DETERMINANTS OF TECHNOSTRESS: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Technostress as an academic domain has evolved significantly since year 1984. Based on the systematic literature review (SLR), eight determinants of technostress were identified which were classified into individual and organizational categories. Individual determinants were further divided into demographic, psychographic and cognitive categories. Outcome of the SLR was the development of a comprehensive framework of technostress. This study can facilitate the top management and the HR managers of organizations to adopt appropriate change management interventions while implementing and augmenting new technologies.

KEY WORDS

computer literacy, determinants, information and communication technology, personality type, self-efficacy, stress, specialization, technology engagement, technostress

JEL CODES

D23, O33, D83, L86, M15, O14

1 INTRODUCTION

Information and communication technology (ICT) has become an inseparable part of modern personal and professional lives. This technological engagement is not only confined to organizational boundary but affects personal spheres too due to massive penetration of internet, apps and smart gadgets. Rapid changes of technologies from personal computers to smart phones and internet, enable the information access in just a single click. However, it keeps individuals under constant pressure to acquire and learn new skills, knowledge and creativity (Lee, 2010). This pressure of acquainting with new technologies creates a feeling of anxiety, fear and stress among the users.

This fear results from feeling of insecurity of losing their jobs, as they might be replaced by technology, automation or digitalization. This

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often takes the form of negative emotions such as nervousness, decreased confidence, increased anxiety and apprehension in using computer (Abdul-Gader and Kozar, 1995; Marcoulides, 1989). Stressful working conditions can adversely affect both employees and employers (Ganster, 2008). These factors lead to creation of stress among the users and is referred as technostress (Brod, 1984; Weil and Rosen, 1997).

As a result of economic development or technological advances, organizations are compelled to restructure, which changes an employee's roles and employment status, creating new and increased demands on employees and their wellbeing (Le et al., 2020). In technology-led reengineering of business processes; new power, authority and decision-making structures are created. These factors induce stress among the individuals, resulting into decreased productivity and performance in organizations (Sinha and Sinha, 2012; Tarafdar et al., 2007).

In this paper, authors carried out an in-depth study of research papers related to technostress from year 1984 to 2020 to identify relevant factors causing technostress. The primary aim of the paper was to integrate and synthesize the findings of existing research papers related to technostress. Based on the systematic literature review; individual determinants: age, gender, self-efficacy, personality type, computer literacy, field of specialization; and organizational determinants: technology engagement and organization climate have been identified as major determinants of technostress. It was followed by the development of a comprehensive framework of technostress. Managerial implications of technostress have also been highlighted in the end. Paper concludes with the limitations and scope for future research.

2 BACKGROUND OF TECHNOSTRESS

Craig Brod was the first author to introduce the term "technostress" in the year 1984. According to him, "technostress was a modern disease of adaptation caused by an inability to cope with the new computer technologies in a healthy manner". Authors Clark and Kalin (1996) were of the opinion that technology was not the problem but human's adverse response to new innovations was the problem. According to Wang et al. (2008), "technostress is negative effect on human attitude, thoughts, behaviors and psychology that directly or indirectly results from technology". They opined that the psychology and attitude of people resisting the change were the major causes of technostress.

Technology has become an indispensable part of modern human life. Business Dictionary defines technology as the purposeful application of information in the design, production, and utilization of goods and services, and in the organization of human activities. ICT encompasses all hardware (including communication technologies like cell phone), networking devices, software applications and systems that enable individuals and organizations to communicate and transact with each other for various purposes. With rapid development and spread of Industry 4.0 technologies like artificial intelligence, machine learning, IOT, Cloud, big data and analytics; radical shift is getting witnessed in every sector and across the globe in recent years.

Due to faster pace of life, rising customers' expectations, growing competition, exceeding regulatory pressures etc.; organizations need to invest in state-of-the-art technologies. Rapid obsolescence of technology necessitates this investment on a regular basis. While this puts pressure on the management of companies in terms of procurement and deployment of IT resources, this affects employees also to a great extent as they need to learn, unlearn and re-learn newer technologies and associated business processes to remain competitive.

