Understanding the Consequences of Technostress: A Non-Linear Perspective

Research paper

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Abstract

Despite the rise in technostress research, two significant gaps have been overlooked. First, although studies on stress proposed curvilinear relationships, such interactions have rarely been examined in the technostress literature. Second, despite stress being multi-disciplinary and theoretically related to emotions, past technostress studies have rarely adopted transdisciplinary approaches. This paper aims to address these knowledge gaps by adopting the triphasic stress model, the appraisal theory of emotions, and the activation theory to investigate and explain the presence of curvilinear relationships within a mediated and moderated model. Data were collected and analyzed by surveying 215 employees from four different medium-sized US organizations. Our findings suggest that antecedents such as ICT-self-efficacy and presenteeism significantly relate to technostressors through cubic S-shaped interactions, while technostressors exhibit a quadratic U-shaped relation with technoexhaustion, whereas technoexhaustion shows a positive linear relationship with discontinuous usage intention. Furthermore, our results partially support the moderating influence of negative affectivity and mediation effects of technoexhaustion. Through this study, we offer a different theoretical perspective and an innovative understanding of the true nature of the technology and stressors. It also offers insights on designing effective organizational ICT tools.

Keywords: technostress, curvilinear, triphasic stress model, activation theory.

1 Introduction

Stress has been a ubiquitous phenomenon often associated with practical, economic, and health consequences for individuals and organizations. Several academic surveys and studies show an increase in overall stress levels from 4.8 to 5.1 on a 10-point scale (American Psychological Association - APA, 2017) and a 9% increase in individuals facing at least one stress symptom per month (APA, 2017). The adverse effects of stress subsequently lead to financial losses, higher mortality rates, mental exhaustion, lower performance, lawsuits, lower profits, and individual dissatisfaction (e.g., Chilton et al. 2005; CNN, 2006). Introduction and dependence on information and communication technologies (ICTs) have also contributed to the presence of stress in the workplace. Although ICTs are essential for businesses, they may lead to adverse outcomes due to their excessive use (Bulgurcu et al. 2010). The effectiveness and efficiency of ICTs raise productivity expectations and a competitive advantage, hence resulting in more stress for employees (Wang et al. 2008).

Stress is an unavoidable part of life, resulting in both negative and positive outcomes (Selye, 1973, 1974). Despite the suggestions from the positive psychology movement (Seligman and Csikszentmihalyi, 2000) and the increasing interest in the positive consequences of stressors (Ohly and Latour, 2014; Eurofound and the International Labor Office, 2017; Folkman and Moskowitz, 2004), technostress (TS) research has largely focused on the negative consequences. Prior IS research framed and viewed technology related stress negatively (e.g., Baroudi 1985). Lately, IS research has focused on the reasons behind the adverse psychological outcomes caused by technology (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Tarafdar et al. 2010; 2011). In sum, TS has been widely recognized as an unintentional negative effect of technology (Ayyagari et al. 2011; Tarafdar et al. 2011). Nevertheless, similar studies have related technology to bad and good stress (e.g., Sethi et al. 1987; Califf et al. 2016). This paper follows their approach of distinguishing between the perceptions and experiences of eustress and distress (Little et al. 2007; Le Fevre et al. 2003; Selye 1983) by testing for curvilinear relationships. Against this background, our research question is as follows:

RQ: What types of relationships exist within a mediated and moderated technostress model?

There are two major contributions emanating from this study. First, although numerous studies on stress from different disciplines examined the nonlinear effects of stressors (e.g., Singh, 1998; Nygaard and Dahlstrom, 2002; Bhuian et al. 2005; Takeuchi et al. 2007; Uotila et al. 2009; Leung et al. 2011; Mihalache et al. 2012; Lindberg et al. 2013; Haans et al. 2016) and despite nonlinearity being suggested as an interesting future research direction in recent TS studies (Srivstava et al. 2015), these types of relationships have been missing in TS literature. This study addresses this specific research gap. Second, since a) stress is multi-disciplinary in nature (Fischer and Riedl, 2017; Tarafdar et al. 2017), b) psychological stress is similar to the literature of emotions (Lazarus, 1993), and c) job stress is also conceptualized as "a constellation of theories and models that addresses a meaningful process or phenomenon" (Nelson and Simmons, 2003 - 04), the current research tests for curvilinear relationships through the theoretical lenses of the triphasic stress model, appraisal theory of emotions, and activation theory.

The rest of the paper is organized as follows: The first section of this paper describes the stress and TS concepts. The second section discusses the adopted models and theories that were utilized to articulate our arguments for the chosen research model and curvilinear relationships. The third section describes the research methodology and data analysis techniques. The fourth section is devoted to the overall empirical findings (including nonlinear regression analysis, restricted cubic splines regression analysis, and nonlinear moderation and mediation analysis). The last section concludes with the limitations, future research directions, research and practical implications, and discussion.

2 Theoretical Foundation

2.1 Stress and Technostress

Early studies have defined stress as either a response from a physiological perspective (McGrath, 1976; Selye, 1956) or as a stimulus from a scientific approach (Baum, 1990). Stress occurs when the relationship is perceived as personally significant and challenges the resources available for successful coping strategies (Folkman, 2013). Thus, in addition to biological factors, psychological and cognitive factors also have an impact on the perception of stress. Given the conceptual and theoretical limitations of both approaches (e.g., Cooper et al. 2001; Cooper and Dewe, 2008; Lazarus and Folkman, 1984), psychological stress theories followed a distinct approach involving transactional processing between the individual and the environment. Therefore, stress has been conceptualized as a process that includes an environmental condition, a demanding/challenging stressor, coping responses, and psychological/behavioral/physiological outcomes (e.g., Folkman, 2011; Lazarus, 1966; Lazarus and Folkman, 1984; McGrath, 1976). Stressors have been defined as conditions and events that induce strain (Kahn and Byosiere, 1992) and can be divided into physical stressors (e.g., poor ergonomic conditions at the workplace), task-related job stressors (e.g., high time pressure, work overload, task complexity, and system breakdown), role stressors (e.g., role overload, role conflict, role ambiguity, and facing illegitimate tasks), social stressors (e.g., poor social interactions and handling difficult customers), work schedule stressors (e.g., night/day time arrangements), career-related stressors (e.g., job insecurity), traumatic events (e.g., disasters), and organizational change (e.g., implementation of new technologies leading to other stressors, such as job insecurity, overtime, and social conflicts).

The conceptualization of stress and stressors offers an adequate starting point for understanding the concept of TS. TS has been defined as the constant need to adapt to new applications, functionalities, software, and programs (Ragu-Nathan et al. 2008); as the inability to adapt to or cope with ICTs in a healthy and positive manner (Srivastava et al. 2015); or as a consequence of perceived work overload and information fatigue (Ayyagari et al. 2011; Ragu-Nathan et al. 2008). For instance, the implementation of new applications, multitasking, constant connectivity, information overload, frequent system upgrades, constant uncertainty, continual relearning, job-related insecurities, and technical problems have been linked to the organizational use of technology (Tarafdar and Tu, 2010; Ayyagari et al. 2011; Tarafdar et al. 2011). Tarafdar et al. (2007) identified five TS creators: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. Because of the omnipresence and practical significance of TS, academic interest in the topic has recently grown. There are several studies examining different technological and cognitive antecedents (Ayyagari et al. 2011; Shu et al. 2011) and different consequences of TS (Tarafdar et al. 2007; 2010; 2014).

2.2 Appraisal Theories of Emotions and the Triphasic Stress Model

Lazarus (1993) argues that since psychological stress theory is equivalent to the theory of emotion and because the two kinds of literature share similar concepts, both fields could be successfully adjoined as the field of emotion theory. Following this suggestion, in this paper, we refer to the concepts of stressors and stress as equivalent to the concept of emotions. Appraisal theories of emotion conceptualize appraisals as direct, immediate, and intuitive cognitive evaluations of the environment (Arnold, 1960). The fundamental principle is that emotions are related to specific combinations of appraisals. Despite earlier theorists studying appraisals as the ones preceding emotions (e.g., Arnold, 1960; Lazarus, 1966), more recent studies showed that emotions could also lead to appraisals (e.g., Keltner et al. 1993; Lerner and Keltner, 2001). This supports the perspective that emotions and appraisals are intertwined as the subset of same affective state (Ellsworth and Scherer, 2003). The concept of appraisal was introduced to emotion theory specifically to support and systematically explain the variability in emotional reactions (e.g., Lazarus and Folkman, 1984; Roseman and Smith, 2001). Although scholars disagree over details of the appraisal criteria (e.g., Reisenzein and Hofmann, 1993; Scherer et al. 2006), they broadly agree on the distinction among emotional reactions and how they are triggered within the realm of appraisal theories (Ellsworth and Scherer, 2003). Most appraisal models evaluate the extent to which a situation is helps one achieve specific goals and distinguishes between positive and negative emotions (Ellsworth and Scherer, 2003). Although most appraisal theories assume linear causations across many psychological, psychophysical, cognitive, and technological processes (e.g., Ausubel and Marchetti, 1997; Treisman, 1999), few theorists have challenged this view and suggested a reciprocal (S-shaped) relationship in which both the cognitive appraisal and emotion development dynamically emerge and interact (e.g., Lewis, 2005; Tong et al. 2009; Kappas, 2001). In other words, emotions are continuously adapted by changes in appraisals, while emotional effects gradually update appraisals. Therefore, there is no evident reason to assume that appraisal–emotion relationships are strictly linear, especially since cognitive-neurological and psycho-physiological disciplines follow the logic of S-shaped functions (Tong et al. 2009). It is possible that appraisals can influence emotions either at extreme ends (U-shaped) or at moderate levels (S-shaped function) (Tong and Tay, 2011). If appraisal–emotion relationships interact at moderate levels, then it should be of interest to theorists, experimenters, and practitioners for theory advancement (Roseman and Kaiser, 2001).

