THE DOUBLE-EDGED NATURE OF TECHNOSTRESS ON WORK PERFORMANCE: A THEORETICAL MODEL AND EMPIRICAL ANALYSIS

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The Double-Edged Nature of Technostress on Work Performance: A Theoretical Model and Empirical Analysis

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CERTIFICATE OF ORIGINALITY

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Abstract

This study is the first step toward adapting cognitive stress appraisal into the technostress context to explain the contradictory findings and fill the research gaps in the current technostress literature. To improve understanding regarding the role of cognitive technostress appraisal in work performance, a theoretical model is proposed and examined using data from 400 full-time employees in China who utilize information and communication technologies (ICT) in their work.

In the research model, technostress is assumed to be neutral in nature, and its effect on workplace outcomes and personal well-being of an individual depends on the appraisal to technostress. A positive appraisal on technostress, that is, technostress challenge appraisal, will generally lead to positive outcomes, whereas a negative appraisal on technostress, that is, technostress threat appraisal, will generally lead to negative outcomes. This study also proposes that different types of technostress are appraised differently even though technostress is neutral in nature from a holistic perspective.

Results of this study suggest that invasion of privacy and job insecurity caused by work-related ICT use lead to technostress challenge appraisal; whereas job insecurity, work–home conflict, and role ambiguity caused by similar ICT use lead to technostress threat appraisal. Furthermore, technostress challenge appraisal and technostress threat appraisal are found to positively and negatively affect work performance respectively. Theoretical and practical implications for both researchers and practitioners are discussed based on the findings.

Keywords: Technostress, transaction theory of stress, technostress challenge appraisal (TCA), technostress threat appraisal (TTA), work–home conflict, work overload, role ambiguity, invasion of privacy, job insecurity

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List of Definitions

Term	Definition	References
Technostress	A state of mental and physiological arousal that results from the use of ICTs for work purposes, i.e., work overload and increased tempo, availability requirements, and work interruptions.	Arnetz and Wiholm (1997); Bradley (2000); Ragu-Nathan et al. (2008); Thomée et al. (2007)
Work Overload	Stress caused by being forced to increase the amount and speed of work because of ICT.	Ragu-Nathan et al. (2008)
Work-Home Conflict	Stress caused by the feeling of needed to be constantly connected and the potential of being reached anytime and anywhere because of ICT.	Ragu-Nathan et al. (2008)
Invasion of Privacy	The perception that privacy has been compromised by the ICT use for work purpose.	Ayyagari et al. (2011)
Role Ambiguity	The perception that one's role performance has become unpredictable and lack information for performing the role because of ICT.	Ayyagari et al. (2011)
Job Insecurity	Stress caused by the thought of the possibility of being replaced by people who are familiar with ICT.	Ragu-Nathan et al. (2008)
Cognitive Technostress Appraisal (CTA)	The process that ICT users make a cognitive evaluation of the effects of the technostress encountered.	Choi et al. (2011); Folkman et al. (1986)

Technostress Challenge Appraisal (TCA)	The perception on the demands that are created by the usage of ICT for work, although demanding and strain-provoking, can be regarded as challenging, potentially rewarding and beatable, which in turns can lead to higher performance, personal growth, and achievement.	Pearsall et al. (2009); Podsakoff et al. (2007); Webster et al. (2011)
Technostress Threat Appraisal (TTA)	The perception on the demands that are created by the usage of ICT for work, which can act as a threat, obstacle, constraint of personal growth and achievement, and the overcoming of those demands will not lead to higher performance.	Pearsall et al. (2009); Podsakoff et al. (2007); Webster et al. (2011)
Technostress Adaptational Outcomes (TAOs)	The outcomes of encountering technostress.	Folkman (1984); Lazarus et al. (1985); Lei and Ngai (2014)
Work Performance	An ICT user's performance at work.	Tarafdar et al. (2010)

Chapter 1 Introduction

This chapter aims to provide an overview of this research study. It first presents why technostress is an important problem in our societies. After that, this chapter briefly describes the current status of the technostress literature and identifies its theoretical gaps. Motivated to address the identified theoretical gaps, the research objectives, and research questions are articulated. Last but not least, this chapter describe the overall structure of this dissertation.

1.1 Technostress as a Problem

Recent technological advancements combined with the desire of organizations to improve productivity and efficiency have resulted in the incorporation of information and communication technologies (ICTs) into the workplace. ICTs provide organizations with various advantages, such as increased employee productivity (Black and Lynch 2001), new business opportunities, and improved work flexibility (Fariselli et al. 1999; Towers et al. 2006). However, these advantages are not without cost. First, despite improved productivity through ICT use, some employees extend their work hours by bringing their work home (Shellenbarger 2012). Second, although ICT use introduces numerous business opportunities, some ICT users, such as individual sellers in the popular Chinese e-commerce platform Taobao, tend to overexert themselves; work overload, in this case, can become fatal (Shonstell 2013). Third, despite the notable work flexibility resulting from ICT use, teleworkers often work beyond the required hours per day and encounter various difficulties in disengaging themselves from their work (Mulki et al. 2009). These undesirable costs are either caused by or related to technostress, which is induced by work-related ICT use.

ICTs have become one of the main sources of stress, superseding the problems related to food and illness of children (Saurine 2008). As one of the most typical workplace ICTs, email has particularly been considered as a symbol of overload and stress (Barley et al. 2010). Some highly experienced users even consider it as their haunt (Weber 2004). Except for emergency cases, Germany's labor ministry has prohibited organizations from contacting staff for work purposes, which is usually done using ICTs, during non-work hours because of the technostress experienced by workers (Vasagar 2013). Thus, technostress seems inevitable because of our heightened interactions with different types of ICTs in our daily life and workplace.

1.2 Technostress as a Research Topic

Owing to its significance, technostress has also become an emerging topic in information systems (IS) research; related studies have been published in top-tier IS journals, such as Information Systems Research, Journal of Management Information Systems, and MIS Quarterly (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Tarafdar et al. 2010). Motivated to understand the different aspects of technostress, as well as prevent and handle its harmful effects, researchers have explored a wide range of technostress-related areas, such as the main factors triggering technostress, its inhibitors, and its negative outcomes (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Tarafdar et al. 2007; Tarafdar et al. 2010). Such studies have presented practical implications on the emergence of technostress and the prevention of its harmful effects.

1.3 Motivation of the Study

Nevertheless, technostress literature suffers significant theoretical gaps that must be addressed. First, despite the breadth of research on technostress, the literature does provide relevant studies on the predictions of technostress adaptational outcomes (TAOs). Several technostress studies failed to find empirical support for their proposed hypotheses (e.g., Ayyagari et al. 2011; Hung et al. 2011; Tu et al. 2005). For example, in Ayyagari et al. (2011), although invasion of privacy, one of the stresses caused by work-related ICT use, was hypothesized to positively affect strain, the empirical results failed to show a significant relationship between the invasion of privacy and strain. This example shows a research gap in technostress literature.

Meanwhile, a critical theoretical framework in traditional stress literature, namely, transaction theory of stress (TTS), has been widely adopted in technostress literature (e.g., Galluch et al. 2015; Ragu-Nathan et al. 2008; Tarafdar et al. 2011). Surprisingly, as a key concept of TTS, cognitive stress appraisal is seldom studied empirically in technostress literature. The process of cognitive stress appraisal has also been considered as a key mechanism determining the outcomes of stressful encounters (Folkman et al. 1986; Ohly and Fritz 2010; Pearsall et al. 2009; Webster et al. 2011). Therefore, ignoring this concept may be one of the main reasons that technostress literature does not perform well in predicting TAOs.

Third, technostress literature generally ignores how technostress may potentially lead to positive TAOs, with most of the studies only investigating negative TAOs (e.g., Tarafdar et al. 2007; Tarafdar et al. 2010). Despite this oversight, some technostress studies inadvertently found a positive relationship between technostress and favorable TAOs from their empirical results. For example, Tu et al. (2005) found a positive correlation between ICT-induced work overload and work performance, yet no study has attempted to investigate such findings further.

Fourth, existing technostress studies seldom attempt to differentiate TAOs from different sources. Different types of technostress are assumed to result in the same TAOs. For example, Tarafdar et al. (2010) predicted that all types of technostress (i.e., techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty) would negatively affect user performance and satisfaction. However, stress literature opposes the prediction of most technostress studies that different types of technostress would lead to the same outcomes (Podsakoff et al. 2007).

1.4 Research Objectives and Questions

To fill in the above-mentioned theoretical gaps, this study adapts the concept of cognitive stress appraisal into the technostress context. In addition, a research model is developed to predict how various types of technostress affect work performance differently through cognitive technostress appraisal (CTA), that is, cognitive stress appraisal in the technostress context. In particular, using CTA enables us to predict both the favorable and unfavorable TAOs of technostress. In sum, this study seeks to achieve the following research objectives:

1. Investigate the relationships between various types of technostress and work performance through the lens of TTS by incorporating the concept of CTA.
2. Develop a research model to predict how different types of technostress would affect an ICT user's work performance by using CTA.
3. Provide plausible explanations for previous inconsistent findings on the relationship between technostress and TAOs; specifically, explain why technostress is sometimes found to be related positively to favorable TAOs.

By the end of this paper, the following research questions will be answered:

R1. Do technostress challenge appraisal (TCA) and technostress threat appraisal (TTA) affect the work performance of an ICT user who has experienced technostress?

R2. How do different types of technostress impose different effects on TCA and TTA?

1.5 Structure of the Dissertation

This dissertation is organized as follows. Chapter 2 provides a brief review of the technostress literature as well as the concepts related to TTS and cognitive stress appraisals. The review presented aims to support the development of research model. Chapter 3 describes the conceptualization and operationalization of TCA and TTA, which are used in the empirical study of the research model developed in this dissertation. In Chapter 4, the research model and hypotheses are developed based on the transaction theory of stress. Chapter 5 presents the methods for validating the research model and Chapter 6 presents the empirical findings from an individual level survey among 400 respondents from Mainland China. In Chapter 7, the paper is concluded with a discussion of the findings, and in Chapter 8, theoretical and practical implications of this study are presented. Chapter 9 identifies the limitations of the study as well as highlights the future research opportunities enabled by this study. Last but not least, the conclusion is provided.

Chapter 2 Theoretical Background

This chapter provides the review of the current literature of technostress, as well as the theoretical foundations supporting the development of the research model. First, the components, antecedent and outcomes of technostress investigated and the theoretical framework employed in the technostress literature are reviewed. Then TTS and the related concepts are introduced to lay the foundation of for the conceptualization of the concept, i.e., CTA.

2.1 An Overview of Technostress

Technostress refers to a state of mental and physiological arousal that results from the use of ICTs for work purposes, including work overload and increased tempo, availability requirements, and work interruptions (Arnetz and Wiholm 1997; Bradley 2000; Ragu-Nathan et al. 2008; Thomée et al. 2007). This state is inevitable in organizations because of our increasing dependence on ICTs for work purposes.

2.1.1 Components of Technostress

Technostress does not refer to any singular type of stress but is an umbrella term for a wide range of stresses caused by work-related ICT use, such as work overload, work–home conflict, and invasion of privacy (Ayyagari et al. 2011). Table 1 presents the major types of technostress investigated in literature and their corresponding definitions.

Conventional stress literature includes studies that focus on a particular type of stress and those that investigate various forms of stress which share common characteristics (e.g., Baer and Oldham 2006; LePine et al. 2004). By comparison, current technostress literature tends to investigate various types of technostress collectively (e.g., Ragu-Nathan et al. 2008; Tarafdar et al. 2007; Tarafdar et al. 2010). For example, Tarafdar et al. (2010) investigated the common antecedents and outcomes of a group of technostress types, including techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. Few studies have attempted to examine a specific type of technostress in depth (e.g., Diaz et al. 2012).

Among the different technostress types studied in the literature, the group of technostress types comprising techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty is the most frequently studied. Ragu-Nathan et al. (2008), Tarafdar et al. (2007; 2010; 2011), and Tu et al. (2005) have all conducted such studies. Although the aforementioned technostress bundle covers a wide range of technostress that we encounter in organizations, it does not represent all the stresses caused by work-related ICT use. For example, this technostress bundle does not cover the invasion of privacy, which is a common type of technostress encountered by ICT users (Ayyagari et al. 2011). Including all types of technostress into a single research model is impossible. However, I would like to argue that researchers should not limit their investigation on a particular technostress bundle, because doing so hinders our search for a more comprehensive understanding of the nature of technostress. Therefore, researchers should be open to examining different technostress groups, as well as continuing their exploration of various types of technostress.

Table 1 – Types of Technostress Studied in the Literature

Types of Technostress Studied in the Literature		
Technostress	**Definition**	**References**
Techno-overload/Work Overload	The technostress that results from the increasing amount and speed of work because of ICT	Ayyagari et al. (2011); Califf et al. (2015); Galluch et al. (2015); Hung et al. (2011); Ragu-Nathan et al. (2008); Tarafdar et al. (2015; 2007; 2010; 2011); Towers et al. (2006); Tu et al. (2005)
Techno-invasion/Work–Home Conflict	The technostress caused by the feeling of being constantly connected and within reach anytime and anywhere because of ICT.	Ayyagari et al. (2011); Diaz et al. (2012); Hung et al. (2011); Ragu-Nathan et al. (2008); Tarafdar et al. (2015; 2007; 2010; 2011); Towers et al. (2006); Tu et al. (2005)
Techno-complexity	The technostress caused by the demand to learn and familiarize oneself with ICT.	Califf et al. (2015); Ragu-Nathan et al. (2008); Tarafdar et al. (2015; 2007; 2010; 2011); Tu et al. (2005)
Techno-insecurity/Job Insecurity	The technostress caused by the possibility of being replaced by ICT or by people familiar with ICT.	Ayyagari et al. (2011); Califf et al. (2015); Ragu-Nathan et al. (2008); Tarafdar et al. (2015; 2007; 2010; 2011); Tu et al. (2005)
Techno-uncertainty	The technostress caused by the fast-changing pace of ICT and the demand to update ICT knowledge accordingly.	Califf et al. (2015); Ragu-Nathan et al. (2008); Tarafdar et al. (2007; 2010; 2011); Tu et al. (2005)
Role Ambiguity	The technostress caused by unpredictable roles and performance levels because of ICT.	Ayyagari et al. (2011)

Invasion of Privacy	The technostress caused by the perception that the privacy of an individual is compromised by ICT.	Ayyagari et al. (2011)
Techno-accessibility	The technostress caused by the simple and easy access to ICT features.	Hung et al. (2011)
Techno-dependency	The technostress caused by the dependence on ICT in the workplace.	Hung et al. (2011)

2.1.2 Antecedents of Technostress

Current technostress literature focuses on identifying the antecedents and outcomes of technostress. However, the mediators and moderators of the relationships between technostress and TAOs are under-researched. Tables 2 and 3 summarize the antecedents and outcomes of technostress identified from literature respectively. The loosely defined concept of technostress inhibitor is particularly notable. In technostress literature, technostress inhibitors serve two purposes: directly reduce the level of technostress experienced by an ICT user and directly reduce the level of unfavorable TAOs. In this study, technostress inhibitors are considered as antecedents of technostress because they are directly related to technostress.

Technostress literature tends to investigate the common antecedents of a technostress bundle rather than the antecedents of a specific type of technostress. Technostress antecedents identified from literature reveal that technology involvement facilitation, technology support provision, and innovation support reduce the technostress bundle experienced by an individual; this bundle contains techno-invasion, techno-overload, techno-uncertainty, techno-insecurity, and techno-complexity (Ragu-Nathan et al. 2008; Tarafdar et al. 2007; 2010; 2011). Information overload induces the technostress bundle containing techno-overload, techno-invasion, and techno-accessibility; task–technology fit also reduces the same technostress bundle (Ayyagari 2012).

A few studies investigated the specific antecedents of different types of technostress. For example, Ayyagari et al. (2011) studied the influence of individual ICT characteristics on the different types of technostress. They found that the usefulness and reliability of IT reduce the work overload experienced by an individual; the presenteeism of ICT increases work–home conflict, invasion of privacy, work overload, and role ambiguity; anonymity reduces the invasion of privacy; and the pace of change increases work overload, role ambiguity, and job insecurity.

Table 2 – Antecedents of Technostress

Antecedents of Technostress		
Antecedents	**Relationship with Technostress**	**References**
Technology Involvement Facilitation	Negative	Califf et al. (2015); Tarafdar et al. (2015; 2010; 2011)
Technology Support Provision	Negative	Califf et al. (2015); Tarafdar et al. (2015; 2010; 2011)
Innovation Support	Negative	Califf et al. (2015); Tarafdar et al. (2015; 2010; 2011)
Usefulness	Negative	Ayyagari et al. (2011); Califf et al. (2015)
Reliability	Negative	Ayyagari et al. (2011); Califf et al. (2015)
Pace of Change	Positive	Ayyagari et al. (2011); Califf et al. (2015)
Presenteeism	Positive	Ayyagari et al. (2011)
Anonymity	Negative	Ayyagari et al. (2011)
Information Overload	Positive	Ayyagari (2012)
Task–Technology Fit	Negative	Ayyagari (2012)

2.1.3 Outcomes of Technostress (Technostress Adaptational Outcomes)

Technostress outcomes identified from literature reveal that the technostress bundle containing techno-invasion, techno-overload, techno-uncertainty, techno-insecurity, and techno-complexity increases the levels of role conflict and role overload, and reduces job satisfaction, work performance, organizational commitment, continuance commitment, innovation, and ICT satisfaction (Ayyagari et al. 2011). Meanwhile, the technostress bundle containing techno-overload, techno-invasion, and techno-accessibility increases job stress (Hung et al. 2011). Finally, the technostress bundle of work–home conflict, work overload, role ambiguity, and job insecurity increases strain (Ayyagari et al. 2011).

This literature review, however, indicates that investigations into the mechanism that can demonstrate how technostress engenders different TAOs are lacking. Most technostress studies fuse technostress bundles as a single construct; hence, the magnitude of the effect of each type of technostress on different TAOs cannot be compared. Although treating a technostress bundle as a single construct can help us understand the common antecedents and outcomes of TAOs, researchers are also encouraged to conceptualize different types of technostress into separate constructs, because it facilitates further examination of each type of technostress.

Table 3 – Outcomes of Technostress

Outcomes of Technostress		
Outcomes	**Relationship with Technostress**	**References**
Role Conflict	Positive	Galluch et al. (2015); Tarafdar et al. (2007; 2011)
Role Overload	Positive	Galluch et al. (2015); Tarafdar et al. (2007; 2011)
Job Satisfaction	Negative	Califf et al. (2015); Ragu-Nathan et al. (2008); Tarafdar et al. (2010; 2011)
Work Performance	Negative	Tarafdar et al. (2007; 2011)
Organizational Commitment	Negative	Ragu-Nathan et al. (2008); Tarafdar et al. (2011)
Continuance Commitment	Negative	Ragu-Nathan et al. (2008); Tarafdar et al. (2011)
Innovation	Negative	Tarafdar et al. (2011)
Strain	Positive	Ayyagari et al. (2011)
Job Stress	Positive	Hung et al. (2011)
ICT Satisfaction	Negative	Tarafdar et al. (2010; 2011)
Turnover Intention	Positive	Califf et al. (2015)

2.1.4 Theoretical Frameworks in the Technostress Literature

Several theoretical frameworks have been adopted in technostress literature. Table 4 presents the major theoretical frameworks adopted in technostress literature, including demand–control theory, person–environment fit model, role theory, sociotechnical theory, and TTS.

These theoretical frameworks serve different purposes. Some focus on explaining the outcomes of technostress, such as role theory. For example, Tarafdar et al. (2007) adopted role theory to explain how technostress leads to role stress, such as role conflict and role overload. Some of the theoretical frameworks are also used to predict conditions leading to technostress. For example, Ayyagari et al. (2011) used the person–environment fit model to predict how different ICT characteristics would relate to various types of technostress.

As mentioned in the Introduction, TTS is the most widely studied among the theoretical frameworks. However, despite its frequent appearance in literature, cognitive stress appraisal, a key concept of TTS, is seldom employed in technostress studies. Given the central role of cognitive stress in determining the outcomes of stressful encounters (Folkman et al. 1986; Ohly and Fritz 2010; Pearsall et al. 2009; Webster et al. 2011), the present study adapted it into the technostress concept and developed a research model to predict the effects of technostress on work performance.

Table 4 – Theoretical Frameworks in the Technostress Literature

Theoretical Frameworks in the Technostress Literature	
Theoretical Frameworks	**References**
Demand-control Theory	Galluch et al. (2015)
Person-environment Fit Model	Ayyagari et al. (2011)
Role Theory	Tarafdar et al. (2007)
Sociotechnical Theory	Tarafdar et al. (2007)
Transaction Theory of Stress	Ayyagari et al. (2011); Califf et al. (2015); Ragu-Nathan et al. (2008); Tarafdar et al. (2010; 2011)

2.2 Transactional Theory of Stress

TTS is a theory developed to predict the outcomes of stressful encounters (Lazarus et al. 1985). It has been widely adopted in different disciplines, including medical and nursing, organizational behavior, clinical psychology, applied psychology, marketing and IS (e.g., Ahmad 2005; Beaudry and Pinsonneault 2005; Boswell et al. 2004; Ferguson et al. 1999; Nyer 1997). TTS mainly proposes two ideas. However, in the technostress literature, these two ideas have received different levels of attentions.