Numerous studies, agencies and experts have predicted that in coming years; millions of jobs will be threatened due to this fourth industrial revolution including IoT, Analytics and artificial intelligence technologies. These disruptive technologies compel organizations to reinvent their business model, philosophy, and processes.

As organization strive for survival and growth, individuals cannot remain complacent. However, everyone in organization does not possess requisite competence and agility to cope up with fast-paced technological changes taking place in environment, leading to technostress.

McKinsey Global Institute (2019) survey indicated that by year 2030, 75 million to 375 million workers will switch occupational categories. This shift may make many jobs redundant at one hand; on other hand, may create new jobs in production process, business, and service delivery mechanism. With the exponential changes in technologies, higher-value jobs will be created that would require altogether different skill sets and result in likely job losses in developed and developing countries including India (World Economic Forum, 2017).

World Bank report indicated that the proportion of jobs threatened by industry 4.0 technologies in India is 69 percentage year-on-year (Business Today, 2017). Ganesh (2018) in his paper referred Job Buzz survey, which highlighted that about 70 percentage of the Indian employees were suspicious of their jobs getting away due to automation and only 20 percentage feel their jobs getting better due to Industry 4.0 technologies. Mehta (2018) in his study referred a FICCI (2017) report, which indicated that there will be decline in routine, lower and middle level jobs and consequent increase in high skill jobs.

3 RESEARCH METHODOLOGY

Authors followed the review method suggested by Akosah-Twumasi et al. (2018) for this paper. Time-period for review was year 1984 (when the term was coined) to year 2020. Authors began this paper by searching various online databases such as Google Scholar, Ebsco Host, Emerald, Jstor, Taylor and Francis and Wiley to identify research papers published on the theme of technostress. Although the number of relevant papers received on these databases was found to be sufficient, search was also performed in other databases like sage, psychnet etc. However, many of the papers were found to be the same, therefore, further search on these databased was not carried out. At initial stage, keywords used were technostress, stress theories, information and communication technology, technology engagement and social networking sites.

In the second stage, experts' opinion was sought to find the new keywords relevant to the subject. Additional identified keywords were social networking service fatigue, teleworking, IT affordance, knowledge workers, digitalization etc. Although, this study attempted to include all the relevant articles on technostress, authors do not claim that the databases included are complete or exhaustive in nature. Fig. 1 summarizes the process mentioned above.

Sankey diagram connecting the three nodes i.e., journal, author(s) and publication year is presented in Fig. 2. It is a visualization tool that depicts the flow of one set of values to another and where the width of the arrow is proportionate to the flow rate. First and last node represent number of papers published in particular journal and year, while node two shows the number of papers published by particular author(s).

Based on the secondary research, authors have identified various determinants which have relevance with technostress or can result into technostress. These factors include age, gender, computer literacy/knowledge/experience, field or area of specialization, personality type, self-efficacy, technology engagement and organization climate. Summary of relevant literature on these determinants, classified into individual and organizational determinants, is presented in Tab. 1.

Sankey diagram connecting the determinant (streams), author(s) and publication year is presented in Fig. 3.

