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Management of Technostress in Service Firms: A Conceptual Model

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Abstract
Digitalization has transformed service firms, subjecting both the employees and the firms to technology-induced stress called technostress. A notable component of a service firm that makes it susceptible to technostress is its intellectual capital – an intangible core asset of the firm. A service firm with a techno-strained IC can be vulnerable to poor: (i) service delivery, (ii) knowledge sharing, and (iii) customer satisfaction; even with spirited employees. *However, existing studies on technostress are essentially focused on the employees. This study, therefore, dedicated itself to the technostress of service firms. Specifically, this study aims to develop a conceptual model for the management of technostress in service firms. The updated integrative literature review method was adopted for the study. Association of Computing Machinery, Google Scholar, and JSTOR databases were the sources of literature for the review. The study established the starved recognition and management of technostress in service firms. A notable outcome from the review study is a conceptual mediated transactional theory of stress and coping (TTSC) model for the diagnosis and management of technostress in service firms. The development and validation of the conceptual TTSC model is strongly recommended.*

Keywords: Technostress, integrative review, technostress management, intellectual capital, TTSC model

INTRODUCTION
A firm driven by digitalization is a digital environment comprising seamlessly interoperable-technologies, software, tech workers, data, and policies complexly interacting to create value for all stakeholders (Axelos, 2019). Digitalization has become an integral part of human life and has transformed the way people live, communicate, and work (Bamel *et al.*, 2022; Pfaffinger *et al.*, 2021; Ross & Maynard, 2021). Digitalization which is now typical of service

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firms has subjected their employees to unique work settings – internet connectivity, multitasking, reachability, hardware and software changes – in ensuring the efficient utilization of all technological infrastructure for effective service delivery (Axelos, 2019).

The unique setting of service firms triggers technology-induced stress (i.e. technostress) in the workplace, which can have severe consequences on both the employees and firms (La Torre *et al.*, 2019, 2020; Ragu-Nathan *et al.*, 2008; Salanova *et al.*, 2013; Tarafdar *et al.*, 2020); if not properly managed in the organization. Organizational stress management, generally, refers to the proactive approaches employed by organizations or firms in identifying and mitigating the effect of stress in the workplace (Molek-Winiarska & Molek-Kozakowska, 2020; Nwobodo *et al.*, 2023; Tran *et al.*, 2020). The stress management approaches entail creating a corporate culture that minimizes the negative effect of stress on both the employees (natural persons) and the firm (juristic person) while promoting innovation, productivity, and competitiveness (Molek-Winiarska & Molek-Kozakowska, 2020; Nielsen *et al.*, 2017; Tran *et al.*, 2020).

Technostress, generally, erodes or improves the intellectual capability of the strained entity depending on the entity's nature and complexity, and the coping strategies employed (Wang, 2021). Both the service firm and its employees are, therefore, susceptible to technological strain as they possess intellectual capabilities – competency for the employees and intellectual capital (IC) for the service firms. The IC of a firm is an intangible core asset of the firm critical to its success, innovation, and competitiveness (Albaz & Khalifa, 2024; Amadi-Echendu, 2007). Technostress increasingly manifests itself in the employees of service firms in numerous ways such as anxiety, fear, and cognitive impairment as digitalization deepens in the workplace (Camarena & Fusi, 2022; Dutta & Mishra, 2023; S. Lee *et al.*, 2023).

However, in the service firms, technostress result in poor: (i) service delivery, (ii) knowledge sharing, and (iii) customer satisfaction; even with spirited employees (Oseremen *et al.*, 2022; Sharma, 2023). Yet, existing studies on technostress are essentially focused on the employees. Moreover, to the best of our knowledge, no framework exists for the management of technostress in service firms. This research, therefore, attempts to fill this void by enriching the literature on technostress as it relates to service firms. This pioneering effort will help to illuminate the concepts of technostress, particularly, as it relates to the IC of service firms and map out a framework for the management of technostress in service firms.

