectations, invasion of privacy didn't significantly relate to strain.

The emergence of role ambiguity (due to ICTs) as a strong predictor of strain implies that individuals have a hard time managing the demands placed by constant interruptions, and by conflicting demands. In terms of person-environment fit framework, it can be viewed as a misfit between demands for attention and the individuals' abilities to deal with these demands. The results seem to provide some indirect empirical support for the argument that in an information economy, attention is a scarce resource (Davenport and Beck, 2001). Therefore, the ability of individuals to focus their attention and deal with constant interruptions and conflicting demands appears to be a major challenge. Consistent with other stress studies in different contexts, work overload (due to ICTs) also materialized as a

significant predictor of strain. The findings indicate that the greater the work overload, the higher the strain experienced by individuals. This lends support to the argument that imbalance between work demands placed by ICTs and individual abilities to deal with such demands lead to strain. ICTs appear to be creating situations where work demands exceed individuals' abilities (Tu et al., 2005).

Blurring of boundaries between work and family life also had a significant impact on strain. Since an individuals' resources (in terms of time, energy etc.) are limited, greater the conflicts between work and family spheres indicate higher levels of strain. Similarly, the positive relationship between job insecurity and strain indicates that as the perceptions of job insecurity increase so too do increased levels of strain in individuals. As modeled, ICTs provide situations in which misfit exist between individual and environment with respect to perceptions of job security. Finally, there was lack of support for the contention that invasion of privacy was a predictor for strain suggesting that, in the present environment individuals might be tolerant and accept invasion of privacy as an offshoot of advances in ICTs'.

6.1.2 Technology characteristics as antecedents to stressors

The proposed model argued that ICTs enhance the misfit between person and environment, there by creating a component of stressors that are attributed to ICTs. The findings between technology characteristics and stressors are discussed below.

6.1.2.1 Predictors of Work Overload

Technology characteristics from 'usability' (usefulness, complexity, and reliability), 'dynamic' (pace of change) and 'intrusive' (presenteeism) characteristics were proposed as antecedents to work overload (H1, H4, and H7). The findings suggest that 47% of variance

in work overload is explained by these factors. Results indicate presenteeism had the strongest impact on work overload, where as usability characteristics had relatively weaker relationships. Perceptions of work overload increased when individuals considered that ICTs enabled individuals to be reached and when technologies are changing beyond their abilities to cope. Increased connectivity enhances the speed of work flow and expectations of productivity (Clark and Kalin, 1996). Subsequently, it creates situations that require individual to work under time pressures and deadlines – seen as contributing to work overload (Cooper et al., 2001; Narayanan et al., 1999).

On the other hand, improving the usability characteristics reduced the perceived work overload. Specifically, it was found that as individuals find ICTs useful and reliable it leads to lower levels of work overload. Contrary to expectations, the structural model indicates that complexity of ICTs didn't significantly relate to work overload in the present sample. It was proposed that as complexity of ICTs increased, work overload increased. However, it is possible that since the ICTs considered here are generic, rather than work-specific, complexity of the technology itself was limited and consequently was not significant.

6.1.2.2 Predictors of Role Ambiguity

Technology presenteeism and pace of change were proposed as antecedents to role ambiguity (H5 and H8). Both proposed links were significant and these two factors explained 70% of the variance in role ambiguity. The findings indicated that greater the perceptions of presenteeism and pace of change increased the role ambiguity perceptions, with presenteeism - role ambiguity relation being the stronger of the two. This suggests that constant connectivity enables interruptions at work and constant changes in ICTs creates

situations in which conflicting demands exist (normal work demands versus new learning demands).

6.1.2.3 Predictors of Work-home conflict

Thirty-two percent of the variance in work-home conflict was explained by the proposed predictor – technology presenteeism (H2). The findings suggest that greater perceptions of presenteeism increased the work-home conflict perceptions. These findings support the arguments that constant connectivity provided by ICTs encroaches on the personal space of individuals. In the present networked world, the results indicate that it is a challenge to maintain a work-life balance.

6.1.2.4 Predictors of Job insecurity

Technology pace of change is proposed as a predictor to job insecurity (H9). As expected, this link was significant and contributed to 3% of explained variance in job insecurity. Although the variance explained is small, the relationship was significant. The findings suggest that greater perceptions of pace of change increased the perceptions of job insecurity. These findings support the arguments that constant changes in ICTs makes individuals apprehensive about their skill set or about the possibility of being replaced.

6.1.2.5 Predictors of Invasion of Privacy

Technology presenteeism and anonymity were proposed as predictors of invasion of privacy (H3 and H6). Both the proposed links were significant and these two factors explained 21% of the variance in invasion of privacy. The findings indicated that greater perceptions of presenteeism increased the perceptions that an individuals' privacy was compromised. Further, results show that greater perceptions of anonymity provided by a technology lessened the concerns about invasion of privacy. These findings suggest that

individuals are wary about the possibility that their actions with ICTs be traced or monitored. Also the constant connectivity enabled by ICTs seems to instill the feeling that individuals were always at work.