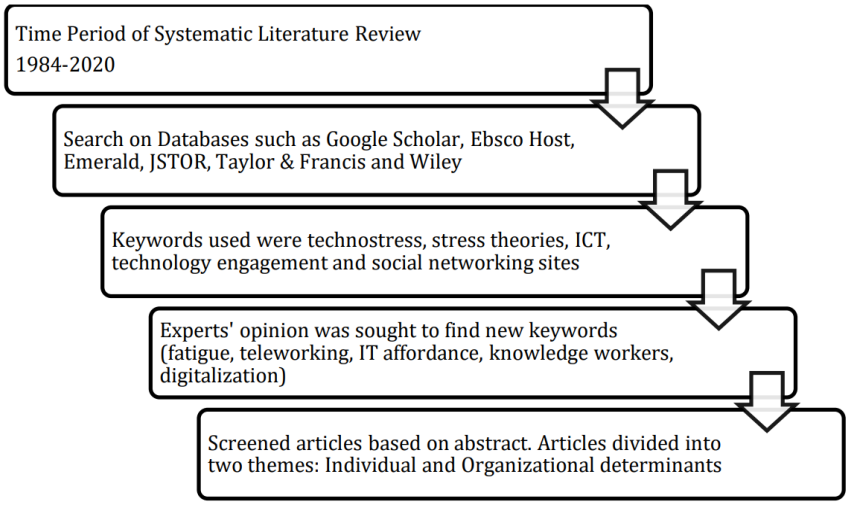

Fig. 1: Literature Review Process

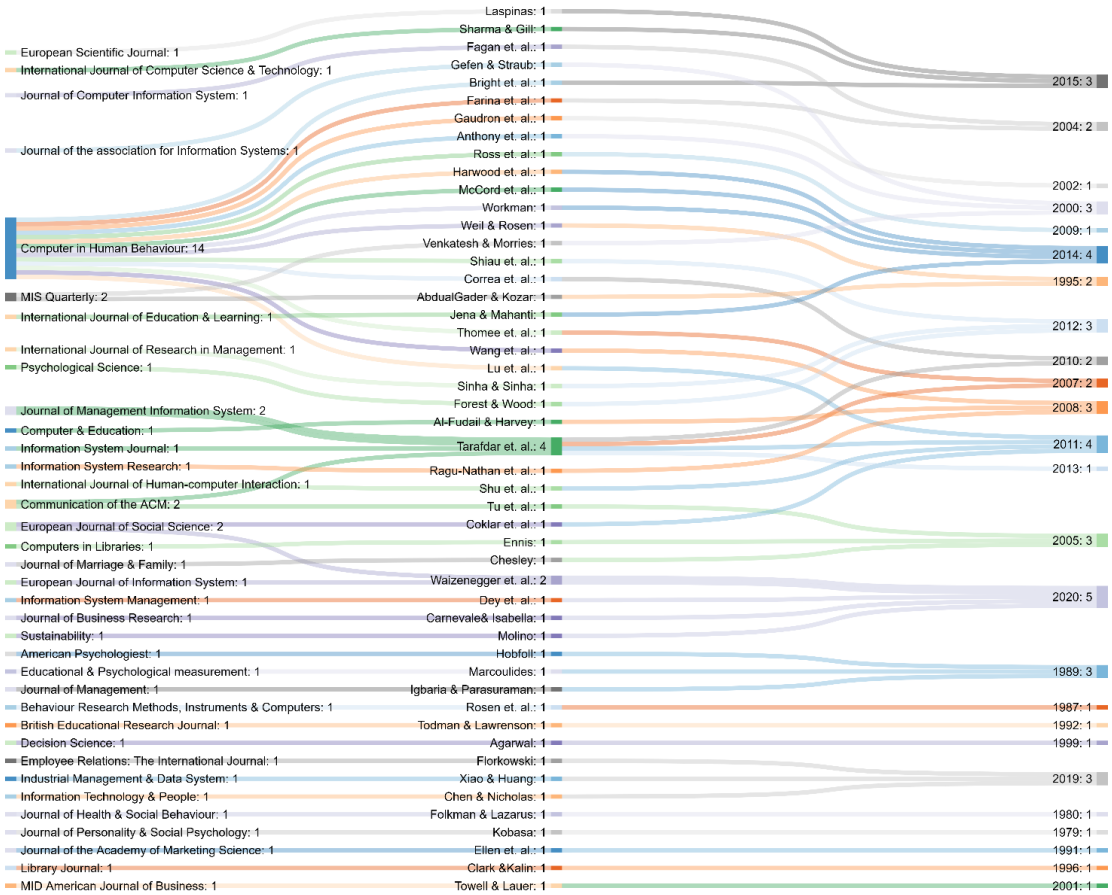

Fig. 2: Sankey Diagram (Journal – Author – Year)