In this study, we have adopted the triphasic stress model (general adaptation syndrome, G-A-S) (Selye, 1950) as a theoretic framework for explaining the combined linear-quadratic interactions as observed in prior studies such as Bhuian et al. (2005). The triphasic stress model emerged from laboratory observations by showing S-shaped patterns through measuring responses to increasing levels of stimuli (Bhuian et al., 2005). The theory conceptualizes a three-phase model of reactions to stress in the form of a sine curve (Nygaard and Dahlstrom, 2002) (see Figure 1). In the first phase, stress negatively affects performance. In the second phase (B to D), performance improves as stress rises. In the final phase (D to E), performance decreases (Nygaard and Dahlstrom, 2002). The model appears to be credible since the triphasic perspective extends (rather than replacing) the existing linear, quadratic and interactive views (Bhuian et al. 2005). As the model a) shows the cyclical (S-shaped) behavior of stress through three different phases (Selye, 1950; Nygaard and Dahlstrom, 2002), and b) incorporates both linear and quadratic perspectives (Bhuian et al. 2005), we can expect triphasic effects of the technostressors (TSS) within our hypothesized mediated nonlinear model. Therefore, in this paper, the differentiation between the different phases leads to the proposition that the reaction of stress could be either positive eustress (pleasant experience) or negative distress (unpleasant experience) (Selye, 1973). We modeled ICT self-efficacy and presenteeism as sine functions of TSS.

In technology management literature (e.g., Foster, 1986; Utterback, 1994), technological evolution and radical innovation are IS-related areas that can be associated with the same pattern of the triphasic stress model. Embracing the technological change requires knowledge regarding how new technologies evolve (Sood and Tellis, 2005). The literature suggests that a new technology evolution follows an S-shaped curve that starts below an outdated technology, intersects it once, and finally ends ahead of the old technology (Utterback, 1994). In practice, it follows a managerial concept of excluding a maturing technology and adopting a new one to stay competitive (Christensen, 1997). Shifting to a new technology occurs at the point of inflection; beyond that threshold, performance increases at a decreasing rate until maturity. In this paper, the shifting in technology resembles the pace that ICTs are rapidly changing and affecting the behavior of employees through adaptation mechanisms, resembling an S-shaped relationship similar to the triphasic stress model (see Figure 2).

3 Model and Hypotheses

Our research model (see Figure 3) is adapted from the expanded stimulus-organism-response (S-O-R) model of organizational stress (Strümpfer, 1986). The S-O-R model is an extended version of Lazarus's psychological stress model. It refers to any factor in the environment (stimulus) as a perceived and appraised stressor before leading to stress (as a reaction) and then to strain (as a consequence). In this study, a similar conceptual framing is followed to relate TS with stress by shifting focus from the organizational to the technological environment (Erasmus, 2003). However, since the S-O-R model lacks curvilinear explanations, we further integrate the triphasic stress model, appraisals theories of emotion, and activation theory to better describe the reasons and logic for our proposed hypotheses.

3.1 ICT Self-Efficacy – Technostressors Relationship

ICT self-efficacy (SE) refers to one's belief in one's capability to successfully use and perform a computer-related task (Compeau and Higgins, 1995). Hence, it is linked to ICT-related stress. Self-efficacy reflects a broad sense of personal competence to manage stressful conditions (Schwarzer, 1992). Self-efficacy is responsible for how people think, feel, and behave. Individuals with low self-efficacy have low self-esteem, pessimistic thoughts, negative feelings, and high anxiety levels. Individuals with high self-efficacy have strong sense of competency, high decision-making qualities, high levels of efforts, high levels of persistence, high commitment levels, greater achievement approaches, behave more proactively, feel less threatened by stressful demand, and perform more challenging tasks (Jex et al. 2001; Bandura, 1997). To date, the basic conceptualization of stressors (i.e., role stressors) and their effects on self-efficacy has proposed and tested linear negative relationships, in which high levels of stressors lead to low levels of self-efficacy (e.g., Brown et al. 2005; Sonnentag and Kruel, 2006). While this perspective dominates stress research, recent developments show the potential for non-linear responses to stress (Lindberg et al. 2013). Despite stressors being generally perceived as harmful, few scholars have opposed the view of the linear negative relationship and found evidence for nonlinear causation (e.g., Lindberg et al. 2013). ICT-efficacy and workload moderate the level of TS (Tarafdar et al. 2011; Suharti and Susanto, 2014). Therefore, self-efficacy could act as an enhancer in the motivation process by reshaping the thoughts towards positive emotional states (Llorens et al. 2007) or could positively influence thoughts in negative scenarios. Since this dynamic construct a) influences perceptions of stress through thought patterns and emotional reactions, b) functions as a cognitive regulator of anxiety arousal (Bandura, 1997), c) can change over time (Gist and Mitchell, 1992), and d) is explained by the appraisal-emotion theory in terms of S-shaped relationships (Leary et al. 1998), we link our arguments to the triphasic stress model and appraisal theories of emotions and hypothesize:

Hypothesis 1*. The relationship between ICT-self efficacy and technostressors exhibits a cubic S-shaped function, with negative and positive slopes at different levels of ICT-self efficacy.*

3.2 Presenteeism (Hyper-connectivity) – Technostressors Relationship

Hyper-connectivity refers to the numerous methods of communication and interaction that overcome time and space boundaries by virtualizing experience and physical presence (Fredette et al. 2012). Technology dependence is one of the growing concerns because of hyper-connectivity (Fredette et al. 2012). Hyper-connectivity can also be defined as the degree to which technology enables users to be accessible anywhere and anytime (Fredette et al. 2012), referred to as presenteeism (McGee, 1996). Presenteeism (PR) is perceived as a source of stress/strain (Van de Heuvel et al. 2010; Ayyagari et al. 2011) and work overload due to endless connectivity (Cooper et al. 2001). Research on hyper-connectivity (constant connectivity/presenteeism) relies on the nonlinear (S-shaped) technological innovation (Foster, 1986; Utterback, 1994) and psychological concepts as key lenses to explore increasingly stressful work environments (Mazmanian and Erickson, 2014). Since hyper-connectivity has been defined as a result of an increasingly accelerated technological evolution affecting individual and organizational behavior (Fredette et al. 2012), it can be curvilinearly associated with the technology and stress-emotions literature. We argue that hyper-connectivity can be a powerful tool for efficiency and development, but it can rapidly change the ways many tasks are performed. Hence, people are expected to adapt to these changes (Fredette et al. 2012). Consequently, it would lead to various stressful situations. Linking our arguments with the appraisals theory of emotions and the triphasic stress model, pattern variations in the relationship between constant connectivity and emotions (stressors) could be expected at all levels. Therefore, we hypothesize the following:

Hypothesis 2. *The relationship between presenteeism and technostressors exhibits a cubic S-shaped function, with negative and positive slopes at different levels of presenteeism.*

3.3 Negative Affectivity as a Moderator

Negative Affectivity (NA) or Neuroticism is one of the five personality dimensions (McCrae and Costa, 2003). It reflects the degree of emotional stability and adjustment. High level of NA or neuroticism a) implies a high level of psychological distress and emotional instability (Costa and McCrae, 1985(a)(b), 1992); b) interferes with one's ability to adapt (Tellegen, 1985); c) implies high levels of job stress (Kumaresan and Ramayah, 2005); and d) relates to ICT-related job disruptions (stress creators) due to individuals' negative beliefs about the technology use (Lazarus and Folkman, 1984; Srivastava et al. 2015). Self-efficacy requires awareness of one's own emotions and the ability to control them to achieve the desired results (Saarni, 2000). Recent studies show that low levels of self-efficacy are preceded by high levels of negative emotions (Martinez and Salanova, 2005). Similar studies show evidence that certain negative emotions influence the levels of self-efficacy (Garcia et al. 2006), buffer the benefits of high control on achievement (Ruthig et al. 2008), and interact as moderators between self-efficacy and achievement (Villavicencio and Bernardo, 2013). Therefore, we hypothesize the following:

Hypothesis 3. *Negative affectivity moderates the relationship between ICT self-efficacy and technostressors.*

In the organizational context, since PR implies the continuous presence of the employee at all times, the work-home boundaries have blurred. A growing body of research suggests that the affective trait (NA) is related to high levels of work-family conflict (Bruck and Allen, 2003; Stoeva et al. 2002). Furthermore, since PR, or hyper-connectivity, is perceived as a source of stress/strain (Van de Heuvel et al. 2010; Ayyagari et al. 2011) and might be related to emotional problems or mood disorders that are associated with high neuroticism (Carballedo et al. 2015), then it would be appropriate to consider NA as a possible moderator between PR and TSS. Therefore, we hypothesize the following:

Hypothesis 4. *Negative Affectivity moderates the relationship between Presenteeism and Technostressors.*

3.4 Technostressors – Technoexhaustion Relationship

Activation theory was prominently used as a theoretical lens for understanding emotion in psychology (Donald B. Lindsley (1907-2003)). The activation theory provides explanation for the causes of job stress (Gardner and Cummings, 1988). The use of the activation theory has focused on inverted U-shaped relationships between job stress or characteristics with performance and satisfaction (Champoux, 1978, 1980, 1992; Gardner, 1986; Schwab and Cummings, 1976). Activation theory argues that both low and high levels of stressors inhibit performance because they either under- or over-stimulate leading to disorganized responses (Scott, 1966). A low level of stressors weakens awareness or resource activation (stimulation), hence resulting in lack of motivation or withdrawal intentions (Onyemah, 2008). A high level of stressors overwhelms reactive and coping capacities, hence leading to discouragement (Schaubroeck and Ganster, 1993). Studies showed that high levels of stressors (e.g., workload & time pressure) reduce performance (Jehn, 1995), creativity and efficiency (Amabile et al. 2002), and effective decision making (Barczak and Wilemon, 2003). On the other hand, moderate levels of stressors provide balanced or optimum stimulation, subsequently leading to desirable outcomes (Nygaard and Dahlstrom, 2002). Therefore, it is argued that moderate levels stressors result in the best performance, while low and high levels of stressors should be associated with poor performance (Rodriguez-Escudero et al. 2010), hence developing an inverted U-shaped relationship. Drawing on these arguments and the activation theory principle, which suggest an inverted U-shaped relationship exists between stressors and performance (positive outcome), we argue for a U-shaped relationship between stressors and strain or exhaustion (negative outcome). We believe that low and high levels of TSS (extreme ends) can be similarly dysfunctional, in which high levels of technoexhaustion (TE) are observed (relative to poor performance). On the other hand, moderate levels of TSS result in minimal TE (relative to optimal performance). Therefore, we hypothesize the following:

Hypothesis 5. *Technostressors will exhibit a U-shaped relationship with technoexhaustion, such as if technostressors increase, technoexhaustion will decrease to a certain limit. Beyond this level, technostressors will show a positive relationship with technoexhaustion.*

3.5 Technoexhaustion – Discontinuous Usage Intention Relationship

Technoexhaustion, defined as a high level of psychological strain, may result from the influence of TSS on individuals (Ragu-Nathan et al. 2008; Ayyagari et al. 2011). Consequently, behavioral strain may also follow as an outcome (Tarafdar et al. 2010). Psychological strain is a major contributing factor to behavioral strain (Ragu-Nathan et al. 2008; Tarafdar et al. 2010). Following studies such as Maier (2015), we identify psychological strain in terms of exhaustion and behavioral strain in terms of discontinuous usage intention (DIS) (withdrawal). In the technology-organizational context, high levels of skills are needed when using ICTs (Ayyagari et al. 2011), which eventually cause TS (Ragu-Nathan et al. 2008) due to time pressure, overload, and invasion of privacy (Tarafdar et al. 2010). These perceptions cause mental exhaustions (Ayyagari et al. 2011) and users can develop intentions to quit (Ragu-Nathan et al. 2008). Whenever ICTs induce feelings of technoexhaustion, users resort to behavioral change to overcome the current situation (Maier, 2015). Hence, we agree that employees feeling technoexhausted report high DIS, despite the perceived benefits of ICTs (Khan and Jarvenpaa, 2010). Therefore, we hypothesize the following:

Hypothesis 6. *A linear positive relationship exists between technoexhaustion and discontinuous usage intention.*

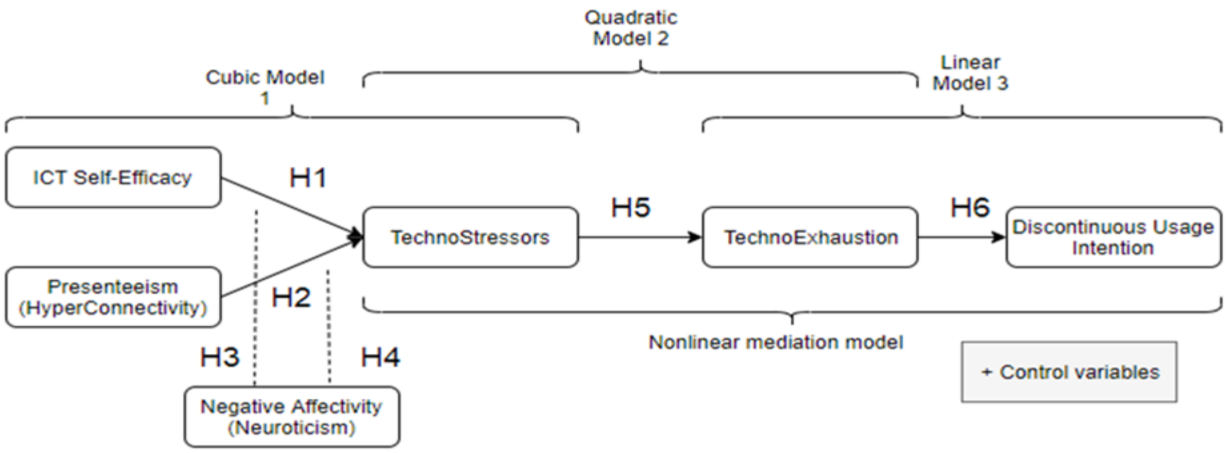

Figure 3. Research Model

4 Method

The sampling frame included US publicly listed firms on the NYSE. From the initial 73 targeted firms, only four accepted to conduct the survey. The firms operate in different industries: health, technology, finance, and construction. Before data collection, the questionnaire was pretested with two executives and three academics. Validated scales from existing literature were adapted to formulate the questionnaire. To measure the 38 items and the 5 control variables, we used a 5-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Table 1 presents the descriptive statistics of the measurements items. Data were collected through a web-based questionnaire sent to the senior executives in charge of the HR departments at each of the four companies. In return, the survey was distributed by the HR managers to senior, middle, and lower management employees. We did not target specific professions or employment levels since employees across all industries manage and use technologies in their jobs (Atanasoff and Venable, 2017). After four months, we reached a final number of 215 effective responses from the 297 sent invitations, yielding a 72% response rate. Demographics (control variables) statistics showed that age(s) (mean = 2.47) between 27 to 37 had the highest percentage of 40.9; gender (mean = 1.66) with females having highest percentage of 65.5; education level (mean = 1.95) with college and university graduated employees having highest percentages of 39.5 and 38.2, respectively; and employment level (mean = 3.25) was concentrated mostly on middle management employees, with 38.9%.

5 Results

First, data were analyzed (internal consistencies, validity, descriptive analysis, linear-nonlinear regression, and restricted cubic splines (RCS) nonlinear regression) using SPSS 23.0. Second, nonlinear mediation was calculated through medcurve analysis (macro extension to SPSS). Third, different confirmatory factor analyses (CFA) were computed using AMOS 23.0. Fourth, WarpPLS 5.0 was used for identifying nonlinear relationships, estimating path coefficients, and modeling nonlinear moderation effects. Fifth, Stata 14.2 was implemented as a concluding robustness check for all cubic and quadratic relationships.

Prior to the regression analysis, all validities (content (Haynes et al. 1995), convergent (Hair et al. 1998), discriminant (Fornell and Larcker, 1981)) and reliability measures were all checked for consistency, robustness, and adequacy (see Table 2 and Table A for factor loadings). The model fit provided an average-to-good overall results with all measurement loadings being statistically significant (see Table 3). Table 4 shows the R, R^2, Adjusted R^2, and the Variance Inflation Factors (VIFs) for each of the models as a test for multicollinearity issues. The F-Test for the difference in R^2 is presented in Table 5 between the linear, quadratic, and cubic forms of all the interactions. The F-test has been used to compare the statistical models to identify which model best fits the data sampling. Further, since the data was self-reported and collected over specific time frame, then common method variance may cause measurement error and haze the real estimates. To overcome such issues, we adopted a number of technical procedures and statistical controls (Podsakoff et al. 2003; Ahuja et al. 2007; Liang et al. 2007; Ayyagari et al. 2011; Srivastava et al. 2015). Specific technical procedures involved clear proposal of the questionnaire, separation of the criterion-predictor items measures and anonymity assurance. However, for statistical control, we used Harman's one-factor test (as a diagnostic tool; not a control method) by loading all variables into exploratory factor analysis (EFA) to determine the number of factors necessary to account for the variance (see Table 6).

Our empirical analysis presents several interesting insights. Table 7 shows the regression results for SE-NA-TSS and PR-NA-TSS (cubic model 1), TSS-TE (quadratic model 2), and TE-DIS (linear model 3). First, for model 1, SE^3 and PR^3 are significantly related to TSS ($t = 2.464$; $\beta = .208$; $p < .015$) and ($t = 4.327$; $\beta = .262$; $p < .015$) respectively, hence supporting H1 and H2 (see Figures 4 and 5). Similarly, NA^3 shows a significant relationship with the model ($t = 5.496$; $\beta = .392$; $p < .015$) and is a moderator for the SE-TSS relationship ($t = 2.153$; $\beta = .188$; $p < .05$), hence supporting H3 (see Figure 8). However, for the PR-TSS relationship, NA showed no significant influence ($t = -.367$; $\beta = -.028$; $p > .05$); hence, H4 was not supported. Second, for models 2 and 3, TSS^2 showed a significant relationship with TE ($t = 3.244$; $\beta = .185$; $p < .015$), and TE showed a significant linear relationship with DIS ($t = 7.595$; $\beta = .462$; $p < .015$), hence supporting H5 and H6 (see Figures 6 and 7).

For models 1 and 2, our findings indicate that low levels of SE and PR will hold a certain level of TSS, but any increase in their levels will lead to a decrease in TSS (negative slope). However, a further increase in SE or PR will lead to an increase in TSS up to a certain limit (positive slope), after which the relationship will show an inverse pattern (negative slope). In other words, the low and downward sloping of TSS (initial phase compared to the triphasic stress model) is equivalent to the concept of eustress, while increasing levels of TSS (middle and last phases) embody the concept of distress. Thus, the perception of eustress emerges when SE and PR are increasing at early stages, hence reflecting on excitement (acquiring new skills) and adaptability. Moderate and high levels are accompanied by increased work overload and expectations to finish more tasks under limited time, hence reflecting on the concept of distress. Moreover, NA showed a significant moderating influence on SE-TSS relationship (i.e., NA positively moderates [amplifies] the relationship), while it has no effect on PR-TSS relationship. For the SE-NA-TSS relationship, low and high levels of SE lead to minimal and constant TSS levels when NA is found at low levels, while low and high levels of SE lead to increased TSS levels when NA is found at high levels. The absence of moderating effect on the PR-TSS relationship is perhaps due to the fact that work-home conflict might be stressful, but negative emotions might not exist in the presence of incentive or reward mechanisms for the employees. Financial gain improves satisfaction rather than making it distressing (Bono and Vey, 2005), hence leading to positive emotions instead of negative emotions. For model 3, our results show the fact that TSS found at minimal or maximum levels have the same damaging effect on the individual in which TE will be at high levels. TSS found at moderate levels lead to low levels of TE, in which the TSS are converted to motivational-positive tools (eustress) for adjusting and getting the task done. For model 4, a simple linear relationship exists between TE and DIS.

5.1 Restricted Cubic Splines (RCS)

As a guideline for examining S-shaped relationships, researchers investigating longitudinal effects can use stage theories (such as G-A-S) to hypothesize different levels of effects at different points in time (e.g., Ahearne et al. 2010). Similarly, stage theories can also be used in cross-sectional research by equating stages to levels of a given independent variable (Nygaard and Dahlstrom, 2002; Bhuian et al. 2005). Following such suggestions, we utilize trigonometric functions of the constructs to estimate their triphasic cubic effects (restricted cubic splines regression).

