Technostressors - a boon or bane? Towards an integrative conceptual model

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Purpose: This paper aims to highlight the positive and negative effects of technostressors on employee attitudes using psychological need satisfaction as an explanatory mechanism and mindfulness as an individual resource, thereby developing an integrative conceptual model.

Design/methodology/approach: A narrative literature review was performed in the technostress, Job Demands-Resources and mindfulness literature to develop the propositions of the integrative conceptual model.

Findings: This paper posits psychological need satisfaction as a mediator in the process by which technostressors impact important employee outcomes. It also proposes mindfulness as a personal resource that helps alleviate technostressor induced burnout and foster work engagement.

Research Implications: The proposed integrative conceptual framework provides some useful directions for future empirical research on this topic of growing importance.

Practical Implications: Based on the findings of this paper, managers can devise and implement a technostressor-specific mitigation strategy to cope with ICT induced work demands. They can also introduce mindfulness-based programs to support positive outcomes when technostressors are present

Originality: This paper is the first to theoretically delineate specific characteristics of technostressors as challenge and hindrance demands, and makes interdisciplinary contributions by extending the role of psychological mechanisms such as psychological need satisfaction and personal resources such as mindfulness in work related technology use research

Keywords: Techno-overload; techno-invasion; techno-complexity; techno-insecurity; techno-uncertainty; technostressors; mindfulness; psychological need satisfaction; job burnout; work engagement

Article classification: Conceptual paper

Introduction

Information and Communication Technology (ICT) occupies an indispensable place in today's work environments as is evidenced by the greater benefits they create through business model innovations and patent applications (Baller *et al.*, 2016), new product developments (Kawakami *et al.*, 2015), service innovations (Ryu and Lee, 2018) and organizational agility (Panda and Rath, 2021). They increase knowledge sharing and enhance teamwork through reduced communication costs (Forman and Zeebroeck, 2012) and instant information transmission (O'Driscoll *et al.*, 2010). Considered the driver of the Fourth Industrial Revolution, work-related technology use have long term consequences as they have the potential to transform core functions of an organization (Bersin, 2017). Increasing technology adoption influences both the number and nature of jobs that will be created in the future (Balsmeier and Woerter, 2019). Technology intensive work environments promote the need for new types of digital leadership (Petry, 2018). Further, employees across different professions need to adapt their responses to cope with increasingly technology mediated work (Adisa *et al.*, 2017; Duxbury and Smart, 2011). Given this growing presence of technology at work, it is important to examine how their use at work may impact employees.

Despite their benefits, the use of ICT for work also creates unpredictability and uncertainty, which lead to frustration, intimidation, and unhappiness among its users (Weil and Rosen, 1997). Such cognitive and emotional strain stemming from difficulties in adapting to existing technology or keeping up with the changing technological landscape is referred to as technostress (Agogo and Hess, 2018; Brod, 1984; Cascio and Montealegre, 2016). Although the double-edged nature of using ICT for work has been acknowledged (Fischer and Riedl, 2015; Stich *et al.*, 2015), there are several questions the emerging technostress literature is silent upon. First, the literature does not account for individual users' differential perceptions of ICT use for work that can create either opportunities for enhanced

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work or obstacles leading to technostress; i.e. it is not clear which factors may create perceptions of technostressors as challenges or threats (Tarafdar, Gupta, *et al.*, 2015). Second, the psychological mechanisms underlying the impact of technostressors on outcomes is also unclear (Tarafdar *et al.*, 2019). Finally, the technostress literature does not elaborate on individual-level mechanisms that can be used to mitigate the adverse effect of technostressors on performance outcomes (Pirkkalainen and Salo, 2016).

< Insert Figure 1 about here >

The conceptual framework (Figure 1) addresses these concerns. This framework was derived using a narrative literature review; in particular a general literature review approach was used. General literature reviews are objective syntheses of the current knowledge about a concept. They are characterized by the underlying propositions which guide future research (Onwuegbuzie and Frels, 2016). In this paper, the authors critically evaluated the published articles on technostressors, psychological need satisfaction and mindfulness to identify the research gaps and develop propositions addressing the same.

Specifically, this paper uses the Job Demands-Resources (JD-R) theory (Schaufeli and Bakker, 2004) to address the first gap by conceptualizing technostressors as challenge and hindrance job demands based on their potential for facilitating growth and development (Cavanaugh *et al.*, 2000; Crawford *et al.*, 2010). Self Determination theory (Deci and Ryan, 2000) is used to address the second gap by proposing psychological needs satisfaction as the underlying mechanism to examine positive states that technology use can engender. The third gap is addressed with evidence from positive organizational scholarship (Sutcliffe *et al.*, 2016) to propose that individuals with higher mindfulness are more likely to derive positive outcomes from using ICT for work.