Tab. 1: Streams of Researches on Determinants of Technostress

Determinants	Articles	References
Individual (27) – includes Demographic (11), Psychographic (5), Cognitive (11)		
Age (D)	7	Sharma and Gill (2015); Ragu-Nathan et al. (2008); Tu et al. (2005); Weil and Rosen (1995); Todman and Lawrenson (1992); Rosen et al. (1987); Howard and Smith (1986)
Gender (D)	4	Çoklar and Şahin (2011); Tarafdar et al. (2011); Gefen and Straub (2000); Weil and Rosen (1995)
Personality Type (P)	2	Anthony et al. (2000); Fariña et al. (1991)
Self-Efficacy (P)	3	Shu et al. (2011); Fagan et al. (2004); Ellen et al. (1991)
Computer Literacy/Knowledge (C)	9	Jena and Mahanti (2014); Tarafdar et al. (2011); Gaudron and Vignoli (2002); Agarwal and Prasad (1999); Brosnan (1998); Weil and Rosen (1995); Fariña et al. (1991); Igbaria and Parasuraman (1989); Howard and Smith (1986)
Field of Specialization (C)	2	Towell and Lauer (2001); Rosen et al. (1987)
Organizational (12)		
Technology Engagement	7	Al-Fudail and Mellar (2008); Thomée et al. (2007); Chesley (2005); Raitoharju (2005); Ennis (2005); Valcour and Hunter (2005); Gant and Kiesler (2001)
Organization Climate	5	Sharma and Gill (2015); Jena and Mahanti (2014); Wang et al. (2008); Tarafdar et al. (2007)

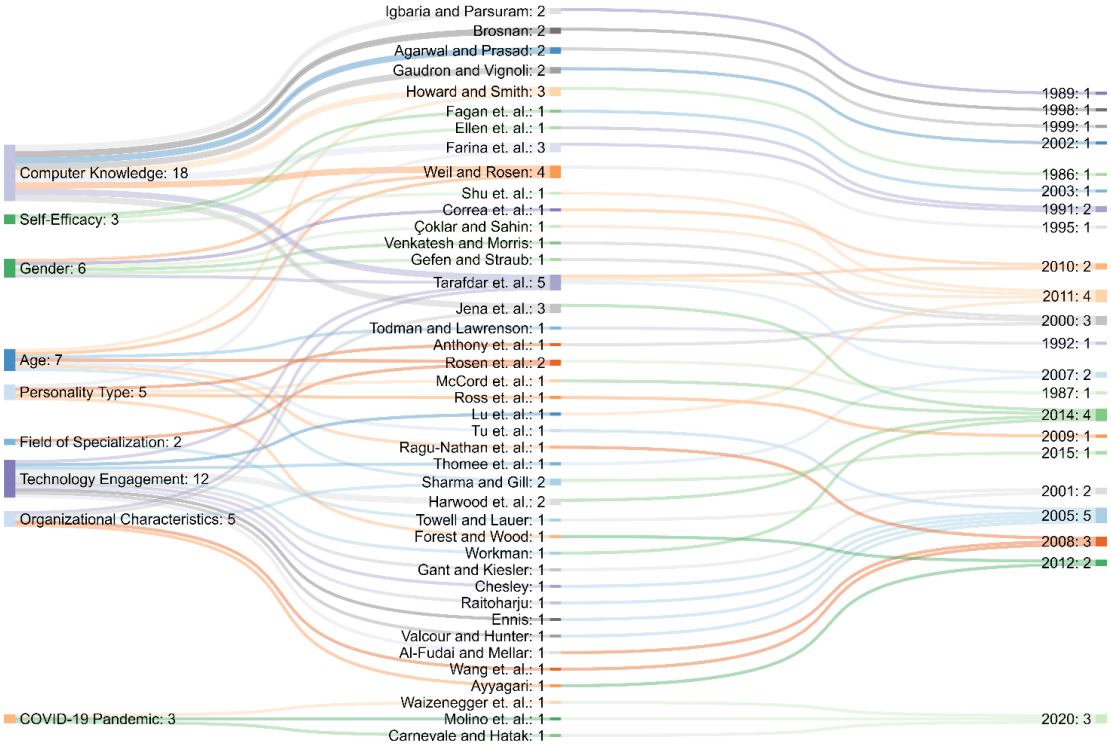

Fig. 3: Sankey Diagram (Determinants – Author – Year)

Under this backdrop, this research aims to broaden the understanding of technostress domain by addressing following research questions:

- RQ_1: What are the main determinants of technostress at individual and organizational levels?
- RQ_2: How can we illustrate technostress in a comprehensive manner?