6.1.3 Moderator hypothesis discussion

Out of the three proposed hypotheses, only technology centrality was supported. The lack of support for technological self-efficacy and technical support is contrary to expectation. There are two plausible arguments for this lack of support. First, since the technologies considered are for most part common-place rather than job specific, it is possible that support and self-efficacy are limited to complex technologies. For example, individuals may not need support structures to use e-mail systems or cell phones. In the present technological age and environment, dealing with basic technologies may be second nature, thereby rendering no evidence for technological self-efficacy and technical support. These two moderators may take on heightened importance, if stressful effects with respect to non-trivial technologies are considered. Another explanation could be that since these two stressors are from 'stress' domain, they might be more relevant in the domain of stressor-strain relationship, which is beyond the scope of this study. Future research could explore these intricacies in more detail.

Results provide some support for technology centrality as a moderator. It is suggested that if the technologies play an integral part in individuals' work tasks and are viewed as beneficial, then individuals are more tolerant towards those technologies. For example, a sales professional might find the use of Blackberry® integral and beneficial to his/her work tasks. The results do provide support for this type of buffering effect. As reported in previous chapter, it was found that keeping the technology characteristics

constant and increasing the levels of technology centrality reduced the levels of stressors. This buffering effect is found for various technology characteristics→stressors relationships. Increasing the perceptions of centrality alleviates the stressful aspects of ICTs, e.g. due to presenteeism, pace of change, usefulness (lack of). Therefore, varying the perceptions of technology centrality can be used as a useful management strategy to reduce the stressful perceptions of individuals towards ICTs.

6.1.4 Exploratory analysis discussion

Exploratory analysis in chapter 5 indicated that there are some differences in the structural model relations based on gender and age. Two structural paths changed based on gender and three structural paths were found to be different in the group analysis for age. Results indicated that in females the relationship between presenteeism and work-home conflict is stronger. It is possible that women have more family related responsibilities making them more sensitive towards work and home boundaries. Similarly the relationship between work-home conflict and strain is stronger in the younger age group. It is possible that this group of individuals have more family responsibilities (for example, raising a family) and therefore value work-home boundaries more.

The results also suggests that technostress as manifested in strain due to ICTs is related to, and is an important component of the broader job strain variable. Given the importance of job strain in the stress literature, the unexplored component of job strain because of ICTs (i.e. strain due to ICTs) deserves further attention.

6.2 Implications for Research

This present study contributes to research on the phenomenon of technology induced stress by integrating stress, IS, and technostress literature streams. This study is one of the first to empirically test this phenomenon, as previous works on technostress are descriptive (with the exception of Tu et al. (2005)). The conceptualization proposed in this study and the empirical test of the same make some unique contributions which are discussed below.

