

TECHONOSTRESS IN ORGANIZATIONS: A REVIEW OF LITERATURE

Research paper

Mahapatra, Monalisa, Indian Institute of Management Kozhikode, Kerala, India, monalisam09fpm@iimk.ac.in

Pillai, Radhakrishna, Indian Institute of Management Kozhikode, Kerala, India, krishna@iimk.ac.in

Abstract

The Technostress (TS) research is one of the emerging areas of study in Information Systems (IS) domain that has drawn significant attention in recent years among scholars and practitioners. It is defined as the stress experienced by the end users of Information and Communication Technologies (ICTs). In this study, we assess the status quo of TS research in an organizational context. We further classified the studies into three different sub-sections, 1) General studies 2) TS due to specific technology 3) TS among specific professionals. Not only TS research is multi-disciplinary in nature, but also with the expeditious growth of ICTs it is widely prevalent across organizations. Hence we expect that our review of extant literature will provide meaningful insights to both researchers and practitioners. Our result indicates that in the organizational context, TS creators negatively influence various job outcomes. However, due to the mandatory use of ICTs, employees find it difficult to cope with the new and evolving technologies. Finally, we also highlight three research gaps that are theoretically significant and practically valuable to both scholars and practitioners and need further attention.

Keywords: Stress, Technostress, Literature Review, Workplace setting.

Technology is a double-edged sword. When it comes to technological innovation and its effects on our lives and culture, both the luddites and the evangelists have a point.

The Guardian, December 2012

1 Introduction

The expeditious growth of Information and Communication Technologies (ICTs) over the past two decades have dramatically influenced organizations and individuals. Adoption of ICTs catalyse business processes by redefining old organizational structures and creating new employment. Even traditional non-IT sectors like agriculture and construction are now embracing ICTs to become competitive (Akinici et al., 2006; Rao, 2007; Mwakaje, 2010). Organizations are implementing ICTs to increase their productivity, effectiveness and efficiency (Bharadwaj, 2000; Melville et al., 2004). For employees across the globe, pervasive ICTs have made it feasible to connect anytime to support and improve business processes and organizational decision making (Hunton et al. 2003; Chandra et al. 2012). Not only in organizational settings, but ICTs have also improved the quality of individuals' private life. Frequent use of social media, e-commerce websites, online banking facilities and instant messaging are making life easier and hassle free (Molla & Heeks, 2007; Khan & Jarvenpaa, 2010).

Although the ubiquity of ICTs provide a great deal of benefits, they have the potential to cause harmful and unintended consequences as well. Researchers and practitioners have constantly shown their concerns over negative consequences of ICTs in terms of high work-home conflicts, information overload, cybercrimes, stress, online frauds and phishing among others (Broos, 2005; Chen et al., 2011; Vranjes et al., 2017). In this study we focus on one such adverse effects of ICTs known as Technostress (TS), the stress experienced by the end users of ICTs (Ragu-Nathan et al., 2008). Existing studies have explained the negative impact of TS on employees' job satisfaction, productivity, and organizational commitment (Tarafdar et al., 2007; Ragu-Nathan et al., 2008; Fuglseth & Sørøbø, 2014). Studies have also shown that employees feel exhausted (Ayyagari et al., 2011), and develop an intention to quit their jobs due to TS (Ragu-Nathan et al., 2008).

In the context of private use, studies showed that users of social media, mobile devices etc. faced fatigue, exhaustion, and stress due to the technologies (Gartner, 2011; Mazmanian et al., 2013; Samaha & Hawi, 2016). However, technology usage is optional here and users always have the option to stop using a technology when they feel stressed (Maier, 2012). In contrast to this, ICTs use is mandatory for work purpose in organizations. So employees have to deal with the rapidly evolving and ever changing ICTs regularly. Thus, TS is a more serious issue in organizations which negatively influences the physical and mental peace of the employees. Hence, this literature review aims to provide a comprehensive analysis of the current research on TS.

The results of our literature review have several contributions. Firstly, the research on stress and its related consequences is multi-disciplinary in nature, widely studied across disciplines like psychology (Testa et al., 2017), medicine (Stein et al., 2007), education (Robotham & Julian, 2006) etc. In such context, it is important for IS researchers to understand and to establish TS a new facet of stress literature. Thus this review gives a road map to observe where the phenomenon of TS stands now. Secondly, it provides the future research gaps in TS domain that need further attention. Thirdly, TS has a negative influence on various job outcomes that gradually hampers the productivities and efficiencies of the employees. This literature review will help the managers to understand the various measures that reduce such negative impacts, provided by the extant literature.

The rest of the paper is organized as follows. Firstly, the paper aims to define stress and TS derived from existing scholarly work in the domain, followed by the research method section. Next in the "results" section the paper is extensively focused on the detailed review of TS literature based on the proposed classifications. We then propose some suggestions for future research direction followed by conclusion.