4 LITERATURE REVIEW OF TECHNOSTRESS DETERMINANTS

Identified determinants of technostress have been classified in two categories:

- Individual Determinants: Demographic (age, gender), Psychographic (self-efficacy, personality type) and Cognitive (computer literacy, knowledge, experience; field of specialization of work).
- Organizational Determinants: Technology Engagement, Organization Climate.

Next section discusses eight determinants given above.

4.1 Individual Determinants

4.1.1 Demographic Determinants

Demographic variable age's impact on technostress has been studied by various researchers. Research conducted by Rosen et al. (1987) among the university students revealed that computer anxiety was correlated with age as older students experienced more anxiety than younger students. A study conducted on school children (9 years old) and university students (First-year Psychology students) concluded that university students had higher levels of computer anxiety than school children (Todman and Lawrenson, 1992). In China, employees older than 35 years witnessed more technostress. It might be because of their rigid thinking and their convenience with conventional work settings and procedures (Tu et al., 2005). Similar study by Sharma and Gill (2015) reveals that senior employees find it more difficult in adopting the technological changes as compared to the younger employees. However, some studies show that younger people are more techno-stressed than their senior counterparts. Weil and Rosen (1995) in their study conducted in 23 countries, found that in the sample of Mexico and Czechoslovakia, computer anxiety was negatively correlated with age. In other words, older students had less technological anxiety. This might be due to their maturity which led them to better handle stressors (Ragu-Nathan et al., 2008). Howard and Smith (1986) found that age did not have significant correlation with computer anxiety.

As per authors' review, gender affects computer related anxiety of a user. A study of Weil and Rosen (1995) concluded that gender and computer anxiety were related. Males showed more computer anxiety than females in the samples of 23 countries. Particularly, it was visible in sample from Italy, Thailand and Kenya while in Israel and Hungary, female respondents had high computer anxiety. It might be because usage of computers at the time of study was relatively less at workplaces in these countries, unless it was compulsory. Gefen and Straub (2000) in their study on academicians found that male academicians' experienced higher technostress compared to women academicians because women used technology only when they required it while men used technology very often. Study of social network users in Turkey revealed that female users experienced more stress than their male counterparts (Çoklar and Şahin, 2011). However, Tarafdar et al. (2011) concluded that gender did not have any significant relationship with technostress.

4.1.2 Psychographic Determinants

Self-efficacy is an individual's belief that he or she is capable of performing a task (Robbins and Judge, 2013). As per the social cognitive theory, computer self-efficacy had a negative relationship with technostress. Study of Fagan et al. (2004) also revealed similar results. Ellen et al. (1991) concluded that people with lower self-efficacy oppose technological changes compare to those having higher self-efficacy. Shu et al. (2011) reaffirmed that people with lower computer self-efficacy and higher technology dependence were found to be more techno-stressed than others with opposite behavioral traits.

Personality is defined as enduring characteristics that describe an individual's behavior (Robbins and Judge, 2013). Research on 176 South African university students by Anthony et al. (2000) was intended at finding correlation

