Challenges in Technostress Research: Guiding Future Work

Emergent Research Forum papers

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Abstract

Since the proliferation of technologies in organizations has been found to lead to technostress in employees and to various negative organizational consequences, much recent research has investigated the factors that can lead to technostress and how to prevent these factors from occurring. However, limited directions currently exist to guide further research in this area. Consequently, the present research-in-progress sets out to determine the key challenges that remain to be addressed by technostress research. The paper finds that technostress research needs to be more theory-driven, needs to evaluate stress more directly instead of indirectly through such concepts as job satisfaction that serve as proxies for stress, needs to advance more rigorous explanations of how and why technology creates stress in users, needs to advance more rigorous explanations of for what kinds of users technology creates stress, and needs to be more diversified in terms of perspectives, methods, measures, and paradigms used.

Keywords

Technostress, ICT, research agenda, research questions.

Introduction

To support his work as a sales manager, Paul has to leverage the ever-growing variety of organizational information and communication technologies (ICTs), which have evolved from traditional PC systems to Wi-Fi phones and voice-over-IP systems. Paul has a positive attitude toward these ICTs and believes they are useful for his job. Yet, like many other workers in today's busy business and computing environments, he faces trouble in using these technologies effectively – because of the various ways in which they create stress in him (Ayyagari et al. 2011). For example, like other workers Paul finds frequent interruptions such as instant messages to be disruptive to mental work, he feels pressured to keep up with the fast pace of technological change, and he has trouble disconnecting from his work due to the constant connectivity enabled by organizational ICTs (Ayyagari et al. 2011; Tarafdar et al. 2011). Thus, Paul is frustrated and feels that ICTs threaten his well-being and job performance; even his body reacts to these threats arising from ICTs, producing elevated levels of stress hormones that can endanger his health (Riedl et al. 2012).

This vignette illustrates the interdependency of two emergent trends in both the western and eastern worlds: workplace stress and the pervasive growth of ICTs in organizations (Cooper et al. 2001; Macik-Frey et al. 2007). Workplace stress in general has been shown to create both psychological and physiological problems for workers (Macik-Frey et al. 2007), and it generates substantial costs for organizations. For example, in the U.S. alone the costs of workplace stress have been estimated to exceed $300 billion per year due to reduced worker productivity, burnout, absenteeism, employee turnover, alcohol use, medical expenses, and stress-related compensation claims (American Psychological Association 2010). These stress-related problems, which have also been described in Australia, China, and Europe (e.g., Medibank 2008), have been rising dramatically in recent years due to workers' growing dependence on modern ICTs (Macik-Frey et al. 2007). Recent studies have shown that workers perceive

higher levels of stress due to technology characteristics such as lack of usability, frequent interruptions (instant messages etc.), and technology intrusiveness (i.e., workers can be reached anywhere at any time) (Ayyagari et al. 2011; Tarafdar et al. 2011). In light of the costs of job stress recognized above, these findings indicate the necessity to examine the stress-related implications of technology.

To understand better the implications of this emerging phenomenon referred to as technostress (i.e., *the stress experienced by people as a result of their ICT use* (Riedl 2013)) for people and organizations, research has begun to explore the phenomenon's nomological network (e.g., Ayyagari et al. 2011; Ragu-Nathan et al. 2008; Riedl et al. 2012; Tarafdar et al. 2007, 2010, 2011). Yet, since such research has examined a novel phenomenon and has, thus, emerged only recently (few studies appeared before 2007), much remains to be learned about technostress. Hence, *the objective of the present paper is to help research on technostress progress by shedding light on the key challenges that remain in this area.*

Challenges in Technostress Research

Tables 1 and 2 offer a **preliminary** literature review of prior research on technostress. This preliminary review focuses on papers published in *MIS Quarterly*, *Information Systems Research*, *Journal of Management Information Systems*, *Journal of the Association for Information Systems*, *Business & Information Systems Engineering*, and *Communications of the ACM*. These papers were identified using keywords such as "technostress," "technology," and "stress." The tables indicate that research into technostress has focused on discovering the antecedents and consequences of the phenomenon, an appropriate approach generally marking the beginning of the exploration of a concept's nomological network (Bacharach 1989). For example, Ayyagari et al. (2011), Ragu-Nathan et al. (2008), and Tarafdar et al. (2007, 2010, 2011) found that technostress arises from such technology characteristics as lack of usability and from the information overload and constant connectivity it enables. Further, these authors have identified such consequences of technostress as reduced worker productivity and lowered IT use intentions. While these insights were relevant and important for the exploration of the phenomenon, much remains to be learned (see Tables 1 and 2).

