Navigating Technostress: An In-Depth Analysis of Determinants and Consequences

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Teknostresle Başa Çıkmak: Belirleyicilerin ve Sonuçların Derinlemesine Analizi

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Makale Bilgisi	Öz
	Bilgi ve iletişim teknolojilerinin yaygın olarak benimsenmesi, bireylerin iş performanslarını optimize etmeleri için bu araçlarla sürekli etkileşim kurmalarını gerektirmektedir. Bu dinamik hem örgütsel hem de bireysel dönüşümleri hızlandırmaktadır. Televizyon, cep telefonu ve bilgisayar gibi cihazlar aracılığıyla bu değişikliklere uyum sağlamaya çalışan kullanıcılar sıklıkla "teknostres" olarak bilinen bir olguyla karşılaşmaktadırlar. Bilgi ve iletişim teknolojilerinin yoğun kullanımından kaynaklanan bir sendrom olarak görülen teknostres, giderek daha fazla akademik araştırmanın odak noktası haline gelmektedir. Teknostres literatüründe bu konu hakkında çok sayıda çalışma olmasına rağmen kapsamlı inceleme sayısı sınırlı kalmaktadır. Bu çalışma, teknostresin tanımını, teknostres modelini, işle ve işle ilgili olmayan teknostres kaynaklarını ve sonuçlarını kapsamlı bir şekilde incelemeyi amaçlamaktadır. Çalışmanın amaçlarını yerine getirmek için Veritabanı Erişim ve İstatistik Sistemi (VETIS) kullanılarak sistematik bir tarama yapılmıştır. Teknostres alanının genel profilini çizen bu çalışma, mevcut literatürü geliştirmeyi ve araştırmalara önemli bir katkı sağlamayı amaçlamaktadır.

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Article Info	Abstract
	The widespread adoption of information and communication technologies necessitates continuous interaction with these tools for individuals to optimize their job performance. This dynamic catalyzes both organizational and individual transformations. Users striving to adapt to these changes through devices such as televisions, mobile phones, and computers often encounter a phenomenon known as "technostress." Technostress, a syndrome arising from the intensive utilization of information and communication technologies, is increasingly the focus of scholarly research. Despite the existence of numerous studies on this topic within the technostress literature, comprehensive reviews remain limited. This study aims to provide a comprehensive examination of the definition of technostress, the technostress model, and the sources of both work-related and non-work-related along with its associated consequences. To fulfill the objectives of the study, a systematic search was conducted using the Database Access and Statistics System (VETİS). Through the delineation of a general profile of the technostress field, this study aims to enhance the existing literature and make a substantial contribution to the body of research.

Introduction

Information and communication technologies (ICTs) are increasingly permeating every facet of our lives, becoming an indispensable component of our daily existence. These technologies enable rapid communication with social networks, facilitate easy access to information, and support the professional execution of tasks. They serve as catalysts for progress and goal attainment at both individual and organizational levels. As a consequence, people can carry out their tasks effectively, flexibly, independent of time and location.

Despite the numerous advantages associated with ICTs, the escalating demand for technology use and the swift pace of technological change can generate pressure and stress among individuals. Furthermore, the inability to effectively manage these technologies can adversely impact psychological well-being (Weil and Rosen, 1997). Within an organizational context, a significant source of pressure and stress stemming from ICT usage and digitalization is known as technostress (Sharma and Tiwari, 2023). Factors such as competitive work environments, the restructuring of organizations in response to technological advancements, increased work pressure, and evolving work hours contribute to a redefined understanding of work, thereby inducing technostress (Popescu et al., 2018).

Technostress manifests when users fail to adapt to ICTs; it is often referred to as the negative aspects of technology and is perceived as an adaptation challenge arising from the difficulty in managing changes in computer technologies (Brod, 1984). Weil and Rosen (1997) characterize it as the "*adverse effects on attitudes, thoughts, behaviors, or physical conditions resulting directly or indirectly from technology*". In organizational terms, technostress denotes "*the stress phenomenon resulting from the use of information systems for organizational tasks*" (Ayyagari et al., 2011). Arnetz and Wiholm (1997) further define technostress as a state of arousal observed in employees who exhibit a dependency on computers due to their professional responsibilities.

Since the early 1980s, extensive studies have been carried out to elucidate the definition, sources, and effects of technostress (Torre et al., 2019). Recent years have witnessed a surge of interest in this subject, particularly in light of the pandemic, which has broadened its scope (Bencsik and Juhasz, 2023). The topic has assumed an interdisciplinary character, encompassing both ICT research and studies in management and organizational psychology.