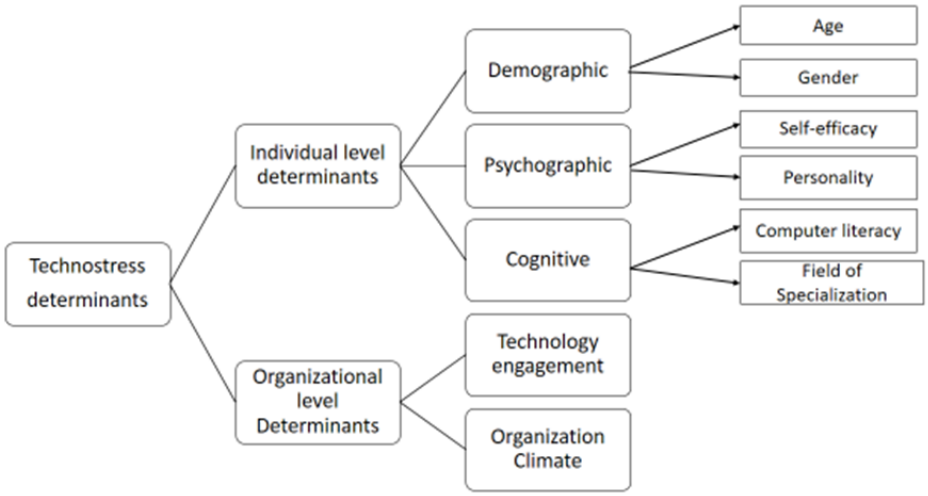

Fig. 4: Technostress Determinants

between dimensions of personality (Openness to experience, Extraversion, Agreeableness, Conscientiousness and Neuroticism) and technophobia. Result of their study indicated that neuroticism correlated positively with computer anxiety. On the other side, openness was inversely correlated with computer anxiety. Chen and Roberts (2019) in their study of social networking site (Facebook) users – undergraduate student from Public American University found that agreeable individuals might be driven by compliance mentality and became addicted to SNSs. Extroverts became addicted to SNSs to enhance pleasure and excitement. Neurotic individuals tend to use SNSs to cope with negative emotions or feelings of deficiency.

4.1.3 Cognitive Determinants

Study by Howard and Smith (1986) did not find significant relationship of computer anxiety with computer knowledge. However, they found an inversely significant relationship between computer anxiety and technology experience. Fariña et al. (1991) concluded that respondents with more computer experience had less anxiety towards the computer. Based on research conducted in 23 countries, Weil and Rosen (1995) found that less experienced students from 17 countries exhibited higher anxiety about computer operation. Negative attitude towards ICTs uses also created nervousness and agitation among computer users (Brosnan, 1998; Gaudron and Vignoli, 2002) while professionals with greater confidence in computers experienced less technostress because of their own competence to manage the technical challenges (Tarafdar et al., 2011).

Educational qualification was generally considered to be inversely related with technostress. Assumption behind this proposition was that educated users had less anxiety compared to less educated users (Igbaria and Parasuraman, 1989; Agarwal and Prasad, 1999). Jena and Mahanti (2014) in their study of academicians found that those who were highly aware with the technology experienced less technostress as they were more confident in dealing with challenges emanating from technological introduction. Five studies conducted among 450 students, consisting of various nationality and specializations, of a State university in USA concluded that social science and humanities students had much higher computer anxiety and were less inclined towards technology compared with their counterparts from science and business backgrounds. Males in science major and females in a social science major had more computer anxiety. (Rosen et al., 1987). A USA based study conducted by Towell and Lauer (2001) compared computer related stress levels among 239 MBA students. They found that MIS major students experienced higher

technostress compared to other specialization students as they had highest interaction with computer and their grades were also highly dependent on the computer work.

4.2 Organizational Determinants

4.2.1 Technology Engagement and Technostress

Stress can be created by technologies in form of extended working hours and need for employees to remain available 24×7 through internet (Walz, 2012). Modern communication devices such as smart phones, laptops, and other collaborative tools compel the employees to perform multiple tasks simultaneously that create communication overload and information overload which might be difficult for them to handle effectively (Ragu-Nathan et al., 2008). These devices and communication applications provide greater flexibility but affect work-life balance to a great extent causing stress (Chesley, 2005). Mobile communication devices also put the employees "on call" for extended hours for official matters. This increases their working hours and restrict their autonomy resulting into stress (Gant and Kiesler, 2001).

A study by Thomée et al. (2007) found that there was no significant relationship between time spent on email and stress among male participants, but found that time spent on e-mailing causes depression among women. Necessity to use technology in different processes associated with different sectors such as health care (Raitoharju, 2005), education (Al-Fudail and Mellar, 2008) and library studies (Ennis, 2005) resulted in avoidance of technology use due to users' negative disposition and resulted in stress. Virtual presence of people due to advance technology made them to work across different time zones and respond to tasks 24×7 (Valcour and Hunter, 2005), which led to work overload (Chesley, 2005). Suh and Lee (2017) found that technology characteristics (IT presentism and the pace of IT change) and job characteristics (job autonomy and task interdependence) jointly explain the technostress.