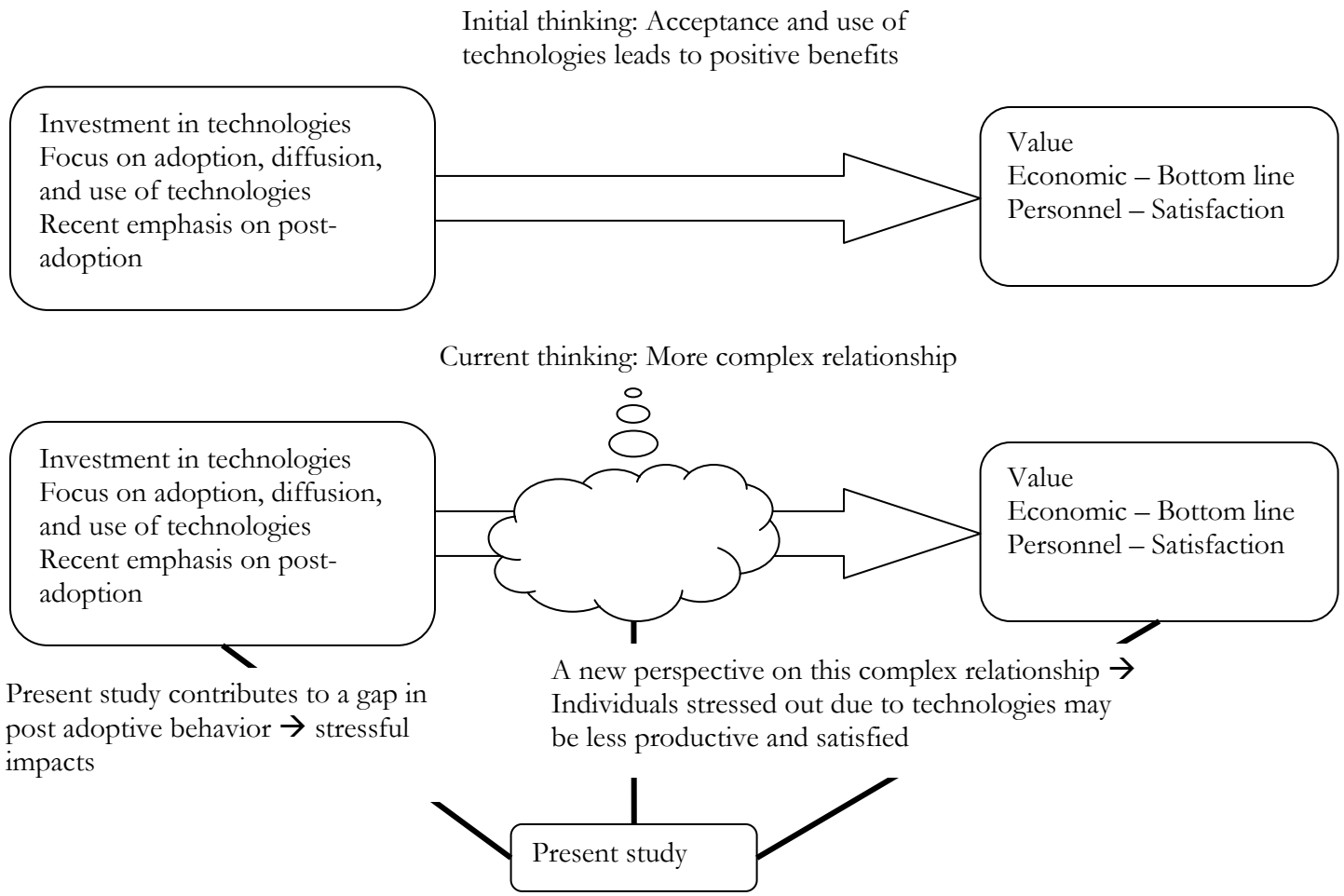

Figure 6.1. Present study in broader literature

Before discussing the contributions of this study, the present work could be placed in broader nomological context, which could ground present work and also provide guidance for future research. At a broader level, this research could be placed in the 'technology acceptance and use' literature – especially, the 'post adoption' literature. This is due to the fact that technostress phenomenon tries to understand the consequences (stressful impacts) of technology adoption and use. This is pictorially shown in figure 6.1. A constant assumption in adoption literature is that once the technologies are adopted, they will be continued to be used. In reality, use of technologies might diminish over time; technologies might be resisted, or used in restricted fashion, among other things (Jasperson et al., 2005). In this context, it is possible that use of ICTs leads to stress which in turn could lead to reluctance to use (as also discussed later in future research section). In other words, the present study indicates that post adoptive behaviors could potentially lead to situations which are different from situations based on implications from pre-adoption research.

Recent discourses on technology acceptance and use identify consequences of technology adoption as requiring more research attention (Benbasat and Barki, 2007; Goodhue, 2007). The present study contributes to this thinking by exploring the unintended consequences of technology use. The developed model would imply that researchers need to consider the stressful impacts of technologies when studying phenomenon related to consequences of technology use. The present study provides guidance in this respect by developing a model based on person-environment framework.

Following subsections discuss the implications of this study, organized as - contributions to technostress & IS research, contributions to stress research, and methodological contributions.

6.2.1 Contributions to Technostress and IS Research

This research starts its own tradition on studying technostress phenomenon. This study extends past stress research by showing that factors of strain due to ICTs (stressors like work overload, work home conflict, role ambiguity etc.,) have their own determinants (usefulness, presenteeism, anonymity etc.). This extends the nomological network when compared to previous occupational-focused stress studies. The proposed model lets researchers to evaluate the root causes of technostress. Rather than just asking "what are the dominant stressors?," it is also important to ask "what are the determinants of these stressors?"

The conceptualization proposed in this model goes beyond the typical occupational stress studies found in IS literature. Recent studies in this tradition looked at work exhaustion and turnover intentions in technology professionals (Moore, 2000), and turnover intentions and work exhaustion in IT road warriors (Ahuja et al., 2007). These studies test the stress models in the context of IT professionals. It should be noted that the arguments in these studies are based mainly on empirical results from stress studies. The model proposed in this study differs from IS occupational stress models in three key areas. First, explicit theoretical arguments are made based on person-environment fit framework. Second, it proposes certain technology characteristics as antecedents to stressors based on the arguments made on person-environment fit framework. Third, the model is not constrained to any particular occupation. In fact, it is developed to understand the impacts of ICTs across different occupations in an organization. Therefore, if the focus is on understanding the impacts of ICTs, rather than on professionals from IT department, the model developed in this study is more appropriate.

The model developed is generic in nature and is tested against the overall technology use of individuals. As such, the technology characteristics developed are not constrained to any particular technology. Therefore, the proposed model could be used to address previous calls for exploring the stressful impacts of ICTs (Weber, 2004). Specifically, he called for more research to better understand email in organizational context – one of the questions being to understand the stressful affects of email. The conceptualization presented in this inquiry could be applied to e-mail to not only address whether use of email systems are stressful, but also shed light on what aspects of email systems are stressful. This provides a complementary perspective to the current status on research in email (Gupta et al., 2006) which addresses issues related to the design of email systems, how to manage emails, and how often to check emails.

This research also sets new directions for future work on technostress. It significantly enhances the understanding of the phenomenon when compared to the previous empirical work of Tu et al. (2005). They identified techno-overload, techno-insecurity etc. as components of technostress. However, this conceptualization is inconsistent with broader stress literature. Further, their conceptualization of techno-overload, for example, treats how technology creates overload as a black box. The present conceptualization of technology characteristics as antecedents to stressors, which act as predictors of strain, is much more consistent with broader stress literature and has more explanatory power as to how different aspects of technologies could be stressful.

The proposed framework is especially useful in studying the psychological manifestation of strain. In addition to the 'strain due to ICTs' dependent variable used in this study, some different manifestations of stress could also be studied. For example, some

studies in the stress literature address the issue of 'depersonalization' – which is referred to as treatment of individuals as objects rather than people in work settings. This type of variable might be relevant when considering the unintended impacts of ICTs. As individuals spend more and more time with ICTs it might distort individuals' social senses. The following examples, which overlap with descriptive accounts of Weil and Rosen (1997), provide accounts along which future work could be conducted. For example, individuals dealing extensively with ICTs might have false sense of 'time'. In other words, individuals might expect immediate results from colleagues as they would expect from ICTs. Further, individuals might techno-identify others i.e., based on their technology use patterns or on the technologies they use. This type of time-sense, identification and resulting frustration could be considered as a different manifestation of stress - social ineptitude.