RCS are introduced as algorithmic and validity testing of nonlinear hypotheses, in which segmentation of an independent variable into multiple regression equations occurs. Regression models in which the function changes along the range of the predictor are called splines (piecewise polynomials). The locations of these shifts are termed knots (change of slopes defining the end and the start of each segment). In this study, a spline model is hypothesized, expecting that the relationships between SE and PR with TSS vary through four equally distant knots, thus testing for a three-phase spline for each model. Applying the algorithmic approach, spline functions overcome many disadvantages by replacing linear approximations with a system of piece-wise polynomial approximations (Suits et al. 1978). Hence, each interval found between two knots relates to $Y(x) = a + b1X^1 + b2X^2 + b3X^3$ for each of the SE and PR relationships. Tables 8a and 8b present the Cubic Spline - Correlations of Parameter Estimates for both antecedents.

- *Cubic Spline Regression model 1a = ba0 + ba1*ICT_Self_Eff + bb1*(ICT_Self_Eff-knot1) *(ICT_Self_Eff ge knot1) + bc1*(ICT_Self_Eff-knot2) *(ICT_Self_Eff ge knot2)*
- *Cubic Spline Regression model 1b = ba0 + ba1*presenteeism + bb1*(presenteeism-knot1) *(presenteeism ge knot1) + bc1*(presenteeism-knot2) *(presenteeism ge knot2)*

5.2 Nonlinear Mediation Test

The nonlinear mediational analysis should be tested based on the concept of instantaneous indirect effects using bootstrapping procedures for inference (Preacher and Hayes, 2010). This approach is the only acknowledged test and, by far, more effective and accurate than Baron and Kenny (1986) or the Sobel test (1982), both of which only address direct linear mediation. It facilitates the assessment of the results by generating both percentile and bias-corrected bootstrap confidence intervals. Figure 9 & Table 9 show the examined model and the estimates for the nonlinear mediation analysis. Interval estimates for the instantaneous indirect effect of TSS (X) on DIS (Y) through TE (M) at low (2.3441), moderate (3.0476), and high (3.7511) values of TSS are a) 95% CI for X 2.3441 = 0.0488 to 0.2844; b) 95% CI for X 3.0476 = 0.1078 to 0.3926; and c) 95% CI for X 3.7511 = 0.1557 to 0.5746. Recalling the point estimates (THETA) for low, moderate, and high TSS (0.1392, 0.2490, and 0.3588, respectively), we observe among DIS relatively low or moderate or high in TSS, there is evidence that increasing TSS can function to increase perceptions of DIS through the partial mediation influence of TE (as the interval estimate is entirely above zero).

6 Limitations and Future Directions

Our study has following limitations. First, since the analysis is based on random sampling, the chosen types of the organizations might affect the results. The sample was mainly focused on four medium-sized US corporations; hence, findings cannot be generalized to large firms or other countries (states) with different ICTs experience. Cultural differences between western and eastern organizations might influence certain stressors over the others (Tu et al. 2005). Therefore, a sample consisting of different cultural background might offer further interesting insights in investigating TS (Chen, 2015). Second, employees and managers from different departments or employment levels experience stress from diverse ICTs sources and complexities. However, the study followed an undifferentiated treatment for the use of ICTs, and diversification of technology was not controlled. Third, the findings can be further developed by analyzing the effects of each of the control variables on TS as suggested by Tarafdar et al (2011). For instance, personal characteristics (e.g., age, gender, and personality) may influence the level of TS experienced by yielding different estimates and levels of intensities. Fourth, only three out of the five TSS were adopted. We considered only the overload, complexity, and uncertainty dimensions for this research since they are considered the most relevant in the IS management-security-related stress and behavioral intention contexts (Anderson and Agarwal, 2010; D'Arcy et al. 2014). Furthermore, techno-invasion and techno-insecurity were found to negatively affect individual productivity (surplus in strain or deficiency in performance) since excessive ICT-related pressure leads to stress and insecurity in employees' personal lives and jobs (Tu et al. 2005). Thus, these two dimensions were removed from our model to avoid extreme measures. However, it could be more interesting for future studies to apply all five dimensions (as one construct or separately) in examining curvilinear relationships in different organizational contexts and locations. Fifth, although we did our best to minimize response bias and noncollinearity issues, the conducted cross-sectional design methodology (self-reporting) might not be as effective as longitudinal or experimental studies that are more suitable for investigating stress-related processes. Therefore, conducting studies that objectively measure the presence of stressors would provide an adequate stance in addressing stress within the curvilinear realm (Muse et al. 2009).

7 Implications for Practice and Research

The majority of IS studies focus on "what technology can do for you" rather than "what technology can do to you" (Ayyagari et al. 2011). Therefore, in this research, we focused on the later concept by showing the curvilinear nature of the technology stressors' relationships and their damaging effects on employees. Our main motive behind testing non-linear relationships is to provide important implications for researchers (in terms of developing new conceptual models based on curvilinear patterns) and for managers (in terms of designing ICTs that stimulate psychological and organizational effectiveness). The empirical support found in this paper opens up new avenues for understanding stress. In particular, for managers dealing with different decisions to help employees deal with high levels of stress, the findings suggest a need for novel and unconventional formulation of strategies. Since, work/ICT designs influence individuals' psychological, social, and physical well-being, then organizational interventions need to examine all features (i.e., task, technology, environment, and individual) through systematic and methodical strategies to achieve balanced levels of stress and optimum performance. Adopting the balance and equilibrium concepts can offer effective and holistic solutions. Since intermediate levels of stressors should encourage employees to push their efforts further (Akgun et al. 2006), our findings suggest developing appropriate diagnostic and interventional tools to a) reduce or increase stressors to moderate instead of high or low levels (excessiveness or absence), b) moderate the ICT-related characteristics that directly balance the effects on stress and performance, c) directly evaluate the level of stressors found in the organization, d) introduce new technologies reasonably and gradually, and e) better manage the stressors levels to yield desirable effects by identifying the three phases of the triphasic stress model. Past studies such as Tarafdar et al. (2007) already suggest the need for managers be cognizant of appropriate management mechanisms to reduce TS to counter the inverse relationship between TS and productivity (Tarafdar et al. 2007).

One main reason for the lack of nonlinear findings is the failure to clearly examine such relationships (Salamin and Hom, 2005). This is one of the few studies that attempt to investigate the curvilinear nature of TSS and invoke different theoretical lenses. Our findings a) propose further investigations in non-linear relationships because they are “theoretically predominant and can be exceedingly useful tools in developing stress theories” (Johnson, 2014) and b) address research calls for implementing multiple theoretical perspectives in TS studies (Fischer and Riedl, 2017; Tarafdar et al. 2017); c) extend previous studies (e.g., Selye, 1964, 1987; Ayyagari et al. 2011; Srivastava et al. 2015) by distinguishing between the concepts of good and bad stress through the perspectives of stressors and technology.

8 Discussion and Conclusion

Technology integration and dependence have created challenges and opportunities for organizational and individual growth (Symantec, 2009). TS has been globally witnessed across different businesses, organizations, nations and cultures (Chen, 2015). We followed suggestions (Jex et al. 1992; Muse et al. 2009) to identify stress from a challenge rather than a threat perspective in the technology context. Hence, we make a distinction between the concepts of being under-challenged and over-challenged. First, our findings show that moderate levels of stressors are the optimum level to obtain best outcome (Onyemah, 2008) as they are evaluated as challenges rather than hindrances leading to inner-stimulation and higher performance outcomes (lower exhaustion) (Rodriguez-Escudero et al. 2010; Gilboa et al. 2008). Second, through the triphasic stress model, we validate previous arguments that quadratic and linear relationships can be seen as complementary in shaping a cubic form. The way we react to stressful situations is important, but managing them is a more demanding task. Balancing between high and low job or ICT-related stressful demands is achieved through developing organizational awareness and appropriate new strategies. To conclude, research efforts and empirical studies on TS have been very limited (Chen, 2015) and lacking in theoretical progress (Tarafdar et al. 2017). Therefore, our findings can promote further research.

References

Agho, A.O., J.L. Price and C.W. Mueller (1992). "Discriminant validity of measures of job satisfaction, positive affectivity and negative affectivity". *Journal of Occupational and Organizational Psychology* 65, 185±196.

Ahuja, M.K., K.M. Chudoba, C.J. Kacmar, D.H. McKnight and J.F. George (2007). "IT road warriors: Balancing work– family conflict, job autonomy, and work overload to mitigate turnover intentions". *MIS Quarterly* 31(1), 1-17.

Ahearne, M., S.B. MacKenzie, P.M. Podsakoff, J.E. Mathieu and S.K. Lam (2010). "The role of consensus in sales team performance". *Journal of Marketing Research* 47(3), 458-469.

Akgun, A.E., G.S. Lynn and J.C. Byrne (2006). "Antecedents and consequences of unlearning in new product development teams". *Journal of Product Innovation Management* 23 (1): 73-88.

Anderson, C.L. and R. Agarwal (2010). "Practicing safe computing: a multimedia empirical examination of home computer user security behavioral intentions". *Journal MIS Quarterly* 34 (3), Pages 613-643.

Arnold, M.B. (1960). *Emotion and personality* (Vols 1 & 2). New York: Columbia University Press.

APA (American Psychological Association) (2009-2017). *Stress in America*. Press room.

Amabile, T., C.N. Hadley and S.J. Kramer (2002). "Creativity under the Gun". *Harvard Business Review* 80 (8):52–61.

Atanasoff, L. and M.A. Venable (2017). "Technostress: Implications for Adults in the Workforce". *The career development quarterly* 65 (4).

Ausubel, J.H. and C. Marchetti (1997). *Elektron: Electrical Systems in Retrospect and Prospect*. Technological Trajectories and the Human Environment, J.H. Ausubel and H.D. Langford, eds., National Academy, Washington DC, pp. 115-140.