Drastic technology usage was witnessed in our daily lives after the outbreak of COVID-19 pandemic. Work from home and remote work options were the vital options to run the organization in this pandemic situation. The lockdown and social distancing forced the organizations to make policy and practices changes. Many employees were forced to work from home with or without any prior experience of technology, which resulted in higher level of stress among them (Waizenegger et al., 2020). Carnevale and Hatak (2020) in their study found that people were in continuous struggle to adapt to the new work platform. Use of technology for work and personal front, blurred the boundary between work and personal lives, resulted into technostress (Dey et al., 2020).

4.2.2 Organization Climate and Technostress

An organization's environment also contributes to technostress among the employees. Tarafdar et al. (2007) propounded that technostress can increase the existing stress due to aspects of individual's role. Wang et al. (2008) concluded that overall technostress is directly proportional to the level of centralization and innovation culture in organization. One of the draw backs of ICTs was information overload in work settings. Individuals may experience stress because of this information overload. But if someone experiences high task technology fit, it lowers his/her stress level (Ayyagari, 2012). Study of Jena and Mahanti (2014) found that organizational tenure of academicians was also related with technostress. Those academicians having greater organizational tenure experienced less technostress due to superior understanding of organization and technologies in use. It may possibly enhance the power of academicians in the institute which might reduce technology related pressure in the academic institute. Technological changes introduced in organization, without involving staff which alter their role, also lead to technostress (Sharma and Gill, 2015)

5 IMPACT OF TECHNOSTRESS

Factors discussed above create technostress which results into psychological, behavioral or physiological strains. Psychological strains can be defined as emotional reactions to stressor conditions. These include dissatisfaction with the job, depression, negative self-evaluation, organizational commitment etc. (Walz, 2012). Behavioral strain is defined as an influence on the action of an individual. Various researches in organizational behavior area described end-users' reactions to ICTs in form of mental stress, anxiety, work pressure etc. Technostress creators on one end decreased the job satisfaction and organizational commitment, while on other end, increased role stress among the individuals that affected the individual's sense of well-being and dedication at the workplace (Tarafdar et al., 2011). Study of Kupersmith (1992) and Tarafdar et al. (2011) showed that utilization of ICTs in libraries had caused technostress among librarians, which reduced their job satisfaction.

Physiological strain can be defined as reactions of human body including the digestive, nervous, endocrine, immune systems etc. to various stressors. Most cited physical symptoms of technostress by librarians were back pain, eye strains, headache, increased heart rate etc., caused by their excessive sitting and computer gazing. (Laspinas, 2015). It also created job insecurity among librarians due to fear of being overtaken by computers (Harper, 2000). Based on the above review, authors have developed following model highlighting various antecedents, determinants (individual and organization) and consequences of technostress.

6 DISCUSSION AND CONCLUSION

This paper contributes to the research on technology induced stress by integrating a large number of research papers causing technophobia, computer anxiety and fatigue. Through systematic literature review, we identified eight determinants of technostress, classified into individual and organizational determinants. Individual determinants have been further divided into demographic, psychographic and cognitive categories. In case of age, majority of studies pointed at positive correlation, however, some studies found negative correlation with age and lack of relationship too. Studies on gender and technostress was also not conclusive. Researches are unanimous about the negative relationship of Computer self-efficacy with technostress. Personality type was found to be a significant predictor of technostress. Studies on relationship between computer literacy/knowledge and technostress produced contradictory results. Similarly, the relationship between the field of specialization and technostress was also not one-sided. At organizational level, technology engagement (nature, application and duration) determined the technostress. Organization climate was also found to be a major determinant of technostress.