The first idea is that stress is a transaction between a person and the environment when it is expected to tax or exceed his/her resources (Folkman and Lazarus 1985). This idea has widely been adopted in the technostress literature (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Tarafdar et al. 2011). For example, in the study conducted by Ayyagari et al. (2011), technostress is described as the transaction between an ICT user and a number of technological characteristics of the ICTs used by the user, i.e., environment. Therefore, the study proposes that different technological characteristics would lead to different types of technostress.

The second idea of TTS is that the outcomes of stressful encounters are not always unfavorable, but rather are determined by the cognitive stress appraisal (Folkman et al. 1986). According to this idea, a stressful encounter would also lead to favorable outcomes, for example, job satisfaction, and better work performance (Ohly and Fritz 2010; Webster et al. 2011). Depending on the cognitive stress appraisal made by an individual, the outcomes of a stressful encounter can be either favorable or unfavorable. However, this idea has not received enough attentions from the IS discipline (Califf et al. 2015; Lei and Ngai 2014).

2.2.1 Cognitive Stress Appraisal

Cognitive stress appraisal has been extensively studied across various disciplines, such as applied psychology, organizational behavior, and medicine (Lazarus et al. 1985; Peacock and Wong 1990; Webster et al. 2010; Webster et al. 2011). Cognitive stress appraisal is argued to play a vital role in determining the outcomes of stressful encounters (Pearsall et al. 2009).

Early studies on the TTS suggested that cognitive stress appraisal consists of two main processes: primary and secondary appraisal processes (Folkman and Lazarus 1985; Folkman and Lazarus 1988). The primary appraisal process is the process that precedes the secondary appraisal of stressful encounters. During the primary appraisal process, an individual evaluates the expected outcomes of a stressful encounter. In other words, the individual would determine whether the stressful encounter is expected to bring benefits or harm, i.e., challenge or threat. During the secondary appraisal process, an individual assesses whether the stressful encounter can be dealt with (Folkman et al. 1986).

However, in the more recent studies on TTS, the process of cognitive stress appraisal is simplified. Owing to the interdependency of primary and secondary appraisal processes, researchers no longer distinguish between them (Fugate et al. 2012; Ohly and Fritz 2010; Webster et al. 2011). For example, when an individual perceives that s/he is not capable of overcoming and dealing with a stressful encounter through the secondary appraisal process, the individual tends to go through the primary appraisal process again to evaluate the stressful encounter as a threat (Folkman and Lazarus 1985). The high level of interdependency between the primary and secondary appraisal processes imposes difficulties in their operationalization. Therefore, in recent studies, most researchers no longer distinguish between primary and secondary appraisal processes (Califf et al. 2015; Fugate et al. 2012; Lei and Ngai 2014; Ohly and Fritz 2010; Webster et al. 2011).

According to recent cognitive stress appraisal studies, an individual makes two types of cognitive stress appraisals after encountering stress, i.e., challenge and threat appraisals of stress (Pearsall et al. 2009; Podsakoff et al. 2007; Skinner and Brewer 2002; Webster et al. 2011). A challenge appraisal of stress is a result of a stressful encounter perceived as challenging, potentially rewarding, and beatable, which can in turn lead to improved work performance, personal growth, and goal achievement, although it is demanding and strain-provoking (Pearsall et al. 2009; Podsakoff et al. 2007; Webster et al. 2011); a threat appraisal of stress is made if the stressful encounter is perceived as a danger and hindrance to personal growth and achievement and when overcoming the stressful encounter is not expected to lead to favorable outcomes (Peacock and Wong 1990; Podsakoff et al. 2007; Webster et al. 2011).

Challenge and threat appraisals of stress are not mutually exclusive in both theoretical and empirical aspects (Ferguson et al. 1999; Folkman 1984). For example, Peacock and Wong (1990) conducted a factor analysis wherein the challenge and threat appraisals of stress encounters were loaded into two separate dimensions. Moreover, an individual could simultaneously make challenge and threat appraisals of the same stressful encounter. For example, Webster et al. (2011) found that several types of workplace stresses, such as role conflict, role ambiguity, and workload, can be simultaneously assessed as both a challenge and a threat.

2.2.1.1 Studies on Cognitive Stress Appraisal in Various Disciplines

A comprehensive review of related studies that fully or partly adopt the idea of cognitive stress appraisal was conducted. Table 5 presents a list of studies that investigate cognitive stress appraisal or other related concepts. Studies related to cognitive stress appraisal appears in different bodies of literature, including in the fields of medicine and nursing, organizational behavior, clinical psychology, applied psychology, and IS. It is noted that there is a lack of studies related to cognitive stress appraisal in the IS literature.

Table 5 – Review of the Literature on Cognitive Stress Appraisal

Review of the Literature on Cognitive Stress Appraisal		
Study	**Summary**	**Discipline**
Ahmad (2005)	The study reports on the development of a measurement scale for the cognitive appraisal of health-related events.	Medicine and Nursing
Beaudry and Pinsonneault (2005)	The study investigates how different types of cognitive appraisals of an IT event leads to different adaptation strategies toward the IT event.	Information Systems
Boswell et al. (2004)	The study classifies different types of workplace stresses into two, i.e., challenge and threat stressors; they determine that challenge and threat stressors result in different workplace outcomes, i.e., challenge and threat stressors lead to desirable and undesirable workplace outcomes, respectively.	Organizational Behavior
Califf et al. (2015)	Based on cognitive stress appraisal, the study proposes that technology characteristics and technostress lead to challenge and threat appraisals, respectively, which in turn result in different types of workplace outcomes.	Information Systems
Cavanaugh et al. (2000)	The study classifies two types of stressful encounters in the workplace, namely, challenge and threat stressors, according to cognitive stress appraisal and finds that challenge and threat stressors lead to different workplace outcomes.	Organizational Behavior

Drach-Zahavy and Erez (2002)	The study demonstrates that the same level of goal difficulty causes different levels of work performance through the mediation of the cognitive appraisal of stress.	Organizational Behavior
Fadel and Brown (2010)	The study reports the development of a measurement scale for the cognitive appraisal of a new information system used by an ICT user and evaluates the relationship between different IS perceptions and cognitive appraisals.	Information Systems
Ferguson et al. (1999)	The study reports the development of a measurement scale for the cognitive appraisal of different life events.	Clinical Psychology
Folkman (1984)	The study shows a theoretical analysis of how cognitive stress appraisal and the sense of personal control result in different coping processes.	Applied Psychology
Folkman and Lazarus (1985)	The study finds that stressful encounters are dynamic and unfolding processes, similar to the cognitive stress appraisal process and that emotion and coping mechanisms in response to stress change over time.	Applied Psychology
Folkman et al. (1986)	The study determines that cognitive stress appraisal affects coping with stressful encounters, which in turn influences the outcomes of stressful encounters.	Applied Psychology
Fugate et al. (2012)	The study focuses on threat appraisal of stressful encounters and investigates how it would lead to a number of undesirable outcomes in the workplace, including absenteeism and intentions to quit.	Organizational Behavior

Gaab et al. (2005)	The study reports the development of a measurement scale for the cognitive appraisal of psychosocial stress.	Clinical Psychology
Kessler (1998)	The study shows the development of a measurement scale for the cognitive appraisal of the health problems of patients with prostate cancer.	Medicine and Nursing
Lei and Ngai (2014)	The study proposes a research model that considers two types of cognitive stress appraisal, i.e., technostress challenge and technostress threat appraisals, and serves as the mediator between different types of technostress and technostress adoption outcomes.	Information Systems
LePine et al. (2004)	The study investigates how stresses that are appraised as challenges or threats affect learning performance.	Applied Psychology
Lepine et al. (2005)	The study reports a meta-analytic test on how stress encounters that are generally appraised as challenges and threats affect work performance individually.	Organizational Behavior
Nyer (1997)	The study investigates how a consumer's cognitive appraisals of a product influence consumer emotions and post-consumption behaviors.	Marketing
Ohly and Fritz (2010)	The study shows that the challenge appraisal of time pressure (a type of stressful encounter) and job control results in relatively high creativity levels and proactive behaviors.	Organizational Behavior
Peacock and Wong (1990)	The study reports the development of a measurement scale for the cognitive stress appraisal of different life events.	Medicine and Nursing

Pearsall et al. (2009)	The study investigates how the different stresses experienced by team members, which are usually appraised as either challenges or threats, would affect team performance and transactive memory.	Organizational Behavior
Podsakoff et al. (2007)	The study reports a meta-analysis on how different stresses usually appraised as challenges and threats individually affect job attitudes, turnover intentions, turnover, and withdrawal behavior.	Organizational Behavior
Skinner and Brewer (2002)	The study investigates how cognitive stress appraisal style affects individual emotion.	Applied Psychology
Steenbergen et al. (2008)	The study investigates the cognitive appraisal of female employees of tasks when they are exposed to an expansion or a scarcity message in the context in which they assume work and family roles.	Organizational Behavior
Wallace et al. (2009)	The study investigates how different stressful encounters often appraised as challenges and threats affect task, organizational citizenship, and customer service performances differently and how organizational support can moderate the effects of these stressful encounters.	Organizational Behavior
Webster et al. (2010)	The study discusses how different stressful encounters often appraised as challenges and threats influence organizational citizenship behavior and job performance through the	Organizational Behavior

	mediation of job satisfaction, strain, and work self-efficacy.	
Webster et al. (2011)	The study shows that all types of stressful encounters can possibly be appraised as both a challenge and a threat, in which case different stress adoption behaviors differ.	Organizational Behavior

Table 5 indicates the numerous studies across different disciplines that aim to develop a measurement scale for the cognitive appraisal of the different types of stresses and transactions between a person and the environment. For example, Ferguson et al. (1999) developed a measurement scale for the cognitive appraisal of different life events, whereas Gaab et al. (2005) created a measurement scale for the cognitive appraisal of psychosocial stress. These developments reflect the importance of establishing a specific measurement scale for the cognitive appraisal of each type of stressful encounter and transaction between a person and the environment, given that the cognitive stress appraisal measurement scale in one discipline may not fit the contexts of other disciplines.

In the IS discipline, the first two studies related to cognitive stress appraisal were conducted by Beaudry and Pinsonneault (2005) and Fadel and Brown (2010). Beaudry and Pinsonneault (2005) conducted a qualitative study investigating a person's cognitive appraisal of different information technologies (IT) events that affect his/her adaptation strategies toward the IT events. Fadel and Brown (2010) developed a measurement scale for a user's cognitive appraisal of a new IS. However, both studies failed to fully adopt the concept of cognitive stress appraisal, as they focused on the cognitive appraisal of IT events and IS and not on the cognitive appraisal of the stress induced by IT events or IS. Therefore, although these IS studies partly adopted the concept of cognitive stress appraisal, they cannot be regarded as studies concerning technostress and CTA.

The study by Lei and Ngai (2014) is the first IS study to adopt the concept of cognitive stress appraisal into the technostress context. The study proposed that different types of technostress result in various TAOs through the mediation of different types of CTA, i.e., TCA and TTA. TCA and TTA would lead to favorable and unfavorable TAOs, respectively. However, the propositions raised in the study were not empirically tested because of the absence of a corresponding measurement scale in the IS literature. Califf et al. (2015) empirically studied the effects of the TCA and TTA on different TAOs, as well as the effects of various technological characteristics and organizational support on TCA and the effects of the different types of technostress on TTA. However, this study did not develop a measurement scale for cognitive stress appraisal in the technostress context, i.e., TCA and TTA, and the measurement scales for TCA and TTA were adapted from studies in other disciplines (Kessler et al. 2003; O'Sullivan 2011). At the same time, a large proportion of its hypotheses were rejected, possibly because of the inadequate measurement scale of the cognitive appraisal of stress in the context of technostress because those adapted from other disciplines are not developed to measure the cognitive appraisal of technostress.

2.2.1.2 Differences between Cognitive Appraisal and CTA

Cognitive appraisal, which has been studied and operationalized in the IS literature (Fadel and Brown 2010), differ from CTA in terms of target. The target of cognitive appraisal, which has been operationalized in the IS literature, is ICT, whereas the target of CTA is stress, i.e., technostress, created through ICT use (Lei and Ngai 2014).

The measurement scale for cognitive appraisal developed in the IS literature cannot act as the measurement scale of CTA considering the differences in the targets of the cognitive appraisals. Moreover, the cognitive appraisal items empirically operationalized in the IS literature do not capture the essential elements required in CTA, i.e., technostress. For example, one of the cognitive appraisal items developed in the IS literature is, "*I see Point n' Click as a chance to change for the better*" (Fadel and Brown 2010, p. 124). Obviously, the item does not include any clue of the ICT demand. Technostress or stress emerges only when the interaction between the ICT and a person poses a demand on the focal person (Day et al. 2012; Karasek 1979), i.e., it potentially taxes the resources of individuals. Demand is a prerequisite of stress, which is defined as "*the non-specific (that is, common) result of any demand upon the body, be the effect mental or somatic*" (Selye 1991, p. 22). Given that those items failed to capture the essential element, that is, technostress, they cannot be directly adapted to the empirical study of CTA.

Chapter 3 Conceptualization and Operationalization of Technostress Challenge Appraisal and Technostress Threat Appraisal

This chapter conceptualizes and develops the measurement scale of two new constructs: TCA and TTA. TCA and TTA represent the cognitive appraisals that individuals make when encountering technostress. The measurement scale of TCA and TTA is developed and validated that can be used to measure the CTA. TCA and TTA are based on TTS, and its empirical measurement is used to provide a foundation for the empirical study of technostress using TTS. I follow a rigorous empirical scale development process (Benbasat and Moore 1992; Moore and Benbasat 1991; Xia and Lee 2005), and the process includes four phases: 1) item generation, 2) scale development, 3) instrument testing, and 4) data analysis and measurement validation.

3.1 Conceptual Development

The constructs under the concept of CTA are conceptualized following the approaches of Moore and Benbasat (1991) and Yi (2009), whose works articulate the construct definitions. Each element of the definitions is elaborated afterward. Given that the definitions of the constructs are used to guide the instrument development process, the operationalization issues of the constructs are considered when articulating these operational definitions. To follow the cumulative tradition in the IS discipline, this study proposes that CTA comprises of TCA and TTA, similar to majority of the latest studies suggesting that cognitive stress appraisal comprises challenge and threat appraisals (Pearsall et al. 2009; Podsakoff et al. 2007; Skinner and Brewer 2002; Webster et al. 2011). Moreover, on the basis of the same motive, TCA and TTA are regarded as not mutually exclusive; the same is viewed in cognitive stress appraisal studies in other disciplines (Ferguson et al. 1999; Folkman 1984; Peacock and Wong 1990; Webster et al. 2011). Thus, TCA and TTA are conceptualized and operationalized in the following sections.

3.2 Technostress Challenge Appraisal

TCA refers to the perception of the demands that are created by ICT use in the workplace; although demanding and strain-provoking, such demands are regarded as challenging, potentially rewarding, and beatable and can in turn lead to improved work performance, personal growth, and goal achievement (Pearsall et al. 2009; Podsakoff et al. 2007; Webster et al. 2011). This definition guides the subsequent measurement development process in this study.

Technostress is appraised as a challenge in many circumstances. For example, when the workload of individuals is increased by ICT use in the workplace, they may perceive such increase in workload as a challenge because overcoming a heavy workload will lead to a sense of achievement and may provide them with the opportunity to demonstrate their capabilities to their supervisors (Boswell et al. 2004; Webster et al. 2010). Theoretically, TCA would lead to several favorable outcomes, such as user satisfaction, intention to continue using ICT, and improved performance (Lei and Ngai 2014). For example, given that TCA will cause individuals to expect that the demand induced by ICT use for work purposes will improve their work performance, their expectation for performance improvement will increase their satisfaction in using ICT for work. Moreover, given that individuals expect that overcoming technostress will lead to high achievements, such individuals will exert additional efforts to address technostress, which would lead to improved performance.

3.2.1 The Differences among TCA and other Related IS Concepts

Some differences exist between TCA and other related IS concepts, such as performance expectancy (PE), which refers to the belief that the adoption of a particular system can improve the performance of the adopter (Venkatesh et al. 2003). According to one of the inventors of the term, (Venkatesh n.d.), PE is identical to perceived usefulness (PU). Therefore, PU and PE are used interchangeably in the current work. PE is one of the most important determinants of IS or IT adoption (Ngai et al. 2007; Pavlou 2003).

TCA and PE are similar in some aspects. First, some outcomes of PE and TCA are identical. PE leads to several favorable outcomes, such as end-user satisfaction (Calisir and Calisir 2004), intention to use a system (Venkatesh et al. 2003), and intention to continue using IS (Bhattacherjee 2001). Theoretically, TCA can lead to the above-mentioned favorable outcomes. Second, PE captures some elements of TCA. Both PE and TCA indicate that ICT use for work purposes will improve the work performance of individuals. Third, both PE and TCA are cognitive IS constructs in the work context. PE refers to the cognitive appraisal of an individual toward a system (Choi et al. 2011).

TCA is different from PE for three reasons. First, PE does not capture the idea that technostress is demanding and strain-provoking. As long as this element is not captured, one cannot ensure whether the encounter (i.e., ICT use in work) is benign-positive or challenging even if PE captures the idea of performance improvement and achievement. Technostress does not emerge if the encounter is benign-positive. Second, PE does not capture the challenging and beatable component. In TCA, individuals expect that they must use ICT for work purposes and tackle the challenging yet beatable demands that are induced by such adoption so as to realize performance improvement and achievement. By contrast, PE does not imply that individuals must tackle such demands. Third, although both PE and TCA are related to performance improvement and achievement, these two concepts propose different causes for such components. Specifically, PE suggests that performance improvement and achievement result from ICT, whereas TCA proposes that these components result from the demands that are created by ICT use for work purposes. Therefore, these two concepts have different focuses.

3.3 Technostress Threat Appraisal

TTA refers to the perception that the demands created by ICT use for work purposes can threaten or hinder personal growth and achievement and that overcoming such demands will not lead to improved performance (Peacock and Wong 1990; Podsakoff et al. 2007; Webster et al. 2011). This definition guides the subsequent measurement development process in this study. Again, the dimensionality of TTA is determined according to the procedure proposed by Polites et al. (2011).

Indubitably, technostress may be appraised as a threat in several circumstances because the majority of the technostress literature focuses on the negative effects of technostress. For example, the role ambiguity that results from ICT use for work purposes may be appraised as a threat because overcoming such ambiguity may make individuals feel different when meeting the expectations of their supervisors and may not lead to improved performance (LePine et al. 2004; Webster et al. 2010). Theoretically, TTA leads to several unfavorable outcomes, such as low levels of user satisfaction, poor work performance, and poor attitude toward ICT. For example, when individuals appraise technostress as a threat, they perceive the demand resulting from ICT use for work purposes as a barrier to performance improvement; in such cases, individuals become unsatisfied with ICT.

3.3.1 The Differences among TTA and other Related IS Concepts

Some differences also exist between TTA and other IS-related concepts, such as anxiety. In the IS context, anxiety is described as "*evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer)*" (Venkatesh et al. 2003, p. 432). Anxiety is considered similar to technophobia in the technophobia literature. Theoretically, anxiety leads to several unfavorable outcomes, such as strain (O'Driscoll et al. 2010), low levels of user satisfaction (Sun et al. 2008), and poor user attitude toward ICT (Igbaria and Parasuraman 1989).

Anxiety, also known as technophobia, tends to be confused with TTA because the two concepts share common characteristics. First, some outcomes of anxiety and TTA, such as stain, low levels of user satisfaction, and poor user attitude toward ICT, tend to overlap. Second, the concept of anxiety captures some elements of TTA. Both anxiety and TTA capture the negative thoughts of individuals toward ICT use.

TTA is different from anxiety for the following reasons. First, unlike TTA, anxiety is not only applicable to the work context. Therefore, TTA is a construct applicable to the work context, whereas anxiety is a construct applicable to any context. Second, TTA is caused by the demands resulting from ICT use for work purposes, whereas anxiety is caused by the existence of ICT and ICT use. Therefore, TTA and anxiety are two different concepts.

3.4 Operationalization of Technostress Challenge Appraisal and Technostress Threat Appraisal

The instrument development process is implemented in four phases (Benbasat and Moore 1992; Moore and Benbasat 1991; Xia and Lee 2005) (see Appendix A). Each phase is elaborated in the following subsections. Appendix B illustrates the roles of participants in different phases of the measurement development process.

3.4.1 Phase One: Item Generation

3.4.1.1 Literature Examination

As described in the previous section, a thorough literature review was conducted to establish the operational definitions and identify the essential components of TCA and TTA, namely, the constructs to be developed in this study.