Ayyagari, R., V. Grover and R. Purvis (2011). "Technostress: technological antecedents and implications". *MIS Quarterly* 35 (4), 831-858.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Barczak, G. and D. Wilemon (2003). "Team Member Experience in New Product Development: Views from the Trenches". *R&D Management* 33:463–479.

Baum, A. (1990). "Stress, intrusive imagery, and chronic distress". *Health Psychology* 9, pp. 653–675.

Baroudi, J. J. (1985) "The Impact of Role Variables on IS Personnel Work Attitudes and Intentions". *MIS Quarterly* 9 (4), pp. 341-356.

Bentler, P.M. and D.G. Bonett (1980). "Significance tests and goodness of fit in the analysis of covariance structures". *Psychological Bulletin* 88, 588–606.

Bhuian, S.N., B. Menguc and R. Borsboom (2005). "Stressors and job outcomes in sales: a triphasic model versus a linear-quadratic-interactive model." *Journal of Business Research* 58 ,141–150.
Bono, J. E. and M.A. Vey (2005). "Toward understanding emotional management at work: A quantitative review of emotional labor research". *Emotions in organizational behavior* (pp. 213-233).
Brown, S. P., E. Jones and T.W. Leigh (2005). "The Attenuating Effect of Role Overload on Relationships Linking Self-Efficacy and Goal Level to Work Performance." *Journal of Applied Psychology* 90 (5), 972–979.
Bruck, C. S. and T.D. Allen (2003). "The relationship between big five personality traits, negative affectivity, type A behavior, and work-family conflict". *Journal of Vocational Behavior* 63 (3), 457-472.
Bulgurcu, B., H. Cavusoglu and I. Benbasat (2010). "Information Security Policy Compliance: An Empirical Study of Rationality-Based Beliefs and Information Security Awareness". *MIS Quarterly* 34 (3), pp.523-548.
Califf, C. B., S. Sarker and C. Fitzgerald (2016). *The Bright and Dark Sides of Technostress: An Empirical Study of Healthcare Workers*. Conference: International Conference on Information Systems. At: Forth Worth, Texas.
Carballedo, A., M. Doyle, G. Lavelle, J. Sojo, H. McCarthy, J. Gormley, V. O'Keane and T. Frodl (2014). "Affective network hyperconnectivity and hypoconnectivity of cognitive control and ventral attention networks in adults with high neuroticism scores". *Annals of Depression and Anxiety* 1 (6), 1029.
Compeau, D. R. and C.A. Higgins (1995). "Computer self-efficacy: Development of a measure and initial test". *MIS Quarterly* 19, 189.
Cooper, C. and P. Dewe (2008). "Well-Being: Absenteeism, Presenteeism, Coasts and Challenges". *Occupational Medicine* 58, 522-524.
Cooper, C.L., P. Dewe and M. O'driscoll (2001). *Organizational Stress: A Review and Critique of Theory, Research and Applications.* Sage, Thousand Oaks, California.
Costa, P. T., Jr. and R.R. McCrae (1985a). "Concurrent validation after 20 years: Implications of personality stability for its assessment". In J. N. Butcher & C. D. Spielberger (Eds.), *Advances in personality assessment* (Vol. 4, pp. 31-54). Hillsdale, NJ: Lawrence Erlbaum.
Costa, P. T., Jr. and R.R. McCrae (1985b). *The NEO Personality Inventory manual*. Odessa, FL : Psychological Assessment Resources.
Costa, P. T., Jr. and R.R. McCrae (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
Champoux, J. E. (1978). "A preliminary examination of some complex job scope- growth need strength interactions". *Academy of Management Proceedings* 59-63.
Champoux, J. E. (1980). "A three sample test of some extensions to the Job Characteristics Model of work motivation". *Academy of Management Journal* 23, 466-478.
Champoux, J. E. (1992). "A multivariate analysis of curvilinear relationships among job scope, work context satisfactions, and affective outcomes". *Human Relations* 45, 87-111.
Chen, L. (2015). "Validating the Technostress Instrument using a Sample of Chinese Knowledge Workers." *Journal of International Technology and Information Management* 24 (1).
Chilton, M.A., B.C. Hardgrave and D.J. Armstrong (2005). "Person-Job Cognitive Style Fit for Software Developers: The Effect on Strain and Performance." *Journal of Management Information Systems* 22 (2), pp 193-226.
Christensen, C. M. (1997). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.* Boston Harvard Business School Press.
CNN (2006). "Making cell phones simple is hard".
D'Arcy, J., A. Gupta, M. Tarafdar and O. Turel (2014). "Reflecting on the "Dark Side" of Information Technology use." *Communications of the AIS*, Forthcoming.
Erasmus, E. (2003). "Psychological Character of Computer-related Technostress". CHI-SA Gauteng, South Africa. Copyright ACM SIGCHI South Africa Chapter.
Eurofound and the International Labour Office (2017). *Working anytime, anywhere: The effects on the world of work*. Ref: EF1658EN, DOI 10.2806/372726.

Ellsworth, P. C. and K.R. Scherer (2003). *Appraisal processes in emotions.* In R. J. Davidson, H. Goldsmith, & K. R. Scherer (Eds.), Handbook of affective science (pp. 572-595). New York, NY: Oxford University Press.

Fischer, T. and R. Riedl (2017). "Techostress research: A nurturing ground for measurement pluralism?" *Communications of the Association for Information Systems* 40 (17), 375–401.

Folkman, S. and J.T. Moskowitz (2004). "Coping: pitfalls and promise". *Annual Review of Psychology* 55:745-74.

Folkman, S. (2011). *The Oxford Handbook of Stress, Health and Coping*. Oxford University Press, New York.

Folkman, S. (2013). *Stress Appraisal and Coping*. Springer, Berlin.

Fornell, C. and D.F. Larcker (1981). "Evaluating structural equation models with unobservable variables and measurement error". *Journal of Marketing Research* 18 (1), 39-50.

Foster, R. (1986). *Innovation: The Attacker's Advantage.* Summit Books, New York.

Fredette, J., R. Marom, K. Steinert and L. Witters (2012). *The Promise and Peril of Hyperconnectivity for Organizations and Societies*. World Economic Forum.

García, M., S. Llorens, M. Salanova and E. Cifre (2006). "Antecedentes de la autoeficacia en profesores de instituto". *Revista de Educación* 339, 387-400.

Gardner, D. G. (1986). "Activation theory and task design: An empirical test of several new predictions". *Journal of Applied Psychology* 71 (3), 411-418.

Gardner, D.G. and L.L. Cummings (1988). "Activation theory and job design: Review and reconceptualization." *Research in Organizational Behavior* 10, P. 81-122.

Gist, M.E. and T.R. Mitchell (1992). "Self-Efficacy: A Theoretical Analysis of Its Determinants and Malleability". *The Academy of Management Review* 17 (2), pp. 183-211.

Gilboa, S., A. Shirom, Y. Fried and C. Cooper (2008). "A Met-analysis of Work Demand Stressors and Job Performance: Examining Main and Moderating Effects". *Personnel Psychology* 61 (2), Pages 227-271.

Haans, R.F.J., C. Pierters and Z.L. He (2016). "Thinking About U: Theorizing and Testing U- and Inverted U-Shaped Relationships in Strategy Research." *Strategic Management Journal* 37: 1177–1195.

Hair, J., R. Anderson, R. Tatham and W. Black (1998). *Multivariate Data Analysis.* Prentice Hall International, London.

Haynes, S.N., D.C.S. Richard and E.S. Kubany (1995). "Content validity in psychological assessment: a functional approach to concepts and methods". *Psychological Assessment* 7 (3), 238-247.

Hu, L. and P. Bentler (1999). "Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives". *Structural Equation Modeling* 6, 1-55.

Jehn, K.A. (1995). "A Multimethod Examination of the Benefits and Detriments of Intragroup Conflict". *Administrative Science Quarterly* 40 (2):256–282.

Jex, S.M., T.A. Beehr and C.K. Roberts (1992). "The Meaning of Occupational Stress Items to Survey Recipients". *Journal of Applied Psychology* 77 (5):623-8.

Jex, S. M., P.D. Bliese, S. Buzzell and J. Primeau (2001). "The impact of self-efficacy on stressor strain relations: Coping style as an explanatory mechanism". *Journal of Applied Psychology* 86, 401–409.

Johnson, J.S. (2014). "Nonlinear analyses in sales research: theoretical bases and analytical considerations for polynomial models". *Journal of Personal Selling & Sales Management* 34 (4), 302–317.

Kappas, A. (2001). *A metaphor is a metaphor is a metaphor: Exorcising the homunculus from appraisal theory*. In K. R. Scherer, A. Schorr & T. Johnstone (Eds.), Appraisal processes in emotion: Theory, methods, and research (pp. 157-172). Oxford, UK: Oxford University Press.

Kahn, R. and P. Byosiere (1992). *Stress in organizations*. In Handbook of Industrial and Organizational Psychology (DUNNETTE M and HOUGH L, ds), pp 571-650, Consulting Psychologists Press, Palo Alto, California.

Keltner, D., P.C. Ellsworth and K. Edwards (1993). "Beyond simple pessimism: Effects of sadness and anger on social perception". *Journal of Personality & Social Psychology* 64, 740-752.

Khan, Z. and S.L. Jarvenpaa (2010). "Exploring temporal coordination of events with Facebook.com". *Journal of Information Technology* 25 (2), pp 137–151.