2 Stress and Technostress Defined

In management studies, the concept of stress is quite old and explained under different theoretical assumptions. The term being under stress is defined as a condition experienced by an individual when there is an “environmental situation that is perceived as presenting a demand which threatens to exceed the person’s capabilities and resources for meeting it, under conditions where he or she expects a substantial differential in the rewards and costs from meeting the demand versus not meeting it” (McGrath 1976, p. 1351). According to Karasek (1979), conditions of high demand and low control is the basis of stressful conditions. In an organizational context, the term occupational stress is one of the widely used phenomena. Based on the stressors-strain approach of occupational stress, any work-related characteristics, situations or events that give rise to stress are known as stressor, and the physiological or psychological response to this stress is known as strain (Hurrell et al., 1998). While this approach comes under the category of variance theory, different process theories have been developed to provide a more integrated framework to characterise occupational stress (Cooper, 1998). All these theories are commonly based on the transactional approach to stress, which describes stress as a dynamic process operating between an individual and its environment (Lazarus, 1966; Cooper et al., 2001). Along with the existing concepts of stressors and strain, transactional approach introduced the idea of situational factors, which can reduce the impact of stressors. Lazarus and Folkman (1984) also introduced the concept of coping and appraisal under the cognitive-relational theory of stress. According to this theory, stress is defined as a multivariate process which can be reduced by appraisal and coping mechanisms.

The concept of stress, its impact on different job outcomes and coping mechanisms are widely studied among different professionals under various contexts (Russell et al., 1987; Gaziel, 1993; Pikó, 1999; Patterson, 2003). However, to provide a concrete literature review inside the scope of IS domain, this study analyses stress-related outcomes among IS professionals and explained the research gaps that lead to the initiation of TS research. Here stressors can be various workplace situations, job roles and demands and personality related characteristics that may lead to unintended consequences and turnover intentions.

In 1983, Weiss studied the negative impact of work stress on IS managers and explained the role of social support to reduce such strain. Based on a literature review on organizational stress among managers, the independent variables i.e., organizational stressors were identified. These stressors lead to various strain responses like job dissatisfaction which further resulted in illness. The study also showed that employees’ social support, individual characteristics like age, sex, schooling years, and organizational factors moderate the relationship between stressors and strain. Using path analysis, Baroudi (1985) demonstrated that role ambiguity highly influenced commitment, job satisfaction and turnover intentions among IS professionals. Due to the continuous innovation and adoption of new technologies by organizations, IS professionals’ shows low productivity (Sethi et al., 1999). Moore (2000) studied the turnover intention in technology professionals which is mediated by work exhaustion. The stressors applied in this context are perceived workload, role ambiguity and conflict, autonomy and fairness of reward. Ahuja et al. (2007) extended this framework to understand turnover intention in case of Information Technology (IT) road warriors. Similarly, many of the other studies high-light various factors like emotional dissonance, organizational commitments, age, gender, human capital, job insecurity etc., are the major reasons for turnover intentions among IS/IT professionals. The above discussions provide an overview of how stress and turnover intentions were perceived among IS professionals.

Table 1 highlights some of the major articles in this context. Here additional variables refer to all the variables except dependent and independent variables.

Study	Independent Variables	Dependent Variables	Additional Variables	Sample	Theory/ Framework
Weiss, (1983)	Organizational stressors	Job dissatisfaction, illness	Social support, personal characters, org. factors	IS Managers	N/A
Baroudi, (1985)	Boundary spanning, role conflict, role ambiguity	Intention to quit	Job satisfaction, commitment	IS professionals across different industry	N/A
Sethi et al., (1999)	Role ambiguity, Role conflict	Affective and Continuous commitment,	Burnout	IS professionals	N/A
Moore, (2000)	perceived work-load, role ambiguity, role conflict, autonomy, fairness of reward	Turnover intention	Work exhaustion	IT professionals	N/A
Ahuja et al., (2007)	Same as Moore with additional factors: work family conflict, Job autonomy	Turnover intention	Work exhaustion, Org. commitment	IT employees	N/A
Shropshire & Kadlec. (2012)	Stress, Job insecurity, Burnout	Turnover intention	Age	IT employees	N/A
Shih et al., (2013)	Same as Moore with additional factors: emotional dissonance	Personal accomplishment	Depersonalization	IT employees	Job burn-out Theory
Eckhardt et al., (2016)	Big five personality traits	Turnover intention	IT job type	IT professionals	Big five personality traits

Table 1. Literature Review of Stress in IS/IT Professionals

According to Ragu-Nathan et al. (2008), although these studies recognize technology related stress, the theoretical and empirical analysis of the phenomenon TS and ICT related stressors for end users were missing in IS literature. Brod (1982) defined TS as “a modern disease of adaptation caused by an inability to cope with new computer technologies in a healthy manner.” Chronologically, TS research can be divided into two different periods. Since Craig Brod, the early 90’s researches were mostly related to the field of psychology and medicine, which comes under the 1st period of study. These studies used excretion of different body hormones and other biological measures to understand technology-related stress in an individual. For example one study showed that after undergoing a stress reduction training program the participants showed a significant improvement in their circulating levels of the stress-sensitive hormone prolactin as well as the cardiovascular risk indicators (Arnetz, 1996). Another study found out that higher levels of the stress-sensitive hormones thyroxin and prolactin among video display unit workers (Berg et al., 1992). Emurian (1993), showed while solving queries presented on a visual display terminal, systolic blood pressure was higher when individuals were under high density condition. Our study focuses more into TS research in IS area which comes under the 2nd period of study, started around late 2000’s and still going on.