Afterward, two literature searches were conducted to generate the initial pool of measurement items for TCA and TTA. The first search aimed to identify the items from existing scales that could entirely fit the definitions of TCA and TTA. No existing scale was identified in the first search. The second search aimed to identify the items from the existing scales that could not entirely fit the definitions of the constructs but could capture some core elements of the constructs as articulated in the previous section. After the second search, 31 and 33 items from the existing scales were identified for TCA and TTA, respectively. These items were then reviewed and modified to fit the definitions and to capture all the elements of the constructs.

3.4.1.2 Item Creation and Modification

The first modifications on the initial pool mainly focused on the identified items for measuring TCA and TTA. I modified these items to make them fit the definitions of TCA and TTA. The items for TCA and TTA should also include demand, which is an essential element of TCA and TTA. Demand is a key element that distinguishes TCA and TTA from other similar items. At the operationalization level, when "demand" is excluded, the items for TCA would not be distinguished from those for attitude and PE, whereas the items for TTA would not be distinguished from those for anxiety. Some examples of the initially modified items for TCA and TTA are presented as follows:

TCA: ICT use for work purposes creates demands that allow me to use my skills and abilities.

TTA: I worry about what is happening at work because of the demand created by ICT use for work purposes.

To ensure content validity, Moore and Benbasat (1991) suggested that new items should be created for those constructs with fewer than 10 identified items and the dimensions of which are not fully covered.

3.4.1.3 Second Item Modification on the Initial Pool

This round aimed to eliminate the redundant or ambiguous items, unify the inconsistent wordings, and ensure that the items fitted their corresponding definitions. A total of 21 and 22 items for TCA and TTA, respectively, were eventually retained.

3.4.2 Phase Two: Scale Development

I conducted four rounds of card sorting exercises to ensure the construct validity and to identify the potentially ambiguous items that had not been identified in the previous phase. Card sorting comes in two types, namely, open and closed card sorting. The first and third rounds of card sorting exercises were open card sorting, whereas the second and fourth rounds were closed card sorting. The details of the card sorting exercises are provided in Appendix D.

3.4.2.1 Results of the First and Second Rounds of Sorting

The average raw agreement and Cohen's kappa in the first round of sorting were 0.937 and 0.877, respectively. The agreement among the judges was relatively high. The overall placement ratios of the items within the target constructs in the individual and panel sections were 95% and 88%, respectively.

The average raw agreement and Cohen's kappa in the second round of sorting were 0.802 and 0.633, respectively. The agreement among the judges was relatively high. Most of the disagreements were for the items from TCA and TTA. The overall placement ratios of the items within the target constructs in the individual and panel sections were 90% and 95%, respectively. The details of both the inter-judge agreements and placement ratios are shown in Appendix E.

3.4.2.2 Initial Refinement after the First and Second Rounds of Sorting

Given that all the items are reflective and that the removal of any item should not alter the meanings of the instrument, I considered the removal of the ambiguous items. After the first and second rounds of card sorting, I removed those items that were considered ambiguous according to the card sorting results. After removing those items, the total number of items for TCA and TTA were 15 and 14, respectively.

3.4.2.3 Refinements on the Dimensionality of Technostress Challenge Appraisal

In the second round of card-sorting exercise, the judges tended to classify the items of TCA into two categories: 1. Self-efficacy in surmounting technostress, and; 2. Expected outcomes of surmounting technostress. This appears that the judges perceived TCA to a multi-dimensional construct. Following the practices of Moore and Benbasat (1991) and the suggestions from Benbasat and Moore (1992), I reconsider the dimensionality of TCA based on the card sorting results. Throughout the process of deciding the multidimensionality of TCA, I would follow the guideline written by Polites et al. (2011).

3.4.2.3.1 Step One – Content Domain and Facets of TCA

The content domain and facets of TCA were reviewed, since the number and nature of the facets of a construct would determine the dimensionality of the construct (Polites et al. 2011). The definition of TCA covers the following facets: 1. Demands created by the usage of ICT for work which is challenging and beatable, and; 2. The overcoming of the demands created by the usage of ICT for work would lead to higher performance, personal growth, and achievement. This means that the pool of items of TCA should cover the above two facets. The dimensionality of a construct is corresponding to the number of facets of the construct. Therefore, based on the facets of TCA, TCA should be a two-dimensional construct and its dimensions are: 1. Self-efficacy in surmounting technostress, and; 2. Expected outcomes of surmounting technostress.

3.4.2.3.2 Step Two – Dimensionality of the Items of TCA

I reviewed the items of TCA and investigated whether they have covered the above-mentioned dimensions. After reviewing all the items of TCA, I found that among the 15 items of TCA, 6 of them referred to facet 1, thus covered dimension 1, and the remaining 9 items referred to facet 2, thus covered dimension 2. Therefore, the items of TCA matched the dimensionality of TCA.

3.4.2.3.3 Step Three – Nature of the Relationship between TCA and its Dimensions

TCA should be a reflective second-order construct because TCA will only cover the common variance of its two dimensions: Self-efficacy in surmounting technostress, and expected outcomes of surmounting technostress. The dimensions of TCA should co-vary, but not interchangeable, because TCA should exhibit both characteristics (dimensions), and it is not acceptable to miss either of the dimensions.

To conclude, TCA was decided to be a two-dimensional construct, which contains two dimensions: 1. Self-Efficacy in Surmounting Technostress (SEST), and; 2. Expected Outcomes of Surmounting Technostress (EOST). The third and fourth rounds of sorting will test the validity of the refinement, as well as the measurement scale.

3.4.2.4 Results of the Third and Fourth Rounds of Sorting

The third round was an open card sorting exercise. The average raw agreement and average Cohen's kappas were 0.819 and 0.715, respectively. The Cohen's kappa was higher than 0.65, which was consistent with the suggestions of Moore and Benbasat (1991). The agreement among the judges was relatively high. Most of the disagreements were for the first dimension of TCA. During the card sorting exercise, one of the judges considered all the items for the first dimension of TCA as ambiguous because these items were similar to those for the second dimension of TCA but were defined differently. Therefore, that judge decided to name those items as ambiguous because the items for the first dimension of TCA should not be grouped with the items for the second dimension. The overall placement ratios of the items within the target constructs in the individual and panel sections were 85% and 93%, respectively. No major dispute was observed among the judges during the card sorting section.

The fourth round was a closed card sorting exercise. The average Cohen's kappa and average raw agreement were 0.419 and 0.59, respectively, which were relatively lower than those in the previous rounds. Therefore, the agreement among the judges was not very high. After the sorting exercise, I discussed with the judges the tasks that they performed. The judges revealed that they encountered some problems in understanding the definitions because the words were too technical. Without an accurate understanding of the definitions, the judges would develop their own understanding that differed from those of the others. The overall placement ratios of the items within the target constructs in the individual and panel sections were 74% and 86%, respectively.

3.4.2.5 Initial Refinements after the Third and Fourth Rounds of Sorting

Given that all the items were reflective and that the removal of any item should not alter the meanings of the instrument, I considered the removal of the ambiguous items according to the results from the third and fourth rounds of card sorting. After closely investigating the items, 11 items were removed because these items contain ambiguous terms and wordings. Exactly 18 items were included in the initial pool after the refinement. The total numbers of items for the first dimension of TCA, second dimension of TCA, and TTA were 5, 6, and 7, respectively.

3.4.3 Phase Three: Instrument Testing

3.4.3.1 Pilot Test – Data Collection

In this stage, a pilot test was conducted on all the instruments. The questionnaires were distributed to 51 respondents, 49 (96%) of which returned usable responses. The respondents were MBA students in a university in Hong Kong. The pilot test had three objectives.

The first objective was to ensure the quality of the questionnaire. Upon completing the questionnaires, the respondents were invited to cite their concerns and comment on the questionnaire. The second objective was to ensure the reliability of the instrument. I calculated the two common measurements of reliability, namely, Cronbach's alpha and Guttman's lower bound (GLB), to achieve this objective. The targeted level of minimum reliability was set between 0.7 and 0.8 (Moore and Benbasat 1991). The third objective was to reduce the overall length of the instrument according to the following measures: inter-item correlations, corrected item-total correlation, Cronbach's alpha if items were deleted, and item standard deviation scores.

3.4.3.2 Pilot Test – Data Analysis and Results

The Cronbach's alphas of the first dimension of TCA, second dimension of TCA and TTA were 0.867, 0.776, and 0.919, respectively, which were relatively favorable. To make the measurement scale parsimonious, I shortened the scale further by removing several items because a measurement scale with a very high Cronbach's alpha would be wasteful (Moore and Benbasat 1991). I ensured the domain coverage of each construct before deleting any item. After closely investigating the items, 5 items were removed because they had identical to other items but with more complex sentence structures. A total of 13 items were retained.

3.4.3.3 Final Field Test

Part-time students who were working for full-time jobs were recruited. It is believed that this sample was suitable. The justifications for the use of part-time students as informants follow the recommendations of Compeau et al. (2012), which are provided as following:

First, part-time students who are full-time workers and most of them are young managers and executives (or working professionals) in their organizations. Second, part-time students come from different industries and organizations, not come from a specific industry or organization. Third, they need to use ICT for work purpose in their work settings on a regular basis. Thus, student sample is believed to be appropriate in this context. The data were collected by distributing questionnaires to the part-time students of a university in Hong Kong. Of the 183 responses collected, 152 were usable. The respondents belonged to a wide range of industries, including manufacturing, government, service, health care, education, finance and insurance, ICT, trading, and utilities and transport. They also came from various organization levels, including top management, administrative staff, middle management, technical staff, and supervisory staff.

3.4.4 Phase Four: Data Analysis and Measurement Validation

3.4.4.1 Data Screening and Descriptive Analysis

Following Xia and Lee (2005), I carefully screened the survey data to identify any unusual patterns, nonresponse bias, and outliers. Any unusual patterns or careless responses in the questionnaires was not identified. Therefore, all the questionnaires were carefully and seriously answered by the respondents. I conducted the extrapolation method proposed by Armstrong and Overton (1977) to examine the nonresponse bias. A t-test was implemented to compare the responses from the early and late respondents to test if there is any significant different in the means of any measurement item between the two groups of respondents. The results, as shown in Table 6, show that all measurement items are not significantly different between two groups. Thus nonresponse bias is unlikely a concern in the sample.

Table 6 – T-Test Results for Nonresponse Bias

T-Test Results for Nonresponse Bias			
Measurement Item		**T-value**	**Sig.**
TCA(SEST)1	Equal variance assumed	-0.59	0.554
	Equal variance not assumed	-0.56	0.578
TCA(SEST)2	Equal variance assumed	0.21	0.836
	Equal variance not assumed	0.21	0.836
TCA(SEST)3	Equal variance assumed	0.75	0.453
	Equal variance not assumed	0.70	0.485
TCA(SEST)4	Equal variance assumed	-0.12	0.903
	Equal variance not assumed	-0.12	0.905
TCA(EOST)1	Equal variance assumed	-0.46	0.645
	Equal variance not assumed	-0.45	0.651
TCA(EOST)2	Equal variance assumed	0.33	0.745
	Equal variance not assumed	0.32	0.747
TCA(EOST)3	Equal variance assumed	0.28	0.778
	Equal variance not assumed	0.30	0.768
TCA(EOST)4	Equal variance assumed	-0.18	0.855
	Equal variance not assumed	-0.18	0.859
TTA1	Equal variance assumed	-0.35	0.728
	Equal variance not assumed	-0.36	0.716
TTA2	Equal variance assumed	0.11	0.915
	Equal variance not assumed	0.11	0.911
TTA3	Equal variance assumed	-0.08	0.940
	Equal variance not assumed	-0.07	0.940
TTA4	Equal variance assumed	-1.00	0.319
	Equal variance not assumed	-0.97	0.337

TTA5	Equal variance assumed	-0.28	0.780
	Equal variance not assumed	-0.28	0.782
WP1	Equal variance assumed	0.30	0.764
	Equal variance not assumed	0.31	0.754
WP2	Equal variance assumed	0.41	0.681
	Equal variance not assumed	0.42	0.672
WP3	Equal variance assumed	-0.26	0.792
	Equal variance not assumed	-0.27	0.784
WP4	Equal variance assumed	0.72	0.473
	Equal variance not assumed	0.75	0.452

*TCA(SEST) = First Dimension of TCA; TCA(EOST) = Second Dimension of TCA; WP = Work Performance

3.4.4.2 Reliability Assessment

The reliability of the scales was assessed according to their Cronbach's alpha, GLB, and composite reliability index values.

The measurement scales of TCA and TTA demonstrated a high level of reliability. The Cronbach's alpha values of the first, second dimensions of TCA and TTA were 0.899, 0.839, and 0.893, respectively. The GLB, Cronbach's alpha, and composite reliability (CR) values of the first dimension of TCA (GLB = 0.899; Cronbach's alpha = 0.899; CR = 0.930), second dimension of TCA (GLB = 0.839; Cronbach's alpha = 0.841; CR = 0.893), and TTA (GLB = 0.893; Cronbach's alpha = 0.894; CR = 0.920) were relatively high. The results are shown in Tables 7 and 8.

Table 7 – Reliability Coefficients

Reliability Coefficients						
	PILOT TEST (n = 49)			**FIELD TEST (n = 152)**		
Constructs / Dimensions	Items	Alpha*	GLB**	Items	Alpha*	GLB**
TCA (First Dimension)	5	0.87	0.88	4	0.90	0.90
TCA (Second Dimension)	6	0.78	0.79	4	0.84	0.84
TTA	7	0.92	0.92	5	0.89	0.89

Table 8 – Scale Properties and Correlations Matrix

Scale Properties and Correlations Matrix					
Construct /Dimension	**Composite Reliability**	**AVE**	**Correlations Matrix**		
			First Dimension of TCA	**Second Dimension of TCA**	**TTA**
First Dimension of TCA	0.93	0.77	**0.88**		
Second Dimension of TCA	0.89	0.68	0.46	**0.82**	
TTA	0.92	0.70	−0.34	−0.41	**0.84**

3.4.4.3 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) was performed to assess the construct validity. The development of the measurement scales of TCA and TTA theory-driven. Given that CFA combines ex-ante theoretical expectations with empirical data to validate the structure of the measurement model, CFA is superior to its alternatives, such as the exploratory factor analysis. CFA was conducted to support the structure of the measurement models of TCA and TTA. The hypothesized two-factor measurement model with one second-order factor (Model 4) was compared with three competing models (see Appendix F). The first competing model was a one-factor model in which all the items were loaded into a single first-order factor (model 1). The second competing model was a two-factor model in which all the items of the first and second dimensions of TCA were loaded into the first factor, whereas those of the TTA were loaded into another factor (model 2). The third competing model was a three-factor model in which all the items of the first dimension of TCA were loaded into the first factor, the items of the second dimension of TCA were loaded into the second factor, and the items of the TTA were loaded into the third factor (model 3). The hypothesized measurement model (model 4) was a two-factor model with one second-order factor in which the items of the first dimension of TCA were loaded into the first factor, the items of the second dimension of TCA were loaded into the second factor, and the items of TTA were loaded into the third factor. I also loaded the first and second dimensions of TCA into a second-order factor.

The hypothesized measurement model was compared with the three competing models using two groups of goodness-of-fit indices (Xia and Lee 2005). The first group included the ratio of chi-square to degrees of freedom, standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA), all of which were relatively sensitive to the sample size. The second group included the comparative fit index (CFI) and Tucker–Lewis index (TLI), which exhibited little sensitivity to the sample size.

I used the target coefficient to justify the existence of the second-order factor of the first and second dimensions of TCA as recommended by Xia and Lee (2005) and Marsh and Hocevar (1985). The target coefficient was calculated as follows:

$$\text{Target Coefficient} = \chi^2(first - order\ \ model)/\chi^2(second - order\ \ model)$$

The target coefficient has an upper limit of 1.0. Thus, the validity of the second-order model was regarded as high when the target coefficient was close to 1.0. I used the target coefficient and the results of the model comparisons to determine the measurement model that best represented TCA and TTA.

Table 9 shows the model fit results of the alternative and hypothesized measurement models for TCA and TTA. The null, one-factor, and two-factor models did not generate satisfactory model fit indices because they did not meet the threshold. By contrast, both the three-factor and two-factor second-order models (hypothesized measurement model) met the threshold.

The validity of the hypothesized measurement model was assessed by calculating the target coefficient. The target coefficient between the three-factor model and the hypothesized measurement model was very close to 1.0, thereby supporting the second-order model (hypothesized model) of the covariation among the first-order factors and indicating the efficacy of the hypothesized model. Moreover, the paths from the second-order factor to the first-order factors of TCA were all significant. Therefore, the hypothesized measurement model best represented the TCA and TTA constructs.

Table 9 – Goodness-of-Fit Indices for the Developing Scale

Goodness-of-Fit Indices for the Developing Scale							
Model	**χ2**	**df**	**χ2/df**	**CFI**	**TLI**	**RMSEA**	**SRMR**
Null	1205.76	78	15.46	0.00	0.00	0.31	0.360
One-Factor	585.68	65	9.01	0.54	0.45	0.23	0.145
Two-Factor	286.25	64	4.47	0.80	0.76	0.15	0.107
Three-Factor	106.45	62	1.72	0.96	0.95	0.07	0.045
Two-factor Second-Order (Hypothesized Measurement Model)	106.45	62	1.72	0.96	0.95	0.07	0.045
Recommended Value	NIL	NIL	≦ 3	≧ 0.9	≧ 0.9	≦ 0.1	≦ 0.1

3.4.4.4 Convergent and Discriminant Validity

The unidimensionality and convergent validity of the two latent components of TCA were assessed by analyzing the single-factor model of each latent variable of TCA. The discriminant validity of the first-order factor of TCA was assessed by comparing the squared average variance extracted (AVE) for each component and the correlations between the focal and remaining components. The discriminant validity would be supported if the square root of AVE were higher than the correlations between the focal and remaining components (Fornell and Larcker 1981).

I generated three first-order models that corresponded to each component of TCA or construct of TTA to test for unidimensionality and convergent validity. The results are shown in Table 10. Most of the fit indices of TTA and the components of

TCA reached the threshold, which indicated that the measurement and components of TTA satisfied the unidimensionality and convergent validity requirements.

Table 10 – Unidimensionality/Convergent Validity

Unidimensionality/Convergent Validity							
Model	**χ2**	**df**	**χ2/df**	**CFI**	**TLI**	**RMSEA**	**SRMR**
First Dimension of TCA	14.93	2	7.46	0.97	0.90	0.21	0.03
Second Dimension of TCA	5.67	2	2.84	0.99	0.96	0.11	0.02
TTA	12.80	5	2.56	0.98	0.96	0.10	0.02

The discriminant validity of this study indicated the degree to which the measurement scales of the components of TCA differed from those of the components of TTA. The results of the comparison between the squared AVE of the components of TCA and TTA and the correlations of each construct with the remaining constructs are presented diagonally in Table 8. The discriminant validity was supported as the squared AVE of each construct was higher than their correlations with the remaining constructs.

3.4.4.5 Nomological Validity

For the nomological validity of the measurement scales of TCA and TTA, I tested the hypothesized relationships among TCA, TTA, and work performance. Following the TTS literature and Lei and Ngai (2014), I established the following hypotheses to support the nomological validity of the measurement scales of CTA:

H1: TCA is positively related to work performance.

H2: TTA is negatively related to work performance.

Following Spiro and Weitz (1990), a one-to-one correlation analysis was conducted to test whether the above the hypotheses would be supported. Partial Least Square (PLS)–structural equation modeling (SEM) was also conducted to provide additional support.

The results supported nomological validity by testing the hypothesized positive relationship between TCA and work performance and the negative relationship between TTA and work performance. Table 11 shows the results of the one-to-one regression analysis. TTA was negatively related to work performance ($\beta = 0.534$, p-value < 0.01), whereas TCA was positive and significantly related to work performance ($\beta = -0.268$, p-value < 0.01). Therefore, H1, H2, and the nomological validity were supported by the data.

Table 11 – Nomological Validity

Nomological Validity						
	One-to-One Regression Analysis			**PLS–SEM Analysis Results**		
Independent Variable	R-square	Beta	T-value	R-square	Beta	T-value
TCA	0.29	0.53**	8.85	0.29	0.54**	7.63
TTA	0.07	−0.27**	3.38		0.00	0.04

*p-value < 0.05; **p-value < 0.01.

PLS–SEM analysis was also conducted to test the hypotheses. The positive relationship between TCA and work performance was supported (β = 0.536, p-value < 0.01), whereas the negative relationship between TTA and work performance was not supported (β = 0.003, p-value > 0.05). The results are also shown in Table 11.

3.4.4.6 Post-Hoc Analysis

The results from the preceding analysis showed an unexpected finding that warranted further investigation. Specifically, TTA was negatively related to work performance in the one-to-one correlation analysis but was not significantly related to work performance in the SEM analysis. Therefore, the negative effects of TTA on work performance that were detected in the one-to-one correlation analysis were partialled out by TCA, since the correlation and the corresponding t-value between TTA and work performance significantly decreased after TCA had added into the research model.