MATERIALS AND METHODS

The updated integrative literature review method was adopted for the study (Almqvist & Lassinantti, 2018; Holm *et al.*, 2021; Sharda & Nowell, 2025; Whittemore & Knafl, 2005). This technique provides an understanding of a specific occurrence and allows for the inclusion of qualitative and quantitative literature review methods (Whittemore & Knafl, 2005). The integrative review method was adopted for this study as it enables a strict focus on the phenomenon of interest – a wide range of inquiry – defining concepts, reviewing theories, and analyzing methodological issues (Hopia *et al.*, 2016; Toronto & Remington, 2020; Whittemore & Knafl, 2005). The integrative review method adopted consists of five broad sequential steps: (i) problem identification, (ii) literature search, (iii) literature evaluation, (iv) literature analysis, and (v) presentation of findings.

Problem Identification

Technostress, not only affects the well-being of employees but also erodes the IC of service firms – the key driver of a firm's innovation and competitiveness. While previous studies have examined the impact of technostress on employees' well-being and outcomes, studies on the

impact of technostress on service firms are scarce. Moreover, several technostress management frameworks as it relates to employee well-being and outcomes – productivity and performance – exist (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2010, 2011) but none exist for managing technostress as it relates to service firm itself. Furthermore, the concepts of technostress as it relates to the IC of firms appear esoteric in literature. The purpose of this integrative review, therefore, is to illuminate the concepts of technostress as it relates to the IC of service firms and design a framework for the management of technostress in service firms.

Literature Search and Evaluation

A literature search was conducted with the following databases: JSTOR, Association of Computing Machinery (ACM), and Google Scholar without any limitations. Keywords related to concepts within the intent and scope of the study were carefully crafted and converted into a search string using the "AND", "OR", "(" and ")" operators to realize the resultant search item viz (Technostress AND management AND (framework OR conceptual OR model) AND (employees OR "Human capital" OR "Intellectual capital") AND (workplace OR organization OR "service firm") AND (coping OR inhibitors)). In addition, a manual search of literature was conducted on some of the references of the retrieved literature from the databases. Thereafter, a prima facie assessment was performed on the resultant search results using their titles, abstracts and keywords.

The resultant preliminary literature (N = 93) was found to be distinct. These literature were then perused for inclusion and exclusion (see Table 1) in step-wise refinement using the literature: (i) title, (ii) abstract, and (iii) content. This resulted in eighteen, eleven and seven surviving literatures respectively as shown in Figure 1. Details of the included studies (n = 7) are summarized in Table 2.

Table 1: Inclusion and Exclusion Criteria

Inclusion	Exclusion
Publication with Title, Abstract, and contents in English language only	Publications with contents (partial or whole) written in languages outside the English Language.
Publications within the scope of Techno-stress, management of technostress, Intellectual capital, framework, conceptual, model, employees, individuals, workplace, organization, service firm, coping, inhibitors	Publications outside the scope of Service firms, Service organizations, and Information Technology (IT) industry