First, while most studies on technostress have briefly referenced relevant theoretical perspectives to broadly frame their research models (see Table 1, column 1), only few of them have leveraged these perspectives fully in their specific hypotheses developments (see Table 1, column 2). This largely atheoretical approach points to our immaturity in this topic (Huber 1983). Hence, more rigorous theory-driven research is needed for an improved modeling of the technostress phenomenon with the potential to result in a more powerful and parsimonious understanding of it. Further, the concept of technostress has often been approximated with such measures as job satisfaction or IT use rather than precisely measured (see Table 1, column 3), limiting our understanding of what exactly technostress is and how it operates. Thus, more rigorous measurements of actual stress are needed to yield a potentially more valid understanding of the concept of technostress.

Perhaps even more importantly, prior research has largely omitted the mediating factors that could explain how and why ICTs result in stress. Except for Ayyagari et al. (2011), who found that technology characteristics lead to stress via such mediators as work-home conflict and role ambiguity from the job-stress literature, past research has merely speculated about potential mediating factors but has not formally conceptualized mediating variables and tested research models concerned with indirect effects (see Table 1, columns 4 & 5).

Source	Theory-driven Approach		IVs and DVs	Mediating Variables / Indirect Effects	
	Column: 1	**2**	**3**	**4**	**5**
	Theoretical Perspective Referenced[1]	*Perspective referenced was fully leveraged*[2]	*Independent and Dependent Variables*	*Speculations about potential mediating mechanisms were offered*	*Mediating variables were conceptualized and formal tests of mediation were done*[3]
Ayyagari et al. 2011	Person-Environment Fit (Edwards 1991)	Yes	IVs = Technology Characteristics; DVs = Strain	Potential mediators: Variables from the job-stress literature	Actual mediators: Variables from the job-stress literature
Ragu-Nathan et al. 2008	Transaction-based Model (McGrath 1976)	No	IVs = Technology characteristics and managerial mechanisms; DVs = job satisfaction, organizational and continuance commitment	No	No
Riedl et al. 2012	Endocrinological Theory (Dickerson and Kemeny 2004)	Yes	IVs = system breakdown (error messages); DVs = Strain (cortisol elevations)	Potential mediators: E.g., threat to goals and lack of control of the situation	No
Tarafdar et al. 2007	Sociotechnical and role theory (e.g., Gross & McEachern 1996)	No	IVs = Technology Characteristics; DVs = Role Stress and Productivity	No	No
Tarafdar et al. 2010	Transaction-based Model (McGrath 1976)	No	IVs = IT characteristics and situational variables; DVs = IT usage and job-related outcomes such as job satisfaction and performance	IT characteristics and situational variables may perhaps affect job-related outcomes indirectly via user satisfaction	No
Tarafdar et al. 2011	Transaction Theory (Lazarus 1991)	No	IVs = IT characteristics, situational variables, and user demographics; DVs = IT usage and job-related outcomes	No	No

Tu et al. 2005	None	Not applicable	IVs = Technology characteristics; DVs = Productivity	No	No
Research Challenge ->	More *rigorous theory-driven* research is needed, with hypotheses justifications fully grounded in theory		More evaluations of actual stress are needed instead of such proxies as job satisfaction or IT use	More rigorous conceptual and empirical explanation is needed of *how & why* technology creates stress (i.e., examining indirect effects / mediation models)	
1. We considered any perspective referenced; 2. This feature implies that the hypotheses justifications were fully tied back into the theoretical perspective referenced; 3. This feature implies that (a) mediating/indirect effects were conceptualized and formally hypothesized, and (b) formal tests of mediation were conducted using, e.g., procedures recommended by Baron & Kenny (1986), Preacher & Hayes (2004), or Sobel (1982).					

Table 1. Challenges in Technostress Research: Theory, Measurement, and Mediation

Similarly, technostress research thus far has largely omitted the moderating factors explaining for what types of users ICTs can result in stress. Such research has merely speculated about potential moderating factors and included demographic variables in its research models (see Table 2, column 1), but it has not formally conceptualized moderation effects and tested corresponding research models concerned with conditional effects (see Table 2, column 2). These limitations are serious since understanding the variables explaining for whom technostress crystallizes as well as how and why it crystallizes is critical for theory development and testing in this area to advance; seminal stress research (Cooper et al. 2001; Lazarus 1999) emphasizes that stress arises from a person's reaction to a stimulus shaped by cognitive processes, not from the specific stimulus per se (i.e., direct, linear effects as those examined in prior research can only yield an initial and partial understanding of the technostress phenomenon).

A final aspect calling for improvement is the lack of conceptual and empirical diversity inherent in prior research on technostress. The vast majority of such research has relied on psychology as the only reference discipline (see Table 2, column 3) and has, thus, primarily employed surveys with perceptual measures (see Table 2, column 4). This single-sided approach ignores the pertinence of bodily reactions to technological stressors. Consistent with seminal research on job stress (e.g., Cooper et al. 2001), researchers should use both perceptual and biological measures of stress to obtain a greater picture and identify more powerful predictive relationships. In accordance with this understanding, it has recently been emphasized that neurobiological measures are useful for research on business and information systems engineering, particularly in the area of technostress (e.g., Dimoka et al. 2011, 2012). A recent study (Riedl et al. 2012) has confirmed this idea, showing that system breakdown can result in elevations of stress hormones. Besides, past research has focused on the behavioral science paradigm to the exclusion of the design science paradigm (see Table 2, column 5), ignoring the complementary cycle between the two paradigms (Hevner et al. 2004). More research creating artifacts with the potential to counter technostress is needed for enhanced practical implications of technostress research.