In IS, TS research was initially conducted by Terafdar et al. (2007) and Ragu-Nathen et al. (2008). Based on the role theory and sociotechnical theory the second order construct TS creators were conceptually developed and empirically validated (Tarafdar et al., 2007). Drawing reference from the transaction based model of stress, TS creators and TS inhibitors correspond to the stressors and situational factors respectively (Ragu-Nathen et al., 2008). TS creators represent the factors that create TS

and TS inhibitors describe the organizational mechanisms that have the potential to reduce the effects of TS (Ragu-Nathan et al., 2008). The five different dimensions to technostress creators are Techno-overload, Techno-invasion, Techno-complexity, Techno-insecurity and Techno-uncertainty. First, techno-overload deals with overloaded information in a limited time that forces employees to work faster and longer. Techno-invasion deals with the Omni-present effect of technology which essentially blurred the line between work-home balances and creates unnecessary disturbances. The third dimension, techno-complexity is about the complexities associated with technologies. Due to this, employees may not be able to develop new skills frequently and their use of existing skills to new technologies may result in creating issues and errors. Techno-insecurity creates a fear of job loss in employees as they perceive new technologies may lead to automation or people with better skills and abilities will replace them in a long run. Finally, techno-uncertainty deals with the frequent and innovative technical changes that makes workers uncertain about their work and job roles.

The research on TS has drawn major attention from practitioners and scholars in the recent years. As technology use is becoming prevalent across various work sectors, employees require high cognitive, social and physical skills to adapt the same (Ayyagari et al. 2011). Lack of these skills lead to negative consequences like dissatisfaction, fear of being replace in job and increase stress level. Hence, TS literature is one of the important categories of study in IS literature and the below discussion provides a detailed review on the same.

3 Research Methods

The research method is presented in two different parts. The first part deals with the search of relevant literature whereas the second part consists of analysis and synthesis of the identified literature.

3.1 Searching the literature

For the literature review, we followed the below two steps (Webster and Watson, 2002).

Step 1

Select the relevant TS studies from the top IS journals (i.e., journals in the Senior Scholars' basket) and top IS conferences like ICIS, ECIS etc. We used keywords like Technostress, Techno-stress, and Technology related stress to identify related literature on TS in IS domain. Also we restricted our search from the year 2007 to 2017 (since the seminal article containing the scale to measure TS creators in IS domain was published in the year 2007 by Tarafdar et al.). However, we also found a country specific study (China) by Tu et al. (2005) that discussed about the five TS creators, thus included in this literature review.

Step 2

Used databases and search engines like EBSCO journal articles index, Brill, ABI/INFORM and Google Scholar to identify relevant articles (written in English only) citing the key articles identified in Step 1.

After downloading the relevant articles from all the above sources, we deleted the duplicate articles in the list. This review includes all the academic articles on TS irrespective of the research methodologies used, rating of the journals and sample/region of the studies. This list do not contain any non-academic articles, books, and studies that focus on stress due to the adoption of some other technologies except ICTs. Finally, we will discuss about the 24 articles (except Neuro-IS studies) that focused on TS in a workplace setting and categorized under our classification.

3.2 Analysis of the literature

The studies on TS in an organizational context highlight the impact of TS on different job outcomes. Here the use of technology is mandatory for work purpose and deals with utilitarian IT (Van der

Heijden, 2004). So employees do not have the freedom to stop the technology usage in a stressful situation as oppose to that of private use context. With these common features, the articles were categorised under three different sub-sections as shown in table 2.

Sub-section	Description	Number of Studies
General studies on TS	Studies that focus on TS in an organizational context.	16
TS due to specific technology use	Studies that highlight TS due to the use of specific technologies in an organization.	2
TS amongst different professionals	Studies focus on specific professionals who faced TS due to mandatory use of ICTs in the workplace	6

Table 2. Sub-divisions of TS literature in an organizational context

4 Analysis of the results

4.1 General studies on TS

While the ubiquity of ICTs increases the effectiveness and efficiencies of the organizations, researchers also highlight its negative impact in terms of technostress among employees. The general studies on TS do not focus on any specific organization or a particular technology or job professionals. Most of the literature deals with this category of studies in an organizational context.

Drawing parallel with the stressor-strain relationship of occupational stress, TS research conceptualize how and what types of techno-stressors cause strain in an individual. The perception of techno-stressors was determined by technological characteristics (Ayyagari et al. 2011) or by organizational environment (Wang et al. 2008) or based on individual differences (Krishnan, 2017). In case of strain, some studies highlight psychological strain like low satisfaction which is the negative emotional response to techno-stressors (Tarafdar et al. 2010) while others focus on behavioural strain like job performance (Ragu-Nathan et al. 2008).

Based on the initial studies of Tarafdar et al. (2007) researchers have explored the effect of TS on different possible job outcomes along with various moderating and mediating variables. For example, studies showed TS creators negatively influenced employee productivity, job satisfaction and organizational commitment (Tarafdar et al., 2007, Ragu-Nathan et al., 2008). However organizational mechanisms like literacy facilitation, technical support provision, involvement facilitations and perceived organizational support act as TS inhibitors that potentially reduce these negative impacts (Ragu-Nathan et al., 2008; Wang & Shu., 2008). Srivastava et al. (2015) studied the moderating role of big five personality traits Openness, Conscientiousness, Extraversion, Neuroticism and Agreeableness on the relationships between technostress creators with job burnout and job engagement. Studies also showed that technostress decreases with the increase in computer efficacy, education, age and lower level of computer dependency (Shu et al., 2011).