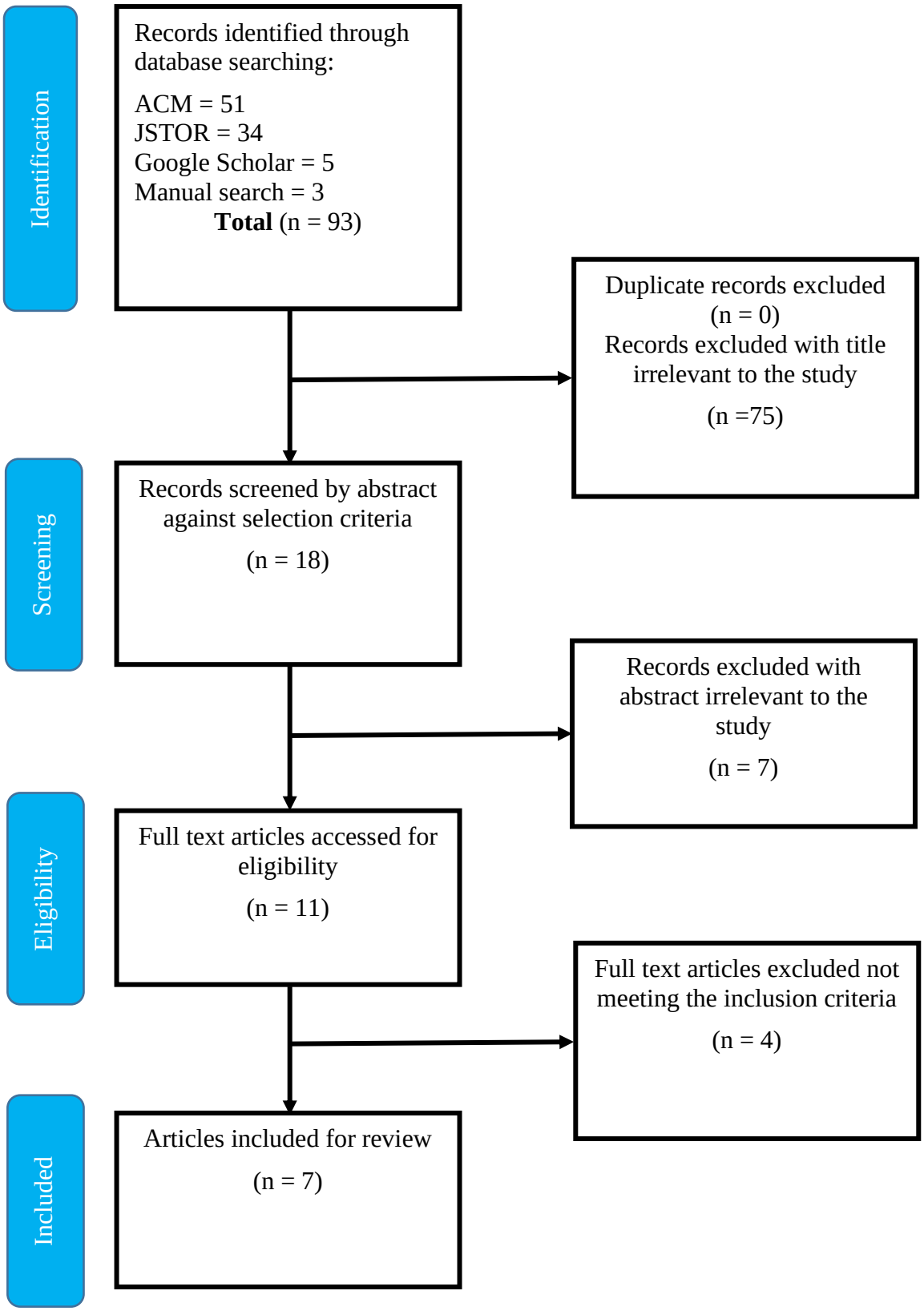

Figure 2: Flow Diagram of Literature Search

Table 2: Included Studies

Citation	Title	Purpose	Theoretical Model	Method	Strained Entity
Tarafdar *et al.* (2007)	The impact of technostress on role stress and productivity	To explore the effects of technostress on role stress and individual productivity using sociotechnical and role theory concepts	Sociotechnical theory and role theory	Survey, exploratory factor analysis, structural equation modeling	IT staff in organizations
Ragu-Nathan *et al.* (2008)	The Consequences of Technostress for End Users in Organizations	To investigate technostress and its relationship with job satisfaction, organizational commitment, and continuance commitment	Transaction-Theory of Stress and Coping	Survey, exploratory and confirmatory factor analysis, structural equation modelling	IT staff in multiple organizations.
Tarafdar *et al.* (2010)	Impact of Technostress on End-User Performance and Innovation	To examine the impact of technostress on end-user performance and innovation, and to study the factors that influence technostress	Not explicitly mentioned, but draws on literature about role, task, technology and situational stressors.	Survey, exploratory factor analysis, confirmatory factor analysis, path analysis	IT staff in organizations.
Karr-WisniewSki and Lu (2010)	When more is too much: Operationalizing technology overload and its impact on knowledge worker productivity	To develop, test, and validate a measurement instrument for technology overload and explore its impact on knowledge worker productivity	Law of diminishing marginal returns applied to technology use	Online surveys, ranking, Q-sort, exploratory factor analysis, Regression analysis	Knowledge workers
Ayyagari *et al.* (2011)	Technostress: Technological Antecedents and Implications	To develop a model for technostress and understand the relationship between technology characteristics and relevant stressors	Person-Technology (P-T) fit framework	Survey, structural equation modelling	IT staff
Tarafdar *et al.* (2011)	Crossing to the Dark Side: Examining Creators, Outcomes, and Inhibitors of Technostress	To explain the factors that contribute to technostress, determine its adverse consequences, and provide mechanisms for organizations to reduce the effect of technostress	Transaction-Theory of Stress and Coping	Questionnaire survey, structured interview, and confirmatory/ path analysis	IT staff across different organizations and roles.
Day *et al.* (2012)	Perceived Information and Communication Technology (ICT) Demands: Scale Development and Validation	To develop a scale assessing ICT demands and examine the direct and moderating effects of organizational ICT support on the ICT demands-strain relationships	Job Demands-Resources (JD-R) Model of Work Stress	Scale development, exploratory structural equation modelling, hierarchical regression	IT staff in various organizations.