Findings from the present study also imply that, at least in the technostress related phenomenon, the individuals' perceptions of usability characteristics seem less critical than 'intrusive', and to some extent 'dynamic' characteristics. This implies that researchers should go beyond the traditional 'usability' characteristics to gain better understanding of consequences of technology use.

Given the importance of 'intrusive' nature of technologies, the understanding obtained from the present model could contribute to some existing research. For example, Speier et al. (2003) call for better understanding on interruptive nature of technology and their impact on performance. In their words, they note "…given the role of information technology as a possible 'generator' of interruptions, we also need to understand more fully the effect of technologies on decision-making performance… (page 790)" Specifically, they call on future research to understand the impacts of email and instant messaging

technologies on the decision maker's performance. The present work contributes by providing evidence that technologies are interruptive and provides guidance in which stressful impacts of various technologies could be evaluated. Although performance is not directly studied, the present model could be extended to accommodate performance aspect. To refresh, the 'interruptive' nature of technology was considered when discussing the technology characteristic of presenteeism and its relation to role ambiguity, as discussed in chapter 3. It is argued that it is easier to get interrupted with the use of technologies and these interruptions in work tasks lead to ambiguity with respect to one's role behavior. Therefore, this study provides one mechanism in which interruptive aspects of technology could be studied.

Results from the exploratory analysis on technology profiles imply that researchers should pay particular attention to technological environment. Apparently, different technologies could have different pathways to stress.

Finally, the conceptualization of making technology characteristics explicit (as antecedents to stressors) brings the IT artifact to the foreground. It is in the spirit of placing particular emphasis on the IT artifact (Orlikowski and Iacono, 2001). Next paragraphs discuss the implications of present work to stress research.

6.2.2 Contributions to Stress Research

Stress research could also gain some insights from the present work. Foremost, it shows that ICTs could be a source of stress implying that this factor should be considered in the job environment. Second, although the developed model was specific to stressors and strain due to ICTs, the concept of determining the predictors of strain (i.e. stressors) could be extended to stress research. The present study provides initial empirical support for such

conceptual models proposed by Kahn and Byosiere (1990). They argued that not only should the effects of stressors (i.e. on strain) be investigated but also the causes to stressors should be investigated.

Finally, the application of person-environment fit framework in a specific technology context i.e. stressors due to ICTs and strain due to ICTs, and the relation of strain due to ICTs to broader job strain measure, indicate that the stress models could be applied at the source of the problem. In other words, rather than measuring stressors broadly (e.g., work overload), they could be constrained to the context (work overload due to ICTs) - doing so enhances the internal validity and might also identify stressors relevant to the context. The present section is concluded by discussing some methodological implications from this study.

6.2.3 Methodological Contributions

Methodologically this study sets some new directions. This is one of the first studies to take advantage of using a market research company for data collection. Although their services are extensively used in practice, they only recently started to make their way in academia (Piccolo and Colquitt, 2006). This kind of service not only reduces the time to collect data, but also provides greater control with respect to data collection. This type of data collection seems genuine [Syracuse University's www.studyresponse.com being one of the service providers] and future of data collection procedures. The descriptive statistics of the data and results from this study provide a favorable decision on using these services.

The study also contributes to research in terms of steps taken to reduce the threat of common method bias. Since the study requires responses to both the predictor and criterion variables from the same individual, some procedural and statistical recommendations were

followed. First, it created psychological separation between criterion and predictor variables. We are unaware of any studies in IS research which used this procedural remedy. Second, the common method variance threat is actively controlled by modeling a latent method factor. This seems to confirm to the latest trend in IS research (Ahuja et al., 2007; Liang et al., 2007).

Present research work also breaks ground in developing new constructs and providing measurements for some existing concepts. Specifically, the concept of constant connectivity is captured in a newly developed construct 'presenteeism'. Also, scales were developed for concepts of 'anonymity', 'invasion of privacy', 'pace of change', and 'job insecurity'. These scales could be further refined and tested in other contexts. The strong support for technology presenteeism as a predictor for various stressors implies that more attention needs to be paid to this concept as ICTs become pervasive.

6.3 Limitations and Future Research

This study informs researchers and practitioners about the phenomenon of technology induced stress in individuals. Like all research efforts, certain calculated compromises have been made in undertaking this study. These limitations are pointed out, which, in part, serve as excellent opportunities for conducting future research.

6.3.1 Limitations

Some of the limitations in this study come from the inherent conflict that exists between undertaking a study that is generalizable versus a study that is very specific (for example, with respect to either technologies, or occupations). One of the main limitations of this study is the aggregated and undifferentiated treatment given to technology use of

individuals. Individuals responded to the technology characteristics (like usefulness, complexity, reliability, presenteeism etc.) by aggregating their perceptions across various ICTs they use. In other words, an individual might have varying perceptions of usefulness with respect to the use of mobile phone versus the use of a laptop. However, only one measure of 'usefulness' is collected concerning their overall technology profile. Although this kind of aggregation sacrifices variability, this is deemed appropriate instead of administering the whole research model for each technology. Further, the profile of technologies provided for respondents to evaluate the technology characteristics could be a limitation in itself. This is because there isn't an easy way to categorize the present ICTs into a mutually exclusive and collectively exhaustive manner.