I investigated whether the negative effects of TTA on work performance, as revealed in the one-to-one correlation analysis, were not directly but were mediated by TCA. Although some TTS studies argued that threat appraisal on stress would directly lead to unfavorable stress adaptational outcomes (Skinner and Brewer 2002;

Webster et al. 2011), such as a low levels of work performance, other studies argued that threat appraisal would affect stress adaptational outcomes through the mediation of challenge appraisal for two reasons: first, individuals would continuously involve themselves in CSA as they reappraise stress; second, the threat appraisal of individuals would negatively affect their challenge appraisal in the stress reappraisal stage (Elfering and Grebner 2012). Therefore, TCA would also mediate the negative effect of TTA on work performance. I thus proposed the following hypothesis:

H3: TCA mediates the negative effects of TTA on work performance.

Following Baron and Kenny (1986), I checked whether mediation effects existed between TTA and work performance by testing the following: 1) the relationship between the independent variable(s) and the mediator(s), in which the former should affect the latter; 2) the relationship between the independent variable(s) and the outcome variable(s), in which the former should affect the latter; and 3) the relationship between the mediator(s) and the dependent variable(s), in which the former should affect the latter.

The second and third steps were already performed in the previous analyses, and both criteria were met. Therefore, I mainly focused on the first step in the post hoc analysis. I used PLS–SEM to test simultaneously for 1) the relationships between the independent variable (i.e., TTA) and the mediator (i.e., TCA), 2) the relationship between the independent variable and the outcome variable (i.e., work performance), and 3) the relationship between the mediator and the outcome variable.

All of these relationships were supported. TTA was significantly correlated with TCA ($\beta = -0.440$, p-value < 0.01), whereas TCA ($\beta = 0.536$, p-value < 0.01) was significantly correlated with work performance. Given that TTA was significantly correlated with all the mediators, the mediation effects were confirmed. The total effect of TTA on work performance was also calculated using Equation 1. The total effect of TTA on work performance was −0.232, which indicated that TTA would negatively affect work performance through the mediation of TCA. The results are shown in Table 12.

Equation 1. Total Effects of TTA on Work Performance $= \beta_{TTA \to TCA} \times \beta_{TCA \to WP} + \beta_{TTA \to WP}$

Table 12 – Nomological Validity: PLS–SEM Analysis Results

Nomological Validity: PLS–SEM Analysis Results			
Independent Variable	**R-square**	**Beta**	**T-Value**
Dependent Variable: Work Performance (WP)			
TCA		0.54**	7.78
TTA	0.29	0.00	0.04
Dependent Variable: TCA			
TTA	0.19	−0.44**	6.40

*p-value < 0.05; **p-value < 0.01.

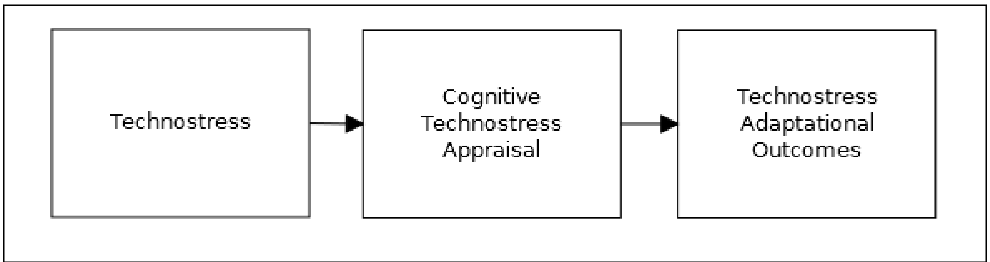
Chapter 4 Research Model and Hypotheses

This chapter presents the core contributions of this dissertation, i.e., the research model developed based on TTS. It starts with presenting the research framework that guides the development of the research model. After that, this chapter presents the development of hypotheses and the logical argument of each hypothesis is elaborated in detail.

4.1 Research Framework

According to TTS, stresses emerge when people encounter an environment that exacts demands upon them that tax or exceed their resources. Current technostress studies generally accept this idea of TTS. For example, Ayyagari et al. (2011) predicted that some ICT characteristics would generate taxing demands that exceed the resources of ICT users and lead to various types of technostress. After encountering stress, people would appraise its nature and determine their further interactions with the stress. Both the result of appraisal (cognitive stress appraisal) and the interaction with the stress would affect the outcomes of stress adaptation, such as personal well-being and workplace outcomes. However, this idea is rarely adopted in technostress literature (Califf et al. 2015; Lei and Ngai 2014). The following subsections focus on the concept that outcomes of stressful encounters are determined by cognitive stress appraisal and discuss how the result of technostress appraisal affects the TAOs of ICT users. Finally, this study discusses how different technostress types would be appraised by ICT users. Figure 1 depicts the framework of the proposed research model. Although TTS also predicts the relationship between stress coping and stress adaptational outcomes, the effects of stress coping on TAOs are not investigated in the current study for reasons discussed in the next section.

Figure 1 – Framework of the Research Model



Framework of the Research Model

4.2 Cognitive Technostress Appraisal and Technostress Adaptational Outcomes

According to TTS, adaptational outcomes of stress are determined by cognitive stress appraisal and stress coping response. Stress coping response refers to a person's "thoughts and actions" on a specific stress (Latack and Havlovic 1992). For two reasons, this study focuses only on cognitive stress appraisal and would not investigate stress coping response, similar to most recent workplace stress studies using TTS (e.g., Cavanaugh et al. 2000; Fugate et al. 2012; Wallace et al. 2009).

First, although numerous studies have attempted to investigate the effect of stress coping response on stress adaptational outcomes, including such response in this research would violate its definition (Nes and Segerstrom 2006). Current stress coping response studies actually measure the coping styles of the focal persons (Latack and Havlovic 1992), which are general and static across different types of stress, rather than the "thoughts and actions" toward a specific stress. For example, the coping inventory for stressful situations (Endler and Parker 1994) measures a person's coping style or habitual method of coping with stress (Delahaij et al. 2010). Thus, recent workplace stress studies using TTS have excluded stress coping response from both their research models and control variables.

Second, the inclusion of stress coping response in the research model would likely cause an error of inclusion (Benbasat and Zmud 2003), given that stress coping response is simply adapted from TTS literature and is not specific for technostress. Investigations on the relationship between traditional stress coping response and TAO will not contribute to IS literature. Strain and work performance, which are examples of TAO, are not IS concepts; traditional stress coping response is also not an IS concept. Investigating the relationship between non-IS concepts is not included within the purview of IS researchers, although this exploration may have contributions in other fields.

Cognitive stress appraisal is the process of appraising stress experienced by a person. Early studies using TTS indicated that when an individual encounters a stressful situation, he becomes engaged in two cognitive stress appraisal processes: primary and secondary appraisals (e.g., Folkman and Lazarus 1985; Folkman and Lazarus 1988). The primary appraisal determines whether the stress encountered is a challenge or a threat, while secondary appraisal determines whether the person who encountered the stress has the resources to cope with it or not. In later studies, researchers tended to ignore secondary appraisal and focused on primary appraisal (e.g., Fugate et al. 2012; Ohly and Fritz 2010; Webster et al. 2011). The first reason for this practice is the recognized interdependence between primary and secondary appraisals. According to Folkman and Lazarus (1985), primary and secondary appraisals are highly interdependent. They observed that when a person finds himself equipped with sufficient resources to overcome stress through secondary appraisal, his level of threat appraisal will decrease as he becomes confident that the available resources will allow him to handle the threat. Conversely, when a person finds he has insufficient resources to cope with a particular stress through secondary appraisal, his level of threat appraisal will increase as the resources he has will not allow him to handle the threat. Given the interdependence between primary and secondary appraisals, their constructs may be difficult to separate when they are operationalized. The second reason is that the definitions of the challenge appraisal have already covered secondary appraisal. Challenge appraisal is defined as a person's perception on the demands from the environment as challenging and surmountable; thus, meeting these demands, regardless of the strain, would lead to a high level of performance, personal growth, and achievement (Pearsall et al. 2009; Podsakoff et al. 2007; Webster et al. 2011). The element "surmountable" reflects the capability or incapability of the focal person to cope with the stress. Therefore, if a person has made a high level of challenge appraisal on a particular stress, that person must have a high level of control appraisal (secondary appraisal). Given the previously mentioned reasons, this model will focus on primary appraisal and not on the secondary appraisal. Therefore, cognitive stress appraisal will henceforth be referred to as the primary appraisal.

Stress can be assessed as a challenge (challenge appraisal) or a threat (threat appraisal) during cognitive stress appraisal. Technostress is a form of stress caused by work-related ICT usage; thus, ICT users who experience technostress also undergo the corresponding form of cognitive stress appraisal process, that is, CTA. During CTA, the person evaluates the effect of technostress (Choi et al. 2011; Folkman et al. 1986). CTA can become either a technostress challenge appraisal (TCA) or a technostress threat appraisal (TTA).

TCA emerges when the demands created by ICT usage (technostress) are perceived as challenging and surmountable, and overcoming these challenges is deemed rewarding and would lead to achievement despite being demanding and strain-provoking (Pearsall et al. 2009; Podsakoff et al. 2007; Webster et al. 2011). TCA leads to positive TAO, except for strain, which is a negative TAO. With TCA, the expectation of the potential reward for surmounting the demands created by work-related ICT use can motivate ICT users in two ways. First, the expectation of potential rewards would directly motivate ICT users to work harder and exert more effort (Lepine et al. 2005). When ICT users expect that demands from work-related ICT use (such as higher workload and acceleration in work tempo) are surmountable and that overcoming such demands is rewarding, they will be motivated to exert additional effort to meet the demands in order to gain the rewards, such as higher performance or recognition from supervisors. Second, the expectation of potential reward will trigger the positive emotions of ICT users, such as excitement and enthusiasm (Webster et al. 2011), which can eventually lead to increased effort and higher satisfaction (LePine et al. 2004). When ICT users have formed a positive emotion toward the demands from work-related ICT use, they would exert more effort and time to meet those demands. Given that ICT users have formed favorable impressions and are more motivated to meet the demands from ICT usage at work, it is expected them to have better work performance and ICT satisfaction when they conduct TCA. Therefore, I posit that:

H1: *TCA will increase the level of work performance.*

TTA emerges when the demands created by ICT usage (technostress) are perceived as threats, obstacles, or constraints, and overcoming them would not be beneficial (Pearsall et al. 2009; Podsakoff et al. 2007; Webster et al. 2011). Hence, TTA leads to negative TAO. With TTA, the expectations of unrewarding results and the constraints caused by the demand from ICT usage also affect the work performance of users in two ways. First, those expectations would decrease the motivation of ICT users to address those demands (Boswell et al. 2004). When users expect that overcoming the demands from work-related ICT use would be unrewarding and serve as a constraint, they would be less motivated to meet those demands. Second, those expectations would stimulate the negative emotions of ICT users, which in turn would lead to decreasing efforts (LePine et al. 2004; Webster et al. 2011). When a negative emotion forms toward the demands from work-related

ICT use, ICT users would exert less effort and time to deal with those demands. ICT users have negative impressions of and are less motivated by the demands created by work-related ICT use. Therefore, it is expected ICT users to have lower work performance and ICT satisfaction when they conduct TTA. Thus, it is hypothesized that:

H2: *TTA will decrease the level of work performance.*

4.3 Technostress and Cognitive Technostress Appraisal

In traditional stress literature, certain stresses such as time urgency and workload are more likely to be appraised as challenges because of their nature, whereas other stresses, such as interpersonal conflict and hassles, are more likely to be appraised as threats (Lepine et al. 2005). I argue that ICT users may tend to conduct different CTA on different technostress (i.e., work overload, work–home conflict, invasion of privacy, role ambiguity, and job insecurity) because of the differences in their nature. Although TCA and TTA would lead to different TAOs, they are not mutually exclusive and do not belong to either end of a continuum, because stress challenge and stress threat appraisals are also not mutually exclusive (Ferguson et al. 1999; Folkman 1984; Peacock and Wong 1990; Webster et al. 2011). Therefore, it is expected that ICT users might simultaneously conduct TCA and TTA on certain technostress types.

It is expected that users who experienced work overload caused by work-related ICT use would tend to conduct a higher level of TCA. ICT use for work gives users a sense of overload (Ayyagari et al. 2011), and because people have to process several tasks simultaneously and work faster because of ICT use (Tarafdar et al. 2010), work overload from ICT use is likely to be appraised as a challenge because of two reasons. First, the workload mentioned would create a high level of time pressure, which is considered a challenge in stress literature (e.g., LePine et al. 2004; 2005). Second, increase in workload has long been considered a positive stressor (challenge) in traditional stress literature (e.g., LePine et al. 2004; 2005), because overcoming higher workload can lead to a sense of achievement and be regarded as an opportunity for the focal persons to demonstrate their capabilities to their supervisors (Webster et al. 2010). The workload from work-related ICT should lead to a higher level of TCA because this workload includes tasks that are central to productivities and evaluations from supervisors.

Moreover, it is expected that the users who experienced work overload from work-related ICT use would tend to conduct a higher level of TTA. Although the increase in workload is usually regarded as a challenge in stress literature, this increase can also be simultaneously appraised as a threat (Webster et al. 2011). I believe that the users who experienced work overload caused by work-related ICT use would conduct a higher level of TTA for the following reasons. First, although work overload from work-related ICT use is surmountable and overcoming it would be rewarding, at the same time, ICT users would perceive that the workload would erode their resources to deal with other demands, and in turn act as a constraint and obstacle when they want to deal with other demands. Second, besides the workload central to performance and evaluations from supervisors, workload from work-related ICT use also contains tasks that are not contributive to performance, such as continuously updating the system and addressing technical problems associated with ICT use like a system crash. This type of workload is likely to be appraised as a threat. I, therefore, hypotheses that:

H3: *Work overload will increase the levels of (a) TCA and (b) TTA.*

It is expected that people who experienced work–home conflict caused by ICT use would tend to conduct a higher level of TTA. I believe that work–home conflict created by work-related ICT use would make ICT users conduct TTA because of several reasons. First, work–home conflict suggests that the ICT users cannot handle both the demands from work-related ICT use and the demands from family life

(Ayyagari et al. 2011). Given that ICT users would have limited resources in dealing with demands from different sources when users handle the work demands, the demands from the family will be compromised. Work–home conflict would likely be appraised as a threat because it reflects the situation wherein ICT users must sacrifice either work or family. Second, work–home conflict from work-related ICT use implies a sense of loss of control of the boundary between work and family life, as ICT users perceive that they cannot stop the invasion of work into their family life (Tarafdar et al. 2007). Given that the sense of losing control would contribute to threat appraisal (Folkman and Lazarus 1985), work–home conflict from work-related ICT use should lead to a higher level of TTA. Third, work–home conflict from work-related ICT use implies the inability of ICT users to rest and disengage from work (Diaz et al. 2012). Therefore, the users would be unable to restore the resources exerted during work. Given the interdependency between TTA and the resources available for dealing with technostress (Folkman and Lazarus 1985), the incapability to restore consumed resources would induce a higher level of TTA. Thus, I propose that:

H4: *Work–home conflict will increase the level of TTA.*

However, there is no theoretical reason to expect that people who experienced work–home conflict from work-related ICT use would conduct a higher level of TCA.

It is expected that people who experienced an invasion of privacy caused by work-related ICT use would tend to conduct a higher level of TTA. ICT users who experienced an invasion of privacy from work-related ICT use would conduct TTA because of the following reasons. First, invasion of privacy indicates that the ICT user has a sense of losing control on the information disclosed to others (Fusilier and Hoyer 1980). The sense of losing control would lead to threat appraisal (Folkman and Lazarus 1985), and thus invasion of privacy from work-related ICT use would induce a higher level of TTA. Second, invasion of privacy is likely to lead to undesirable outcomes (Acquisti and Grossklags 2005). For example, it may cause personal information leak to a third party or lead to the unauthorized secondary use of personal information (Acquisti and Grossklags 2005; Pavlou 2003). Therefore, ICT users are likely to expect that invasion of privacy would lead to undesirable outcomes. As TTA is known to be triggered by undesirable outcomes from technostress, invasion of privacy created by work-related ICT use should lead to a higher level of TTA.

It is likewise expected that people experiencing an invasion of privacy from using ICT for work would tend to have higher TCA levels. Furthermore, invasion of privacy should not be purely negative. Zweig and Webster (2002) failed to find support for the proposed negative relationship between the invasion of privacy and usefulness of monitoring systems. Surprisingly, a subsequent study discovered a positive relationship between the invasion of privacy and the usefulness of monitoring systems (Zweig and Webster 2002). One possible explanation is that the negative effects of the invasion of privacy are offset by its positive effects, and so the invasion of privacy would be simultaneously appraised as a challenge and a threat. It is believed that ICT-created invasion of privacy for work would also be appraised as a challenge.

Privacy is a concept widely studied across different disciplines, such as economics, psychology, marketing, law, philosophy, social science, and IS (Pavlou 2011). This complex concept is investigated and interpreted by scholars through different perspectives. Privacy is a moral or legal right in law, yet in economics, it is a commodity that can be exchanged for certain benefits (Smith et al. 2011). In IS and the social sciences, control is commonly perceived as an essential element of privacy (Bélanger and Crossler 2011; Pavlou 2011), and privacy is one's selective control on another's access to reduce one's vulnerability (Smith et al. 2011). Based on the above definitions of privacy and of the invasion of privacy by Ayyagari et al. (2011), perceived invasion of privacy is the perception that one's selective control on access by another has been compromised. Although organizational behavior literature shows that certain workplace practices, such as workplace monitoring and personnel selection, cause a higher level of perceived invasion of privacy when they are directed toward non-performance related data (Alge 2001; Tolchinsky et al. 1981), this collection of workplace information does not represent invasion of privacy in its entirety. As long as the employees perceive they are being monitored by the organization, a sense of invasion of privacy created by work-related ICT use would emerge because employees cannot selectively control the access of the organization; this perceived loss of control violates psychological boundaries (Zweig 2005). Therefore, the perception of being monitored, both on performance and non-performance aspects, contributes to the perception of invasion of privacy.

The perception of invasion of privacy created by work-related ICT use indicates that the action and performance of users are visible to others (Ayyagari et al. 2011). When actions and performance are visible to supervisors and other organizational members who influence a user's performance evaluations, the latter perceives his actions and performance as an opportunity to impress his supervisors despite being under stress. Action visibility also enables supervisors and other co-workers to provide relevant and timely feedback to focal ICT users (Wells et al. 2007), helping them address work demands and enhance performance (Aiello and Shao 1993). Invasion of privacy is likely perceived as a challenge because it implies a chance to improve work performance. However, surmounting invasion of privacy does not necessarily mean an ICT user will be able to control access. "Surmounting" can refer to controlling the content of information available. For example, when ICT users realize their email usage is being monitored, they can avoid using company email accounts to handle personal matters and reply to emails after work hours to impress supervisors. Therefore, it is proposed that:

H5: *Invasion of privacy will increase the levels of (a) TCA and (b) TTA.*

It is expected that people who experienced role ambiguity caused by work-related ICT use would tend to conduct a higher level of TTA. In traditional stress literature, role ambiguity is always considered a hindrance or threat (LePine et al. 2004; 2005). Role ambiguity from work-related ICT use should also be appraised as a threat because of two reasons. First, role ambiguity is partly triggered by the need to simultaneously serve several roles, which creates numerous interruptions when ICT users need to switch from one task to another and from one role to another (Ayyagari et al. 2011). Obviously, the frequent role and task switching does not contribute to the productivity of ICT users but hinders them instead from better performance. Second, role ambiguity created by work-related ICT use is partly triggered by the uncertainty on the ICT used for work purpose (Ragu-Nathan et al. 2008) (Ragu-Nathan et al. 2008). When using ICTs for work, users have to deal with the uncertainty from the ICT used for work purpose; in addition to the daily work demands, the need to deal with the uncertainty caused by the ICT used would deplete the users' resources for dealing with work demands that are central to work performance. However, without dealing with the uncertainty of the ICTs used for work purpose, ICT users might face difficulty in performing their tasks on ICTs.