Literature Analysis

The included studies were published between 2007 and 2012 (see Table 2). While some of the studies focused on defining, understanding, and measuring technostress through various technostress creators – techno-overload, techno-invasion, techno-insecurity, techno-complexity, techno-uncertainty – in relation to its antecedents and consequences (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007, 2010, 2011), others focused on technology overload and its impact on the productivity of knowledge workers and ICT demands and supports – availability, communication, ICT control, ICT hassles, employee

monitoring, learning, response expectations, workload, personal assistance, and resources/upgrades support – that impacts employee well-being (Day *et al.*, 2012; Karr-Wisniewski & Lu, 2010). Methodologically, surveys and structural equation modelling (SEM) were the predominant methods used in testing relationships in the included studies with exploratory and confirmatory factor analysis used in validating constructs (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007, 2010, 2011). Four studies used the quantitative method only (Ayyagari *et al.*, 2011; Day *et al.*, 2012; Tarafdar *et al.*, 2007, 2010), and the three others engaged the mixed method approach (Karr-Wisniewski & Lu, 2010; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011).

In the qualitative aspect of the mixed method, Ragu-Nathan *et al.* (2008) and Tarafdar *et al.* (2011) used the structured interview approach for exploratory purposes and content validation of the survey design. However, Karr-Wisniewski & Lu (2010) employed a web-based open-ended question to interview 61 knowledge workers. Quantitatively, all the included studies used survey instruments to gather responses from respondents which were then analysed statistically.

Theoretically, the included studies adopted and utilized several models or frameworks in explaining their concepts. Ayyagari *et al.* (2011), used the Person-Technology (P-T) fit framework to investigate how technology characteristics influence stressors by creating a misfit between an individual's abilities and the demands of the technological environment. Two studies used the Transaction Theory of Stress and Coping (TTSC) framework to examine and understand the technostress phenomenon – conditions, outcomes, and inhibiting mechanisms (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). Tarafdar *et al.* (2007), used the sociotechnical and role theory in exploring the effects of technostress on role stress and productivity by examining how ICT use creates stress and impacts organizational roles. Day *et al.* (2012), utilized the Job Demands-Resources (JD-R) model as a basis for examining the impact of ICT demands and supports on employee strain by exploring how ICT factors and processes can be perceived as stressful by workers. Tarafdar *et al.* (2010) used a theory that was not explicitly mentioned but drawn from literature to explain how technostress creators and situational variables impact end-user satisfaction and performance. Karr-Wisniewski & Lu (2010) applied the law of diminishing marginal returns to technology use in explaining the impact of technology overload on knowledge worker productivity. The study population for all included studies are Tech workers – IT staff and knowledge workers – of service firms. These studies focused on the impact of technostress on Tech workers as it relates to job satisfaction, performance, innovation, knowledge, and productivity.

Presentation of Findings

The included studies discussed the concepts of technostress, its consequences and causes, as well as the management strategies, and its impact on employee and organizational outcomes.

The key findings from the included studies are discussed as follows:

(i) Concepts of Technostress

In service firms, the prevalent stress is technostress – stress induced by technology's interactive mechanism towards value co-creation (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2010, 2011). Technostress is a nascent concept used in relating technology use to stress. Technostress is the transformation of techno-stressors (stressful demands, stimuli, situations, or pressure brought on by ICT) into techno-strain (unfavourable effects of those stressors) (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011).

The impact of technostress extends beyond employee well-being, it also affects the overall success of the firm leading to adverse consequences with feelings of overwhelm, fatigue, and burnout (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). These consequences – decreased productivity, decreased job satisfaction, increased turnover, mental health issues, decreased organizational performance, and increased absenteeism – can be severe on the employees and firm (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). Technostress as a phenomenon can lead to several adverse consequences on the employees – decreased job satisfaction, decreased productivity, increased role stress, decreased innovativeness, reduced organizational commitment, and diminished employee functioning – of service firms that are highly dependent on technology for their role (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007, 2010, 2011).