Kumaresan, S. and T. Ramayah (2005). “Organizational and personality influences on job stress: The case of Malaysian managers”. *Malaysian Management Review.*
Lazarus, R.S. (1966). *Psychological stress and the coping process.* New York: McGraw-Hill.
Lazarus, R.S. (1993). “From psychological stress to the emotions: a history of changing outlooks”. *Annual Review of Psychology* 44 (1), 1-22.
Lazarus, R. S. and S. Folkman (1984). *Stress, Appraisal, and Coping.* New York: Springer.
Le Fevre, M., J. Matheny and G. Kolt (2003). ‘Eustress, distress, and interpretation in occupational stress”. *Journal of Managerial Psychology* 18 (7), 726–744.
Leary, M.R., A.L. Haupt, K.S. Strausser and J.T. Chokel (1998). “Calibrating the sociometer: The relationship between interpersonal appraisals and self-esteem”. *Journal of Personality and Social Psychology* 74:1290–1299.
Lerner, J. S. and D. Keltner (2001). “Fear, anger, and risk”. *Journal of Personality and Social Psychology* 81 (1), 146-159.
Leung K., K.L. Huang, C.H. Su and L. Lu (2011). “Curvilinear relationships between role stress and innovative performance: Moderating effects of perceived support for innovation.” *Journal of Occupational and Organizational Psychology* 84, 741–758.
Lewis, M. D. (2005). “Bridging emotion theory and neurobiology through dynamic systems modeling”. *Behavioral and Brain Sciences* 28, 169-194.
Llorens, S., W. Schaufeli, A. Bakker and M. Salanova (2007). “Does a positive gain spiral of resources, efficacy beliefs and engagement exist?” *Computers in Human Behavior* 23, pp. 825-841.
Liang, H., N. Saraf, Q. Hu and Y. Xue (2007). “Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management”. *MIS Quarterly* 31, 59–87.
Lindberg, E., J. Wincent and D. Ortqvist (2013). “Turning stressors into something productive: an empirical study revealing nonlinear influences of role stressors on self-efficacy”. *Journal of Applied Social Psychology* 43 (2), 263–274.
Little, L.M., B.L. Simmons and D.L. Nelson (2007). “Health Among Leaders: Positive and Negative Affect, Engagement and Burnout, Forgiveness and Revenge”. *Journal of Management Studies* 44 (2), pp. 243–260.
Maier, C., S. Laumer, C. Weinert and T. Weitzel (2015). “The effects of technostress and switching stress on discontinued use of social networking services: a study of Facebook use”. *Information System Journal* 25 (3), https://doi.org/10.1111/isj.12068
Martínez, I. and M. Salanova (2005). ‘Burnout en la enseñanza’. *Revista de Psicología del Trabajo y las Organizaciones* 21, 55-70.
Mazmanian, M. and I. Erickson (2014). *The product of availability: Understanding the economic underpinnings of constant connectivity*. In CHI 2014: One of a CHInd - Conference Proceedings, 32nd Annual ACM Conference on Human Factors in Computing Systems (pp. 763-772). Association for Computing Machinery. DOI: 10.1145/2556288.2557381.
McGrath, J.E. (1976). *Stress and behavior in organizations.* In Handbook of Industrial and Organizational Psychology (DUNNETTE M. D. Ed.), pp 1351-1395 Rand-McNally, Chicago, Illinois.
McGee, M. K. (1996). *“Burnout!”.* InformationWeek, pp. 34-40.
McCrae, R.R. and P.T. Jr. Costa (2003). *Personality in adulthood: A Five-Factor Theory perspective* (2nd. ed.). New York: Guilford Press. McCrae, R. R., & Costa, P. T., Jr. (in press). Cross-cultural perspectives on adult personality trait development. In D. Mroczek & T. Little (Eds.), Handbook of personality development. Hillsdale, NJ: Erlbaum.
Mihalache, O.R., J.J.J.P. Jansen, F. Van Den Bosch and H.W. Volberda (2012). “Offshoring and firm innovation: the moderating role of top management team attributes”. *Strategic Management Journal* 33 (13), 1480-1498.
Muse, L.A., S.G. Harris and H.S. Field (2009). “Has the Inverted-U Theory of Stress and Job Performance Had a Fair Test?” *Human Performance* 16 (4), 349-364, DOI: 10.1207/S15327043HUP1604_2.
Nelson, D.L. and B.L. Simmons (2003-2004). *Eustress: An elusive construct, an engaging pursuit*. In Emotional and Physiological Processes and Positive Intervention Strategies. Research in Occupational Stress and Well-being (PERREWE PL and GANSTER DC, Eds), Vol. 3, pp 265-322, Emerald Group Publishing Limited, Oxford, UK.

Nygaard, A. and R. Dahlstrom (2002). “Role stress and effectiveness in horizontal alliances.” *Journal of Marketing* 66 (2), pg. 61.
Ohly, S. and A. Latour (2014). “Work-related smartphone use and well-being in the evening: The role of autonomous and controlled motivation”. *Journal of Personnel Psychology* 13 (4),174–183.
Onyemah, V. (2008). “Role Ambiguity, Role Conflict, and Performance Empirical Evidence of an Inverted-U Relationship”. *Journal of Personal Selling & Sales Management* 28, 299-313.
Preacher, K.J. and A.F. Hayes (2010). “Quantifying and Testing Indirect Effects in Simple Mediation Models When the Constituent Paths Are Nonlinear”. *Multivariate Behavioral Research* 4, :627–660.
Podsakoff, P.M., S.B. Mackenzie, J. Lee and N.P. Podsakoff (2003). “Common method biases in behavioral research: a critical review of the literature and recommended remedies”. *Journal of Applied Psychology* 88 (5), 879-903.
Ragu-Nathan, T. S., M. Tarafdar, B.S. Ragu-Nathan and T. Qiang (2008). “The consequences of technostress for end users in organizations: conceptual development and empirical validation.” *Information Systems Research* 19 (4), 417-433.
Reisenzein, R. and T. Hofmann (1993). “Discriminating emotions from appraisal-relevant situational information: Baseline data for structural models of cognitive appraisals”. *Cognition and Emotion* 7, 271-293.
Rodríguez-Escudero, A.I., C. Pilar and J. Munuera-Alemán (2010). “Positive and Negative Effects of Team Stressors on Job Satisfaction and New Product Performance”. *Journal of Product Innovation Management* 27 (6):856 – 868. DOI10.1111/j.1540-5885.2010.00756.
Roseman, I. J. and S. Kaiser (2001). *Applications of appraisal theory to understanding, diagnosing, and treating emotional pathology*. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), Appraisal processes in emotion: Theory, methods, research (pp. 249-267). New York, NY: Oxford University Press.
Roseman, I. J. and C.A. Smith (2001). *Appraisal theory: Overview, assumptions, varieties, controversies.* In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), Appraisal processes in emotion: Theory, methods, research (pp. 3-19). Oxford, UK: Oxford University Press.
Ruthig, J. C., R.P. Perry, S. Hladkyj, N.C. Hall, R. Pekrun and J.G. Chipperfield (2008). “Perceived control and emotions: interactive effects on performance in achievement settings”. *Social Psychological Education* 11, 161–180.
Saarni, C. (2000). *Emotional Competence: A Developmental Perspective.* In R. Bar-On, & J. D. A. Parker (Eds.), The Handbook of Emotional Intelligence: Theory, Development, Assessment, and Application at Home, School, and in the Workplace (pp. 68-91). San Francisco, CA: Jossey-Bass.
Salamin, A. and P.W. Hom (2005). “In Search of the Elusive U-Shaped Performance-Turnover Relationship: Are High Performing Swiss Bankers More Liable to Quit?” *Journal of Applied Psychology* 90 (6), 1204-1216.
Scherer, K.R., E.S. Dan and A. Flykt (2006). “What determines a feeling’s position in affective space? A case for appraisal”. *Cognition and Emotion* 20 (1), 92-113.
Schaubroeck, J. and D.C. Ganster (1993). “Chronic demands and responsivity to challenge”. *Journal of Applied Psychology* 78, 73-85.
Schwarzer, R. (Ed.) (1992). *Self-efficacy: Thought control of action*. Washington, DC: Hemisphere.
Scott, W.E. (1966). “Activation theory and task design”. *Organizational Behavior and Human Performance* 1, 3-30.
Selye, H. (1950). *The physiology and pathology of exposure to stress: a treatise based on the concepts of the general adaptation-syndrome and the diseases of adaptation.* Montreal, Canada: ACTA.
Selye, H. (1956). *The Stress of Life.* McGraw-Hill, New York, New York.
Selye, H. (1964). *From Dream to Discovery.* McGraw-Hill, New York, NY.
Selye, H. (1973). “The evolution of the stress concept”. *American Scientist* 61 (6), 692-699.
Selye, H. (1974). *Stress without distress.* Philadelphia, PA: J.B. Lippincott Co.
Selye, H. (1983). *The Stress Concept: Past, Present and Future*. Stress Research, C.L. Cooper (eds.), New York: John Wiley.
Selye, H. (1987). *Stress without Distress.* Transworld, London.
Seligman, M.E.P. and M. Csikszentmihalyi (2000). “Positive Psychology: An Introduction”. *American Psychologist* 55 (1):5-14 DOI10.1037/0003-066X.55.1.5
Sethi, A.S., D.H.J. Caro and R.S. Schuler (1987). *Strategic Management of Technostress in an Information Society*, Hogrefe.