Theoretical background

Technostressors

Aspects of technology that create stress have been called as 'technostress creators' or 'technostressors', including techno-overload, techno-invasion, techno-complexity, techno-insecurity and techno-uncertainty (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007). *Techno-overload* refers to when technology requires employees to work longer and faster, characterized by the completion of more work in less time, information overload, and multitasking. *Techno-invasion* refers to the intrusive effect of technology in situations where employees never feel free from them due to constant connectivity, accessibility, and immediate response expectations. *Techno-complexity* refers to situations when employees feel inadequate because of the time and effort spent in learning and understanding complex technology. *Techno-insecurity* is when employees feel insecure about losing their jobs in the face of new technology and co-workers who might know more about these technologies. *Techno-uncertainty* occurs when users feel unsettled due to frequent organization wide upgrades and accompanying software and hardware changes. Technostressors negatively affect productivity (Hung *et al.*, 2015; Tarafdar *et al.*, 2007), performance (Brooks and Califf, 2017; Tarafdar, Pullins, *et al.*, 2015), organizational commitment (Jena, 2015), and innovation (Tarafdar, Pullins, *et al.*, 2015), and are also linked to increases in negative affectivity (Jena, 2015), role stress (Tarafdar, Pullins, *et al.*, 2015), work-life conflict (Oh and Park, 2016), job dissatisfaction, and job distress (Ragu-Nathan *et al.*, 2008) among employees. Table I lists the major outcomes of technostressors.

< Insert Table I about here >

Table I indicates that all the results have been negative. While it is true that technostressors can create frustration, unpredictability, and uncertainty for employees (Weil

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and Rosen, 1997), their potential for enabling positive states through increased information access, temporal and spatial flexibility, and opportunities for growth have remained largely ignored (Day, Scott, & Kelloway, 2010; Tarafdar et al., 2019). This could be due to the existing theoretical frameworks used within the technostress literature – the Person-Environment (PE) fit model and the Transactional Model of Stress and Coping (Lazarus and Folkman, 1987). The PE fit model (see (Ayyagari *et al.*, 2011) views strain as the mismatch between an individual's abilities and values, and the technology characteristics of the work environment such as complexity, dynamism and intrusiveness. Such ideas of fit imply a non-changing, almost static relationship between the individual's characteristics and the environment's attributes (Mark and Smith, 2008).

Irrespective of a PE fit's presence, work related technology use necessitates changing patterns of interactions between employees and their work characteristics. This interaction is addressed in the Transactional Model of Stress and Coping (Lazarus and Folkman, 1987). Per this theory, stress results from a transaction between *a stressor* and an *individual's response to it*. 'Stressors' are stimuli in the work environment perceived by most employees in most situations as having a negative impact on them (Demerouti *et al.*, 2001). Stressors require a negative cognitive appraisal of a "threat, loss, or challenge" attached to them (McCrae, 1984). However, this too provides an incomplete explanation as adopting the stressor perspective overlooks the potential benefits of work-related technology usage. Given that the dual nature of work related technology use has been empirically demonstrated, i.e. some employees find it enabling (Fujimoto *et al.*, 2016) while others find it stressful (Agogo and Hess, 2018), it becomes necessary to account for this supposed contradiction. Towards this, the authors propose the following alternative conceptualization of technostressors as either challenge or hindrance job demands leading to positive or negative outcomes respectively.

Technostressors as job demands – Challenge vs. hindrance

Alternative to the negative connotation of stressors, job demands refer to "physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills and are therefore associated with certain physiological and/or psychological costs" (Schaufeli & Bakker, 2004, p. 296). A 'demand' perspective becomes salient because regardless of positive or negative evaluations of technology use, employees will have to attend to and continue to use them at the workplace. Job demands may be further classified as challenge or hindrance demands (van den Broeck *et al.*, 2010). Challenge demands are difficulties that can be overcome with expenditure of time and effort and are opportunities for demonstrating competence and growth. Hindrance demands go beyond the individual's agentic control and detracts from the realization of work goals (Cavanaugh *et al.*, 2000; Lepine *et al.*, 2005; Podsakoff *et al.*, 2007). Empirical studies have since substantiated this distinction with differential effects on team performance (Pearsall *et al.*, 2009), organizational citizenship behaviors, and work engagement (Kim and Beehr, 2018).

<Insert Table II here>

Table II maps the characteristics identified as challenges in the job demands literature, with characteristics of technostressors identified within the technostress literature. Those characterized as challenges involve greater workloads, time pressures, task complexity, and overload similar to the effects of techno-overload and techno-complexity. For instance, techno-overload, through information overload, time urgency, and multitasking requirements push employees to work longer, faster, and manage more work than usual (Ragu-Nathan *et al.*, 2008). Techno-complexity imposes workload and time pressures by increasing the complexity of work and the requirement to keep oneself abreast of latest developments (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007). Despite this, challenge demands are

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expected to stimulate conditions for growth and development, i.e., techno-overload and techno-complexity can engender learning and growth opportunities. For instance, techno-overload requires cognitive flexibility in one's work patterns to keep up with increasing needs for speed and efficiency while techno-complexity engenders learning (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007). Cognitive demands, such as of overload and flexibility, have led to increments in health and job satisfaction (Meyer and Hünefeld, 2018; Xie *et al.*, 2019), and learning demands have increased intrinsic motivation and creative performance (Glaser *et al.*, 2015). Based on the above studies, it can be said that techno-overload and techno-complexity produce cognitive and learning pressures that create conditions for growth despite the increases in workload and time pressures.