(ii) Technostressors and Inhibitors

Some of the included studies established the fact that technostress is a phenomenon that is caused by an individual's inability to cope with technology use and is created by certain factors – techno-overload, techno-complexity, techno-insecurity, techno-invasion, techno-uncertainty (Ayyagari *et al.*, 2011; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007, 2010, 2011). Organizations can reduce the effects of these factors by implementing technology-based mechanisms known as inhibitors – technical support provision, literacy facilitation, and technology involvement facilitation (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011).

(iii) **Technology Overload**

Technology overload or techno-overload occurs when an employee's productivity is crowded with technology tools (Ayyagari *et al.*, 2011; Day *et al.*, 2012; Karr-Wisniewski & Lu, 2010; Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2007, 2010, 2011). Technology overload consists of three dimensions – system feature overload, information overload, and communication overload – that contribute to productivity loss (Karr-Wisniewski & Lu, 2010).

(iv) **Gender and Tech Savviness**

In terms of gender, when the use of Information Systems (IS) is voluntary, men experience more technostress than women (Tarafdar *et al.*, 2011), while Professionals or well-educated employees with greater IT knowledge experience less technostress as it relates to savviness (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011).

(v) **Technostress Models**

The included studies adopted several models or frameworks in explaining their concepts. Ayyagari *et al.* (2011), used the Person-Technology (P-T) fit framework to manage the effect of technostress arising from the misfit between an individual's abilities and the demands of the technological environment. Ragu-Nathan *et al.* (2008) and Tarafdar *et al.* (2011), used the Transaction Theory of Stress Coping (TTSC) framework to manage the effect of technostress arising from the transactional process between an individual and the demands of the technological environment, with emphasis on the coping role of inhibitors. Tarafdar *et al.* (2007), used the sociotechnical and role theory in managing the effect of technostress by considering the interaction between social and technical factors of a firm. Day *et al.* (2012), utilized the Job Demands-Resources (JD-R) model in managing technostress by creating a balance between job demands and available resources while Karr-Wisniewski & Lu (2010), applied the law of diminishing marginal returns to

technology use in managing the effect of technostress by balancing technology use with employee well-being and productivity to avoid diminishing returns from setting in.

DISCUSSION

As evident in Figure 2, the number of included studies (n = 7) accounts for 7.53% of the preliminary literature (N = 93) used for the integrative review. Duplicate records excluded from the study accounted for 0% while records excluded based on titles irrelevant to the study account for 80.65%. 38.89% of records were excluded based on irrelevant abstracts to the study while 36.36% of the literature was excluded based on irrelevant contents. Though literature on stress and technostress generally abound, only a handful of the framework is directed toward the management of technostress in organizations.

From the included studies, it was evident that technostress is a negative phenomenon arising from the use of technology and caused by several factors termed technostressors or technostress creators. Ragu-Nathan *et al.* (2008) and Tarafdar *et al.* (2011) identified five technostress creators: (i) techno-overload – the state of stress or exhaustion due to excessive use of technology; (ii) techno-invasion – the interfering nature of technology in our daily lives due to the advancement and constant connectivity; (iii) techno-complexity – the perception that new technologies are challenging to learn and use; (iv) techno-insecurity – the feeling of self-doubt experienced by individuals due to their lack of knowledge about modern or new technologies; and (v) techno-uncertainty – the feeling of doubt brought on by ongoing technological improvements and updates.

Technostress inhibitors are techniques and mechanisms put in place within an organization or firm to mitigate the effects of technostress by promoting a healthier and more productive relationship with digitalization. Ragu-Nathan *et al.* (2008) and Tarafdar *et al.* (2011) identified three technostress inhibitors driven by technology: (i) literacy facilitation – the process of supporting individuals in improving their technology literacy skills; (ii) technical support provision – availability and accessibility of resources, advice, and help to support people or firms in identifying, addressing, and preventing technical problems; and (iii) involvement facilitation – methods and techniques that help people and individuals embrace, use, and profit from technology in productive manner.