People who experienced role ambiguity caused by work-related ICTs are not expected to have increased levels of TCA because such role ambiguity seems insurmountable. Role ambiguity caused by work-related ICTs implies the inability to prioritize and handle conflicting demands to deal with ICT problems and work tasks (Ayyagari et al. 2011). These ICT problems include software updating, system crashes, and system operations, all of which diminish a user's time and resources for handling other work tasks. Inability to handle conflicting demands gives rise to a sense of role ambiguity, which is created neither by organizational settings nor by unclear job responsibilities. Supervisors or peers cannot help the focal person clarify such ambiguity, making it insurmountable. Moreover, ICT users will encounter role ambiguity as long as they use ICTs for work. Thus, it is hypothesized that:

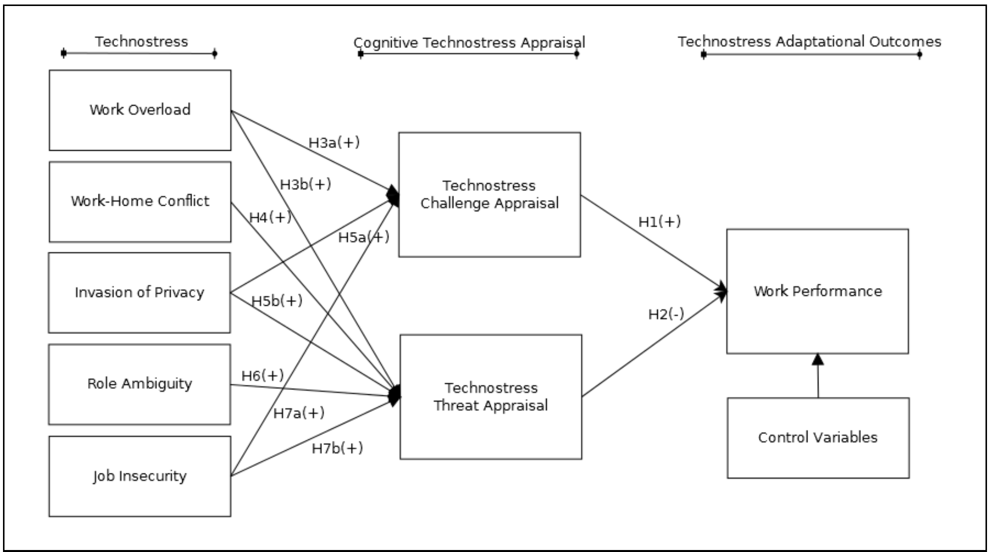
H6: *Role ambiguity will increase the level of TTA*.

It is expected that people who experienced job insecurity created by work-related ICT use would tend to conduct increased levels of TTA. Job insecurity caused by such ICT use would be appraised as a threat because of two reasons. First, the job insecurity created by work-related ICT use is triggered by a person's fear of ICT use, such as the fear of being replaced by ICTs or by others who are familiar with ICTs (Ayyagari et al. 2011). Such fear related to technostress tends to be interpreted as a threat induced by ICT use for work. Second, the job insecurity created by work-related ICT use reflects ICT users' feelings of helplessness and low self-confidence regarding ICT use for work (Tarafdar et al. 2007; 2010), that is, ICT users perceive that they do not have enough resources to deal with work-related ICT use and its related demands. The sense of helplessness contributes to the threat appraisal on the demands created by work-related ICT use.

It is expected that people who experienced job insecurity because of work-related ICTs also tend to conduct higher levels of TCA. Although job insecurity is usually regarded as a threat in stress literature (e.g., Lepine et al. 2005), it could also be appraised as a challenge and lead to favorable outcomes (Probst et al. 2007; Staufenbiel and König 2010). For example, when an ICT user feels his job security will be compromised or replaced by ICTs or ICT-related workers, the user can take measures to reduce job insecurity by, for example, increasing work effort and conducting impression management (Brockner et al. 1992; Huang et al. 2013), thus leading to enhanced work performance. I, therefore, propose that:

***H7:** Job insecurity will increase the levels of (a) TCA and (b) TTA.*

Figure 2 – Research Model



Research Model

4.4 Control Variables

A number of variables are controlled because they may potentially affect CTA or TAOs and are beyond the focus of this study. Computer experience, both in the organization and the industry, is controlled in this study because it may potentially affect the work performance of an ICT user. The reasoning is that an ICT user with a higher level of computer experience may use ICTs for work purposes more effectively and deftly than other users with less computer experience (Lee et al. 2007; Liaw and Huang 2003). Job position and industry are also controlled because both attributes of an ICT user may affect the nature of his tasks, which may also affect work performance (Kacmar et al. 2009; Osterman 1995).

I likewise control for the relationship between TCA and TTA in this study to control for the reappraisal effects. According to stress literature, threat appraisal on a stressful encounter will reduce the level of challenge appraisal made by an individual during the stress reappraisal process (Elfering and Grebner 2012). However, the relationship between TCA and TTA is not hypothesized even though TTA may affect TCA because the technostress reappraisal process is beyond the scope of this study.

Last but not least, following the suggestion from Chin et al. (2013), a measured latent marker variable (MLMV) is controlled in this study to control for the potential common method bias (CMB). Details of the method of using MLMV to control for CMB are elaborated in later sections.

Chapter 5 Research Methodology

This chapter presents the research methodology of this dissertation. It includes the statistical tools which are used in the study, the construct operationalization, data collection method and process. The data is collected through the online survey, as online survey allows researchers to reach a wide range of potential respondents and ensure the completeness of the responses. A set of predefined and structured questionnaire is developed and used to capture data from the targeted respondents through the online survey method.

5.1 Statistical Tools

The main purpose of this study is to develop and validate a research model that can predict the effects of various types of technostress on work performance based on a well-established theory, TTS. Quantitative data are most suitable for validating a mature theory (Edmondson and Mcmanus 2007). Therefore, a survey is chosen as the research method. Specifically, SEM is used to conduct the analysis on the empirical data.

SEM is used to validate the research model because of its following merits. First, it allows simultaneous validation of both the measurement and the structural model. Second, it enables researchers to simultaneously model the relationships among multiple dependent and independent constructs (Gefen et al. 2000). Two types of techniques can be used to implement SEM: covariance-based SEM (CB-SEM) and PLS-SEM (Goodhue et al. 2012). Although both CB-SEM and PLS-SEM share the merits mentioned above, they are developed based on different statistical methodologies and mechanisms. The techniques have certain advantages and disadvantages over each other (Barclay et al. 1995), and the choice between them should be made according to the characteristics and assumptions of the study.

PLS-SEM is chosen in this study for a number of reasons. First, this research model includes a formative construct, MLMV, which is necessary for controlling the potential CMB; PLS-SEM can handle research models with formative measurements, whereas CB-SEM cannot (Gefen et al. 2000). Moreover, as the research model is relatively complex (containing constructs with various indicators), and the study is an extension of existing theories and models, PLS-SEM is a more appropriate choice than CB-SEM (Hair et al. 2011).

5.2 Data Collection

To improve its generalizability and understand the impact of using ICT for work purposes on ICT users' work performance in general settings, this study does not limit the target respondents to any particular industry, organization, or job position. Therefore, the targeted respondents are individuals who are full-time employees required to use ICTs for work purposes.

The People's Republic of China (PRC) was chosen as the context of the empirical study because it has one of the biggest communication networks in the world and the largest number of ICT and Internet users in the world (Daxue-Consulting 2014; Zhang and Zheng 2009). Data were collected by using the panel service provided by an online marketing research company. The online marketing research company is one of the leading online survey service providers in the PRC. Until April 2016, over 1 million panelists profiled by 27 attributes were registered in its database. Data were collected through an online panel company because this allowed us to exert more control on the quality of data. Several academic studies have also employed online panel data because of these advantages (e.g., Ayyagari et al. 2011; Li and He 2014). Details of using the online marketing company are elaborated in the Appendix. Through the company, the questionnaire was distributed to four major cities in PRC, also known as the first-tier cities of Beijing, Shanghai, Guangzhou, and Shenzhen. These cities were chosen because most of the ICT-enabled businesses and knowledge workers (who are likely to use ICT for work purposes) in the PRC are concentrated in these cities (Wan 2012).

The questionnaire was translated into Chinese because the online survey was administered in the PRC. A panel consisting of researchers and a translator reviewed the face validity of the questionnaire. Some minor changes were made on the wordings of the questionnaire on the basis of the comments from the panel.

5.3 Measurement Scales for Constructs of the Research Model

Existing measurement scales in literature are adopted whenever possible. All the constructs of the research model were reflective and measured by multiple items with a 7-Likert scale ranging from 1 “Strongly Disagree” to 7 “Strongly Agree.” The measurement scales of work overload, work–home conflict, invasion of privacy, role ambiguity, and job insecurity were adopted from Ayyagari et al. (2011). Work overload was measured by a three-item scale. A sample item is, “ICTs create many more requests, problems, or complaints in my job than I would otherwise experience.” Work–home conflict was also measured by a three-item scale. One of the items is, “I do not get everything done at home because I find myself completing job-related work due to ICTs.” Meanwhile, invasion of privacy was measured by a four-item scale. A sample item states, “I feel uncomfortable that my use of ICTs can be easily monitored.” Role ambiguity was also measured by a four-item scale. One of the items is, “I am unsure what to prioritize: dealing with ICT problems or my work activities.” Job insecurity is measured by a three-item scale. A sample item is “ICTs will advance to an extent where my present job can be performed by a less skilled individual.” The measurement scale of work performance was adopted from Tarafdar et al. (2010). It was measured by a four-item scale. One of the items is, “ICTs help me accomplish more work than would otherwise be possible.” The measurement for TCA and TTA were self-developed, and the development of measurement scales for TCA and TTA underwent the rigorous process proposed by Moore and Benbasat (1991). Details are provided in Chapter 3. TCA was measured by an eight-item scale. A sample item is, “I feel that I am successfully managing the demands created by the usage of ICTs for work purpose.” TTA was measured by a five-item scale. One of the items states, “Using ICTs for work purpose creates demands that will have a negative impact on me.”

5.4 Measurement Scales for Control Variables

Following the practice of Venkatesh and Morris (2000), computer experience was measured by directly asking the respondents the number of years he/she has used computers. The question posed is, "How many years of experience do you have using computers in general?" The job position and industry of the respondents are also measured by directly asking the respondents. As these control variables are categorical variables, they would be transformed into dummy variables.

The study follows a cross-sectional design; hence, it may potentially suffer from CMB. To handle and control the influence of CMB on the structural path, following suggestions from Chin et al. (2013), 13 items of MLMV were also included in the questionnaire. The 13 items must be unrelated to one another and to the context of the study; therefore, the MLMV is a formative construct. A sample item of the MLMVs states "I prefer birds over fishes." The scales varied from 1 "Strongly Disagree" to 7 "Strongly Agree." Details of the MLMV approach for controlling CMB will be discussed in later paragraphs.

5.5 Remedies for Common Method Bias (CMB)

CMB has long been considered a potential problem in behavioral research (Podsakoff et al. 2003), especially in studies involving self-reported data (Keeping and Levy 2000). The emergence of CMB is attributed to a number of reasons, such as social desirability, consistency motif and implicit theories of the respondents, and ambiguity of items in the questionnaire (Podsakoff et al. 2003). Following the recommendations of Podsakoff and Organ (1986), both procedural and statistical remedies are used in this study to handle CMB.

5.5.1 Procedural Remedies

To prevent the emergence of CMB, the following procedural remedies were performed (Podsakoff et al. 2003; Podsakoff and Organ 1986): 1) improving scale items, 2) protecting respondent anonymity and reducing evaluation apprehension, and 3) proximal separation of measurement.

The aim of improving scale items is to reduce ambiguity and social desirability in the item. Ambiguity in the items is reduced by avoiding double-barreled questions, defining unfamiliar and ambiguous terms, and avoiding complex syntax. Social desirability in the item can be reduced by avoiding evaluative questions.

Protecting respondent anonymity and reducing evaluation can eliminate the effects of social desirability. In the cover letter of the questionnaire, the anonymity of the respondents was ensured. To reduce evaluation apprehension, the respondents were also informed that there is no definite right or wrong answer in the questionnaire.

Proximal separation of measurement, which aims to prevent the effects of consistency bias and implicit theory, was implemented by separating the questions corresponding to different constructs into separate web pages. Respondents could not easily access previous questions that they had already answered. This arrangement reduces their ability to refer to their previous responses in order to answer subsequent questions.

5.5.2 Statistical Remedies

The MLMV approach proposed by Chin et al. (2013) was used as the method for controlling the CMB. Other prevalent statistical remedies for handling CMB are suggested in literature, including Harman's single-factor test, partial correlation technique, multi-trait-multi-method (MMTM) technique, correlation marker technique, CFA marker technique, and unmeasured latent marker construct (ULMC) (Liang et al. 2007; Lindell and Whitney 2001; Podsakoff et al. 2003; Richardson et al. 2009; Shadish et al. 2002; Williams et al. 1996; Williams et al. 2010). However, owing to some of their critical shortcomings listed in Table 13 (Chin et al. 2012), these techniques are not used in the present study.

Table 13 – Drawbacks of Different Statistical Remedies of CMB

Drawbacks of Different Statistical Remedies of CMB		
Drawbacks	**Approach(es)**	**References**
Ineffective in Correcting the Influence of CMB	• Harman's Single-factor Test • CFA Marker Technique • ULMC	Liang et al. (2007); Lindell and Whitney (2001); Podsakoff et al. (2003); Richardson et al. (2009); Williams et al. (2010)
Not Supported by any Numerical Proof or Simulation Test	• Harman's Single-factor Test • Correlation Marker Technique • ULMC	Liang et al. (2007); Lindell and Whitney (2001); Podsakoff et al. (2003); Richardson et al. (2009); Williams et al. (2010)
Seldom Detects any CMB	• CFA Marker Technique • ULMC	Liang et al. (2007); Lindell and Whitney (2001); Podsakoff et al. (2003); Richardson et al. (2009); Williams et al. (2010)
Unrealistic Assumptions on the Sources of CMB	• Partial Correlation Techniques	Podsakoff et al. (2003); Williams et al. (1996)
Difficult to Implement and Suffers from Identification Problems, Specification Errors, and Sampling Errors	• MMTM	Shadish et al. (2002)

MLMV approach is used because of the following advantages. First, it has been rigorously proved using simulations. Second, it can correct 100% of the effects of CMB on structural path estimates. Third, it is cost-effective, requiring only the addition of 12 items to the questionnaire to control completely for the effects of CMB. Finally, MLMV does not require the researcher to make assumptions regarding the source of CMB. In fact, this approach has been widely adopted since its introduction (Sojer et al. 2015; Wang et al. 2016).

As mentioned, for the MLMV approach to correct for the influence of CMB, extra items had to be included in the questionnaire. These extra items compose the latent marker variable, which would be used to capture the existing CMB. According to the results of the simulation test by Chin et al. (2013), a latent marker variable containing 4 items can already remove 72% of the effects of CMB, whereas a latent marker variable containing 12 items can remove 100% of the effects. Note that the items of the latent marker variable have to be unrelated to the research model. Moreover, they should not be related to one another (Chin et al. 2013). Consequently, 13 items for the MLMV were created in this study.

Chapter 6 Data Analysis and Results

This chapter presents the process and results of data analysis. First, it describes the pilot study and sample characteristics. The process and results of the validation of the measurement model are also presented. The measurement model is validated by examining its reliability, and convergent validity and discriminant validity. The results of CFA are also presented. Third, this chapter describes the handling of common method bias. Last but not least, it presents the results of hypothesis testing by using the Partial Least Square – Structural Equation Modeling.

6.1 Pilot Study

A pilot test was conducted prior to the actual implementation of the online survey. Full questionnaires were distributed to 69 part-time MBA students in a Hong Kong university, all of whom were employed full-time and need to use ICTs for work purposes. These respondents were required to fill in the entire questionnaire and provide comments on its face validity. The pilot test respondents revealed that the questionnaire was well developed.

6.2 Sample Characteristics

A total of 400 responses were collected. The online survey was designed to require the respondents to answer all the questions in order to complete it; hence, there was no missing data. Tables 14-21 show the demographic information of the respondents. There is an almost equal split corresponding to gender: 53% of the respondents were female and 47% were male. Most of the respondents came from the ICT industry, and the smallest group came from the utilities and transport industry. This proportion is understandable because employees in the ICT industry naturally use ICTs for work purposes, and employees in the utilities and transport industry, such as bus drivers, rarely need to use ICTs for work. The top three job positions of the respondents are middle management, technical, and administrative. Most of the respondents are relatively young; around 70% of them are below 36 years old. In terms of education, around 80% of the respondents have acquired at least a bachelor's degree. The respondents also tend to have short tenures in their organizations. A relatively large proportion of the respondents has been working for the same organization or job position for less than 6 years. The regions in which the respondents lived are relatively evenly distributed.

Table 14 – Respondent Demographics – Gender

Respondent Demographics - Gender		
	No.	**Percentage**
Female	210	53%
Male	190	47%

Table 15 – Respondent Demographics – Industry

Respondent Demographics - Industry		
	No.	**Percentage**
Manufacturing	61	15%
Government	17	4%
Service	20	5%
Health Care	10	3%
Education	21	5%
Finance and Insurance	17	4%
Information and Communication Technology	202	51%
Trading	22	6%
Utilities and Transport	15	4%
Others	15	4%

Table 16 – Respondent Demographics – Job Position

Respondent Demographics – Job Position		
	No.	**Percentage**
Executive / Top Management	72	18%
Administrative	85	21%
Middle Management	117	29%
Technical	103	26%
Supervisory	23	6%

Table 17 – Respondent Demographics – Age

Respondent Demographics – Age		
	No.	**Percentage**
20-25	53	13%
26-30	110	28%
31-35	117	29%
36-40	59	15%
41-45	37	9%
46-50	13	3%
51 or above	11	3%

Table 18 – Respondent Demographics – Education

Respondent Demographics – Education		
	No.	**Percentage**
Below post-secondary	22	6%
Post-secondary	63	16%
Bachelor's Degree	287	72%
Master's Degree	26	7%
Doctorate Degree	2	1%

Table 19 – Respondent Demographics – Tenure in Current Company

Respondent Demographics – Tenure in Current Company		
	No.	**Percentage**
Under 1 year	13	3%
1-2 years	54	14%
3-4 years	83	21%
5-6 years	104	26%
7-8 years	63	16%
9-10 years	33	8%
11 years or above	50	13%

Table 20 – Respondent Demographics – Tenure in Current Position

Respondent Demographics – Tenure in Current Position		
	No.	**Percentage**
1-2 years	23	6%
3-4 years	100	26%
5-6 years	131	35%
7-8 years	82	22%
9-10 years	25	7%
11 years or above	18	5%

Table 21 – Respondent Demographics – Region

Respondent Demographics – Region		
	No.	**Percentage**
Beijing	104	26%
Shanghai	113	28%
Guangzhou	84	21%
Shenzhen	99	25%

6.3 Measurement Model

Tests and metrics were conducted and evaluated to assess the validity of the measurement model. First, a CFA was used to validate the factor structure of the focal constructs of the research model. I estimated a measurement model that included all the latent variables in this research model (i.e., work overload, work–home conflict, invasion of privacy, role ambiguity, job insecurity, TCA, TTA, and work performance) using Mplus 5.0 (Muthén and Muthen 2007). All the factor loadings were statistically significant, as shown in Table 22.

Table 22 – Factor Loadings

Factor Loadings		
Construct	**Items**	**Factor Loadings**
Work Overload	WO1	0.702**
	WO2	0.847**
	WO3	0.810**
Work-Home Conflict	WHC1	0.757**
	WHC2	0.869**
	WHC3	0.802**
Invasion of Privacy	IoP1	0.824**
	IoP2	0.875**
	IoP3	0.828**
	IoP4	0.807**
Role Ambiguity	RA1	0.817**
	RA2	0.852**
	RA3	0.804**
	RA4	0.807**
Job Insecurity	JI1	0.711**
	JI2	0.871**
	JI3	0.815**
Technostress Challenge Appraisal	TCA1_1	0.679**
	TCA1_2	0.764**
	TCA1_3	0.756**
	TCA1_4	0.831**
	TCA2_1	0.721**
	TCA2_2	0.751**
	TCA2_3	0.667**

	TCA2_4	0.631**
Technostress Threat Appraisal	TTA1	0.847**
	TTA2	0.877**
	TTA3	0.863**
	TTA4	0.851**
	TTA5	0.860**
Work Performance	WP1	0.751**
	WP2	0.759**
	WP3	0.777**
	WP4	0.761**

** p-value <= 0.01

Moreover, the measurement model generated good fit indices. All the common metrics, including Chi-square/degree of freedom ($\chi2/df$), CFI, TLI, RMSEA, and SRMR, passed the corresponding threshold values (Browne and Cudeck 1992; Kline 2016). Table 23 presents the goodness-of-fit indices of the measurement model. Therefore, the validity of the factor structure is supported by the CFA.

Table 23 – Goodness-of-Fit Indices for the Measurement Model

Goodness-of-Fit Indices for the Measurement Model							
Model	**χ2**	**df**	**χ2/df**	**CFI**	**TLI**	**RMSEA**	**SRMR**
Hypothesized Measurement Model)	1180.612	497	2.375	0.924	0.914	0.059	0.059
Recommended Value	NIL	NIL	≦ 3	≧ 0.9	≧ 0.9	≦ 0.1	≦ 0.1

Second, I examined the reliability and the AVE of each construct to assess their convergent validities (Barclay et al. 1995; Chin 1998). Table 24 shows the Cronbach's alpha, AVE, and CR of the research constructs. The reliability of the constructs was assessed by examining Cronbach's alpha and CR. The Cronbach's alpha and CR of a construct were acceptable if they exceed 0.7 (Fornell and Larcker 1981). For all the research constructs in this study, the Cronbach's alphas and CR were higher than 0.8, and some even exceeded 0.9. Meanwhile, the AVE reflects the variance captured by indicators relative to the measurement error (Fornell and Larcker 1981; Thatcher and Perrewe 2002). The AVE of a construct is acceptable if it is higher than or equal to 0.5 (Barclay et al. 1995). The AVEs of all research constructs have values higher than 0.5. Thus, the convergent validities of the research constructs are supported.