The present study also didn't control for the diversity of technology use. It is possible that individuals who use 10 different technologies for a total of 10 hours could have varied stressful manifestations compared to individuals who use one technology for 10 hours. Just dealing with numerous technologies could be a source of stress. Further, although we believe that critical technology characteristics are considered, the proposed characteristics might not be exhaustive. Further, as technologies change and new technologies are introduced, it is possible that new characteristics that are not considered might gain significance. A possible solution is to consider a typology for technology characteristics – which is discussed later in the future research section.

Also, the respondents consisted of individuals from different occupations and organizations. For example, the present work didn't differentiate between a physician and a teacher. Further, it didn't differentiate between individuals working in profit/non-profit or government/non-government organizations. There might be certain organizational and

occupational differences that could be investigated. Accordingly, the differentiating effects of profession and occupation could be taken into account in future research.

The present study utilized data collected at one point in time. Therefore, it cannot confirm the causality of the links proposed in the model. However, as pointed out by Moore (2000), some of the links between stressors and strain are previously tested longitudinally, and provide some support for the causality proposed in this study. Future research should consider using longitudinal designs. One additional advantage of using longitudinal designs might be such designs could better control common method bias – as they provide temporal separation between criterion and predictor variables.

Most of the scales used in this study are adapted from literature. For example, the work overload scale from stress literature is adapted to reflect work overload due to ICTs. Therefore, our results do not directly compare with results of previous stress research. Although the adapted scales exhibited good psychometric properties in the present study, future research is encouraged to test the psychometric properties of these scales, especially the scale of presenteeism which is developed new in this study.

6.3.2 Future research

Since this study provides initial evidence about stressful impacts of technology, future research might focus on exploring the stressful effects of one very specific technology that might be relevant from technology context or from the organizational context. For example, future research might explore questions like - is the use of BlackBerry stressful? Or is the use of BlackBerry by sales professionals stressful?

Another potential research avenue is to consider developing a taxonomy or typology for ICTs. This will be necessary if the focus of a research question is to see the stressful

impacts of one group of technologies, for example mobile technologies. However, as pointed out before there is no known categorization of ICTs that effectively categorizes different technologies in a mutually exclusive and collectively exhaustive fashion. The previous categorizations have mainly focused on differentiating technologies along (i) storage, (ii) communication, and (iii) processing dimensions. However, with the integration of data and communication technologies, there is a need for developing a better taxonomy or typology.

The availability of an accepted typology for ICTs might enable easier generalization and comparison of research findings. Although the present conceptualization of technology characteristics is exhaustive, lack of an accepted typology makes it possible that not all ICTs could be represented by the present framework in an appropriate manner. Also, assessment of future technologies would become much easier if a universally accepted typology of ICTs exists.

Once such a group of technologies is developed, the present conceptualization could be used to profile various technologies. Specifically, the strength of the relationships between technology characteristics-stressors-strain could be tested for various technologies. In this way, it is possible to identify which particular technology characteristic is most stressful for any technology and whether it significantly differs when compared to other technologies. Such pinpoint analysis could be used for developing appropriate policies to deal with the stressful impacts of technologies. Initial exploratory analysis in this direction, as presented in previous chapter, provides some promising avenues for future research.

Evidence of technostress being related to overall job strain (as presented in exploratory analysis) presents potential research avenues. Previous research has related strain

to turnover intentions, organizational commitment and job satisfaction (Ahuja et al., 2007; Jex, 1998; Moore, 2000). Specifically, it is argued that strained and exhausted individuals are less committed, have greater turnover intentions and have lower job satisfaction. Given the importance of human capital to present day organizations, future research could extend the present study to see the impact of technostress on these outcomes.

Future research could also place more emphasis on context. It is possible that stressful impacts of technology are episodic i.e. context and time dependent. An individual might be comfortable dealing with a technology, but several technologies requiring individual attention might be stressful. Similarly, professionals in certain fields might experience higher stress levels during certain times. For example, accounting professionals might have heightened stressor levels during a tax season, and similarly attorneys during a trial. Exploration of this type of research might require different research designs and could provide rich insights.

In addition to the psychological manifestations of strain considered in this study, there are other unintended effects of using ICTs. Because of the focus of this study, detailed consideration to these issues is beyond the scope of this study. For example, one of the widely known physiological concerns of using ICTs is that of Carpal Tunnel Syndrome (CTS). Recent discussions on Blackberry® thumbs also point out potential problems of repetitive strain disorders. Exploring the unintended consequences of ICTs along physiological symptoms is another fruitful research avenue.

In addition to future studies that are tied directly to technostress phenomenon, the present conceptualization and work on technostress could be extrapolated to other related issues in IS research – two of which are presented below. First, if individuals perceive

technologies to be stressful, it seems possible that they might resist such technologies. It is interesting to note that the resistance might not occur at the adoption stage, but once the technologies have been adopted. The resistance could occur in the form of passive resistance or reluctant use. Initial insights into this type of work could be found in Marakas and Hornik (1996). They identified that individuals are involved in recalcitrant behavior (indicative of passive resistance misuse) resulting from both fear and stress stemming from the intrusion of technology.