< Insert Table III about here >

Table III maps the characteristics identified as hindrances in the job demands literature with characteristics of technostressors identified within the technostress literature. Hindrances involve role conflicts, role overloads, situational constraints beyond the control of the individual, concerns of job insecurity, and interpersonal conflict. Techno-invasion disrupts work-home boundaries of employees and creates role conflicts, role overload, and reduces well-being (Ayyagari *et al.*, 2011; Schlachter *et al.*, 2018). Techno-insecurity creates fears of job insecurity and distrustful working conditions. Techno-uncertainty introduces ambiguities that inhibit an individual's ability to predict or control. Hindrance demands impose constraints that prevent the achievement of valued goals (Cavanaugh *et al.*, 2000). Insecurity demands have been associated with poorer mental health (Sverke *et al.*, 2002) and well-being (Silla *et al.*, 2009). Decrements in goal clarity due to techno-uncertainty impede job satisfaction and performance (Arvey *et al.*, 1976). The above studies indicate that techno-invasion, techno-insecurity and techno-uncertainty promote intrusive, distrustful and ambiguous working conditions which hinder job performance and employee growth.

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Therefore, this paper proposes a classification of techno-invasion, techno-uncertainty, and techno-insecurity as hindrance demands.

In summary, existing models of technostressors have ignored their potential positive outcomes due to the adoption of a stress perspective. However, technostressors such as techno-overload and techno-complexity share features of challenge demands, while techno-invasion, techno-insecurity and techno-uncertainty share features of hindrance demands. Therefore, based on the JD-R theory, this paper proposes that these technostressors will not have a uniform impact on outcomes; rather they will lead to differential outcomes based on the classification of challenge or hindrance demands.

Employee outcomes - Burnout and work engagement

Burnout is an individual's response to chronic occupational stressors, defined by exhaustion, cynicism, and reduced professional efficacy (Maslach *et al.*, 2001). *Exhaustion* implies feelings of 'being overextended' and drained of one's energies. *Cynicism* refers to feelings of apathy, detachment and hostility towards one's job. *Reduced professional efficacy* denotes reductions in feelings of proficiency, adequacy, and productivity with regard to one's competencies (Maslach and Leiter, 2016). These psychological pressures together create significant decrements in mental health and well-being (Maslach *et al.*, 2001). The role, time, and job security pressures created by technostressors act as low intensity psychological pressures, which when experienced over the course of one's work life, lead to burnout. Although job burnout as a general outcome of workplace demands has received attention, burnout resulting specifically due to technostressors has remained unexamined. Work engagement, on the other hand refers to an active, positive work related state of mind characterized by high levels of energy (vigor), dedication and absorption with one's work tasks (Schaufeli *et al.*, 2006). Studies show that engagement promotes extra role performance (Gupta and Sharma, 2018), and organizational citizenship behaviours (Kapil and Rastogi,

2020). However, this widely studied construct in organizational behavior literature (Bailey *et al.*, 2017) remains unexamined in technostressors literature.

Conceptual model and propositions

Distinctive impacts of challenge and hindrance technostressors

According to the JD-R theory, both challenge and hindrance technostressors may result in burnout as follows. The very need to deal with demands, regardless of their nature as challenge or hindrance, leads to expenditure of attentional, cognitive, and/or emotional effort (Hobfoll, 1989). Indeed, any demand is a kind of overload and results in psychological anxiety and higher arousal (Perrewe and Ganster, 1989). Job demands lead to job burnout (Farivar and Esmaeelinezhad, 2021). Particularly, empirical studies indicate positive associations between both challenge and hindrance type of work demands to frustration, emotional exhaustion, and strain (Webster *et al.*, 2011). Therefore:

P1: Challenge and hindrance technostressors relate positively to burnout.

The JD-R theory further states that challenge demands increase work engagement, whereas hindrance demands reduce it (Bailey *et al.*, 2017). This follows from Selye's (1984) proposal that some demands can create eustress–a sense of challenge and fulfillment, while others create distress. In line with this reasoning, studies report challenge demands arouse positive affective states while hindrance demands arouse negative affective states (Netemeyer *et al.*, 1995; Podsakoff *et al.*, 2007; Rodell and Judge, 2009). The former broadens thought-action repertoires increasing energy, dedication, and absorption thereby supporting work engagement, whereas the latter activates avoidance, inattention and distractions, preventing work-engagement (Fredrickson, 2001; Roth and Cohen, 1986). Hence, the authors propose as follows:

P2: Challenge (hindrance) technostressors relate positively (negatively) to work

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engagement.

Psychological need satisfaction as a mediator

This paper proposes psychological need satisfaction as an explanatory variable in the differential challenge and hindrance technostressors–outcomes relationships. Self Determination Theory identifies three basic psychological needs across individuals (Deci and Ryan, 2000; Ryan and Deci, 2000), namely a) *autonomy* – desire to steer one's work tasks and career as per one's own choice; b) *competence* – desire for task mastery and successful accomplishment of goals despite challenges; and c) *relatedness* – desire to belong to, identify, and have meaningful relationships with colleagues (Baard *et al.*, 2004). Need satisfaction boosts well-being, vitality and performance, while need frustration impairs psychological health (Gagné and Deci, 2005; Vansteenkiste and Ryan, 2013). Although other factors such as positive and negative affect could influence psychological need satisfaction (Stanley et al., 2021), their impact depends, in part, on factors like dispositional positive and negative affectivity (Fisher, 2002), and individuals' information processing capacities (Potter et al., 2000). Further, prior research establishes the mediating role of psychological need satisfaction between job characteristics and outcomes such as turnover intentions, work related well-being (Ilardi *et al.*, 1993), engagement (Wang *et al.*, 2020), strain, and performance (De Gieter *et al.*, 2018). Therefore, in the context of ICT use at work, this paper uses the Conservation of Resources theory (Hobfoll, 1989) to propose that technostressors impact employees' psychological need satisfaction. The presence of demands diminishes an individual's finite corpus of cognitive and affective capacities, thus reducing the extent to which autonomy, competence, and relatedness needs are satisfied. Need satisfaction impacts burnout negatively and work engagement positively.