Although a substantial number of studies addressing various facets of technostress have been published, comprehensive reviews remain scarce (La Torre et al., 2019). Consequently, there is a pressing need for further examinations to address the literature holistically and identify existing gaps. It is posited that future research will significantly contribute to consolidating fragmented knowledge on this subject (Torre et al., 2019). Accordingly, this study aims to thoroughly examine and integrate the definition of technostress, the technostress model, the sources of both professional and personal technostress, and its associated consequences. To achieve this aim, existing studies focusing on technostress have been meticulously analyzed.

This study presents several significant contributions to the field. By integrating various determinants and consequences of technostress, this research establishes a comprehensive framework that enhances the understanding of the phenomenon within both individual and organizational contexts. Furthermore, the study identifies specific gaps in the existing literature, thereby providing a valuable framework for future researchers. Finally, the findings will yield actionable insights for organizations looking to reduce the negative impacts of technostress including strategies for effective technology management and employee support.

Method

To fulfill the objectives of the study, a systematic search was conducted using the Database Access and Statistics System (VETİS) across various academic databases, including Web of Science, Scopus, and Google Scholar. The keyword "*technostress*" was employed to identify articles encompassing the definition, determinants, or consequences of technostress. Publications such as books, theses, and proceedings were excluded from this analysis since this study mainly focused on articles. Following the verification of the appropriateness of article titles, abstracts, and subtitles, a thorough examination was undertaken. Non-empirical research pertaining to the symptoms, prevalence, prevention, and solutions of technostress was not included within the study's scope. Moreover, studies addressing the overall stress levels of employees and various types of stress were also excluded. Articles published in languages other than English or Turkish were not considered for inclusion. Consequently, over 60 studies specifically included in the study. The search flow is depicted in Figure 1.
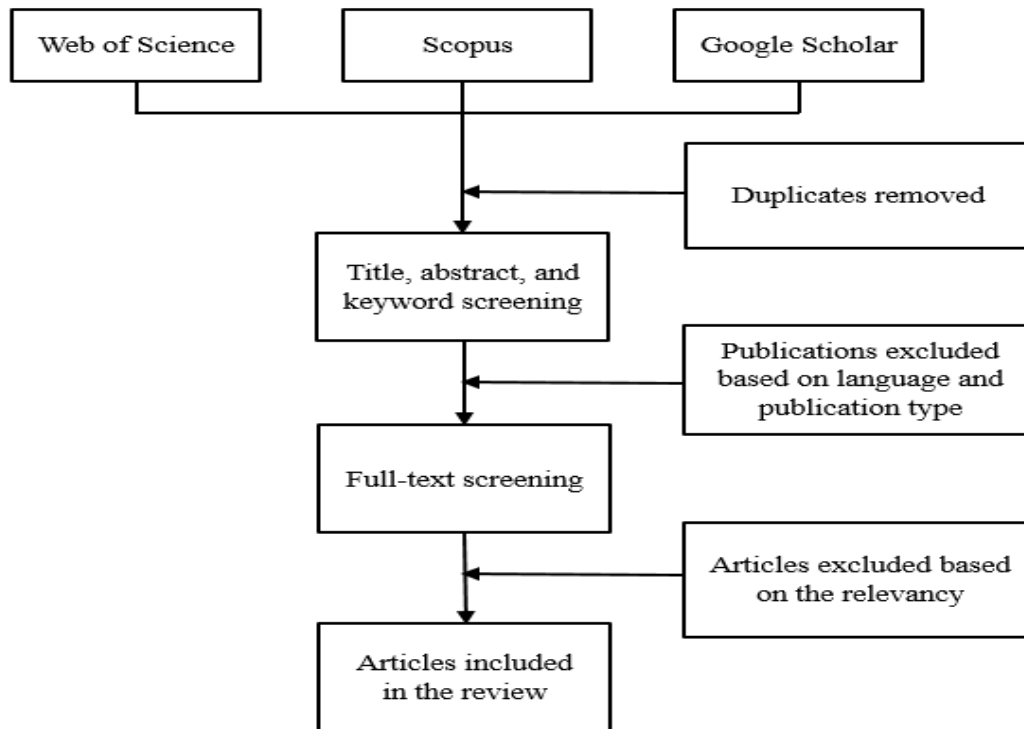

Figure 1. Search Flow

Conceptual and Theoretical Framework

Technostress and Technostress Model

Technostress was initially introduced by Brod in the early 1980s, defined as "a modern adaptation disease stemming from difficulty in effectively managing new computer technologies" (Brod, 1984, p. 16). The concept subsequently expanded into fields such as psychology and management sciences, gaining an interdisciplinary nature (Jonušauskas and Raišienė, 2016). In this context, Weil and Rosen (1997) described it as "the adverse effects that technology causes, either directly or indirectly, on attitudes, behaviors, and mental health". In the literature, technostress is treated as a distinct concept separate from work stress and general stress (Brod, 1984; Ayyagari et al., 2011), and it is claimed that technostress increases individuals' overall stress and work stress levels.