Organization culture and technology characteristics also play an important role in TS research. Study showed that employees from more centralized companies often perceive more technostress and TS is highest in companies that are highly innovative and centralize (Wang, 2008). Using the Person-environment fit model as a theoretical lens, Ayyagari et al. (2011) proposed that at specific technology characteristics like usability, intrusiveness, and dynamism are related to various workplace stressors by controlling negative affectivity and technology usage. Among the stressors role ambiguity and work overload are the dominating ones that create strain among employees.

To empirically validate the proposed models and hypotheses, majority of the research on TS adapted survey based approach. However, some studies examine this phenomena in experimental designs and from Neuro-IS perspective. For example, in human-computer interaction task, system is highly essential to work effectively. Laboratory experiment revealed that system breakdown in such context, in-

creased the level of cortisol, which is a major stress hormone in human (Riedl et al., 2012). Another study examined whether Neuro-IS and psychometrics methods constitute alternatives or complements in technostress context. For triangulation of results, the authors conducted a laboratory experiment as well as a survey based data collection and analysis method in the context of TS. They concluded that though both these types of data capture different aspects of TS research, together it was providing a more holistic view (Tams et al., 2014). Based on transactional model of stress, Galluch et al., (2015) conducted two laboratory experiment to test their model and used a non-invasive salivary technique to measure alpha-amylase hormone to indicate strain.

Table 3 highlights the publications (except Neuro-IS studies) that comes under this sub-section.

Study	Independent Variables	Dependent Variables	Additional Variables	Sample	Theory/ Framework
Tu et al., (2005)	Technostress Creators	Employee productivity	N/A	700 employees in 12 Chinese companies	N/A
Tarafdar et al., (2007)	Technostress Creators	Productivity	Role stress (role conflict and role overload)	233 employees from two public sector organizations	Socio-technical theory and role theory
Ragu-Nathan et al., (2008)	Technostress Creators	Job satisfaction, Organizational commitment, Continuance commitment	Technostress inhibitors	608 end users in five organization	Transaction based model of stress
Wang & Shu, (2008)	Technostress	Role conflict, role overload	Perceived Organizational Support (POS)	285 IT professionals	Role Theory
Wang et al., (2008)	Centralization, innovation	Technostress	N/A	1029 employees in 86 Chinese Organizations	N/A
Tarafdar et al., (2010)	Innovation support,	End-user satisfaction, end-user performance	Involvement facilitation, Technostress Creators	233 public sector employees	Transaction based model of stress
Ayyagari et al., (2011)	Technological Characteristics	Emotional exhaustion	W-H conflict, invasion of privacy, work overload, role ambiguity, job insecurity	661 employees across various professions	Person-Environment fit model
Chen & Karahanna, (2011)	Technology mediated interruptions	Work life conflict, Non-work performance	N/A	137 employees from a technology firm	N/A
Hung et al., (2011)	Ubiquitous TS creators	Productivity, Job stress	Stress inhibitors	622 employees of various organizations	N/A
Shu et al., (2011)	Technology Dependency, Computer Self Efficacy	Technostress Creators	N/A	289 employees who use computer in their routine work	social cognitive theory
Ayyagari, (2012)	Information overload, T-T fit	Technostress	N/A	664 employees who use technology for work-related tasks	Task-technology fit
Fuglseth & Sørrebø, (2014)	TS Creators and TS inhibitors	Employees intention to extend the use of ICT	Employee satisfaction with ICT use	216 employees	Transaction theory of stress, IS continuance theory

Suharti et al., (2014)	workload, technology competence	Performance	Technostress	138 employees working in an engineering dept.	N/A
Srivastava et al., (2015)	Technostress Creators	Job burnout and Job engagement	Big five personality traits	152 managers who regularly use IT	Transactional model of stress and coping
Satish Krishnan, (2016)	Personality traits and espoused culture	Technostress creators	N/A	322 full time employees	Personality theory
Gaudioso et al., (2017)	Techno-invasion & Techno-overload	Work-exhaustion	Work-family conflict, distress, adaptive coping	242 full time employees	Coping theory

Table 3. General Studies on TS

4.2 TS due to specific technology use

Research on TS due to specific technology use is still in its nascent stage with few contributions. While TS in an organization is widely studied, focus on a particular ICT has recently drawn attention from scholars. With regards to the use of telemedicine technologies, Yan et al. (2013) proposed a model to study the impact of complementary fit and supplementary fit on the techno-stressors, mainly work overload and role ambiguity. Using the lens of person-technology model, they also proposed that personal innovativeness of IT will moderate the given relationship. In another study, using coping theory and moral disengagement theory, D’Arcy et al. (2014) conceptualize workplace stress due to the complex and ambiguous information security requirements and its coping response. They developed and empirically tested the model of security related stress led to information security policy violation intentions and the mediating effect of moral disengagement.