Table 24 – Reliability and Average Variance Extracted

Reliability and Average Variance Extracted			
	Cronbach's Alphas	**AVE**	**Composite Reliability**
Invasion of Privacy	0.90	0.77	0.93
Job Insecurity	0.84	0.76	0.90
Role Ambiguity	0.89	0.75	0.92
Technostress Challenge Appraisal	0.85	0.77	0.89
Technostress Threat Appraisal	0.93	0.79	0.95
Work-home Conflict	0.85	0.76	0.91
Work Overload	0.83	0.74	0.90
Work Performance	0.85	0.68	0.90

Finally, the discriminant validities of the research constructs were examined by comparing the square root of the AVE of each construct with the correlations among the focal construct and other constructs (the former metric must be larger than the latter) (Chin 1998). Table 25 presents both the correlations of constructs and the square roots of AVE. Results support the discriminant validities of the research constructs.

Table 25 – Correlation of Constructs and Square Root of Average Variance Extracted

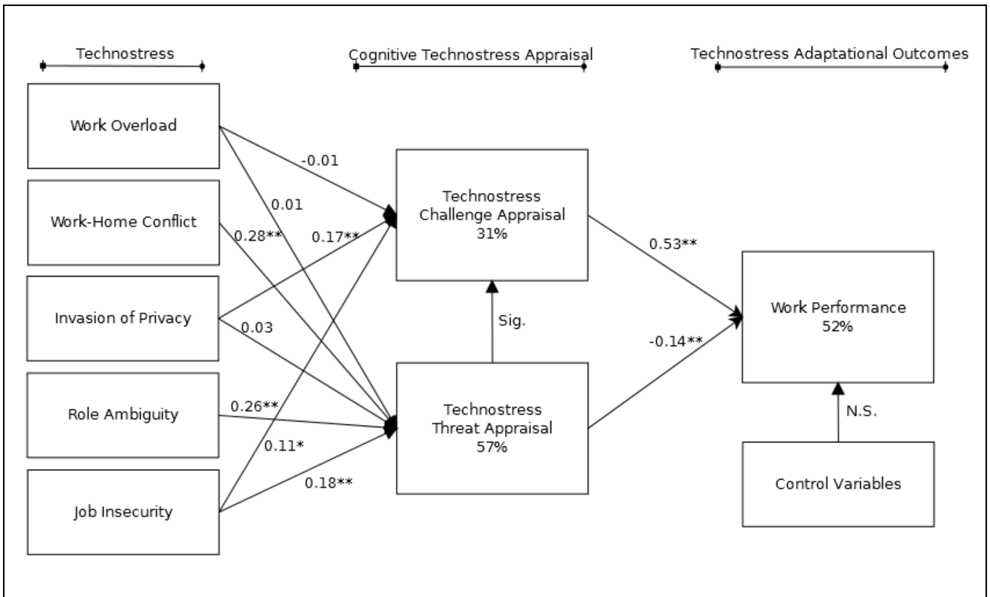
Correlation of Constructs and Square Root of Average Variance Extracted								
Construct	**TCA**	**TTA**	**WO**	**WHC**	**IoP**	**RA**	**JI**	**WP**
TCA	**0.88**							
TTA	0.01	**0.89**						
WO	0.12	0.46	**0.86**					
WHC	0.11	0.64	0.62	**0.87**				
IoP	0.18	0.49	0.48	0.62	**0.88**			
RA	0.16	0.65	0.50	0.63	0.62	**0.87**		
JI	0.16	0.57	0.48	0.54	0.55	0.61	**0.87**	
WP	0.66	-0.13	-0.04	-0.07	0.01	-0.06	0.04	**0.82**

*WO = work performance; WHC = work-home conflict; IoP = invasion of privacy; RA = role ambiguity; JI = job insecurity; WP = work performance

6.4 Structural Model

The hypothesized model shown in Figure 2 was tested by using the measurement model validated in the previous section. The structural model was tested using SmartPLS 2.0 (Ringle et al. 2005), a software implementing the PLS-SEM. I performed the bootstrapping procedure to generate t-statistics, which were then used to evaluate the statistical significance of the paths. Results of the structural model are presented in Figure 3.

Figure 3 – Structural Model with Results



Structural Model with Results

Sig. – Significant; N.S. – Non significant; *p < 0.05; **p < 0.01

Two approaches can use MLMVs to control for the CMB (Chin et al. 2013): construct level correction (CLC) and item level correction (ILC). Both approaches can effectively eliminate the effects of potential CMB on the structural model.

However, each approach has its advantages. Stated briefly, the CLC approach can obtain a more accurate estimate of structural paths at the expense of accurate item loadings, whereas using ILC can obtain more item loadings at the expense of an accurate estimate of structural paths (Chin et al. 2013). Given this study's interest in obtaining an accurate estimate of structural paths, I decided to use the CLC approach. To implement the CLC approach, I created as many formative CMB control constructs, that is, MLMVs, as there are research constructs in the model, and used those MLMVs in the research model as the control variable for each research construct.

None of the control variables significantly affected work performance, except for TTA, which was significantly and positively related to TCA ($\beta = -0.15$; $p < 0.01$). Therefore, although a large proportion of respondents are from the ICT industry, because the industry does not significantly affect work performance, the effects of industry on the model are unlikely to pose a concern. After controlling for the control variables and CMB, the R-squares of work performance, TCA, and TTA were obtained. They were 0.52, 0.31, and 0.57, respectively.

TCA also demonstrated a statistically significant, positive relationship with work performance ($\beta = 0.53$; $p < 0.01$). ICT users who made more TCA were more likely to report higher levels of work performance, thus supporting H1. Conversely, TTA demonstrated a statistically significant, negative relationship with work performance ($\beta = -0.14$; $p < 0.01$). ICT users who made more TTA were more likely to report lower levels of work performance, thus supporting H2.

Surprisingly, work overload failed to demonstrate statistically significant relationships with both TCA and TTA. In this sample, ICT users who experienced higher levels of work overload were no more likely to report higher levels of TCA (β

= -0.01; $p > 0.05$) and TTA ($\beta = 0.01$; $p > 0.05$). Therefore, H3a and H3Bb were not supported.

Work–home conflict demonstrated a statistically significant, positive relationship with TTA ($\beta = 0.28$; $p < 0.01$). In this sample, ICT users who experienced an increased level of work–home conflict were more likely to report higher levels of TTA, thus supporting H4.

Invasion of privacy demonstrated a statistically significant, positive relationship with TCA ($\beta = 0.17$; $p < 0.01$). In this sample, ICT users who experienced increased levels of invasion of privacy were more likely to report higher levels of TCA, thus supporting H5a. However, invasion of privacy did not demonstrate a statistically significant relationship with TTA ($\beta = 0.03$; $p > 0.05$). ICT users who experienced higher levels of invasion of privacy were no more likely to report higher levels of TTA. Therefore, H5b was not supported.

Role ambiguity demonstrated a statistically significant, positive relationship with TCA ($\beta = 0.26$; $p < 0.01$). In this sample, ICT users who experienced higher levels of role ambiguity were more likely to report higher levels of TTA, thus supporting H6.

Job insecurity demonstrated a statistically significant, positive relationship with TCA ($\beta = 0.11$; $p < 0.05$). In this sample, ICT users who experienced increased levels of role ambiguity were more likely to report higher levels of TCA, thus supporting H7a. Job insecurity also demonstrated a statistically significant, positive relationship with TTA ($\beta = 0.18$; $p < 0.01$). In this sample, ICT users who experienced high levels of role ambiguity were more likely to report higher levels of TTA, thus supporting H7b. The summary of hypothesis testing is presented in Table 26.

Table 26 – Summary of Hypothesis Testing

Summary of Hypothesis Testing	
Hypotheses	**Supported**
H1: TCA will increase the level of work performance ($\beta = 0.53; p < 0.01$)	Yes
H2: TTA will decrease the level of work performance ($\beta = -0.14; p < 0.01$)	Yes
H3a: Work overload will increase the level of TCA ($\beta = -0.01; p > 0.05$)	No
H3b: Work overload will increase the level of TTA ($\beta = 0.01; p > 0.05$)	No
H4: Work-home conflict will increase the level of TTA ($\beta = 0.28; p < 0.01$)	Yes
H5a: Invasion of privacy will increase the level of TCA ($\beta = 0.17; p < 0.01$)	Yes
H5b: Invasion of privacy will increase the level of TTA ($\beta = 0.03; p > 0.05$)	No
H6: Role ambiguity will increase the level of TTA ($\beta = 0.26; p < 0.01$)	Yes
H7a: Job insecurity will increase the level of TCA ($\beta = 0.11; p < 0.05$)	Yes
H7b: Job insecurity will increase the level of TTA ($\beta = 0.18; p < 0.01$)	Yes

Chapter 7 Discussions

TTS is widely employed in current technostress literature, yet cognitive stress appraisal, an important component of TTS, has seldom been incorporated in empirical technostress studies. The adaptation of cognitive stress appraisal into the technostress context, CTA, is necessary because it facilitates the prediction of TAOs. The present research set out to incorporate CTA in literature and investigate how various types of technostress experienced by an ICT user would affect his/her work performance. Therefore, rather than examining the direct effects of various types of technostress on work performance, this research focused on examining how various types of technostress experienced by an ICT user would lead to different CTA, namely, TCA and TTA, and in turn affect his/her work performance. Several important and interesting findings concerning the relationships among different types of technostress and work performance emerged from this study.

Not surprisingly, the findings reveal that job insecurity, work–home conflict, and role ambiguity caused by work-related ICT use lead to increased levels of TTA, and consequently, to a lower level of work performance. These findings are consistent with the current technostress literature, which mainly leads to unfavorable outcomes. For example, Ragu-Nathan et al. (2008) and Tarafdar et al. (2007; 2010; 2011) proposed and found that technostress would lead to lower levels of job satisfaction, ICT performance, ICT satisfaction, organizational commitment, and a higher level of role stress.

However, the findings reveal that job insecurity, together with the invasion of privacy from work-related ICT use, leads to a higher level of TCA, which then increases the level of work performance. These findings extend our understanding on the positive TAOs and how technostress could generate them. These findings challenge the implicit assumption of mainstream technostress literature that technostress would only lead to unfavorable TAOs (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008). The findings regarding job insecurity caused by work-related ICT use are particularly important, as they imply that particular types of technostress would simultaneously lead to favorable and unfavorable TAO. This finding is also consistent with the findings in the traditional literature that a person may make both challenge and threat appraisals after encountering particular stresses (Webster et al. 2011).

However, this sample failed to show that invasion of privacy caused by work-related ICT use is positively related to TTA. Although this is beyond my expectations, the results do confirm the findings in the previous literature. For example, in Ayyagari et al. (2011), invasion of privacy did not significantly relate to unfavorable TAO. Perhaps this is because people are willing to sacrifice a certain level of privacy in order to gain benefits in return; as long as there are explicit benefits, ICT users may ignore the threats posed by the invasion of privacy (Han and Maclaurin 2002; Zhao et al. 2008).

Contrary to my expectations, the work overload caused by work-related ICT use was found unrelated to both TCA and TTA. A plausible reason is that work overload caused by such ICT use may have curvilinear relationships with both TCA and TTA, that is, the positive effects of work overload on both TCA and TTA would diminish and, up to a certain point, effects of work overload on both TCA and TTA would become negative. In traditional stress literature, the workload has curvilinear relationships with a number of work outcomes, such as individual learning (van

Ruysseveldt and van Dijke 2011), job performance, and job satisfaction (Janssen 2001). Future studies may seek to investigate empirically whether certain types of technostress would have curvilinear relationships with TCA and TTA. The unexpected findings may also caused by the conceptualization of work overload in this study. In the literature of organizational behavior, work overload is usually broken down into two components: qualitative and quantitative overload. Qualitative and quantitative overload are different in nature, i.e., one is usually treated as a challenge whether another is usually treated as a threat (Cordes and Dougherty 1993; LePine et al. 2004). Therefore, the two components may offset the effects of each other, and not separating the two components may lead to insignificant findings.

Chapter 8 Research Contributions

This chapter describes the theoretical contributions as well as the practical implications of the findings of this dissertation. The theoretical contributions are first discussed. Although this dissertation is academic oriented, the findings also generate practical implications that organizations may pay attention to.

8.1 Theoretical Contributions

This research study has several theoretical contributions. First, the study fully incorporates the concept of CTA into technostress literature and uses this concept to explore the positive aspects of technostress, something which has long been ignored in technostress literature. Although Califf et al. (2015) partially incorporated the concept of CTA into their research model, their study only tested the relationship between technostress and TTA, and not the relationship between technostress and TCA. Instead of testing the relationship between technostress and TCA, their study tested the relationship between technological characteristics and TCA. Therefore, their research model only explored the advantages of certain technological characteristics of ICTs, but not the advantages of technostress. This research shows that invasion of privacy and job insecurity caused by work-related ICT use positively affect TCA, which in turn leads to an increased level of work performance. Therefore, our understanding of the outcomes of technostress is deepened.

Second, this study demonstrated that different types of technostress have different natures and, accordingly, have different effects on the same set of TAOs.

Certain types of technostress caused by work-related ICT use (e.g., job insecurity) could affect work performance both positively and negatively. Conversely, there are also types of technostress (e.g., role ambiguity and work–home conflict) caused by work-related ICT use that only lead to unfavorable TAOs. The current research identifies the types of technostress that will be beneficial and those that will be counterproductive, suggesting that researchers should not simply assume uniformity among all types of technostress and always treat different types of technostress as holistic constructs with multi-dimensions.

Third, this paper contributes to TTS literature by empirically demonstrating that certain types of technostress would be simultaneously appraised as both challenge and threat. Although TTS suggests that stress would be appraised as both challenge and threat, most of the stress studies proposed that stress would only lead to either challenge or threat appraisal, and few studies group some stresses as challenge stress and others as threat stress (e.g., Podsakoff et al. 2007; Webster et al. 2010). Only Webster et al. (2011) provided empirical supports for such claim. This study provided additional support for the claim, as it found that the job insecurity caused by work-related ICT use would positively affect both TCA and TTA. This outcome suggests that researchers should not assume that stresses would only be appraised as either challenge or threat, as some of them may be appraised as both at the same time. The above assumption may likewise hinder us from knowing the true nature of stresses.

Fourth, this study have contributed to the literature by the conceptualization and operationalization of the TCA and TTA. Although few studies has attempted to use incorporate TCA and TTA into the investigation of technostress, these two constructs has never been formally conceptualized and operationalized (Califf et al.

2015; Lei and Ngai 2014). However, without a well-validated measurement scale, the validity and reliability of the results of empirical studies cannot be guaranteed. A formal conceptualization and operationalization of TCA and TTA are necessary to value the cumulative tradition of the IS discipline because a measurement scale with "*high degrees of validity and reliability is a prerequisite for the beginning of a cumulative tradition*" (Moore and Benbasat 1991, p. 193).

Finally, this study fully explored the relationship between technostress and TAOs. Previous technostress studies tend to posit the direct relationship between technostress and TAO. However, those studies provide us with very limited knowledge on how TAO would be affected by technostress. The present study found that different types of technostress lead to different types of CTA, namely, TCA and TTA, which in turn affect work performance differently. When the concept of CTA is incorporated, TTS can be used as a lens to examine the mechanisms of how each type of technostress would lead to different TAO.

8.2 Practical Implications

I believe the findings can provide three main practical contributions to organizations and managers. First, this study can potentially help organizations establish better policies to handle technostress. When technostress is assumed to be negative in nature, current technostress literature can only generate suggestions to reduce the level of technostress experienced by employees. However, reducing the level of technostress may also reduce the technostress appraised as a challenge, an effect that is beneficial to organizations. This study provides organizations the implications of the study with which organizations can maximize the positive effects and minimize the negative effects of technostress. For example, organizations may intervene on how technostress is appraised by employees, that is, organizations may assist employees to conduct TCA instead of TTA, by convincing employees that technostress is surmountable, and overcoming technostress would lead to achievements.

Second, the findings can provide insights for managers and system designers by investigating how ICT users will appraise different types of technostress. For organization managers, such knowledge can help them establish strategies and policies to maintain an adequate level of invasion of privacy and job insecurity, and a low level of role ambiguity and work–home conflicts created by ICT use for work. These strategies and policies can lead to a high level of TCA and a lower level of TCA. Subsequently, favorable TAO will be achieved because TCA leads to a favorable TAO, whereas TTA leads to unfavorable TAO. As various technological characteristics lead to technostress, systems designers can help ICT users increase their levels of TCA and reduce their levels of TTA by selecting characteristics that will lead to the type of technostress that can be appraised as a challenge while eliminating technostress that can be appraised as a threat. Therefore, systems designers can help ICT users improve their productivity levels and ICT and job satisfaction by designing ICT devices.

Third, managers can use the measurement scales of TCA and TTA to investigate the technostress of their employees as well as to understand whether such technostress is positively or negatively appraised. The existing measurement scales of technostress can only be used to identify the types of technostress that are experienced by employees, such as techno-overload or techno-insecurity. However, these measurement scales cannot accurately predict the outcomes of such technostress. Given that the measurement scales of TCA and TTA can help managers predict the outcomes of technostress experienced by employees, these scales can also help them in implementing early and proactive interventions to technostress that can also prevent negative TAOs.

Chapter 9 Conclusions and Limitations

This chapter first presents the limitations of the study as well as the potential solutions to these limitations. Moreover, the future research opportunities enabled by the findings of this dissertation are articulated. Finally, the conclusions of the study are provided in this chapter.

9.1 Limitations and Future Research

The primary limitation of this study relates to its external validity. The data were collected from PRC; therefore, it might limit the generalizability of the study to other populations. Future studies should seek to assess the extent to which the study's findings are applicable in the workplaces in other countries.

Another limitation is that the study employed cross-sectional data to validate the research model, which may potentially suffer from CMB. However, both procedural and statistical remedies were applied to handle to potential effects of CMB, including the MLMV approach provided by Chin et al. (2013), who claimed it could reduce the effects of CMB by 100%. Moreover, cross-sectional data cannot provide any proof for causal directions. Therefore, future studies may use experiments or quasi-experiments to validate the causal directions of the research model and replicate the results of this study.

The third limitation is that the study assumes linear relationships among technostress, TCA, and TTA. However, certain studies have proposed that the relationships between stresses and their outcomes are curvilinear (e.g., Jamal 1985; Janssen 2001). This proposed relationship is one of the possible reasons this study failed to find support for some of the hypotheses, as this phenomenon may also happen in technostress. Future studies should be conducted to investigate the nature of the relationship among technostress, TCA, and TTA, specifically ascertaining whether it is linear or curvilinear.

This study also highlighted some opportunities for future research studies on technostress. First, although the study found significant relationships among different types of technostress, TCA and TTA, the variances of TCA and TTA experienced by the types of technostress studied here are 0.31 and 0.57 respectively. This finding suggests that other types of technostress would contribute to the development of TCA and TTA. Future studies may explore the effects of different types of technostress, which are the key factors affecting the favorability of TAOs. Exploring the effects of different types of technostress on TCA and TTA can enlighten us about the true nature of technostress. Future studies may also investigate the effects of different technological characteristics of ICTs on TCA and TTA, whereby the findings may potentially help system designers improve the TAOs of ICT users by modifying the technological characteristics of ICTs.

Second, future studies may also explore the effects of the personal characteristics of ICT users on TCA and TTA. This may potentially help managers identify employees who are more likely to suffer from unfavorable TAOs. Once identified, interventions can be used to improve the favorability of their TAOs.

Third, it would be useful to investigate how TAOs could be favorably affected by organizational interventions (that is, the widely studied technostress inhibitors) such as involvement facilitation, innovation support, technical support provision, and literacy facilitation. Whether these organizational interventions would directly affect TAOs, or affect TAOs through other mechanisms remains unclear. For example, it is possible that organizational interventions can directly reduce the level of technostress experienced by an ICT user, or affect the level of TCA and TTA. If organizational interventions are found to directly reduce the technostress of an ICT user, such findings should be used with caution, as some of the technostress may generate favorable TAOs.

Fourth, future studies may investigate how ICT users cope with the technostress experienced. Exploratory studies using focus groups, interviews, and grounded theory approach can be conducted to investigate individual ICT users' coping responses that are specific to technostress. The results can consequently contribute to both technostress and traditional literature by promoting a new set of coping responses. Moreover, the findings will provide reliable information based on coping responses exclusive to technostress. Such knowledge can be used to conceptualize the coping responses specific to technostress and develop their corresponding measurements.

Last but not least, future studies may focus on the technostress triggered by a particular type of ICTs. The results of this study can be regarded as the starting point for our explorations on the effects of technostress through the lens of TTS in a general sense, as this study investigates the effects of technostress triggered by the general ICTs that people use for work purpose. Since different types of ICTs have different characteristics and natures, the technostress triggered by a particular type of ICT may be different from the technostress triggered by other types of ICTs. For example, the technostress triggered by social media might be different from the technostress triggered by collaborative software, as the former is more hedonic in nature.