Second, present work could also provide new perspective on another established research stream – IT use-business value. This stream explores the dynamics of technology investments, use and their impact on value creation (could be construed to be at individual or business level). Since use of various technologies is shown to have unintended consequences (i.e. stress), and due to the fact that stressed individuals are negatively related to job performance, is it possible that lack of productivity gains are actually due to cancellation of any gains from the losses suffered due to technostress? Future research should be aware of potential productivity losses due to technostress when evaluating the value of technologies.

The present study placed emphasis mainly in the business context. However, it could provide insights into technologies implemented by government agencies. They invest millions of dollars to improve service-oriented processes. However, these agencies might not be tapping into a portion of population that perceives use of technology-enabled services to be stressful. Therefore, the onus is on the agencies to identify respective characteristics of technology that are source of the problem and alleviate these concerns. The present study provides a framework which could be extended to these types of studies.

6.4 Implications for Practice

The present work also offers some managerial implications which could be used to ameliorate some of the unintended effects of ICT use. These are described below.

Technostress is real: The results from this study provide support for the phenomenon of technostress. Most of the IS research is concentrated on understanding what technology can do *for* you. However, given the significance of technostress, and stress in general, it is important that organizations be aware of what technologies can do *to* you. Therefore, organizations could use the model developed in this study as a tool to assess the levels of technostress. Since the model is not technology specific, it can be customized to fit the needs of different departments or divisions. By focusing on a technology or a set of technologies, each organizational group could get better insight into the dominant causes of technostress. Understanding the specific causes would be a first step in developing effective management programs to deal with technostress.

Bottom-line impacts of technostress The presence of technostress and its relation to overall manifestation of stress in job (i.e. job strain) would urge management to focus on two aspects that directly impact bottom-line of an organization. First, stressed individuals are shown to have lower productivity and have higher propensity to quit. Considering the importance of human capital, human resource managers should focus on reducing levels of technostress. Second, stress has been related to many health ailments and considering the prohibitive cost to companies that pay for health benefits, managers have incentive to

proactively reduce stress levels. Although, this might involve organizations spending money upfront, the overall benefits realized will outweigh costs involved.

Importance of usability characteristics of technologies cannot be over emphasized: Previous research on adoption and diffusion of technologies has underscored the importance of developing technologies that demonstrate characteristics of usefulness and reliability. The present work suggests that not only are these characteristics important from an adoption point of view, but they can also help reduce stressful impacts of technologies. Results indicate that by improving the perceptions of usefulness and reliability (either by developing better systems or by communicating these characteristics better) the work overload perceptions of individuals could be reduced. As is shown before, work overload is one of the dominant causes of technostress.

Technology centrality as a management lever: The findings from the study suggested that technology centrality reduced the stressful impacts of certain technology characteristics. Therefore, management could work on improving the perceptions of technology centrality. This could be achieved by propagating success stories about how central and beneficial technologies are for work tasks. For example, recent advertisements by Blackberry are promoting users' success stories that often depict use of Blackberry as central to users' work tasks. Although this example points out the strategy of Blackberry, similar strategies could be used by management within the organizations at different structural levels.

If increasing the centrality of technologies in work processes involves change (as it might), management can couple the present implications with insights from diffusion of innovation

research. It might be beneficial for management to identify 'innovators' – who are willing to try new ICT related innovations, and propagate their success stories. This coupled with eventual network effects would provide management with mechanisms to enhance the technology centrality.

Time and attention management strategies: The finding of role ambiguity as a dominant stressor and technology presenteeism as one of the key stressful characteristic of technology calls for certain managerial interventions. It was suggested that the interruptions and uncertainty created by technologies as a cause for role ambiguity. Accordingly, management should train employees with respect to effective time management strategies to deal with these situations. Also, managers should develop policies that encourage members in teams/groups to keep a part of work-day exclusively for themselves (free of interruptions) to do real work. For example, it could be communicated to the group members that they will not be replying to email or taking phone calls etc., during this time period and ask other members to cooperate. Also, some explicit policies or arrangements could be made so that employees do not abuse the constant connectivity provided by technologies. For example, if a policy that emails could be responded in a day's time is maintained and encouraged by the group, it would relieve the pressure on individuals to check and respond to emails constantly. Further, managers should encourage individuals with strong work-home boundaries as role models. Although, ever-present employees might seem productive at first glance, the results of this study show that these type of individuals' well-being could suffer - increasing overall costs to the organization

Manage expectations while on the job: Related to the above point, managers can implement explicit work norms (at least as relates to ICTs) and there by manage the expectations on the job of an individual. This might alleviate some of the concerns of work overload and work-home conflict due to ICTs. For example, managing expectations on after-hour availability (i.e. after work day, weekend, vacations etc) can reduce work-home conflict situations. Similarly, by managing expectations, individuals might perceive lower demands on their resources leading to lower perceptions of work overload.

Management should be sensitive to individual differences: The exploratory analysis revealed that differences exist in some of the relationships across age and gender. For example, it was suggested that the relation between work-home conflict and strain is much stronger for younger age group. It is possible that individuals in younger age group have family responsibilities that take on heightened importance. Therefore, managers need to be aware of these sensitive differences so as to develop effective policies for their groups.