Schwab, D.P. and L.L. Cummings (1976). “A theoretical analysis of the impact of task scope on employee performance”. *Academy of Management Review* 1, 23–35.
Srivastava, S.C., S. Chandra and A. Shirish (2015). “Technostress creators and job outcomes: theorizing the moderating influence of personality traits.” *Information Systems Journal* 25, 355–401.
Shu, Q., Q. Tu and K. Wang (2011). “The impact of computer self-efficacy and technology dependence on computer- related technostress: a social cognitive theory perspective.” *International Journal of Human-Computer Interaction* 27, 923–939.
Singh, J. (1998). “Striking a Balance in Boundary-Spanning Positions: An Investigation of Some Unconventional Influences of Role stressors and Job Characteristics.” *Journal of Marketing* 62, 69-86.
Sonnentag, S. and U. Kruel (2006). “Psychological detachment from work during off-job time: The role of job stressors, Job involvement, and recovery-related self-efficacy”. *European Journal of Work and Organizational Psychology* 15 (2) DOI10.1080/13594320500513939.
Sood, A. and G.J. Tellis (2005). “Technological Evolution and Radical Innovation”. *Journal of Marketing* 69, 152–168.
Steiger, J.H. (1990). “Structural model evaluation and modification: an interval estimation approach”. *Multivariate Behavioural Research* 25, 173±180.
Stoeva, A. Z., R.K. Chiu and J.H. Greenhaus (2002). “Negative affectivity, role stress, and work–family conflict”. *Journal of Vocational Behavior* 60 (1), 1–16.
Strumpfer, D. (1986). *Executive stress*. (In Barling, J., Fullagar, C. & Bluen, S. Behaviour in organisations: South African perspectives. Isando: McGraw-Hill. p. 533-559.
Suharti, L. and A. Susanto (2014). “The impact of workload and technology competence on technostress and performance of employees”. *Indian Journal of Commerce and Management Studies* 5 (2), 1-7.
Symantec (2009). *Symantec Internet Security Threat Report.* Trends for 2008.
Takeuchi, R., D.P. Lepak, S.V. Marinova and S. Yun (2007). “Nonlinear influences of stressors on general adjustment: The case of Japanese expatriates and their spouses”. *Journal of International Business Studies* 38 (6), 928-943.
Tarafdar, M., T.U. Qiang, T.S. Ragu-Nathan and B.S. Ragu-Nathan (2011). “Crossing to the dark side: examining creators, outcomes, and Inhibitors of technostress.” *Communications of the ACM* 54 (9), 113-120.
Tarafdar, M., Q. Tu, B.S. Ragu-Nathan and T.S. Ragu-Nathan (2007). “The impact of technostress on role stress and productivity.” *Journal of Management Information Systems* 24 (1), 301-328.
Tarafdar, M., Q. Tu and T.S. Ragu-Nathan (2010). “Impact of technostress on end-user satisfaction and performance.” *Journal of Management Information Systems* 27 (3), 303-334.
Tarafdar, M., E.B. Pullins and T.S. Ragu-Nathan (2014). “Examining impacts of technostress on the professional salesperson's behavioural performance”. *Journal of Personal Selling & Sales Management* 34 (1), 51-69.
Tarafdar, M., C.L. Cooper and J.F. Stich (2017). “The technostress trifecta—Techno eustress, techno distress and design: Theoretical directions and an agenda for research”. *Information Systems Journal* 1 (37).doi: 10.1111/isj.12169.
Tellegen, A. (1985). *Structures of Mood and Personality and Their Relevance to Assessing Anxiety, with an Emphasis on Self-Report*. In A. H. Tuma, & J. D. Master (Eds.), Anxiety and the Anxiety Disorders (pp. 681-706). Hillsdale, NJ: Erlbaum.
Tong, E.M.W., P.C. Ellsworth and G.D. Bishop (2009). “An S-Shaped Relationship Between Changes in Appraisals and Changes in Emotions”. *Emotion* 9 (6):821-37 DOI10.1037/a0017812.
Tong, E.M.W. and K.L.H. Tay (2011). “S-shaped Appraisal–Emotion Relationships: The Role of Neuroticism.” *Social Psychological and Personality Science* 2 (5) 487-493.
Treisman, M. (1999). “There are two types of psychometric function: A theory of cue combination in the processing of complex stimuli with implications for categorical perception”. *Journal of Experimental Psychology: General* 128, 517-546. doi:10.1037/ 0096-3445.128.4.517.
Tu, Q., K. Wang and Q. Shu (2005). “Computer-Related Techno-stress in China.” *Communications of the ACM* 48 (4), pp. 77-81.
Utterback, J.M. (1994). “Radical Innovation and Corporate Regeneration.” *Research Technology Management* 37 (4), 10.

Uotila, J., M. Maula, T. Keil and S.A. Zahra (2009). "Exploration, exploitation, and financial performance: analysis of S&P 500 corporations". *Strategic Management Journal* 30 (2), 221-231.

Van den Heuvel, O.A., Y.D. Van der Werf, K.M.W. Verhoef, S.J. De Wit, H.W. Berendse, E.C. Wolters (2010). "Frontal-striatal abnormalities underlying behaviours in the compulsive-impulsive spectrum". *Journal of Neuro Science* 289: 55–59.

Villavicencio, F. T. and A.B.I. Bernardo (2013). "Positive academic emotions moderate the relationship between self-regulation and academic achievement". *British Journal of Educational Psychology* 83 (2), 329-340.

Watson, D. and L.A. Clark (1984). "Negative affectivity: The disposition to experience aversive emotional states". *Psychological Bulletin* 96, 465-490.

Wang, K., Q. Shu and Q. Tu (2008). "Technostress under different organizational environments: An empirical investigation." *Computers in Human Behavior* 24 (6), 3002-3013.

Appendix

Variables	Item #	References	Mean	St. Dev.
TO	5 items	Ragu-Nathan et al., 2008; Tarafdar et al., 2007	2.98	0.99
TC	5 items		2.45	1.00
TUN	3 items		3.71	0.88
SE	6 items	Compeau & Higgins, 1995	3.52	0.78
PR	6 items	Ayyagari et al., 2001	3.66	0.72
NA	6 items	Watson & Clark, 1984; Agho et al., 1992	2.91	1.06
TE	4 items	Ayyagari et al., 2011	2.64	1.09
DIS	3 items	Maier et al., 2015	3.00	0.87

Table 1. Items, Sources and Descriptive Statistics

	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)	Maximum Shared Variance (MSV)
DIS	0.847	0.908	0.766	0.319
SE	0.869	0.901	0.602	0.355
NA	0.909	0.928	0.683	0.437
PR	0.849	0.888	0.569	0.355
TC	0.867	0.904	0.655	0.442
TO	0.837	0.883	0.606	0.442
TUN	0.805	0.885	0.719	0.304
TE	0.917	0.942	0.801	0.437

Table 2. Cronbach's alpha, CR, AVE, MSV

**(MSV < AVE) (Fornell & Larcker, 1981) supports discriminant validity*

CMIN/DF	CFI	NFI	RMSEA	SRMR
1.881	0.90	*0.88*	0.051	0.075
= or < 3	= or > 0.90	= or > 0.90	= or < 0.05	= or < 0.08
Hair et al. 2010	Hair et al. 2010	Bentler & Bonnet, 1980	Steiger, 1990	Hu & Bentler, 1999

Table 3. Model fit

	R	R^2	Adjusted R^2	VIF = $(1/1-R^2i)$
Model 1	0.523	0.274	0.256	***1.38**
Model 2	0.567	0.321	0.315	***1.47**
Model 3	0.462	0.213	0.209	***1.27**

Table 4. R, R^2, Adjusted R^2, and VIFs

**VIFs < 5, Multicollinearity is not a problem in this research*

Models	R	R^2	F-Test Difference in R^2
SE-TSS (Linear Function)	0.349	0.122	29.499
SE-TSS (Quadratic Function)	0.350	0.122	14.782
SE-TSS (Cubic Function)	**0.371**	**0.138**	**11.250**
PR-TSS (Linear Function)	0.355	0.126	30.352
PR-TSS (Quadratic Function)	0.372	0.139	16.888
PR-TSS (Cubic Function)	**0.376**	**0.141**	**11.474**
TSS-TE (Linear Function)	0.536	0.288	86.02
TSS-TE (Quadratic Function)	**0.567**	**0.321**	**50.199**

Table 5. Curve Fitting Analyses - Anova F-Test

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.265	27.742	27.742	4.479	12.106	12.106
2	5.357	14.479	42.221	3.790	10.245	22.350
3	2.724	7.361	49.583	3.460	9.353	31.703
4	1.885	5.095	54.678	3.134	8.469	40.172
5	1.588	4.292	58.970	3.100	8.377	48.550
6	1.455	3.932	62.902	3.072	8.302	56.852
7	1.290	3.486	66.388	2.372	6.410	63.261
8	**1.189**	**3.213**	**69.601**	**2.346**	**6.340**	**69.601**
9	0.836	2.258	71.860			

Table 6. Harman's One Factor Test – Total Variance Explained

Variables	**Model 1**				**Model 3**		
	Technostressors				Discontinuous Usage Intention		
	t	Stnd B	St Er.		t	Stnd B	St Er.
ICT efficacy[3]	**2.464***	**.208***	**.025***	Technoexhaustion	**7.595***	**.462***	**.048***
Presenteeism[3]	**4.327***	**.262***	**.031***				
NegativeAffectivity[3]	**5.496***	**.392***	**.018***				
NA x PR[3]	-.367	-.028	.013				
NA x SE[3]	**2.153****	**.188****	**.006****				
		Model 2					
	Technoexhaustion						
	t	Stnd B	St Er.				
Technostressors[2]	**3.244***	**.185***	**.083***				