Study	Focused Technology	Independent Variables	Dependent Variables	Additional Variables	Sample	Theory/ Framework
Yan et al., (2013)	Telemedicine Technologies	Complementary and supplementary fit	Work overload, Role ambiguity, Strain	Personal innovativeness of IT	N/A	Person-Environment Theory
D’Arcy et al., (2014)	Information Security	Security related stress	ISP violation Intention	Moral disengagement	539 employees	Coping theory, Social Cognitive Theory, Moral disengagement theory

Table 4. TS due to specific technology in an organization

4.3 TS among specific professionals

This classification highlights the impact of technology related stress on different working professionals such as faculties, administrative staffs, sales professionals, journalists etc. For example, Ye et al. (2007) demonstrated that duration of daily visual display terminal use without breaks was significantly associated with eyestrain, back pain, and psychological distress among administrative staffs. The field of teaching and education is one of the biggest traditional non-IT sectors which is gradually embracing ICTs and thus inducing stress among teachers and librarians. Based on the person-environment fit theory, Al-Fudali and Mellar (2008) developed the teacher–technology environment interaction model (T-TE) to investigate stress among teachers. For triangulation of the results, they collected data through direct observations, recordings of the galvanic skin response (GSR) and interviews from teachers and it showed the existence of technostress when teachers use ICTs in the classroom. It arises

due to the lack of fit between teacher and the teaching environment i.e. they lack the ability to cope with the environmental demands. Similarly usage of ICTs also induce technostress among librarians which leads to technical and health issues (Yuvaraj & Singh, 2015).

In case of sales professionals, TS adversely impact the performance by increasing role stress and decreasing innovation but in the presence of TS inhibitors the negative impacts can be reduced (Tarafdar et al, 2014). This study shows technology self-efficacy of the salesperson makes him confident about technology use which can reduce the impact of TS creators on technology-enabled innovation. Similarly organization mechanisms like literacy facilitation and active involvement of the sales professionals while introducing new technologies reduces the impacts of TS.

The below table shows some of such studies in IS literature.

Study	Independent Variables	Dependent Variables	Additional Variables	Sample	Theory/ Framework
Ogan & Chung, (2002)	Age, gender, tenure track, faculty rank	Technology related stress	N/A	403 journalism faculties	N/A
Ye et al., (2007)	Duration of daily visual display terminal	Eyestrain, neck or upper extremity pain, back pain, mental health	Breaks and rest during work	3070 administrative staffs	N/A
Al Fudail & Mellar, (2008)	Primary and Secondary appraisal	Strain	Coping	9 teachers with 32Hrs of teaching activities	Teacher-Technology-Environment interaction model
Ahmad et al., (2009)	Technostress Creators	Organizational Commitment	N/A	N/A	N/A
Tarafdar et al., (2014)	Technostress creators	Technology enabled performance	TS inhibitors, Technology self-efficacy, role stress, technology enabled innovation	237 institutional sales professionals	Transactional model of stress, Social cognitive theory
Yuvraj & Singh, (2015)	Technostress Creators	N/A	N/A	200 Librarian	N/A

Table 5. TS among specific professionals

Integrating all these studies, we further represent them in a pictorial format which captures the antecedents and consequences of technostress creators (Figure 1). It also captures the additional moderators and mediators to provide a holistic overview on TS research in a workplace context.

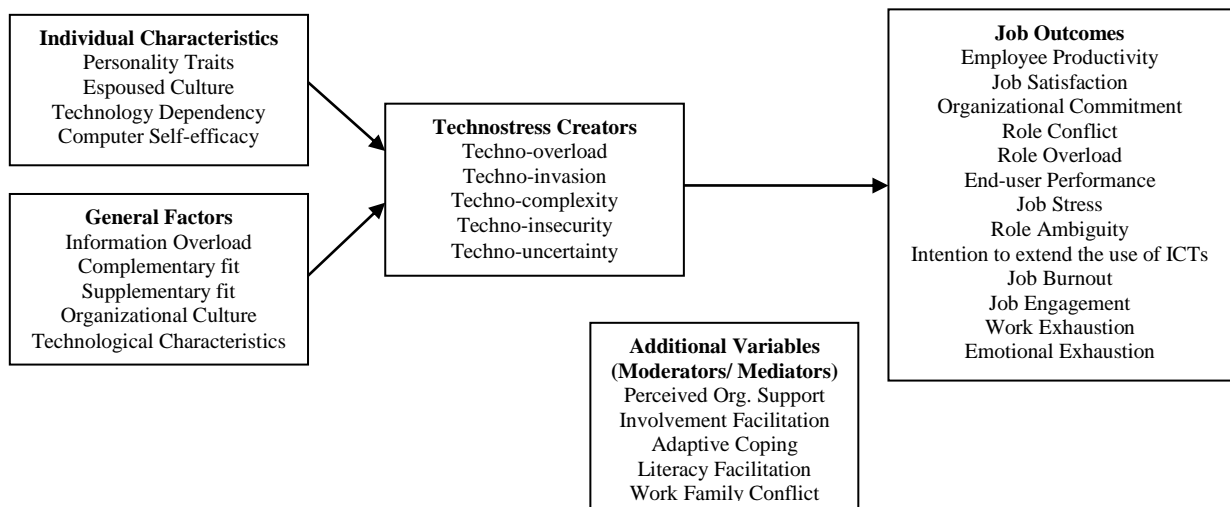


Figure 1: A pictorial Representation of TS literature in Organizational Context

5 Future research scope

The above discussion empathises that stress generated due to specific technology use is in a booming stage. Technostress researchers also highlight several research gaps in their respective studies. Analysing all those articles and research gaps, below are the listed ones that draw our attention.