9.2 Conclusions

The study identified the research gaps based on the review of technostress literature. Consequently, I believe that the incorporation of CTA is a plausible solution to fill those research gaps. A research model and a set of hypotheses were developed in this study incorporating the idea of CTA. This study would serve as the initial step toward CTA adaptation in the technostress context. It is believed that this research provides a useful method of understanding how technostress would affect TAO. Empirical tests were conducted to validate the research model, and most of the hypotheses were supported. Based on the findings, this study breaks the ground for future studies by using the concept of CTA to investigate the double-edged nature of technostress. I expect this research would promote further study on the nature of technostress.

Appendix A – The Four-Phase Instrument Development

Appendix B – Roles of Participants of Different Phases of the Measurement Development Process

Phase	**Participants**	**No. of Participants**	**Roles**
Card Sorting Exercise	Ph.D. and MBA students with full-time employment	11	Assess the construct validity of the initial items
Pilot Test	Part-time MBA students with full-time employment	49	Provide comments on the instrument; respond to the survey in the pilot test
Final Test	Part-time MBA students with full-time employment	152	Respond to the final survey

Appendix C – Card Sorting Procedures

Each item from the initial pool was printed on a separate index card (3 × 5 inches). Each pile contained 43 index cards that were grouped according to their code numbers. A different panel of judges was assigned for each round of the card sorting exercises. In the first three rounds, the panel comprised four research students who were pursuing their Ph.D. degrees in universities in Hong Kong. These students were mainly from the fields of organizational behavior and IS. In the fourth round, the panel comprised three MBA students enrolled in a university in Hong Kong. All of these students were serving as managers of their respective organizations. I employed practitioners as judges to ensure the generalizability of the sorting results.

Both the open and closed card sorting exercises involved two sections, namely, individual and panel sorting. In the individual section, the judges were required to perform the card sorting task individually, whereas, in the panel section, the judges were required to perform the task collaboratively. Before the formal card sorting exercise, I asked a separate researcher to perform the card sorting task to ensure the validity of the card sorting procedure and the understandability of the instructions. A trial sorting exercise was conducted before each round of card sorting exercises to ensure that the judges understood the instructions and knew how to perform their card sorting task. Table D shows the items for the trial sorting.

Table D. Test Items for Trial Sorting

Test Items	**Sources of Items**
This product is probably more advanced than any other similar product.	Brown and Dacin (1997)

This product probably features advanced components.	Brown and Dacin (1997)
This product is sophisticated.	Brown and Dacin (1997)
This product is socially responsible.	Brown and Dacin (1997)
This product has more benefits to the society's welfare than other products.	Brown and Dacin (1997)
This product contributes to society.	Brown and Dacin (1997)
This product is complex.	Claudy et al. (2011)
This product is difficult to use.	Claudy et al. (2011)
This product requires much knowledge.	Claudy et al. (2011)
The product is surprising.	Created*
The product is well-designed by a poor designer.	Created*
This fair trade product has many advanced features.	Created*

*These items are created by the authors and are deliberately constructed to be ambiguous.

Open Card Sorting (First and Third Rounds)

In the individual section of the open card sorting round, each judge was given a pile of blank index cards and another pile of item cards that were printed with the initial pool of items. Each judge was asked to conduct his/her sorting task individually. During the sorting process, the judges were required to sort the item cards into separate piles according to their perceived underlying constructs. If the item was too ambiguous or could fit in more than one group, the judges were to place these cards in a separate pile, write "too ambiguous/doesn't fit" on a blank card, and place this card on top of the pile of ambiguous cards. After sorting the item cards into piles, the judges were required to name each pile of item cards and provide a set of statements that described the overall meaning of each pile, except for the pile of ambiguous item cards. In the panel section, the same judges were asked to perform the same sorting procedure on the same set of items collaboratively.

Closed Card Sorting (Second and Fourth Rounds)

In the individual section of the closed card sorting, each judge was given a pile of item cards and three envelopes. Except for those envelopes that were labeled "too ambiguous/doesn't fit," each envelope was given a name of a construct and its corresponding definition. Each judge was asked to conduct his/her sorting task individually. They were then asked to match the item cards with the envelopes according to their names and definitions of constructs and then place these item cards into the corresponding envelopes. The item cards that contained items that were too ambiguous or could fit into more than one envelope were placed into an envelope that was labeled "too ambiguous/doesn't fit." In the panel section, the same judges were required to perform the same sorting procedure on the same set of items collaboratively.

Inter-Rater Reliabilities and Item Placement Ratios

The inter-rater reliabilities of the sorting procedure were assessed by using two measures, namely, Cohen's kappa and item placement ratio (Moore and Benbasat 1991). Cohen's kappa was employed to reflect the level of agreement on the results of the card sorting for each pair of judges. The level of agreement would be considered acceptable if the Cohen's kappa exceeded 0.65 (Moore and Benbasat 1991).

The item placement ratios of the individual and panel sections were calculated for each round of item sorting. The item placement ratio refers to the ratio between the number of items included in their intended groups and the number of items sorted in the sorting round. A high item placement ratio guarantees a high degree of inter-judge agreement.

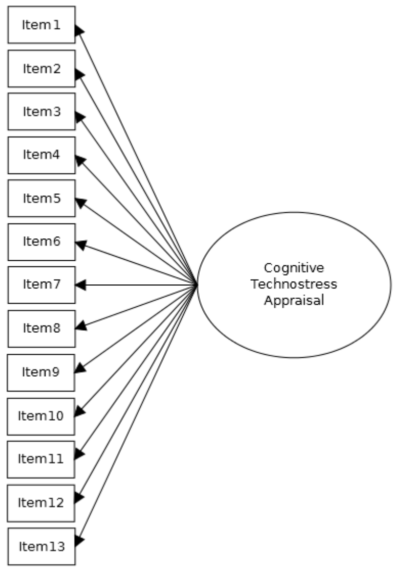
Appendix D – Results of Card Sorting Exercises

Table E1. Inter-Judge Agreements				
Agreement Measure	**Round 1**	**Round 2**	**Round 3**	**Round 4**
Raw Agreement	0.93	0.91	0.93	0.66
	0.91	0.70	0.86	0.55
	0.93	0.86	0.79	0.59
	0.93	0.72	0.79	N/A
	0.95	0.88	0.76	N/A
	0.98	0.74	0.72	N/A
Average	0.94	0.80	0.81	0.60
Cohen's Kappa	0.86	0.83	0.89	0.49
	0.82	0.45	0.80	0.36
	0.86	0.75	0.69	0.40
	0.86	0.46	0.69	N/A
	0.91	0.78	0.63	N/A
	0.95	0.53	0.59	N/A
Average	0.88	0.63	0.72	0.42

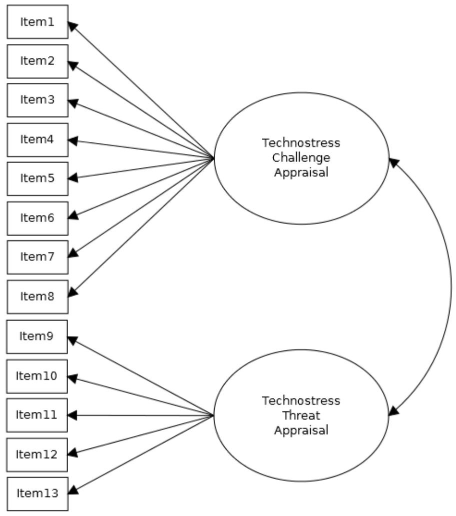
Table E2. Placement Ratio Summary				
Individual Section				
Placement Ratios	Round 1	Round 2	Round 3	Round 4
Technostress Challenge Appraisal	94%	88%	NA	NA
	NA	NA	58%	44%
	NA	NA	83%	65%
Technostress Threat Appraisal	97%	91%	98%	93%

Average	95%	90%	85%	74%
Panel Section				
Placement Ratios	Round 1	Round 2	Round 3	Round 4
Technostress Challenge Appraisal	91%	95%	NA	NA
	NA	NA	100%	67%
	NA	NA	78%	89%
Technostress Threat Appraisal	95%	95%	100%	93%
Average	88%	95%	93%	86%

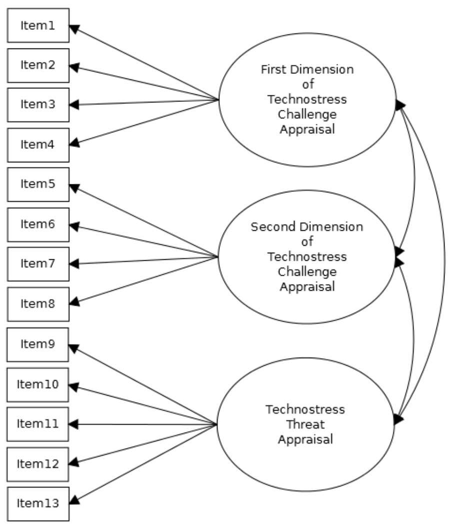
Appendix E – Competing Models for TCA and TTA



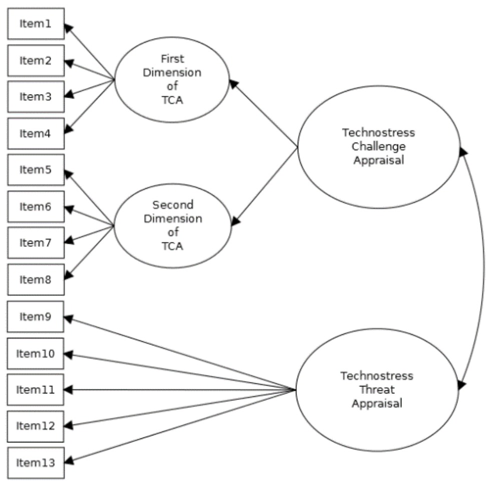
Model 1. One-Factor First-Order Model



Model 2. Two First-Order Factors



Model 3. Three First-Order Factors



Model 4. A First-Order Factor and a Second-Order Factor with Two Second-Order Factors (Hypothesized Model)

Appendix F – Details about the Online Survey Company

The online panel agent that distributed the questionnaire for this study is an online survey company based in the People's Republic of China (China) with over 1 million registered panelists. It profiles the registered panelists by 27 attributes, including gender, age, profession, income, and industry. The panelists come from different cities of China. Every registered panelist has gone through a comprehensive registration process, and the email address, IP address, and mobile phone numbers of applicants have been verified to prevent multiple registrations.

Online surveys reach the targeted respondents through the following mechanisms. The agent sends invitations to registered panelists whose attributes fit the requirements of the online survey. If the 27 attributes saved in the database do not fully cover the attributes of the targeted participants, the agent will use screening questions to exclude the non-targeted participants.

To encourage registered panelists to participate in the online surveys, incentive points are given for participation. The accumulated incentive points can be exchanged for different types of gifts. Upon finishing a survey, each registered panelist who participates in the survey is assigned an integrity score based on the quality of his responses to the survey. Registered panelists who continuously obtain low integrity scores will have their accounts deactivated and can no longer receive invitations for surveys.

To ensure the quality of the responses, the agent takes two main measures. First, it limits access to the online surveys, that is, only the invited registered panelists can respond to the focal questionnaire, and each registered panelist is allowed to respond to each questionnaire once. Second, it matches the demographic data provided by the survey responses with the registered information of the registered panelists. If the demographic data does not match the registered information, then the corresponding response is removed from the dataset.

Owing to the features of the agent, this study used its panel service to collect data. Using the online panel agent particularly helped us reach sample frame requirements by sending invitations to a representative random sample whose attributes matched the characteristics of the targeted respondents. This goal can hardly be achieved using a traditional questionnaire. Screening questions enable us to implement a precise sample framework as well.

The targeted respondents were individuals in full-time employment who use ICTs for work purposes. The sample frame did not set any restriction on the occupation, industry, and post in the organization. Therefore, the following two screening questions were developed:

1. Do you work full time?
2. Do you need to use information and communication technologies for work purposes?

Respondents were also provided examples of ICTs as follows:

- Mobile technologies [cell phone, smartphone, pager, laptop, personal digital assistant (PDA)]
- Network technologies (Internet, Intranet, VPN)
- Communication technologies (e-mail, voice mail)
- Enterprise and database technologies (PeopleSoft®, SAP®, Oracle® applications)

- Generic application technologies (word processing, spreadsheet, presentation)
- Collaborative technologies (instant messaging, video conferencing, teleconferencing)
- Other work-specific technologies

**Technostress, the stress caused by work-related ICT use, is the state of mental or physiological stimulation caused by heavy usage of ICTs for professional purposes, which is usually attributed to increasing work overload, accelerated tempo, and erosion of personal time, among others.

References

Acquisti, A., and Grossklags, J. 2005. "Privacy and Rationality in Individual Decision Making," *IEEE Security and Privacy Magazine* (3:1), pp. 26-33.

Ahmad, M. M. 2005. "Psychometric Evaluation of the Cognitive Appraisal of Health Scale with Patients with Prostate Cancer," *Journal of Advanced Nursing* (49:1), pp. 78-86.

Aiello, J. R., and Shao, Y. 1993. "Electronic Performance Monitoring and Stress: The Role of Feedback and Goal Setting," in *Human-Computer Interaction: Applications and Case Studies,* M.J. Smith and G. Salvendy (eds.). Amsterdam: Elsevier Science Publishers, pp. 1011-1016.

Alge, B. J. 2001. "Effects of Computer Surveillance on Perceptions of Privacy and Procedural Justice," *Journal of Applied Psychology* (86:4), pp. 797-804.

Armstrong, J. S., and Overton, T. S. 1977. "Estimating Nonresponse Bias in Mail Surveys," *Journal of Marketing Research* (14:3), pp. 396-402.

Arnetz, B. B., and Wiholm, C. 1997. "Technological Stress: Psychophysiological Symptoms in Modern Offices," *Journal of Psychosomatic Research* (43:1), pp. 35-42.

Ayyagari, R. 2012. "Impact of Information Overload and Task-Technology Fit on Technostress," *Southern Association for Information Systems Conference*, Atlanta, GA, USA, pp. 18-22.

Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: Technological Antecedents and Implications," *MIS Quarterly* (35:4), pp. 831-858.

Baer, M., and Oldham, G. R. 2006. "The Curvilinear Relation between Experienced Creative Time Pressure and Creativity: Moderating Effects of Openness to Experience and Support for Creativity," *Journal of Applied Psychology* (91:4), pp. 963-970.

Barclay, D., Higgins, C., and Thompson, R. 1995. "The Partial Least Squares (PLS) Approach to Causal Modeling: Personal Computer Adoption and Use as an Illustration," *Technology Studies* (2:2), pp. 285-309.

Barley, S. R., Meyerson, D. E., and Grodal, S. 2010. "E-Mail as a Source and Symbol of Stress," *Organization Science* (22:4), pp. 887-906.

Baron, R. M., and Kenny, D. A. 1986. "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations," *Journal of Personality and Social Psychology* (51:6), pp. 1173-1182.

Beaudry, A., and Pinsonneault, A. 2005. "Understanding User Responses to Information Technology: A Coping Model of User Adaptation," *MIS Quarterly* (29:3), pp. 493-524.

Bélanger, F., and Crossler, R. E. 2011. "Privacy in the Digital Age: A Review of Information Privacy Research in Information Systems," *MIS Quarterly* (35:4), pp. 1017-1041.

Benbasat, I., and Moore, G. C. 1992. "Development of Measures for Studying Emerging Technologies," *the 25th Hawaii International Conference*: IEEE, pp. 315-324.

Benbasat, I., and Zmud, R. W. 2003. "The Identity Crisis within the IS Discipline: Defining and Communicating the Discipline's Core Properties," *MIS Quarterly* (27:2), pp. 183-194.

Bhattacherjee, A. 2001. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), pp. 351-370.

Black, S. E., and Lynch, L. M. 2001. "How to Complete: The Impact of Workplace Practices and Information Technology on Productivity," *The Review of Economics and Statistics* (83:3), pp. 434-445.

Boswell, W. R., Olson-Buchanan, J. B., and LePine, M. A. 2004. "Relations between Stress and Work Outcomes: The Role of Felt Challenge, Job Control, and Psychological Strain," *Journal of Vocational Behavior* (64:1), pp. 165-181.

Bradley, G. 2000. "The Information and Communication Society: How People Will Live and Work in the New Millennium," *Ergonomics* (43:7), pp. 844-857.

Brockner, J., Grover, S., Reed, T. F., and Dewitt, R. L. 1992. "Layoffs, Job Insecurity, and Survivors' Work Effort: Evidence of an Inverted-U Relationship," *Academy of Management Journal* (35:2), pp. 413-425.

Brown, T. J., and Dacin, P. A. 1997. "The Company and the Product: Corporate Associations and Consumer Product Responses," *Journal of Marketing* (61:1), pp. 68-84.

Browne, M. W., and Cudeck, R. 1992. "Alternative Ways of Assessing Model Fit," *Sociological Methods & Research* (21:2), pp. 230-258.

Califf, C., Sarker, S., Sarker, S., and Fitzgerald, C. 2015. "The Bright and Dark Sides of Technostress: An Empirical Study of Healthcare Workers," in:

Thirty Sixth International Conference on Information Systems. Forth Worth.

Calisir, F., and Calisir, F. 2004. "The Relation of Interface Usability Characteristics, Perceived Usefulness, and Perceived Ease of Use to End-User Satisfaction with Enterprise Resource Planning (ERP) Systems," *Computers in Human Behavior* (20:4), pp. 505-515.

Cavanaugh, M. A., Boswell, W. R., Roehling, M. V., and Boudreau, J. W. 2000. "An Empirical Examination of Self-Reported Work Stress among U.S. Managers," *Journal of Applied Psychology* (85:1), pp. 65-74.

Chin, W. W. 1998. "The Partial Least Squares Approach to Structural Equation Modeling," in *Modern Methods for Business Research,* G.A. Marcoulides (ed.). Mahwah, N.J.: Lawrence Erlbaum, pp. 295-336.

Chin, W. W., Thatcher, J. B., and Wright, R. T. 2012. "Assessing Common Method Bias: Problems with the ULMC Technique," *MIS Quarterly* (36:3), pp. 1003-1019.

Chin, W. W., Thatcher, J. B., Wright, R. T., and Steel, D. 2013. "Controlling for Common Method Variance in PLS Analysis: The Measured Latent Marker Variable Approach," in *New Perspectives in Partial Least Squares and Related Methods,* H. Abdi, W.W. Chin, V. Esposito Vinzi, G. Russolillo and L. Trinchera (eds.). New York, NY: Springer New York, pp. 231-239.

Choi, J. N., Sung, S. Y., Lee, K., and Cho, D. S. 2011. "Balancing Cognition and Emotion: Innovation Implementation as a Function of Cognitive Appraisal and Emotional Reactions toward Innovation," *Journal of Organizational Behavior* (32:1), pp. 107-124.

Claudy, M. C., Michelsen, C., and O'Driscoll, A. 2011. "The Diffusion of Microgeneration Technologies – Assessing the Influence of Perceived Product Characteristics on Home Owners' Willingness to Pay," *Energy Policy* (39:3), pp. 1459-1469.

Compeau, D., Marcolin, B., Kelley, H., and Higgins, C. 2012. "Generalizability of Information Systems Research Using Student Subjects-a Reflection on Our Practices and Recommendations for Future Research," *Information Systems Research* (23:4), pp. 1093-1109.

Cordes, C. L., and Dougherty, T. W. 1993. "A Review and an Integration of Research on Job Burnout," *Academy of Management Review* (18:4), pp. 621-656.

Daxue-Consulting. 2014. "Sector Report: ICT Industry in China," Switzerland Global Enterprise.

Day, A., Paquet, S., Scott, N., and Hambley, L. 2012. "Perceived Information and Communication Technology (ICT) Demands on Employee Outcomes: The Moderating Effect of Organizational ICT Support," *Journal of Occupational Health Psychology* (17:4), pp. 473-491.

Delahaij, R., Gaillard, A. W. K., and van Dam, K. 2010. "Hardiness and the Response to Stressful Situations: Investigating Mediating Processes," *Personality and Individual Differences* (49:5), pp. 386-390.

Diaz, I., Chiaburu, D. S., Zimmerman, R. D., and Boswell, W. R. 2012. "Communication Technology: Pros and Cons of Constant Connection to Work," *Journal of Vocational Behavior* (80:2), pp. 500-508.

Drach-Zahavy, A., and Erez, M. 2002. "Challenge Versus Threat Effects on the Goal-Performance Relationship," *Organizational Behavior and Human Decision Processes* (88:2), pp. 667-682.

Edmondson, A. C., and Mcmanus, S. E. 2007. "Methodological Fit in Management Field Research," *Academy of Management Review* (32:4), pp. 1155-1179.

Elfering, A., and Grebner, S. 2012. "Getting Used to Academic Public Speaking: Global Self-Esteem Predicts Habituation in Blood Pressure Response to Repeated Thesis Presentations," *Applied Psychophysiology and Biofeedback* (37:2), pp. 109-120.

Endler, N. S., and Parker, J. D. A. 1994. "Assessment of Multidimensional Coping: Task, Emotion, and Avoidance Strategies," *Psychological Assessment* (6:1), pp. 50-60.