Table 7. Linear and Nonlinear Regression Analyses

*n = 215, * (p<0.015), ** (p<0.05)*

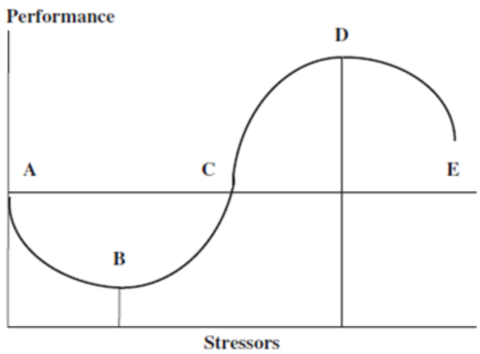

Figure 1. Triphasic stress model

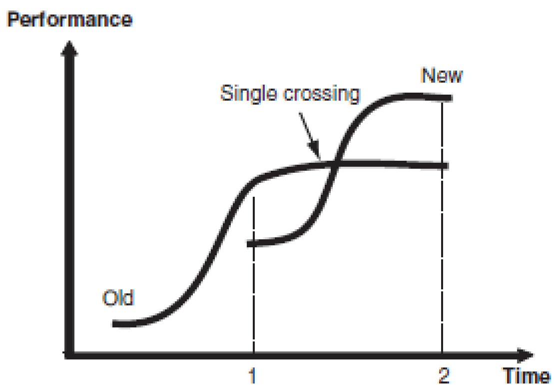

Figure 2. Technological S Curve

Source: Sood & Tellis, 2005

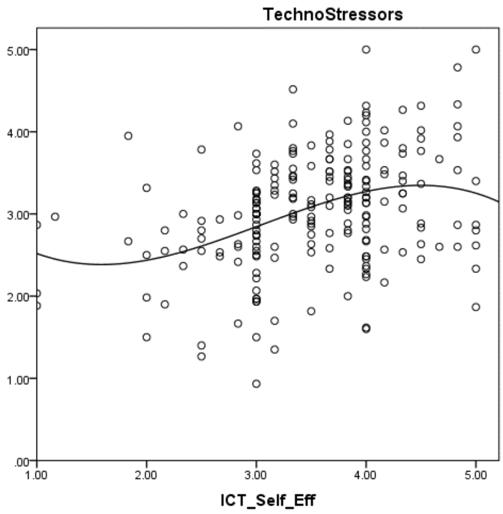

Figure 4. SE-TSS Cubic S-shaped Relationship

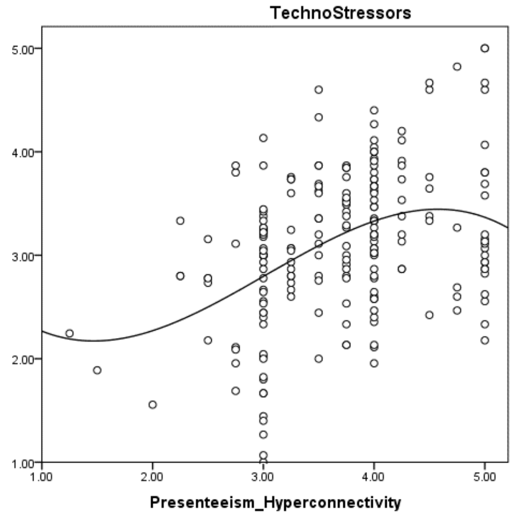

Figure 5. PR-TSS Cubic S-shaped Relationship

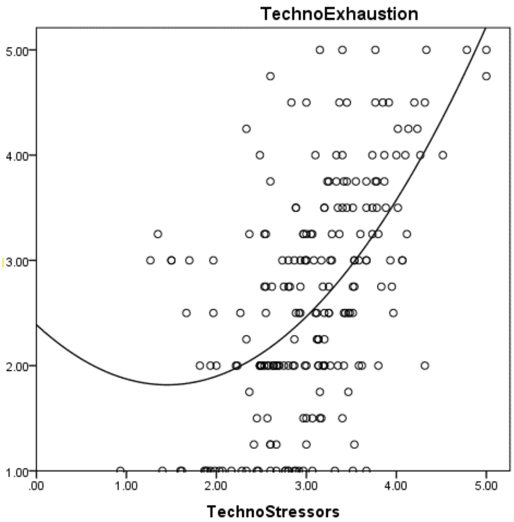

Figure 6. TSS-TE U-shaped Relationship

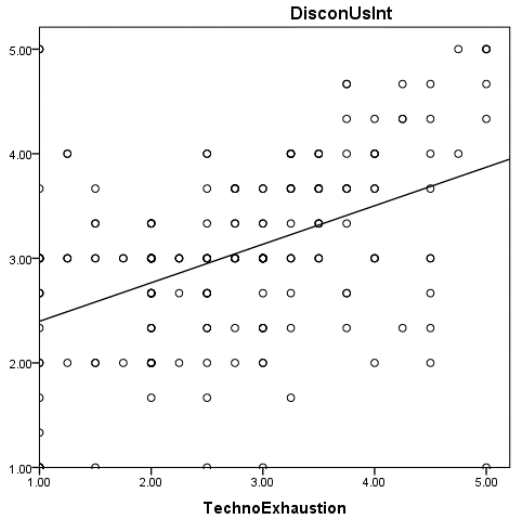

Figure 7. TE-DIS Linear Relationship

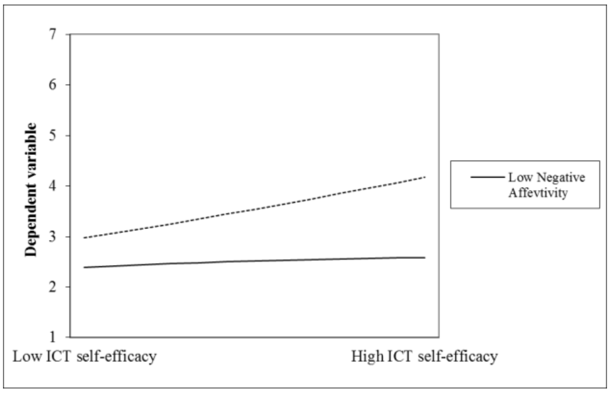

Figure 8. SE-NA-TSS Interaction

	Ba0	Ba1	Bb1	Bc1	Knot1	Knot2
Ba0	**1.000**	-.972	.145	.000	-.507	.000
Ba1	-.972	**1.000**	-.150	.000	.640	.000
Bb1	.145	-.150	**1.000**	-.985	.335	-.939
Bc1	.000	.000	-.985	**1.000**	-.434	.930
Knot1	-.507	.640	.335	-.434	**1.000**	-.325
Knot2	.000	.000	-.939	.930	-.325	**1.000**

Table 8a. SE-TSS Cubic Spline - Correlations of Parameter Estimates

	Ba0	Ba1	Bb1	Bc1	Knot1	Knot2
Ba0	**1.000**	-1.000	1.000	-.160	-1.000	.078
Ba1	-1.000	**1.000**	-1.000	.160	1.000	-.078
Bb1	1.000	-1.000	**1.000**	-.160	-1.000	.078
Bc1	-.160	.160	-.160	**1.000**	.160	.386
Knot1	-1.000	1.000	-1.000	.160	**1.000**	-.078
Knot2	.078	-.078	.078	.386	-.078	**1.000**

Table 8b. PR-TSS Cubic Spline - Correlations of Parameter Estimates

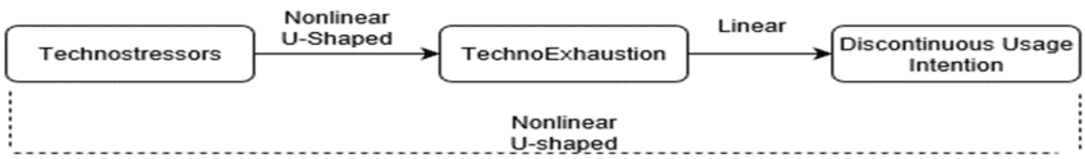

Figure 9. Nonlinear Mediation Model

Bias Corrected Bootstrap Confidence Interval for THETA			
XVAL	LowerCI	THETA	UpperCI
2.3441	0.0488	0.1392	0.2844
3.0476	0.1078	0.2490	0.3926
3.7511	0.1557	0.3588	0.5746

Table 9. Instantaneous Indirect Effects

	Component							
	1	2	3	4	5	6	7	8
Techno-Overload 1	.043	-.060	.045	.065	**.718**	.004	-.100	.040
Techno-Overload 2	.156	.141	.254	.016	**.658**	.326	.114	-.076
Techno-Overload 3	.148	.108	.277	.004	**.757**	.146	.173	-.039
Techno-Overload 4	.028	.105	.189	.136	**.675**	.180	-.054	.281
Techno-Overload 5	.141	.134	.278	.164	**.665**	.194	.124	.092
Techno-Complexity 1	.245	.008	**.729**	-.051	.161	.206	.155	.066
Techno-Complexity 2	.217	-.008	**.723**	.041	.045	.142	.131	-.064
Techno-Complexity 3	.197	.063	**.713**	-.130	.359	.118	.115	-.070
Techno-Complexity 4	.121	.133	**.618**	.107	.277	.139	.084	.153
Techno-Complexity 5	.179	.022	**.794**	-.009	.221	.198	.176	-.018
Techno-Uncertainty 2	-.039	.071	.113	.202	.127	-.062	.037	**.777**
Techno-Uncertainty 3	.043	.146	-.039	.258	-.032	.091	.030	**.817**
Techno-Uncertainty 4	-.006	.134	-.052	.154	.089	-.012	-.018	**.806**

ICT Self-Efficacy 4	.184	**.703**	-.030	.108	.142	.063	.208	.109
ICT Self-Efficacy 5	.118	**.779**	-.024	.197	.159	.058	.148	.035
ICT Self-Efficacy 6	.166	**.748**	-.033	.194	.084	-.016	.122	-.057
ICT Self-Efficacy 8	.011	**.658**	.008	.266	.017	.152	-.061	.176
ICT Self-Efficacy 9	.057	**.772**	.214	.197	-.104	.079	-.047	.101
ICT Self-Efficacy 10	-.044	**.765**	.090	.184	.037	-.011	-.071	.104
Technoexhaustion 1	.287	.078	.258	.086	.130	**.705**	.189	.005
Technoexhaustion 2	.299	.065	.166	.019	.204	**.813**	.100	-.020
Technoexhaustion 3	.255	.107	.309	-.014	.228	**.754**	.116	.090
Technoexhaustion 4	.366	.068	.194	.036	.214	**.748**	.142	-.045
Negative Affectivity 1	**.791**	.126	.111	.046	.151	.050	.091	-.026
Negative Affectivity 2	**.663**	.041	.232	-.143	.065	.183	.274	.047
Negative Affectivity 3	**.781**	.104	.258	-.073	.082	.212	.173	-.049
Negative Affectivity 4	**.832**	.055	.137	-.026	.038	.222	.116	.105
Negative Affectivity 5	**.787**	.029	.138	.015	-.046	.284	.092	-.025
Negative Affectivity 6	**.726**	.144	.146	.046	.251	.142	.140	-.046
Presenteeism 1	.064	.292	.087	**.558**	.278	-.090	.242	.134
Presenteeism 2	.121	.245	-.013	**.717**	.107	.042	.084	.080
Presenteeism 3	-.199	.187	-.010	**.714**	.180	-.080	.062	.115
Presenteeism 4	-.078	.195	.104	**.717**	.037	-.178	-.213	.295
Presenteeism 5	-.024	.190	-.071	**.731**	-.018	.145	.008	.118
Presenteeism 6	.015	.181	-.024	**.765**	-.055	.139	.032	.129
Disc. usage intention 1	.185	.021	.217	.015	.109	.169	**.757**	.145
Disc. usage intention 2	.239	.110	.208	.134	.005	.160	**.821**	-.050
Disc. usage intention 3	.352	.119	.189	.013	.004	.114	**.741**	-.065

Table A. Factor Loadings