5.1 Longitudinal data collection

Longitudinal studies are designed to understand the impact of changes over time (Laird & Ware, 1982). In TS research no studies investigate the impact of TS over a period of time. Existing studies use cross sectional data collection methods to explain the impact of TS inhibitors like perceived organizational support, training facilitations, technology support provisions etc. on the relationships between TS creators and job outcomes. However, to provide a complete understanding of the roles of TS inhibitors, it is required to measure technostress before and after the implementation of specific inhibitor mechanisms.

5.2 Implementation of coping mechanisms

Coping is an act of adaption that people perform in response to various disruptive events (Lazarus and Folkman, 1984). There exists two different types of coping; problem focused coping and emotion focused coping. The first one focuses on problem solving to eliminate the causes of the stress while the second deals with managing or reducing the emotional distress. Based on these, Carver et al. (1989) developed a multidimensional coping inventory consists of conceptually distinct scales to measure problem focused and emotional focused coping (see table 6 below). Among these scales active coping, planning, restraint coping, suppression of competing activities and seeking of instrumental social support measures problem focused coping while seeking of emotional social support, positive reinterpretation, acceptance, denial and turning to religion measure emotion-focused coping. However in existing technostress re-search none of the studies incorporate these concepts to reduce TS. Though Ragu-Nathan et al. (2008) developed the scale for technostress inhibitors and Srivastava et al. (2015) used personality traits as coping mechanisms, implementation of proper coping mechanisms is still missing in technostress study.

Table 6 highlights the different types of coping and their definition.

Type	Definition
Active Coping	The process of taking active steps to try to remove the stressors
Planning	Thinking about how to cope with stressors
Suppression of competing activities	Trying to avoid becoming distracted by other events/ Putting other projects aside
Restraint Coping	Waiting for an appropriate opportunity to act upon
Seeking social support for instrumental reasons	Seeking advice, assistance or information
Seeking social support for emotional reasons	Getting moral support, sympathy or understanding
Focusing on and venting of emotions	The tendency to focus on the distress and ventilate those feelings
Behavioural Disengagement	Reducing the attempt to deal with stressors/ giving up
Mental Disengagement	Using alternative activities to take one's mind off the problem
Positive reinterpretation and growth	Coping aimed at managing distress emotions rather than dealing with the stressors
Denial	Coping through denying the existence of the event
Acceptance	Accepting the reality of the stressful events
Turning to religion	Turn to religion practices to get emotional support

Table 6. *Types of Coping*

5.3 TS due to specific technology use

Stress generated due to the usage of specific technology in an organizational context needs further attention. For example stress due to dealing with new ERP systems may have different antecedent that of virtual collaborative technology use. As TS has negative impacts on productivity, satisfaction, job engagement etc. managers need to understand specific stress factors in specific context to apply relevant coping strategy.

6 Conclusion

In today's world ICTs implementation become mandatory for achieving organizational effectiveness and efficiencies. However, one cannot ignore the negative consequences that are caused by the technologies. In such context, our study focused on providing a detailed literature review on Technostress in organizations, one of the negative consequences of ICTs. The review showed that TS is becoming a serious issue that negatively influence employee productivity, job satisfaction, and job engagement while it increases role stress, burnout and exhaustion. It also provides various mechanisms proposed by literature to reduce such negative impacts. We also highlights some research gaps that existing in this field of research and need further attention.

References

- Ahmad, U. N. U., Amin, S. M., & Ismail, W. K. W. (2009). The impact of technostress on organizational commitment among Malaysian academic librarians. *Singapore Journal of Library and Information Management*, 38, 103-23.
- Ahuja, M. K., Chudoba, K. M., Kacmar, C. J., McKnight, D. H., & George, J. F. (2007). IT road warriors: Balancing work-family conflict, job autonomy, and work overload to mitigate turnover intentions. *MIS Quarterly*, 1-17.
- Akinci, B., Kiziltas, S., Ergen, E., Karaesmen, I. Z., & Keceli, F. (2006). Modeling and analysing the impact of technology on data capture and transfer processes at construction sites: a case study. *Journal of construction engineering and management*, 132(11), 1148-1157.
- Al-Fudail, M., & Mellar, H. (2008). Investigating teacher stress when using technology. *Computers & Education*, 51(3), 1103-1110.
- Arnetz, B. B. (1996). Techno-stress: a prospective psychophysiological study of the impact of a controlled stress-reduction program in advanced telecommunication systems design work. *Journal of Occupational and Environmental Medicine*, 38(1), 53-65.
- Ayyagari, R. (2012, March). Impact of information overload and task-technology fit on technostress. In Proceedings of the *Southern Association for Information Systems Conference* (pp. 18-22).
- Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: technological antecedents and implications. *MIS Quarterly*, 35(4), 831-858.
- Baroudi, J. J. (1985). The impact of role variables on IS personnel work attitudes and intentions. *MIS Quarterly*, 341-356.
- Berg, M., Arnetz, B. B., Lidén, S., Eneroth, P., & Kallner, A. (1992). Techno-stress. A psychophysiological study of employees with VDU-associated skin complaints. *Journal of Occupational and Environmental Medicine*, 34(7), 698-701.
- Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS Quarterly*, 169-196.
- Brod, C. (1982). Managing technostress: optimizing the use of computer technology. *Personnel Journal*, 61(10), 753-57.
- Broos, A. (2005). Gender and information and communication technologies (ICT) anxiety: Male self-assurance and female hesitation. *Cyber Psychology & Behavior*, 8(1), 21-31.
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: a theoretically based approach. *Journal of personality and social psychology*, 56(2), 267.
- Chandra, S., Srivastava, S. C., & Theng, Y. L. (2012). Cognitive absorption and trust for workplace collaboration in virtual worlds: An information processing decision making perspective. *Journal of the association for information systems*, 13(10), 797-835.
- Chen, A. J., & Karahanna, E. (2011). Personal life interrupted: Understanding the effects of technology mediated interruptions from work to personal life. In Proceedings of the *International Conference on Information Systems*.
- Chen, C. S., Su, S. A., & Hung, Y. C. (2011). U.S. Patent No. 7,958,555. Washington, DC: U.S. Patent and Trademark Office.
- Cooper, C.L. (Ed.). (1998). Theories of organizational stress. *New York: Oxford*.
- Cooper, C. L., P. Dewe, M. P. O'Driscoll. (2001). *Organizational Stress: A Review and Critique of Theory, Research, and Applications*. Sage, Thousand Oaks, CA.
- D'Arcy, J., Herath, T., & Shoss, M. K. (2014). Understanding employee responses to stressful information security requirements: a coping perspective. *Journal of Management Information Systems*, 31(2), 285-318.
- Eckhardt, A., Laumer, S., Maier, C., & Weitzel, T. (2016). The effect of personality on IT personnel's job-related attitudes: Establishing a dispositional model of turnover intention across IT job types. *Journal of Information Technology*, 31(1), 48-66.
- Emurian, H. H. (1994). Cardiovascular and electromyography effects of low and high density work on an interactive information system. *Computers in human behavior*, 9(4), 353-370.