Source	Moderating Variables / Conditional Effects		Conceptual & Empirical Diversity		
	1	2	3	4	5
	Speculations about potential moderating mechanisms were offered	*Moderating variables were conceptualized and formal tests of moderation were done*[1]	*Reference Discipline*	*Method / Stress Measure*	*Paradigm of IS Research*
Ayyagari et al. 2011	Self-efficacy and technical support may serve as moderators	No	Psychology	Large-scale Survey / Perceptual	Behavioral science
Ragu-Nathan et al. 2008	Moderating effects were tested in an alternative model but not found. Yet, results showed that individual differences such as age can influence stress	No	Psychology	Large-scale Survey / Perceptual	Behavioral science
Riedl et al. 2012	No	No	Neuro-biology	Laboratory Experiment / Biological	Behavioral science
Tarafdar et al. 2007	Demographics and organizational actions may moderate the link between technostress and productivity	No	Psychology	Large-scale Survey / Perceptual	Behavioral science
Tarafdar et al. 2010	The authors note that situational variables may also negatively moderate the relationship between stressors and strain	No	Psychology	Large-scale Survey / Perceptual	Behavioral science
Tarafdar et al. 2011	No	No	Psychology	Large-scale Survey / Perceptual	Behavioral science
Tu et al. 2005	Results showed that such group differences as age can influence technostress	No	Psychology	Large-scale Survey / Perceptual	Behavioral science

Research Challenge ->	More rigorous conceptual and empirical explanation is needed of *for whom* technology creates stress (i.e., examining conditional effects / moderation models)	More *diversity in perspectives, methods, measures, & paradigms* is needed for more powerful predictions and greater practicality
1. This feature implies that (a) moderating/conditional effects were conceptualized and hypothesized, and (b) formal tests of moderation were conducted using, e.g., hierarchical regression with product terms (Aiken & West 1991).		

Table 2. Challenges in Technostress Research: Moderation and Diversity

Based on these five challenges, we advance the following research agenda:

Research Question 1: Which psychological or biological stress theories are most pertinent in predicting technostress?

Research Question 2: How can stress be measured most accurately and holistically?

Research Question 3: What factors are most important in explaining how and why technology creates stress in users?

Research Question 4: What factors are most important in explaining under what conditions or for what types of users technology creates stress?

Research Question 5: How do different perspectives, methods, measures, and paradigms have to be combined to explain and predict technostress most accurately and provide more useful information to managers and systems designers?

Limitations

As with any research, our study has its limitations. Perhaps most importantly, the literature review used in this paper was preliminary, implying that it needs to be expanded in a systematic fashion. We will conduct a new, rigorous review, following recent IS research (Sarker et al. 2013), by reviewing technostress studies in the AIS Senior Scholars' Basket of Journals (the basket of eight). Since these journals have a global reach and reputation and are considered the leading mainstream journals in the IS field, they are likely to include the major contributions related to technostress (Webster & Watson 2002). Accordingly, conducting a new, rigorous literature review with a focus on the AIS Senior Scholars' Basket of Eight will allow us to identify an appropriate representation of published technostress research. Once conducted, the new, systematic literature review will be presented following the concept-centric approach proposed by Webster and Watson (2002). The literature review will also take into consideration the relations between reference discipline and stress measure as well as between method and stress measure. A second limitation concerns the presentation of our analysis and of the identified challenges. For example, some might argue that the above-cited technostress studies were all heavily theory-based and that they paid ample attention to moderation effects. In our full paper, we will have the journal space necessary to provide more detailed analyses to back up our claims.

Conclusion and Next Steps

Since there is a mass of technostress research building up in the literature but limited directions to guide such research, this research-in-progress determined the key challenges that remain to be addressed. The paper found that technostress research needs to be more theory-driven, needs to evaluate stress more directly instead of indirectly through such concepts as job satisfaction that serve as proxies for stress, needs to advance more rigorous explanations for how and why technology creates stress in users, needs to advance more rigorous explanations for what kinds of users technology creates stress, and needs to be more diversified in terms of perspectives, methods, measures, and paradigms used.

Next steps necessary for the present paper include adding richer examples from the literature and explanations / illustrations of what we learned from the paper. Furthermore, we will discuss in the full paper how exactly future technostress research could be improved through the design of a richer study. We will also broaden the paper's appeal by including specific design science-related questions, such as how to build systems that are less stressful and more usable. Moreover, we will include the enjoyment issue of eustress, and we will make a call for research that examines the interplay between design/usability and stress research.

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