< Insert Figure 2 about here >

Specifically, it may be argued that challenge technostressors fulfil employees' psychological needs, whereas hindrance technostressors do not, as shown in Figure 2. Cognitive demands relate positively to the need for competence and relatedness while emotional demands associated with role stressors, job insecurity and work-family conflict relate negatively to all three needs (Van den Broeck *et al.*, 2008, 2016). Similarly, techno-overload and complexity can stimulate the cognitive capacities of individuals, while techno-invasion, insecurity and uncertainty trigger emotional responses in individuals. For instance, techno-overload necessitates optimal task prioritization and attention to detail in the face of multiple interruptions; techno-complexity necessitates continual learning and skill set updating in the face of rapid technology changes (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007). Optimization, decision-making, sustained attention, and learning represent techno-complexity, which in turn stimulate and satisfy employees' psychological needs. Techno-insecurity impedes competence and relatedness need satisfaction; techno-uncertainty prevents autonomy and competence need satisfaction' and techno-invasion reduces autonomy and relatedness need satisfaction. Such demands for accessibility, visibility, and constant reaffirmation of one's worth to the industry could reduce one's overall need satisfaction. Current research only examines the overall impact of technostressors without examining underlying mechanisms that lead to differential impacts. Thus, the authors aim to extend the current literature on the influence of challenge and hindrance technostressors to outcomes, with the following propositions:

P3a: Challenge technostressors relate positively to psychological needs satisfaction

P3b: Hindrance technostressors relate negatively to psychological needs satisfaction

P3c: Psychological needs satisfaction relates negatively (positively) to burnout (work engagement).

Resources

Within the JD-R theory, resources are primarily of two types – job and personal resources. Job resources refer to supports provided by the organization or aspects of the job itself that are functional in achieving work goals, personal growth and development (Schaufeli and Bakker, 2004). Job resources such as perceived organizational support have been shown to increase employee engagement in the IT industry (Sihag, 2020). On the other hand, personal resources refer to employees' own positive psychological capacities that they use to successfully control their work environments (Xanthopoulou *et al.*, 2009). For example, core self-evaluations serve a protective role in the presence of work demands (Jain and Nair, 2020). Within studies of technostress, the former has been defined as technostress inhibitors[1] These mitigation mechanisms analogous to job resources are aimed at increasing the performance, well-being, and efficiency of the employee by creating support systems to manage technostressors. While studies demonstrate the efficacy of technostress inhibitors in at least partially moderating the effect of technostressors, there are limited conceptualizations of how individual level mitigation play a role (Pirkkalainen and Salo, 2016; Tarafdar *et al.*, 2019). Specifically, this paper proposes mindfulness, a state of consciousness characterized by non-judgmental awareness and attention to present moment experience as a personal resource that can activate approach tendencies towards technostressors while also maintaining perceptual clarity and equanimity, thus preventing negative emotions during usage (Brown and Ryan, 2003).

Mindfulness as a Personal Resource

Mindfulness is defined as "a state of consciousness characterized by receptive attention to

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[1] Technostress inhibitors include literacy facilitation, technical support provision and involvement facilitation and are organization provided supports to alleviate technostress (Ragu-Nathan *et al.*, 2008)

and awareness of present events and experiences, without evaluation, judgment, and cognitive filters" (Glomb, Duffy, Bono, & Yang, 2011, p. 119). Also called 'bare attention', it allows the individual to perceive experience as it is, without applying pre-conceived expectations of what the experience could have been or what it should be (Kabat-Zinn, 1994). Higher mindfulness is often accompanied by emotional balance and reduced auto-pilot reactions, both of which are important towards stress reduction (Brown and Ryan, 2003). Although mindfulness was originally conceptualized in the field of clinical and counseling psychology to mitigate chronic pain and prevention of major depressive episodes through processes of self-monitoring and self-regulation (Kabat-Zinn, 1982; Teasdale *et al.*, 2000), it has eventually found a strong foothold in human resource management with organizations increasingly adopting mindfulness in the workplace (Sutcliffe *et al.*, 2016). Examination of its role as a personal resource is even more recent (Grover et al., 2017). Mindfulness can be a boundary condition for the technostressor-outcomes relationships because it has been found to weaken the relationship between overload (work stressor) and mental and physical symptoms of strain (Fisher *et al.*, 2019), reduce perceptions of emotional demands and psychological stress (Grover *et al.*, 2017), and lessens need frustration when subjected to a controlling work environment (Schultz *et al.*, 2015). Mindfulness also contribute to employee well-being despite challenging work circumstances (Tarraf *et al.*, 2019) and can create pro-environmental behaviour at the workplace through self-transcendental values (Kumar *et al.*, 2021).

The theoretical underpinnings for the role of mindfulness as a personal resource stem from literature in psychology. The primary mechanism through which mindfulness serves a protective function is decentering (Brown *et al.*, 2007). Decentering denotes the objective relationship a mindful individual develops towards their thoughts and emotions. At its core, it involves a shift in perspective, from narrow self-referential processing characterized by

cognitive and emotional distortions to an open, non-judgmental acceptance characterized by perceptual clarity and equanimity (Shapiro *et al.*, 2006; Sears and Kraus, 2009). This in turn enhances self-regulation, flexibility in responses, and greater capacity to pay attention to and engage with difficult situations. An unbiased processing of technostressors can thus become possible through the decentering capacity of mindfulness.