The concept has been defined in various ways by numerous researchers. Hadiburg (1989) characterized technostress as a pathological response resulting from inadequate coping with information technologies (IT). According to Kim and Lee (2021), technostress is the psychological pressure arising from difficulties in adapting to IT. Tarafdar et al. (2007) describes it as the adjustment problem experienced by users who struggle to manage or adjust to IT. Panahi (2023) refers to it as "stress arising from the uncertainty caused by technological changes". The widely accepted definition describes it as the stress felt by users of IT when using these technologies (Ragu-Nathan et al., 2008; Ayyagari et al., 2011). In other words, it is the stress that arises when employees use IT to fulfill their tasks.

In studies on technostress, the transactional approach to stress and coping developed by Lazarus and Folkman (1984) is often employed as the theoretical framework (Rademaker et al., 2023). According to the model, stress is a product of the interaction between individual and environmental factors and involves two appraisal processes. During the primary appraisal process, the person assesses the demands posed by their environment, while in the secondary appraisal process, they determine how to cope with those demands (Rademaker et al., 2023). In this context, stress encompasses not only a single structure but also the relationships among various concepts (McGrath, 1976; Tarafdar et al., 2011).

Technostress, within the framework of the transactional stress model, refers to a dynamic and adaptable state that involves the interaction between the user and the technological environment, influenced by sociopsychological factors (Caro et al., 1985). When applying the model's appraisal processes to technostress, primary appraisal involves evaluating the demands of ICTs, thereby facilitating interaction between the user and these technologies. Secondary appraisal pertains to the user's determination of how to cope with these demands. Tarafdar et al. (2019) conceptualized technostress as a multi-stage process based on this model, establishing the technostress model on the premise that an individual exposed to technostress factors assesses these factors as either challenging or threatening and determines coping strategies in response (Tarafdar et al., 2019; Adeniji and Igarashi, 2022).

Analysis of Determinants and Consequences of Technostress

Determinants of Technostress

Numerous factors contribute to the emergence of technostress, which are often categorized as its determinants and serve to exacerbate its levels. The pervasive adoption of ICTs and the resultant 24/7 work culture are among the most significant sources of technostress (Güğerçin, 2024). Although the literature on this topic remains in its developmental stages, several scholars have systematically categorized the sources of technostress.

Tarafdar et al. (2007) delineated five categories of technostress sources: techno-overload, techno-uncertainty, techno-invasion, techno-insecurity, and techno-complexity. Techno-overload occurs when employees are subjected to excessive information, compelling them to manage multiple tasks simultaneously. Due to advancements in IT, employees often find themselves required to work rapidly and for extended durations. Those experiencing techno-overload may perceive an increased obligation to work harder and faster (Ragu-Nathan et al., 2008). Techno-uncertainty stems from employees' inability to continually update and enhance their skills in response to changes in ICTs, resulting in a context where technological advancements generate a sense of uncertainty among users, who feel compelled to engage in ongoing education regarding new technologies (Ragu-Nathan et al., 2008).

Techno-invasion manifests when these technologies encroach upon personal life, thereby mixing the lines between work and personal life (Ragu-Nathan et al., 2008). A principal factor contributing to this phenomenon is the constant availability and connectivity of employees. Techno-insecurity denotes the job insecurity experienced by employees due to the use of IT, reflecting a pervasive fear of job loss attributable to technological advancements. Techno-complexity refers to the challenges associated with adapting to new technologies, emphasizing employees' perceived inadequacies in managing these innovations (Ragu-Nathan et al., 2008). The rapid evolution of employed technologies can lead to the swift obsolescence of users' knowledge, necessitating continual self-renewal. Within this context, techno-complexity becomes salient when users exert considerable effort to master new technologies (Tarafdar et al., 2007).

Ivancevich and Matteson (1980) analyzed the sources of technostress across five categories: environmental, technological, individual, social group, and organizational stress factors. Environmental factors encompass variables such as lighting, noise, temperature, humidity, and pollution. Technological factors involve innovations in technology, the rate of dissemination of these innovations within organizations, and the associated policies and procedures. Individual factors pertain to role conflict, role ambiguity, workload, impediments to career mobility, and job management. Social factors include group conflict, the absence of supportive relationships, a lack of shared objectives, value and norm conflicts, and phenomena such as groupthink. Organizational factors encapsulate issues such as inadequate participation, deficiencies in organizational structure, professional hierarchy, and the absence of coherent policies and procedures.