Lazarus and Folkman (1984) defined stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his/her resources and endangering his/her well-being". They mentioned that stress results from an imbalance between demand and resources. This definition focused on two aspects – appraisal and coping. Appraisal means a person acknowledges that something which they have are at stake. These can be in form of their job, goal, values or beliefs (Lazarus, 2001). The mechanism to deal with such cognitive underpinning emotion is coping, which is defined as "the cognitive and behavioral efforts made to master, tolerate or reduce external and internal demands and conflict among them" (Folkman and Lazarus, 1980). This coping mechanism as cognitive efforts (self-efficacy) and behavior (gather computer knowledge and experience), if implemented well, can reduce the demand (technostress).

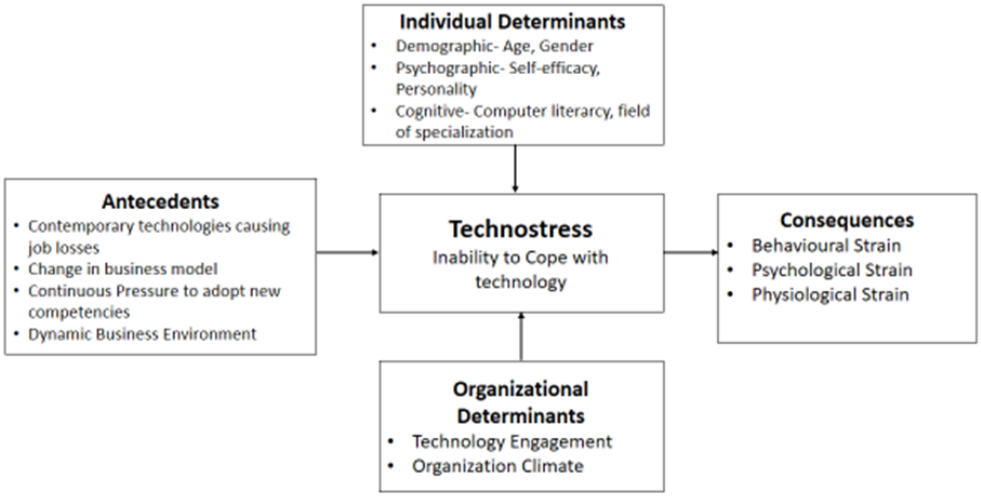

Fig. 5: Technostress Framework: Antecedents, Determinants and Consequences

This research can facilitate the top management of organizations and the HR managers to adopt appropriate change management interventions such as training, coaching, counselling, mentoring, hand-holding etc., while introducing new technologies in their organization. Florkowski (2019) studied the technology's influence on general work attitudes within the HR department and found that top-management support was inversely proportional to technostress. Champions need to be identified by the top management for each SBU, division and department who can create enabling environment and lead their fellow colleagues for technology adoption. Training should be provided in varying duration depending on employees' roles and in phases (awareness building seminar, demonstration followed by actual usage of tools). Training material should be prepared in different languages and should be made available offline and online for ease of access. Online and/or offline support, can also enable smooth adoption of technology (Li and Wang, 2021).

Organizations need to take a pragmatic view involving all segments of employees (based on determinants mentioned above – age, gender etc.) while adopting technology in their organization. Special attention should be given to vulnerable groups who consider technology as intimidating. In operational terms, heterogenous groups can be formed based on age, past knowledge, specialization etc. In other words, there cannot be a 'One Size Fits All' strategy while adopting technology in an organization (Tyler et al., 2020). Additionally; in view of technostress, top management and technology managers should consider technology implementation in pilot mode/stage wise implementation. By this, various technological and behavioral issues can be identified before organization-wide roll out of technology. More involvement of employees at each stage of technology adoption and upgradation is also another mechanism of resolving the technostress.

HR managers need to understand genuine anxieties and fears of employees. For allaying employees' concerns, continuous communication with all stakeholders can play an important role (Nisafani et al., 2020). For smooth introduction and stabilization of technology, suitable reward mechanism can also be explored. IT policy should lay more emphasis on people and process issues (including change management) than technology issues (hardware, software etc.). Lastly, functional managers' role becomes important as technology ultimately gets intertwined with various functional processes, therefore, requires constructive support from them at a regular interval. In technology adoption, top management should lead by example.

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