6.5 Conclusion

This study represents an initial step in integrating the stress and IS literature for explaining the phenomenon of technostress. Although previous research in IS literature has looked at issues related to stress in IS professionals, the issues of stress *due to* ICTs itself has not received attention. Overall, the present study identifies the IT artifact (technology characteristics), and relates this to stressors, which in turn predict the strain due to ICTs. Considering the pervasiveness of ICTs in organizational and individual life, it is imperative that impacts of ICTs are understood. To this end, the conceptualization presented in this

study makes a step in this direction and it is hoped that the present work will serve as an impetus for attention towards technostress phenomenon.

APPENDICES

Appendix A

Items and Loadings

Construct	Items	Factor Loadings	Reliability (alpha) α
Work Overload	1. ICTs create many more requests, problems, or complaints in my job than I would otherwise experience.	0.73	0.88
	3. I feel busy or rushed due to ICTs.	0.88	
	4. I feel pressured due to ICTs.	0.87	
Work Home Conflict	1. Using ICTs blurs boundaries between my job and my home life.	0.83	0.93
	2. Using ICTs for work-related responsibilities creates conflicts with my home responsibilities.	0.90	
	3. I do not get everything done at home because I find myself completing job-related work due to ICTs.	0.92	
Invasion of Privacy	1. I feel uncomfortable that my use of ICTs can be easily monitored.	0.85	0.94
	2. I feel my privacy can be compromised because my activities using ICTs can be traced.	0.92	
	3. I feel my employer could violate my privacy by tracking my activities using ICTs.	0.91	
	6. I feel that my use of ICTs makes it easier to invade my privacy.	0.84	
Role Ambiguity	2. I am unsure whether I have to deal with ICT problems or with my work activities.	0.86	0.93
	3. I am unsure what to prioritize: dealing with ICT problems or my work activities.	0.86	
	4. I can NOT allocate time properly for my work activities because my time spent on ICTs-activities varies.	0.90	
	5. Time spent resolving ICT problems takes time away from fulfilling my work responsibilities.	0.82	
Strain	1. I feel drained from activities that require me to use ICTs.	0.91	0.97
	3. I feel tired from my ICT activities.	0.97	

	4. Working all day with ICTs is a strain for me.	0.93	
	5. I feel burned out from my ICT activities.	0.92	
Usefulness	1. Use of ICTs enables me to accomplish tasks more quickly.	0.87	0.94
	2. Use of ICTs improves the quality of my work.	0.89	
	3. Use of ICTs makes it easier to do my job.	0.93	
	4. Use of ICTs enhances my effectiveness on the job.	0.92	
Complexity	1. Learning to use ICTs is easy for me.	0.77	0.90
	2. ICTs are easy to use.	0.86	
	3. It is easy to get results that I desire from ICTs.	0.94	
Reliability	1. The features provided by ICTs are dependable.	0.85	0.86
	3. The capabilities provided by ICTs are reliable.	0.90	
	4. ICTs behave in a highly consistent way.	0.86	
Presenteeism	1. The use of ICTs enables others to have access to me.	0.90	0.97
	2. ICTs make me accessible to others.	0.94	
	3. The use of ICTs enables me to be in touch with others.	0.97	
	4. ICTs enable me to access others.	0.95	
Anonymity	2. It is easy for me to hide how I use ICTs.	0.92	0.95
	3. I can remain anonymous when using ICTs.	0.90	
	4. It is easy for me to hide my ICT usage.	0.97	
	5. It is difficult for others to identify my use of ICTs.	0.88	
Pace of Change	1. I feel that there are frequent changes in the features of ICTs.	0.88	0.94
	2. I feel that characteristics of ICTs change frequently.	0.93	
	3. I feel that the capabilities of ICTs change often.	0.87	
	5. I feel that the way ICTs work changes often.	0.80	
Job Insecurity	2. ICTs will advance to an extent where my present job can be performed by a less skilled individual.	0.89	0.84
	3. I am worried that new ICTs may pose a threat to my job.	0.80	
	5. I believe that ICTs make it easier for other people to perform my work activities.	0.71	
Technology Centrality	2. I find ICTs beneficial for my work tasks.	0.89	0.91
	3. ICTs have positive impacts on my work tasks.	0.89	

	4. Important things required by my job involve using ICTs.	0.92	
	5. ICTs play a central role in my work activities.	0.80	
	6. ICT use is central to my job.	0.75	
Internal Technical Self-efficacy	I could complete my work activities using ICTs if...		0.91
	1. ... I had never used ICTs like it before.	0.72	
	2. ... I had only the manuals for reference.	0.91	
	3. ... there was no one around to tell me how to do it	0.90	
External Technical Self-efficacy	I could complete my work activities using ICTs if...		0.93
	4. ... I could call someone for help if I got stuck.	0.92	
	5. ... someone else helped me get started.	0.84	
	6. ... someone showed me how to do it first.	0.77	
Technical Support	3. The technical assistance provided is: adequate/inadequate	0.84	0.91
	5. The advice and opinions provided are: relevant/irrelevant;	0.83	
	6. The time required to respond to service requests is: short/long;.	0.76	
Negative Affectivity	1. I often find myself worrying about something;	0.72	0.86
	2. My feelings are hurt rather easily;	0.72	
	3. I suffer from nervousness;	0.82	
	4. My mood often goes up and down;	0.78	
	6. I often lose sleep over my worries;	0.71	

Appendix B

Control variable analyses

In the proposed research model it was argued that stressors due to ICTs (i.e. work overload, role ambiguity, work-home conflict, invasion of privacy, and job insecurity) should be controlled for technology usage, and strain due to ICTs should be controlled for the dispositional variable negative affectivity. The results support this argument. The results for control variables is shown below.