Finally, the included studies addressed the management of technostress with several frameworks. However, the frameworks in the included studies with the exception of the TTSC model were socially and person-inclined whereas the TTSC is transactional and cognition-inclined. Thus, the raw aspect of technostress – technostress as it relates to firms' IC – as evident from the foregoing discussions, can be appreciated with a TTSC framework designed for the purpose. This study, therefore, set the requisite foundation for such a framework, which is nonexistent, by designing a TTSC-based framework for the diagnosis and management of technostress on a firm's IC; as captured in the following subsection.

CONCEPTUAL FRAMEWORK DESIGN

Technostress is the fallout experienced by employees of service firms through the introduction and interaction with new technology. Employees experience technostress when they fail to adapt or cope with technology in a healthy manner (Brod, 1984). In the organizational context, literature focusing on technostress has been about the natural person and associated outcomes – job satisfaction, productivity, performance, and commitment – (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). Technostress affects individuals and firms since both possess intellectual capabilities – competence for humans and intellectual capital (IC) for organizations. The IC,

an intangible asset, is critical to the success of the firm and drives innovation and competitiveness (Alekseeva *et al.*, 2020). Therefore, since service firms possess the intellectual capability, it is also capable of being stressed like humans.

The management framework consists of key components or constructs as follows: technostress creators – techno-overload, techno-invasion, techno-insecurity, techno-complexity, and techno-uncertainty (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011); intellectual capital – human capital (HC), structural capital (SC), relational capital (RC) (Alekseeva *et al.*, 2020); corporate components of HC – job satisfaction, SC – knowledge management system, and RC – customer relationship (Alavi & Leidner, 2001; Bontis, 1998; Edvinsson & Malone, 1997; Gupta & Zeithaml, 2006; Nonaka & Takeuchi, 1995); and technostress inhibitors – literacy facilitation, technical support provision, involvement facilitation (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). The structure of this conceptual framework is such that all components are connected based on the TTSC model as depicted in Figure 3. The TTSC model (Cooper *et al.*, 2001; Lazarus & Folkman, 1984), is a psychological framework and one of the widely used lenses in studying the concept of stress, and it states that stress happens when an individual believes that the imposed demand on them exceeds their resources. Demands (stressors or technostress creators), here, refer to factors that create stress due to technology use in the organizational environment, and such conditions are considered damaging, threatening or challenging to the well-being of the individuals (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011; Torres, 2021). Stress manifestation known as strain can be physiological – hormonal changes, faster heart rate –, and psychological – exhaustion, dissatisfaction. Resources, on the other hand, are elements that allow individuals to cope with stressful situations and can be both personal (health, knowledge, belief etc.) and situational (inhibitors) (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011; Torres, 2021).