Mindfulness and techno-overload

Techno-overload has increased the speed at which employees work and imposed tighter deadlines leading to work intensification. Overload leads to multitasking, reducing the concentration and absorption with which employees perform current work tasks (Galluch *et al.*, 2015). Drawing on evidence from cognitive psychology we propose that mindful individuals are less susceptible to attentional lapses and off-task interruptions (Slutsky *et al.*, 2018) created by techno-overload. Studies indicate that mindful individuals have enhanced attention (Moore and Malinowski, 2009; Valentine and Sweet, 1999) and exhibit greater conflict monitoring, alertness and orientation to current task performance (Jha *et al.*, 2007). Thus, through optimal allocation of cognitive resources, they may be better able to handle the task and role prioritization conflicts created by techno-overload.

Mindfulness and techno-complexity

Another significant demand posed by technostressors is its complexity and the rapid pace at which ICT advancements take place. Regardless of their personal preferences, mindfulness enables individuals to be less attached and biased towards the choices ahead of them (Hafenbrack *et al.*, 2014; Hopthrow *et al.*, 2017) and also promotes adaptive learning (Chiesa *et al.*, 2011). This allows mindful individuals to non-judgmentally recognize the merit of such learning pressures and engage with them.

Thus, individuals with higher trait mindfulness show greater positive affect, and task prioritization despite the presence of multiple information and communication overload, and

learning demands created by techno-overload and techno-complexity. Therefore, mindfulness can weaken the harmful impact of challenge technostressors on burnout while strengthening their beneficial impact on work engagement, as proposed:

> *P4: Mindfulness a) weakens the positive relationship between challenge technostressors and burnout, and b) strengthens the positive relationship between challenge technostressors and work engagement.*

Mindfulness and techno-invasion

Intrusive demands such as techno-invasion create fuzzy work-home boundaries that elicit emotional automatic-pilot stress reactions (Kiburz *et al.*, 2017). Individuals with mindfulness show reduced automatic-pilot reactions when faced with ambiguous stimuli; instead they respond through greater stimulus labelling, a thought-out and not impulsive response (Brown *et al.*, 2007). This is further supported by studies that relate mindfulness with reduction in negative emotions (Broderick, 2005), and anxiety symptoms (Strauss *et al.*, 2014).

Mindfulness and techno-insecurity

Techno-insecurity stems from fears of losing one's job to technology in the future. Mindfulness accords a balanced time-perspective with a strong emphasis on present moment experience (Stolarski *et al.*, 2016) that can possibly reduce the future-focused anxieties associated with techno-insecurity.

Mindfulness and techno-uncertainty

 The frequent changes created by ICT increase ambiguity and create a need for constant monitoring to stay updated and relevant. Due to increases in perceptual sensitivity and vigilance (MacLean *et al.*, 2010), mindful employees may be more receptive to the changes created by techno-uncertainty. Thus, individuals with higher mindfulness show greater emotional balance in the face of techno-invasion, more present-focused attention rather than

future-focused anxiety in the face of techno-insecurity, and greater monitoring capacities in the face of frequent changes created by techno-uncertainty. Therefore, mindfulness can weaken their harmful impact on both burnout and work engagement, as follows:

P5: Mindfulness weakens a) the positive relationship between hindrance technostressors and burnout, b) the negative relationship between hindrance technostressors and work engagement.

Mindfulness and psychological needs satisfaction

Studies indicate that greater mindfulness promotes greater satisfaction of basic psychological needs of competence, autonomy and relatedness (Rigby *et al.*, 2014). For instance, lower mindfulness was related to lower personal competence (Ying, 2008), and higher mindfulness showed greater autonomously-motivated behavior (Levesque and Brown, 2007). Mindfulness was also associated with increased relationship satisfaction in both studies of familial relationships (Barnes *et al.*, 2007; Carson *et al.*, 2004) and among the general population (Saavedra *et al.*, 2010). The self-regulatory capacity of mindfulness associated stems from non-judgmental attention, non-reactive acceptance, and reduced ego-referential processing (Glomb *et al.*, 2011), all of which can serve a protective function in the presence of overloading, invasive, ambiguous, uncertain and insecure working conditions created by intensive work-related technology use. Both in accordance with the JD-R theory that a personal resource can serve a stress buffering role (Schaufeli and Taris, 2014), and on the basis of the above arguments the authors propose that mindfulness will moderate the mediating role of personal needs satisfaction in the impact of challenge and hindrance technostressors on outcomes, as follows:

P6: Mindfulness a) weakens the mediating effect of psychological need satisfaction between challenge technostressors and burnout, and b) strengthens the mediating

effect of psychological need satisfaction between challenge technostressors and work

engagement.

P7: Mindfulness weakens the mediating effect of psychological need satisfaction in the

impact of hindrance technostressors on a) burnout, and b) work engagement.