Control Variable Relationship	Standardized Coefficient (β)
For Technology Use and	
Work Overload	.21*
Role Ambiguity	.19*
Work-Home Conflict	.21*
Invasion of Privacy	.09**
Job Insecurity	.11*
For Negative Affectivity and	
Strain	.14*

* Significant at 1%
** Significant at 5%

The links between technology usage and stressors are all significant (β's ranging from 0.09 to 0.21, all significant at 5% at least). The results indicate that as individuals become more dependent on technologies (i.e. increasing technology usage) they experience higher levels of stressors. It could also be interpreted that as technology use increases there are greater instances in which ICTs could enhance the stressors. Also, the link between negative affectivity and strain is significant at 1% with a standardized coefficient of 0.14. This implies that individuals' experience of strain could be explained by their tendency to evaluate

situations more negatively. In other words, with all things constant, individuals who experience higher levels of negative affectivity will report higher levels of strain.

Appendix C

Job Strain Scale

The scale used for job strain (House and Rizzo, 1972) is presented below.

Job Strain (Strongly Disagree = 1; Strongly Agree = 7)

1. My job tends to directly affect my health.
2. I work under a great deal of tension.
3. I have felt fidgety or nervous as a result of my job.
4. If I had a different job, my health would probably improve.
5. Problems associated with my job have kept me awake at night.
6. I have felt nervous before attending meetings in the company.
7. I often "take my job home with me" in the sense that I think about it when doing other things.

Appendix D

Satorra-Bentler Chi-Square Correction

The maximum likelihood (ML) estimation method assumes multivariate normality. When this assumption is not met, the chi-square (χ^2) based estimates are not valid (Byrne, 2006). It is suggested that 'ROBUST' option be invoked with ML estimation method to correct for multivariate nonnormality (Byrne, 2006). This option provides Satorra-Bentler chi-square estimate (S-B χ^2).

When comparing two models estimated by ML method, it is acceptable to take the difference between χ^2 estimates. However, to compare two models estimated by ML ROBUST option, the S-B χ^2's cannot be compared directly (i.e. not acceptable to take difference between S-B χ^2's). The difference between S-B χ^2 needs to be scaled. This scaling procedure is illustrated below by comparing model A and model B estimated through ROBUST option.

Model A:

Let ML- χ^2 value be represented as	M_{0a}
S-B χ^2	M_{1a}
Then, k_a is represented as	M_{0a} / M_{1a}
Degrees of freedom	df_a

Model B:

Let ML- χ^2 value be represented as	M_{0b}
S-B χ^2	M_{1b}
Then, k_b is represented as	M_{0b} / M_{1b}

Degrees of freedom	df_b

Then, S-B scaling factor S-$B_{scaling}$	$[(k_a*df_a)-(k_b*df_b)]/\Delta df$
Finally, S-B χ^2 difference between models A and B is given by	$(M_{1a}- M_{1b})/$ S-$B_{scaling}$

An illustrated example for S-B χ^2 difference is given below. The following depicts the test to check for discriminant validity between work overload and role ambiguity[8] constructs.

Model A: Work overload and role ambiguity are freely correlated

ML- χ^2 value be represented as	2493.31
S-B χ^2	1992.72
Then, k_a is represented as	1.2512
Degrees of freedom	811

Model B: Work overload and role ambiguity are perfectly correlated

Let ML- χ^2 value be represented as	2621.93
S-B χ^2	2111.14
Then, k_b is represented as	1.2419
Degrees of freedom	812

Based on the above calculations, S-B scaling factor S-$B_{scaling}$ is 6.27

Finally, S-B χ^2 difference between models A and B is 128.61/ 6.27 = 20.51

[8] See table 5.7

Therefore, comparison of models A and B (i.e. to check the discriminant validity between work overload and role ambiguity) yielded a scaled S-B χ^2 difference of 20.51 which is significant at 1% for 1 degree of freedom (from Chi-square tables).

Appendix E

Alternate measure of strain due to ICTs

Because 'strain' is the main dependent variable of interest, an additional measure of strain due to ICTs is also included in the survey to fortify the findings of this study. If similar pattern of results are obtained with two different measures of strain due to ICTs, it enhances the confidence in study results. Accordingly, a new measure of strain due to ICTs is adapted from Van Katwyk et al. (2000). The scale in the present context is provided below.

Below are a number of statements that describe different emotions that use of ICTs on job can make a person feel. Please indicate the amount to which any part of ICT use has made you feel that emotion in the past 30 days.
1- Never, 2- Rarely, 3-sometimes, 4-quite often, 5-extremely often or always

Use of ICTs for work activities has made me feel

1- Depressed
2- Discouraged
3- Gloomy
4- Fatigued
5- Bored

The results of the analysis with this measure of strain (due to ICTs) revealed similar pattern of relationships. Therefore, further details of these results are not reported. [The correlation between the two measures of strain is found to be 0.76].

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