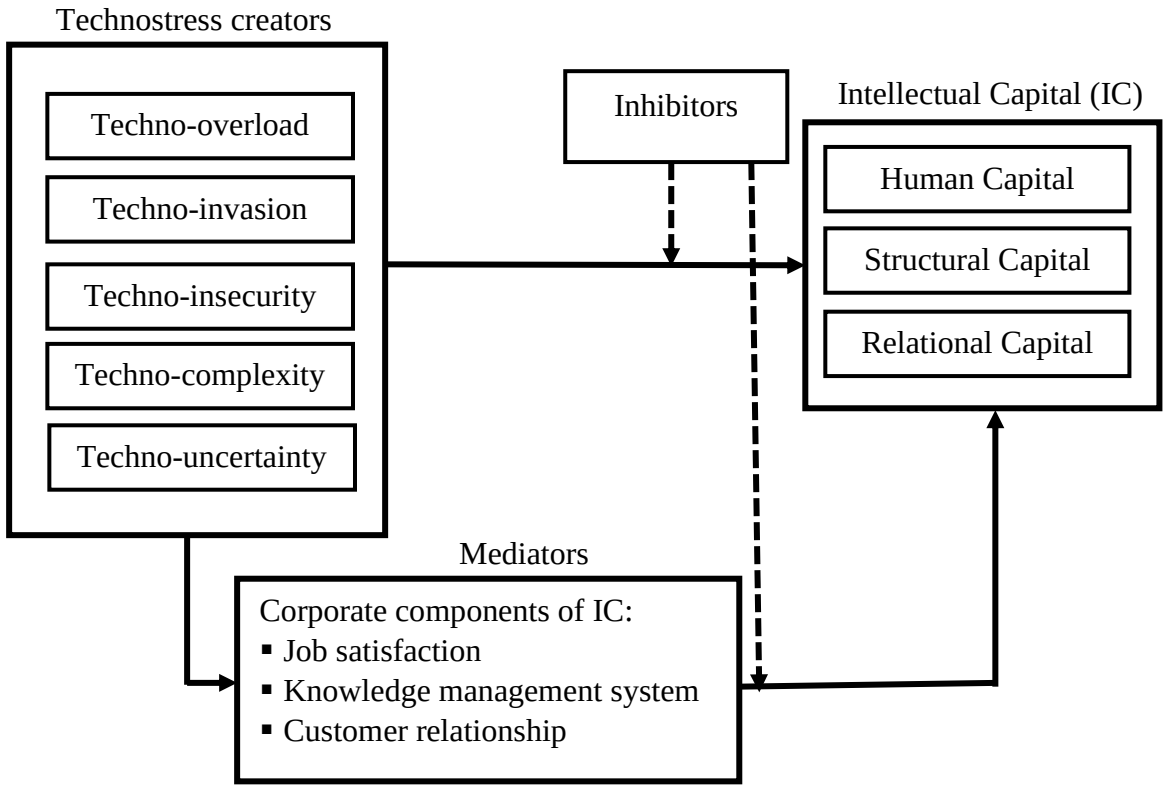

Figure 3: Conceptual TTSC Framework for Managing Effect of Technostress on IC

As shown in Figure 3, the demands are the technostress creators, the strained variable is the intellectual capital of the firm, and the resources or situational factors are the inhibitors provided by the management for coping. Integrated into the TTSC, is the mediation of the relationship between intellectual capital (IC) and technostress creators by some corporate components (job satisfaction, knowledge management system, and customer relationships) for the protection of IC and intervention against the effect of technostress creators. Whenever the IC of a firm is strained, it is the firm as an entity that reacts, which might result in the deterioration of the firm, poor service delivery and return on investment, job dissatisfaction, poor knowledge sharing, and poor customer loyalty and trust (Oseremen *et al.*, 2022; Sharma, 2023). In an attempt to maintain equilibrium, the internal mechanisms – mediators and inhibitors – must react, regulate, control, and maintain a stable internal environment to handle the effect of technostressors for its survival (Ragu-Nathan *et al.*, 2008; Tarafdar *et al.*, 2011). This conceptual framework will help in managing the effects of technostressors on the IC of service firms.

CONCLUSION

This study addressed the critical issue of organizational stress management in this era of digitalization, with a specific focus on technostress and its impact on the intellectual capital (IC) of service firms. It addresses the pervasive nature of technology use in modern workplaces and how the resulting demands – increased workload, constant connectivity, and rapid technological changes – lead to stress among employees. It also emphasizes the fact that technostress, a special type of stress induced by technology use, not only affects individuals but also erodes the intellectual capabilities of firms. While there exist studies on technostress and its effects on employees' well-being and outcomes, the dearth of literature on the impact of technostress on the IC of firms was made evident.

To this end, this study designed a conceptual framework for managing the effect of technostress on the IC of service firms based on the TTSC model. The framework integrates technostress creators (techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty), intellectual capital (human, structural, and relational capital), technostress inhibitors (literacy facilitation, technical support provision, and involvement facilitation), and corporate components of IC (job satisfaction, knowledge management systems, and customer relationships) in managing the IC of firms. The study emphasized that IC is the core intangible asset that drives innovation and competitive advantage, and protecting it from the adverse effects of technostress is crucial. It also recognizes that firms, like individuals, can be stressed, and the mediation of the framework by the corporate components of IC protects and intervenes against the effect of technostress creators.

The study, therefore, called on service firms to recognize and be mindful of the impact of technostress on their intellectual capital. By creating awareness and implementing effective management strategies, service firms can promote a healthier and more productive work environment while at the same time, protecting its core asset i.e. IC from being strained by technology. Future research will be directed towards the development and validation of the TTSC conceptual model designed for managing the effect of technostress on the intellectual capital (IC) of service firms.

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