Discussion and implications

This paper examines the role of technostressors as demands of the work environment and formulates propositions that take into account their ability to both facilitate and hinder work. Given the extant literature till date has focused only on the negative outcomes of technostressors, the conceptualization in this paper enables an examination of both positive and negative outcomes that stem from work-related technology use. Positive outcomes such as work engagement are important as studies associate them to better physical health (Seppälä *et al.*, 2012) lesser mental health problems (Simbula and Guglielmi, 2013), greater participation in after-work recovery and leisure activities (Sonnentag *et al.*, 2012), and higher happiness levels between partners (Rodríguez-Muñoz *et al.*, 2014). On the work front, engagement promotes job performance (Tanskanen *et al.*, 2019), innovative work behaviours (Agarwal, 2014), and organizational citizenship behaviours (Kapil and Rastogi, 2020).

The authors also propose psychological need satisfaction as the mechanism through which technostressors, differentiated as challenge and hindrance demands result in their distinctive outcomes. Further, this paper examines how mindfulness could moderate the direct as well as mediated relationships between challenge and hindrance technostressors-outcomes. In doing so, the authors lay out a comprehensive conceptual framework that delineates technostressors as challenges and hindrances, put forward psychological need satisfaction as a mediator leading to distinctive outcomes, while also incorporating mitigation mechanisms at the individual level (mindfulness) that boosts / buffers the challenge and hindrance technostressors-outcomes relationships.

Theoretical contributions

This paper makes several important theoretical contributions. First, it contributes to technostress literature through the differentiation of technostressors as challenge or hindrance demands based on their ability to promote growth and development on the job (Crawford *et al.*, 2010). An understanding of which technology aspects create positive growth or lead to decrements in mental health and performance is crucial to shape employee attitudes and engagement with technology-mediated work. Future research supporting this distinction can contribute to the literature on digital mindsets (Solberg *et al.*, 2020) and employee attitudes supportive of digital transformations (Cetindamar *et al.*, 2021).

Second, this paper makes a multidisciplinary contribution to both technostress literature and organizational psychology by proposing psychological need satisfaction, an individual-level psychological mechanism, as the mediator in the technostressors-outcomes relationship. This provides a useful starting point in understanding why some users find technology-intensive work enabling while others find it detrimental; this in turn can guide practitioners in designing an optimal 'new normal', i.e., technology-mediated work structures and processes that enable the basic psychological needs. To the best of authors' knowledge, this is the first conceptualization of technostressors as challenge and hindrance demands as well as the first to consider psychological need satisfaction as a mediator in technostressor-outcomes relationships. Empirical support for these hypotheses will enrich the literature on psychological foundations of technology and information systems use (Tarafdar *et al.*, 2019).

Third, the study introduces mindfulness as a personal resource in managing technostressors. Some studies have confirmed the benefits of personal resources such as self-efficacy and self-esteem (Heuven *et al.*, 2006; Tims *et al.*, 2011), but others have failed to demonstrate their significance in reducing job demands (Grover *et al.*, 2018). This could possibly be due to the fact that the current personal resources studied (psychological capital

variables) are evaluative states that stem from mindful attention and awareness. This claim is supported by studies that show increases in mindfulness is accompanied by increases in resilience (Bajaj and Pande, 2016), self-esteem, positive affect and optimism (Bajaj *et al.*, 2016; Randal *et al.*, 2015), and self-efficacy (Malinowski and Lim, 2015). Thus, this paper provides a more robust justification for using mindfulness as a personal resource in the context of technostressors and their impact on employee outcomes. Evidence towards the beneficial role of mindfulness will advance literature supporting personal resources within the JD-R theory (Schaufeli and Taris, 2014). Further, future research confirming the positive effect of mindfulness in the technostressor-outcomes relationship can enhance the literature on mindfulness in information technology, technology adoption and information systems use (Dernbecher and Beck, 2017; Sun *et al.*, 2016).

Finally, this paper contributes to Self Determination Theory by proposing that employees, by being mindful, can modify the effect of demands on need satisfaction or frustration. Mindful employees stay resilient and emotionally stable even in the face of demands posed by technostressors; these employees positively reappraise demands as challenges and use them as enablers for better work-engagement and well-being. Thus, we go beyond the mere existence of need satisfaction, and instead propose a disposition (one that can be cultivated), namely mindfulness, as a self-enabled proactive way of achieving need satisfaction.

Managerial implications

Besides the above theoretical contributions, this paper also highlights some important managerial implications. First, the differentiation of techno-overload and techno-complexity as challenge demands can prevent negative employee attitudes towards overload and complexity, instead prompting an active search for the growth-promoting potential of these technostressors. Such a distinction may become especially important during times of exogenous shocks, such as those being experienced by organizations during the ongoing

COVID-19 pandemic (Caligiuri *et al.*, 2020; Carnevale and Hatak, 2020). For example, adopting a challenge demand as opposed to a stressor view of techno-overload and techno-complexity enable employees to reframe the rapid shift from physical to virtual modes of working as opportunities for greater efficiency and learning on the job, rather than as stressful or demotivating factors. Second, in the wake of such disruptions, organizations need to provide intervention programs to enable adaptive coping and well-being. Towards this end, this conceptualization provides managers with the rationale to provide mindfulness promotion programs, both formal, such as Mindfulness Based Stress Reduction (MBSR), breath focus and body scan, and informal, such as 60 second breaks, mindful meetings, and communication. Work engagement of employees who deal with technostressors as an integral part of their job can also be improved by providing mindfulness training. Finally, this paper may also help HR departments to configure work design practices in a manner that would increase the availability of challenge technostressors while reducing the presence of hindrance technostressors.