- Fuglseth, A. M., & Sørebo, Ø. (2014). The effects of technostress within the context of employee use of ICT. *Computers in Human Behavior*, 40, 161-170.
- Galluch, P., Grover, V., & Thatcher, J. B. (2015). Interrupting the workplace: Examining stressors in an information technology context. *Journal of the Association for Information Systems*, 16(1), 1-47.
- Gartner. (2011). Gartner Survey Highlights Consumer Fatigue with Social Media. URL: <http://www.gartner.com/it/page.jsp?id=1766814>
- Gaudioso, F., Turel, O., & Galimberti, C. (2017). The mediating roles of strain facets and coping strategies in translating techno-stressors into adverse job outcomes. *Computers in Human Behavior*, 69, 189-196.
- Gaziel, H. H. (1993). Coping with Occupational Stress among Teachers: a cross-cultural study. *Comparative Education*, 29(1), 67-79.
- Hung, W. H., Chang, L. M., & Lin, C. H. (2011, July). Managing the Risk of Overusing Mobile Phones in the Working Environment: A Study of Ubiquitous Technostress. In *PACIS* (p. 81).
- Hunton, J. E., Lippincott, B., & Reck, J. L. (2003). Enterprise resource planning systems: comparing firm performance of adopters and nonadopters. *International Journal of Accounting information systems*, 4(3), 165-184.
- Hurrell Jr, J. J., Nelson, D. L., & Simmons, B. L. (1998). Measuring job stressors and strains: where we have been, where we are, and where we need to go. *Journal of occupational health psychology*, 3(4), 368.
- Karasek Jr, R. A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. *Administrative science quarterly*, 285-308.
- Khan, Z., & Jarvenpaa, S. L. (2010). Exploring temporal coordination of events with Facebook.com. *Journal of Information Technology*, 25(2), 137-151.
- Krishnan, S. (2017). Personality and espoused cultural differences in technostress creators. *Computers in Human Behavior*, 66, 154-167.
- Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. McGraw-Hill, New York.
- Lazarus, R. S., S. Folkman. (1984). *Stress, Appraisal, and Coping*. Springer, New York.
- Laird, N. M., & Ware, J. H. (1982). Random-effects models for longitudinal data. *Biometrics*, 963-974.
- Maier, C., Laumer, S., Eckhardt, A., & Weitzel, T. (2012). When Social Networking Turns to Social Overload: Explaining the stress, Emotional Exhaustion, and Quitting Behaviour from Social Network sites' Users. In *ECIS* (p. 71).
- Mazmanian, M., Orlikowski, W. J., & Yates, J. (2013). The autonomy paradox: The implications of mobile email devices for knowledge professionals. *Organization science*, 24(5), 1337-1357.
- McGrath, J. E. 1976. Stress and behavior in organizations. M. D. Dunnette, ed. *Handbook of Industrial and Organizational Psychology*. Rand-McNally, Chicago, 1351-1395.
- Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly*, 28(2), 283-322.
- Molla, A., & Heeks, R. (2007). Exploring e-commerce benefits for businesses in a developing country. *The Information Society*, 23(2), 95-108.
- Moore, J. E. (2000). One road to turnover: An examination of work exhaustion in technology professionals. *MIS Quarterly*, 141-168.
- Mwakaje, A. G. (2010). Information and communication technology for rural farmers' market access in Tanzania. *Journal of Information Technology Impact*, 10(2), 111-128.
- Ogan, C., & Chung, D. (2002). Stressed out! A national study of women and men journalism and mass communication faculty, their uses of technology, and levels of professional and personal stress. *Journalism & Mass Communication Educator*, 57(4), 352-369.
- Pikó, B. (1999). Work-related stress among nurses: a challenge for health care institutions. *The journal of the Royal Society for the Promotion of Health*, 119(3), 156-162.
- Ragu-Nathan, T. S., Tarafdar, M., Ragu-Nathan, B. S., & Tu, Q. (2008). The consequences of technostress for end users in organizations: Conceptual development and empirical validation. *Information systems research*, 19(4), 417-433.