Fadel, F. J., and Brown, S. A. 2010. "Information Systems Appraisal and Coping: The Role of User Perceptions," *Communications of the Association for Information Systems* (26:6), pp. 107-126.

Fariselli, P., Oughton, C., Picory, C., and Sugden, R. 1999. "Electronic Commerce and the Future for SMEs in a Global Market-Place: Networking and Public Policies," *Small Business Economics* (12:3), pp. 261-275.

Ferguson, E., Matthews, G., and Cox, T. 1999. "The Appraisal of Life Events (ALE) Scale: Reliability and Validity," *British Journal of Health Psychology* (4), pp. 97-116.

Folkman, S. 1984. "Personal Control and Stress and Coping Processes - a Theoretical-Analysis," *Journal of Personality and Social Psychology* (46:4), pp. 839-852.

Folkman, S., and Lazarus, R. S. 1985. "If It Changes It Must Be a Process: Study of Emotion and Coping During Three Stages of a College

Examination," *Journal of Personality and Social Psychology* (48:1), pp. 150-170.

Folkman, S., and Lazarus, R. S. 1988. "Coping as a Mediator of Emotion," *Journal of Personality and Social Psychology* (54:3), pp. 466-475.

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., and Gruen, R. J. 1986. "Dynamics of a Stressful Encounter: Cognitive Appraisal, Coping, and Encounter Outcomes," *Journal of Personality and Social Psychology* (50:5), pp. 992-1003.

Fornell, C., and Larcker, D. F. 1981. "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error," *Journal of Marketing Research* (18:1), pp. 39-50.

Fugate, M., Prussia, G. E., and Kinicki, A. J. 2012. "Managing Employee Withdrawal During Organizational Change: The Role of Threat Appraisal," *Journal of Management* (38:3), pp. 890-914.

Fusilier, M. R., and Hoyer, W. D. 1980. "Variables Affecting Perceptions of Invasion of Privacy in a Personnel Selection Situation," *Journal of Applied Psychology* (65:5), pp. 623-626.

Gaab, J., Rohleder, N., Nater, U. M., and Ehlert, U. 2005. "Psychological Determinants of the Cortisol Stress Response: The Role of Anticipatory Cognitive Appraisal," *Psychoneuroendocrinology* (30:6), pp. 599-610.

Galluch, P. S., Grover, V., and Thatcher, J. B. 2015. "Interrupting the Workplace: Examining Stressors in an Information Technology Context," *Journal of the Association for Information Systems* (16:1), pp. 1-47.

Gefen, D., Straub, D. W., and Boudreau, M. C. 2000. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of the Association for Information Systems* (4:1), pp. 1-79.

Goodhue, D. L., Lewis, W., and Thompson, R. 2012. "Comparing PLS to Regression and LISREL: A Response to Marcoulides, Chin, and Saunders," *MIS Quarterly* (36:3), pp. 703-716.

Hair, J. F., Ringle, C. M., and Sarstedt, M. 2011. "PLS-SEM: Indeed a Silver Bullet," *Journal of Marketing Theory and Practice* (19:2), pp. 139-152.

Han, P., and Maclaurin, A. 2002. "Do Consumers Really Care About Online Privacy?," *Marketing Management* (11:1), pp. 35-38.

Huang, G. H., Zhao, H. H., Niu, X. Y., Ashford, S. J., and Lee, C. 2013. "Reducing Job Insecurity and Increasing Performance Ratings: Does Impression

Management Matter?," *Journal of Applied Psychology* (98:5), pp. 852-862.

Hung, W., Chang, L., and Lin, C. 2011. "Managing the Risk of Overusing Mobile Phones in Working Environment: A Study of Ubiquitous Technostress," *the 15th Pacific Asia Conference on Information Systems*, Brisbane, Australia.

Igbaria, M., and Parasuraman, S. 1989. "A Path Analytic Study of Individual Characteristics, Computer Anxiety and Attitudes toward Microcomputers," *Journal of Management* (15:3), pp. 373-388.

Jamal, M. 1985. "Relationship of Job Stress to Job-Performance - a Study of Managers and Blue-Collar Workers," *Human Relations* (38:5), pp. 409-424.

Janssen, O. 2001. "Fairness Perceptions as a Moderator in the Curvilinear Relationships between Job Demands, and Job Performance and Job Satisfaction," *Academy of Management Journal* (44:5), pp. 1039-1050.

Kacmar, K. M., Collins, B. J., Harris, K. J., and Judge, T. A. 2009. "Core Self-Evaluations and Job Performance: The Role of the Perceived Work Environment," *Journal of Applied Psychology* (94:6), pp. 1572-1580.

Karasek, R. A. 1979. "Job Demands, Job Decision Latitude, and Mental Strain - Implications for Job Redesign," *Administrative Science Quarterly* (24:2), pp. 285-308.

Keeping, L. M., and Levy, P. E. 2000. "Performance Appraisal Reactions: Measurement, Modeling, and Method Bias," *Journal of Applied Psychology* (85:5), pp. 708-723.

Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., Howes, M. J., Normand, S.-L. T., Manderscheid, R. W., Walters, E. E., and Zaslavsky, A. M. 2003. "Screening for Serious Mental Illness in the General Population," *Archives of General Psychiatry* (60:2), pp. 184-189.

Kessler, T. A. 1998. "The Cognitive Appraisal of Health Scale: Development of Psychometric Evaluation," *Research in Nursing & Health* (21:1), pp. 73-82.

Kline, R. B. 2016. "Principles and Practice of Structural Equation Modeling." New York: Guilford Press.

Latack, J. C., and Havlovic, S. J. 1992. "Coping with Job Stress - a Conceptual Evaluation Framework for Coping Measures," *Journal of Organizational Behavior* (13:5), pp. 479-508.

Lazarus, R. S., DeLongis, A., Folkman, S., and Gruen, R. 1985. "Stress and Adaptational Outcomes: The Problem of Confounded Measures," *American Psychologist* (40:7), pp. 770-785.

Lee, C.-C., Cheng, H. K., and Cheng, H.-H. 2007. "An Empirical Study of Mobile Commerce in Insurance Industry: Task–Technology Fit and Individual Differences," *Decision Support Systems* (43:1), pp. 95-110.

Lei, C. F., and Ngai, E. W. T. 2014. "The Double-Edged Nature of Technostress on Work Performance: A Research Model and Research Agenda," *2014 International Conference on Information Systems*, Auckland, New Zealand: Association for Information Systems.

LePine, J. A., LePine, M. A., and Jackson, C. L. 2004. "Challenge and Hindrance Stress: Relationships with Exhaustion, Motivation to Learn, and Learning Performance," *Journal of Applied Psychology* (89:5), pp. 883-891.

Lepine, J. A., Podsakoff, N. P., and Lepine, M. A. 2005. "A Meta-Analytic Test of the Challenge Stressor-Hindrance Stressor Framework: An Explanation for Inconsistent Relationships among Stressors and Performance," *Academy of Management Journal* (48:5), pp. 764-775.

Li, Z., and He, Y. 2014. "The Moderating Role of Consumer Heterogeneity on Two Objectives for Online Purchase: Saving Money and Saving Time," in: *Pacific Asia Conference on Information Systems*. Chengdu, China PRC: Association for Information Systems.

Liang, H. G., Saraf, N., Hu, Q., and Xue, Y. J. 2007. "Assimilation of Enterprise Systems: The Effect of Institutional Pressures and the Mediating Role of Top Management," *MIS Quarterly* (31:1), pp. 59-87.

Liaw, S.-S., and Huang, H.-M. 2003. "An Investigation of User Attitudes toward Search Engines as an Information Retrieval Tool," *Computers in Human Behavior* (19:6), pp. 751-765.

Lindell, M. K., and Whitney, D. J. 2001. "Accounting for Common Method Variance in Cross-Sectional Research Designs," *Journal of Applied Psychology* (86:1), pp. 114-121.

Marsh, H. W., and Hocevar, D. 1985. "Application of Confirmatory Factor Analysis to the Study of Self-Concept: First- and Higher Order Factor Models and Their Invariance across Groups," *Psychological Bulletin* (97:3), pp. 562-582.

Moore, G. C., and Benbasat, I. 1991. "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* (2:3), pp. 192-222.

Mulki, J., Bardhi, F., Lassk, F., and Nanavaty-Dahl, J. 2009. "Set up Remote Workers to Thrive," *MIT Sloan Management Review* (51:1), pp. 63-69.

Muthén, L. K., and Muthen, R. 2007. *Mplus: The Comprehensive Modeling Program for Applied Researchers (Version 5.0)*. Los Angeles, CA:

Nes, L. S., and Segerstrom, S. C. 2006. "Dispositional Optimism and Coping: A Meta-Analytic Review," *Personality and Social Psychology Review* (10:3), pp. 235-251.

Ngai, E. W. T., Poon, J. K. L., and Chan, Y. H. C. 2007. "Empirical Examination of the Adoption of WebCT Using TAM," *Computers & Education* (48:2), pp. 250-267.

Nyer, P. 1997. "A Study of the Relationships between Cognitive Appraisals and Consumption Emotions," *Journal of the Academy of Marketing Science* (25:4), pp. 296-304.

O'Sullivan, G. 2011. "The Relationship between Hope, Eustress, Self-Efficacy, and Life Satisfaction among Undergraduates," *Social Indicators Research* (101:1), pp. 155-172.

O'Driscoll, M. P., Brough, P., Timms, C., and Sawang, S. 2010. "Engagement with Information and Communication Technology and Psychological Well-Being," in *New Developments in Theoretical and Conceptual Approaches to Job Stress: Research in Occupational Stress and Well-Being,* P.L. Perrewé and D.C. Ganster (eds.). London: Emerald Publishing, pp. 269-316.

Ohly, S., and Fritz, C. 2010. "Work Characteristics, Challenge Appraisal, Creativity, and Proactive Behavior: A Multi-Level Study," *Journal of Organizational Behavior* (31:4), pp. 543-565.

Osterman, P. 1995. "Work Family Programs and the Employment Relationship," *Administrative Science Quarterly* (40:4), pp. 681-700.

Pavlou, P. A. 2003. "Consumer Acceptance of Electronic Commerce: Integrating Trust and Risk with the Technology Acceptance Model," *International Journal of Electronic Commerce* (7:3), pp. 101-134.

Pavlou, P. A. 2011. "State of the Information Privacy Literature: Where Are We Now and Where Should We Go?," *MIS Quarterly* (35:4), pp. 977-988.

Peacock, E. J., and Wong, P. T. P. 1990. "The Stress Appraisal Measure (SAM) - a Multidimensional Approach to Cognitive Appraisal," *Stress Medicine* (6:3), pp. 227-236.

Pearsall, M. J., Ellis, A. P. J., and Stein, J. H. 2009. "Coping with Challenge and Hindrance Stressors in Teams: Behavioral, Cognitive, and Affective Outcomes," *Organizational Behavior and Human Decision Processes* (109:1), pp. 18-28.

Podsakoff, N. P., LePine, J. A., and LePine, M. A. 2007. "Differential Challenge Stressor-Hindrance Stressor Relationships with Job Attitudes, Turnover Intentions, Turnover, and Withdrawal Behavior: A Meta-Analysis," *Journal of Applied Psychology* (92:2), pp. 438-454.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., and Podsakoff, N. P. 2003. "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies," *Journal of Applied Psychology* (88:5), pp. 879-903.

Podsakoff, P. M., and Organ, D. W. 1986. "Self-Reports in Organizational Research - Problems and Prospects," *Journal of Management* (12:4), pp. 531-544.

Polites, G. L., Roberts, N., and Thatcher, J. 2011. "Conceptualizing Models Using Multidimensional Constructs: A Review and Guidelines for Their Use," *European Journal of Information Systems* (21:1), pp. 22-48.

Probst, T. M., Stewart, S. M., Gruys, M. L., and Tierney, B. W. 2007. "Productivity, Counterproductivity and Creativity: The Ups and Downs of Job Insecurity," *Journal of Occupational and Organizational Psychology* (80:3), pp. 479-497.

Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., and Tu, Q. 2008. "The Consequences of Technostress for End Users in Organizations: Conceptual Development and Empirical Validation," *Information Systems Research* (19:4), pp. 417-433.

Richardson, H. A., Simmering, M. J., and Sturman, M. C. 2009. "A Tale of Three Perspectives: Examining Post Hoc Statistical Techniques for Detection and Correction of Common Method Variance," *Organizational Research Methods* (12:4), pp. 762-800.

Ringle, C. M., Wende, S., and Will, A. 2005. "SmartPLS 2.0 (Beta)." from www.smartpls.de

Saurine, A. 2008. "New Technology Turns on New Ways to Stress," in: *The Daily Telegraph*. Sydney.

Selye, H. 1991. "History and Present Status of the Stress Concept," in *Stress and Coping: An Anthology,* A. Monat and R.S. Lazarus (eds.). New York: Columbia University Press, pp. 21-35.

Shadish, W. R., Cook, T. D., and Campbell, D. T. 2002. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston: Houghton Mifflin.

Shellenbarger, S. 2012. "More Work Goes 'Undercover'," in: *The Wall Street Journal (Asia Edition)*.

Shonstell, A. 2013. "The E-Commerce Entrepreneurs Who Are Literally Working Themselves to Death," in: *Business Insider*.

Skinner, N., and Brewer, N. 2002. "The Dynamics of Threat and Challenge Appraisals Prior to Stressful Achievement Events," *Journal of Personality and Social Psychology* (83:3), pp. 678-692.

Smith, H. J., Dinev, T., and Xu, H. 2011. "Information Privacy Research: An Interdisciplinary Review," *MIS Quarterly* (35:4), pp. 989-1015.

Sojer, M., Alexy, O., Kleinknecht, S., and Henkel, J. 2015. "Understanding the Drivers of Unethical Programming Behavior: The Inappropriate Reuse of Internet-Accessible Code," *Journal of Management Information Systems* (31:3), pp. 287-325.

Spiro, R. L., and Weitz, B. A. 1990. "Adaptive Selling - Conceptualization, Measurement, and Nomological Validity," *Journal of Marketing Research* (27:1), pp. 61-69.

Staufenbiel, T., and König, C. J. 2010. "A Model for the Effects of Job Insecurity on Performance, Turnover Intention, and Absenteeism," *Journal of Occupational and Organizational Psychology* (83:1), pp. 101-117.

Steenbergen, E. F., Ellemers, N., Haslam, S. A., and Urlings, F. 2008. "There Is Nothing Either Good or Bad but Thinking Makes It So: Informational Support and Cognitive Appraisal of the Work-Family Interface," *Journal of Occupational and Organizational Psychology* (81:3), pp. 349-367.

Sun, P., Tsai, R. J., Finger, G., Chen, Y., and Yeh, D. 2008. "What Drives a Successful E-Learning? An Empirical Investigation of the Critical Factors Influencing Learner Satisfaction," *Computers & Education* (50), pp. 1183-1202.

Tarafdar, M., Pullins, E. B., and Ragu-Nathan, T. S. 2015. "Technostress: Negative Effect on Performance and Possible Mitigations," *Information Systems Journal* (25:2), pp. 103-132.

Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., and Ragu-Nathan, T. S. 2007. "The Impact of Technostress on Role Stress and Productivity," *Journal of Management Information Systems* (24:1), pp. 301-328.

Tarafdar, M., Tu, Q., and Ragu-Nathan, T. S. 2010. "Impact of Technostress on End-User Satisfaction and Performance," *Journal of Management Information Systems* (27:3), pp. 303-334.

Tarafdar, M., Tu, Q., Ragu-Nathan, T. S., and Ragu-Nathan, B. S. 2011. "Crossing to the Dark Side: Examining Creators, Outcomes, and Inhibitors of Technostress," *Communications of the ACM* (54:9), pp. 113-120.

Thatcher, J. B., and Perrewe, P. L. 2002. "An Empirical Examination of Individual Traits as Antecedents to Computer Anxiety and Computer Self-Efficacy," *MIS Quarterly* (26:4), pp. 381-396.

Thomée, S., Eklöf, M., Gustafsson, E., Nilsson, R., and Hagberg, M. 2007. "Prevalence of Perceived Stress, Symptoms of Depression and Sleep Disturbances in Relation to Information and Communication Technology (ICT) Use among Young Adults – an Explorative Prospective Study," *Computers in Human Behavior* (23:3), pp. 1300-1321.

Tolchinsky, P. D., McCuddy, M. K., Adams, J., Ganster, D. C., Woodman, R. W., and Fromkin, H. L. 1981. "Employee Perceptions of Invasion of Privacy: A Field Simulation Experiment," *Journal of Applied Psychology* (66:3), pp. 308-313.

Towers, I., Duxbury, L., Higgins, C., and Thomas, J. 2006. "Time Thieves and Space Invaders: Technology, Work and the Organization," *Journal of Organizational Change Management* (19:5), pp. 593-618.

Tu, Q., Wang, K. L., and Shu, Q. 2005. "Computer-Related Technostress in China," *Communications of the ACM* (48:4), pp. 77-81.

van Ruysseveldt, J., and van Dijke, M. 2011. "When Are Workload and Workplace Learning Opportunities Related in a Curvilinear Manner? The Moderating Role of Autonomy," *Journal of Vocational Behavior* (79:2), pp. 470-483.

Vasagar, J. 2013. "Out of Hours Working Banned by German Labour Ministry," in: *The Telegraph*.

Venkatesh, V. n.d. "Technology Acceptance." *Viswanath Venkatesh*, from http://www.vvenkatesh.com/it/organizations/theoretical_models.asp

Venkatesh, V., and Morris, M. G. 2000. "Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior," *MIS Quarterly* (24:1), pp. 115-139.

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. 2003. "User Acceptance of Information Technology: Toward a Unified View," *MIS Quarterly* (27:3), pp. 425-478.

Wallace, J. C., Edwards, B. D., Arnold, T., Frazier, M. L., and Finch, D. M. 2009. "Work Stressors, Role-Based Performance, and the Moderating Influence of Organizational Support," *Journal of Applied Psychology* (94:1), pp. 254-262.

Wan, W.-S. 2012. "Global and Regional Sourcing of ICT- Enabled Business Services: Upgrading of China, Hong Kong and Singapore Along the Global Value Chain," in: *Department of Geography and Environment*. London: The London School of Economics and Political Science.

Wang, Z., Sharma, P. N., and Cao, J. 2016. "From Knowledge Sharing to Firm Performance: A Predictive Model Comparison," *Journal of Business Research* (69:10), pp. 4650-4658.

Weber, R. 2004. "Editor's Comments: The Grim Reaper: The Curse of E-Mail," *MIS Quarterly* (28:3), pp. iii-xiii.

Webster, J. R., Beehr, T. A., and Christiansen, N. D. 2010. "Toward a Better Understanding of the Effects of Hindrance and Challenge Stressors on Work Behavior," *Journal of Vocational Behavior* (76:1), pp. 68-77.

Webster, J. R., Beehr, T. A., and Love, K. 2011. "Extending the Challenge-Hindrance Model of Occupational Stress: The Role of Appraisal," *Journal of Vocational Behavior* (79:2), pp. 505-516.

Wells, D. L., Moorman, R. H., and Werner, J. M. 2007. "The Impact of the Perceived Purpose of Electronic Performance Monitoring on an Array of Attitudinal Variables," *Human Resource Development Quarterly* (18:1), pp. 121-138.

Williams, L. J., Gavin, M. B., and Williams, M. L. 1996. "Measurement and Nonmeasurement Processes with Negative Affectivity and Employee Attitudes," *Journal of Applied Psychology* (81:1), pp. 88-101.

Williams, L. J., Hartman, N., and Cavazotte, F. 2010. "Method Variance and Marker Variables: A Review and Comprehensive CFA Marker Technique," *Organizational Research Methods* (13:3), pp. 477-514.

Xia, W. D., and Lee, G. H. 2005. "Complexity of Information Systems Development Projects: Conceptualization and Measurement Development," *Journal of Management Information Systems* (22:1), pp. 45-83.

Yi, J. 2009. "A Measure of Knowledge Sharing Behavior: Scale Development and Validation," *Knowledge Management Research & Practice* (7:1), pp. 65-81.

Zhang, X. D., and Zheng, Y. 2009. *China's Information and Communications Technology Revolution : Social Changes and State Responses*. London New York: Routledge.

Zhao, S., Grasmuck, S., and Martin, J. 2008. "Identity Construction on Facebook: Digital Empowerment in Anchored Relationships," *Computers in Human Behavior* (24:5), pp. 1816-1836.

Zweig, D. 2005. "Beyond Privacy and Fairness Concerns: Examining Psychological Boundary Violations as a Consequence of Electronic Performance Monitoring," in *Electronic Monitoring in the Workplace: Controversies and Solutions,* W. John (ed.). Hershey, PA, USA: IGI Global, pp. 101-122.

Zweig, D., and Webster, J. 2002. "Where Is the Line between Benign and Invasive? An Examination of Psychological Barriers to the Acceptance of Awareness Monitoring Systems," *Journal of Organizational Behavior* (23:5), pp. 605-633.