Limitations and directions for future research

Being a conceptual paper, this paper has a few limitations that future research may address. First and foremost, this paper integrates diverse literatures to propose an integrative conceptual model and several testable propositions, which may be empirically tested in future studies. Second, with regard to the challenging and hindering aspects of technostressors, there is an increasing focus on using the technology interface itself to create positive states of mind (Brivio *et al.*, 2018). For instance, creating systems that prevent e-mail alerts after hours or that allow self-paced learning during upgrades can greatly promote positive psychological states of work-life balance and satisfy needs such as competence. Future studies can devote attention to the simulation and testing of optimal design of technology-intensive work.

Third, irrespective of the nature of the industry and type of technology used, it is the

individual perceptions of technostressors that may impact outcomes. For example, two employees (e.g., managers vs. non-managers) in the same industry with identical norms and type of technology used might report completely different perceptions of technostress ((Stadin *et al.*, 2020). Such individual perceptions may be shaped by demographic variables such as age, gender, and professional experience, whose effects show mixed evidence (Jena and Mahanti, 2014; Marchiori *et al.*, 2018). Future studies may identify and test such demographic variables as boundary conditions. Additional factors namely individuals' technology readiness (Parasuraman, 2000), ICT use frequency, ICT control over work related technology use (Day *et al.*, 2012; Maier *et al.*, 2015), and technology self-efficacy (Shu *et al.*, 2011) may also be examined as boundary conditions in relation to the impacts of technostress. Similarly, future research may examine the role of various mindfulness interventions to establish their effectiveness in helping employees manage the time and workload challenges faced by them.

Finally, current evidence for the impact of leaders on technostress are mixed. For instance, Fieseler, Grubenmann, Meckel, and Muller (2014) indicate that leadership serves a protective role in the presence of technology induced stress, whereas Harris et al. (2015) show that higher leader-member exchange quality exacerbated the negative impact of information overload on subordinates' work-family conflict. Given that social relations function as resources depending on their capacity to stimulate the preservation of other valued resources (Hobfoll, 1989), their role within the context of technology use might benefit from further inquiry. Such an examination of the interplay of personal and social resources would lead to a richer conceptualization of technostress mitigation mechanisms

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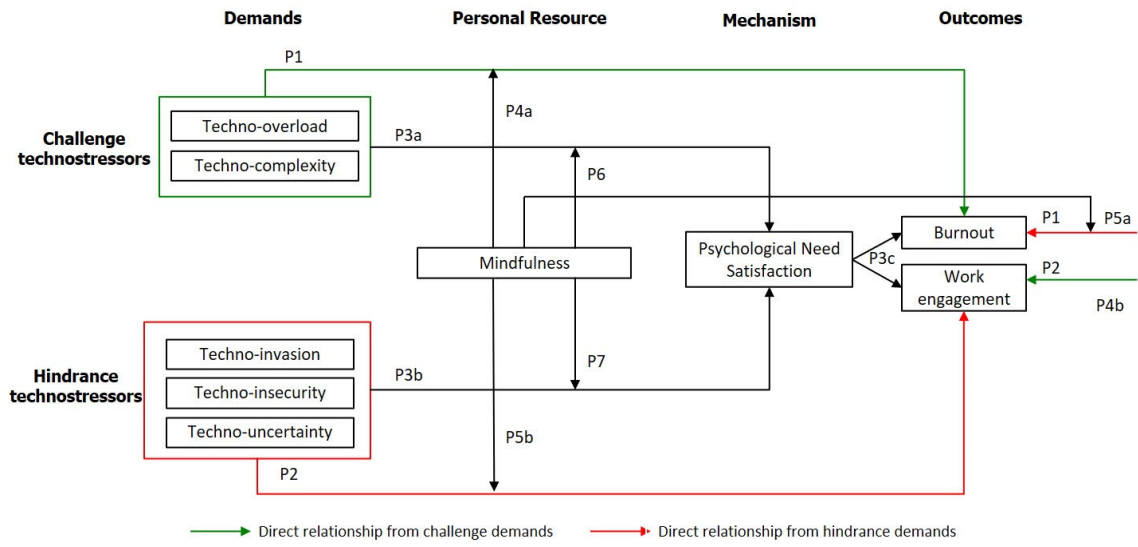
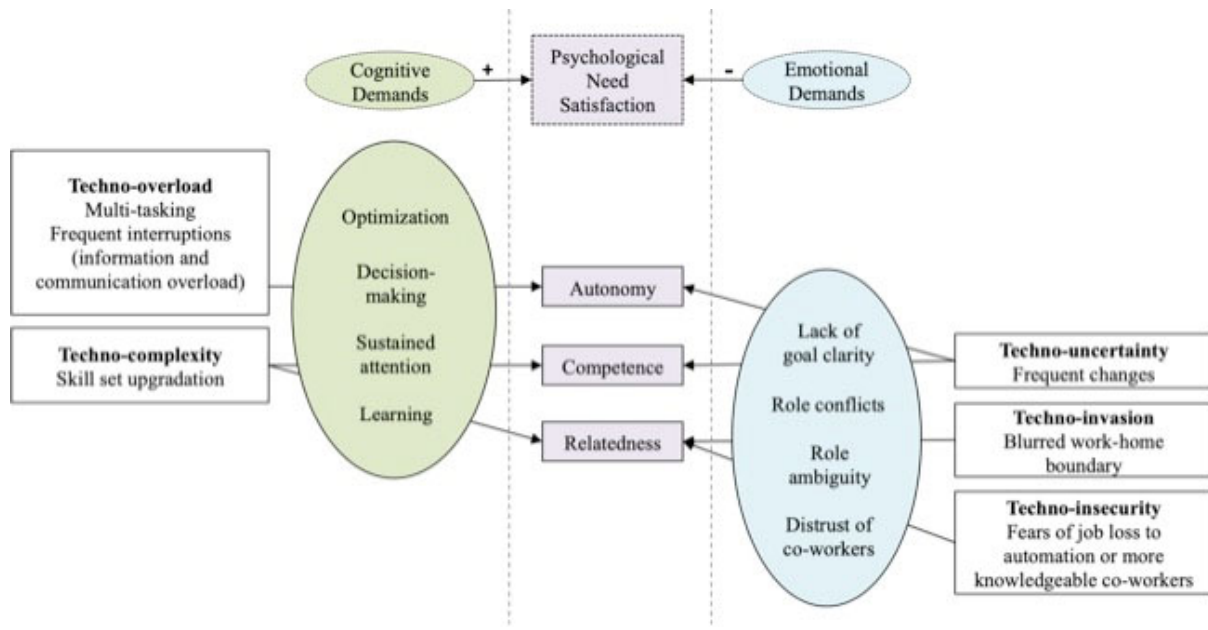**Figure 1**. Conceptual framework