- Rao, N. H. (2007). A framework for implementing information and communication technologies in agricultural development in India. *Technological Forecasting and Social Change*, 74(4), 491-518.
- Riedl, R., Kindermann, H., Auinger, A., & Javor, A. (2012). Technostress from a neurobiological perspective. *Business & Information Systems Engineering*, 4(2), 61-69.
- Robotham, D., & Julian, C. (2006). Stress and the higher education student: a critical review of the literature. *Journal of further and higher education*, 30(02), 107-117.
- Russell, D. W., Altmaier, E., & Van Velzen, D. (1987). Job-related stress, social support, and burnout among classroom teachers. *Journal of applied psychology*, 72(2), 269.
- Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, 57, 321-325.
- Sethi, V., Barrier, T., & King, R. C. (1999). An examination of the correlates of burnout in information systems professionals. *Information Resources Management Journal*, 12(3), 5-13.
- Shih, S. P., Jiang, J. J., Klein, G., & Wang, E. (2013). Job burnout of the information technology worker: Work exhaustion, depersonalization, and personal accomplishment. *Information & Management*, 50(7), 582-589.
- Shropshire, J., & Kadlec, C. (2012). I'm leaving the IT field: The impact of stress, job insecurity, and burnout on IT professionals. *International Journal of Information and Communication Technology Research*, 2(1).
- Shu, Q., Tu, Q., & Wang, K. (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(10), 923-939.
- Srivastava, S. C., Chandra, S., & Shirish, A. (2015). Technostress creators and job outcomes: Theorising the moderating influence of personality traits. *Information Systems Journal*, 25(4), 355-401.
- Stein, D. J., Seedat, S., Iversen, A., & Wessely, S. (2007). Post-traumatic stress disorder: medicine and politics. *The Lancet*, 369(9556), 139-144.
- Suharti, L., & Susanto, A. (2014). The impact of workload and technology competence on technostress and performance of employees. *Indian Journal of Commerce and Management Studies*, 5(2), 1.
- Tams, S., Hill, K., de Guinea, A. O., Thatcher, J., & Grover, V. (2014). NeuroIS-alternative or complement to existing methods? Illustrating the holistic effects of neuroscience and self-reported data in the context of technostress research. *Journal of the Association for Information Systems*, 15(10), 723.
- Tarafdar, M., Bolman Pullins, E., & Ragu-Nathan, T. S. (2014). Examining impacts of technostress on the professional salesperson's behavioural performance. *Journal of Personal Selling & Sales Management*, 34(1), 51-69.
- Tarafdar, M., Pullins, E. B., & Ragu-Nathan, T. S. (2015). Technostress: Negative effect on performance and possible mitigations. *Information Systems Journal*, 25(2), 103-132.
- Tarafdar, M., Tu, Q., & Ragu-Nathan, T. S. (2010). Impact of technostress on end-user satisfaction and performance. *Journal of Management Information Systems*, 27(3), 303-334.
- Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. *Journal of Management Information Systems*, 24(1), 301-328.
- Testa, R. J., Michaels, M. S., Bliss, W., Rogers, M. L., Balsam, K. F., & Joiner, T. (2017). Suicidal ideation in transgender people: Gender minority stress and interpersonal theory factors. *Journal of Abnormal Psychology*, 126(1), 125.
- Tu, Q., Wang, K., & Shu, Q. (2005). Computer-related technostress in China. *Communications of the ACM*, 48(4), 77-81.
- Van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 695-704.
- Vranjes, I., Baillien, E., Vandebosch, H., Erreygers, S., & De Witte, H. (2017). The dark side of working online: Towards a definition and an Emotion Reaction model of workplace cyberbullying. *Computers in Human Behavior*, 69, 324-334.

- Wang, K., & Shu, Q. (2008). The moderating impact of perceived organizational support on the relationship between technostress and role stress. In *Database and Expert Systems Application*. 19th International Workshop on (pp. 420-424). IEEE.
- Wang, K., Shu, Q., & Tu, Q. (2008). Technostress under different organizational environments: An empirical investigation. *Computers in Human Behavior*, 24(6), 3002-3013.
- Webster, J., & Watson, R. T. (2002). Analysing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, xiii-xxiii.
- Weiss, M. (1983). Effects of work stress and social support on information systems managers. *MIS Quarterly*, 29-43.
- Yan, Z., Guo, X., Lee, M. K., & Vogel, D. R. (2013). A conceptual model of technology features and technostress in telemedicine communication. *Information Technology & People*, 26(3), 283-297.
- Ye, Z., Abe, Y., Kusano, Y., Takamura, N., Eida, K., Takemoto, T. I., & Aoyagi, K. (2007). The influence of visual display terminal use on the physical and mental conditions of administrative staff in Japan. *Journal of physiological anthropology*, 26(2), 69-73.
- Yuvaraj, M., & Singh, A. K. (2015). Effects and Measures of Technostress among Librarians in selected University Libraries of Delhi. *Library Philosophy and Practice*, 0_1.