Figure 2. Modified conceptual framework

Table I. Summary of results for dependent variables studied with technostressors

Outcome	Direction	Author
IT enabled productivity	Negative - supported	Pirkkalainen et al. (2019)
Strain	Positive - supported	Pirkkalainen et al. (2017)
Sales performance; Technology enabled innovation	Negative – supported Negative – supported	Tarafdar et al. (2015)
End-user satisfaction; End-user performance	Negative – supported Negative – supported	Tarafdar et al. (2010)
Organizational commitment; Job satisfaction; Negative affectivity; Technology enabled performance	Negative - supported Negative – supported Positive - supported Negative - supported	Jena (2015)
Job satisfaction	Negative – supported	Ragu-Nathan et al. (2008)
Work-life conflict	Positive – supported	Oh & Park (2016)
Work exhaustion	Positive – supported	Fieseler et al. (2014)
Role stress; Productivity	Positive – supported Negative - supported	Tarafdar et al. (2007)
Productivity	Negative – rejected	Hung et al. (2015)
End-user satisfaction	Negative - supported	Fuglseth & Sørebø (2014)
Work-family conflict Job distress Work exhaustion	Positive - supported Positive - supported Positive - supported	Gaudioso et al. (2017)
Performance	Negative - supported	Brooks & Califf (2017)

Table II. Characteristics of techno-overload and techno-complexity with challenge demands

Challenging work characteristics	Techno-overload	Techno-complexity
Perceived increase in workload / overload (Cavanaugh et al., 2000; Crawford et al., 2010; Lepine et al., 2005; Podsakoff et al., 2007; Rodell & Judge, 2009; Zhang, Lepine, Buckman, & Wei, 2014)	Work intensification (Karr-Wisniewski & Lu, 2010; Ragu-Nathan et al., 2008; Tarafdar et al., 2007; Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2011) Multiple and simultaneous requests (Ragu-Nathan et al., 2008; Tarafdar et al., 2011)	Learning beyond mandatory job requirement (Ragu-Nathan et al., 2008; Tarafdar et al., 2011)
Task complexity (Crawford et al., 2010; Zhang et al., 2014)		Complex technical capabilities (Karr-Wisniewski & Lu, 2010; Ragu-Nathan et al., 2008; Tarafdar et al., 2011)
Time pressure (Cavanaugh et al., 2000; Crawford et al., 2010; Lepine et al., 2005; Podsakoff et al., 2007; Zhang et al., 2014)	Time urgency (Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)	Additional time investment to handle complexity (Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)
Increases in attention (Crawford et al., 2010; Lepine et al., 2005; Rodell & Judge, 2009)	Information overload (Karr-Wisniewski & Lu, 2010; Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)	

Table III. Characteristics of techno-invasion, insecurity and uncertainty with hindrance demands

Hindering work characteristics	Techno-invasion	Techno-insecurity	Techno-uncertainty
Situational constraints (organizational factors beyond the control of the individual) (Cavanaugh et al., 2000; Crawford et al., 2010; Lepine et al., 2005; Podsakoff et al., 2007)	Immediate response expectations (Ragu-Nathan et al., 2008; Schlachter et al., 2018; Tarafdar et al., 2007, 2011)		Frequent upgrades (Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)
Concerns about job insecurity (Cavanaugh et al., 2000)		Automation/advancements in technology (Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)	Ambiguity about present and future job requirements (Ragu-Nathan et al., 2008; Tarafdar et al., 2007)
Role ambiguity / role conflict (Crawford et al., 2010; Lepine et al., 2005; Rodell & Judge, 2009; Zhang et al., 2014)	Blurred work-home boundaries (Ragu-Nathan et al., 2008; Schlachter et al., 2018; Tarafdar et al., 2007, 2011)		
Interpersonal conflict (Lepine et al., 2005; Zhang et al., 2014)		Withholding knowledge (Ragu-Nathan et al., 2008; Tarafdar et al., 2011) Distrust of co-workers (Ragu-Nathan et al., 2008; Tarafdar et al., 2007, 2011)	