Ayyagari et al. (2011) concentrated on the technological characteristics that contribute to technostress,

categorizing these factors into three groups: usability, dynamism, and invasiveness. The usability characteristic encompasses perceptions of utility and reliability. The dynamism characteristic relates to the velocity of technological change. The invasiveness characteristic addresses issues such as presenteeism and anonymity. Consequently, as perceptions of technological utility, reliability, or anonymity diminish, the level of technostress correspondingly increases (Ayyagari et al., 2011). Furthermore, an increase in the rate of technological change or perceptions of presenteeism is associated with elevated levels of technostress (Ayyagari et al., 2011).

In a systematic literature review focused on identifying the factors that contribute to technostress, Bhatt and Kothari (2020) categorized these determinants into two primary groups: individual and organizational factors. Individual factors encompass age, gender, personality traits, self-efficacy, computer skills, and areas of expertise (Bhatt and Kothari, 2020; Ragu-Nathan et al., 2008; Sharma and Gill, 2015; Gefen and Straub, 2000; Tarafdar et al., 2011). Organizational factors encompass technology dependency and organizational climate (Bhatt and Kothari, 2020; Tarafdar et al., 2007; Al-Fudail and Mellar, 2008). With respect to individual factors, the influence of age, gender, and personality type on technostress varies across studies; however, it has been observed that employees with lower self-efficacy perceptions or diminished computer literacy experience higher levels of technostress (Bhatt and Kothari, 2020). Among organizational factors, technology dependency has been shown to contribute to an increase in technostress.

Tu et al. (2008) focused on the mechanisms through which IT generate technostress among employees. Firstly, these technologies expose employees to intense information flows and excessive communication burdens via devices like mobile phones, computers, and tablets. According to Tu et al. (2008), excessive communication burdens may induce stress as employees feel compelled to operate at higher speeds and with greater intensity. Secondly, the prevalence of IT can result in a loss of control over time and space for employees, thereby generating stress. Lastly, the complexity inherent in IT can exacerbate technostress levels by fostering feelings of inadequacy among employees.

Mirowska and Bakıcı (2024) highlighted the inadequacies in the literature regarding the sources of technostress, attempting to elucidate these sources through the lens of the transactional model of stress and coping. This model seeks to unpack the intricate nature of stress faced by employees and is frequently employed in technostress literature (Mirowska and Bakıcı, 2024). Their research identified techno-invasion, techno-overload, techno-complexity, techno-uncertainty, communication facilitated by IT, technology-supported work environments, and a reduction in informal interactions as pertinent sources of technostress (Mirowska and Bakıcı, 2024).

Shu et al. (2011) established that as age and technology dependency increase, levels of technostress also rise; conversely, a belief in one's computer skills is linked to reduced levels of technostress. Conversely, Ragu-Nathan et al. (2008) discovered that men experience higher levels of technostress than women, and contrary to the findings of Shu et al. (2011), technostress tends to increase as age decreases. Saini and Phoolka (2024) determined that the work-related use of social media amplifies technostress.

Several studies have posited that technostress should not be regarded as an isolated phenomenon emerging solely from technology; rather, emphasis has been placed on the relationship between the user and the technology (Willermark et al., 2023; Ayyagari et al., 2011). In essence, technostress arises from the interplay between the user and technology. Moreover, the manner in which users engage with technology, the types of technology employed, and the users' knowledge and skills have also proven influential (Gimpel and Schmied, 2019; Willermark et al., 2023). The findings from these investigations are succinctly summarized in Table 1.

Table 1. Determinants of Technostress

Determinants	Sector	References
Techno-overload Techno-uncertainty Techno-invasion Techno-insecurity Techno-complexity	Public	Tarafdar et al. (2007)
Environmental factors (light, noise, etc.) Technological factors (technological innovations, etc.) Individual factors (role conflict, role ambiguity, etc.) Social factors (group conflict, lack of supportive relationships, etc.) Organizational factors (lack of participation, deficiencies in organizational structure, etc.)	Health	Ivancevich and Matteson (1980)
Techno-invasion Techno-overload Techno-complexity Techno-uncertainty Communication based on IT IT-supported work environment Decrease in informal interactions	Various sectors	Mirowska and Bakıcı (2024)
Individual factors (age, gender, personality type, self-efficacy, computer literacy, and area of expertise) Organizational factors (technology dependence and organizational climate)	Various sectors	Bhatt and Kothari (2020)
Work-related use of social media	IT	Saini and Phoolka (2024)
Digitalization	Banking, Informatics, Education	Tınaztepe and Kılıç (2021)
Technology management	Health	Adel-Mehraban et al. (2019)
IT-supported work environment	Various sectors	Stich et al.(2017)
Constant Availability Connectivity Pressure Increased Workload Inner Obligation for Availability	Advertising, Public Relations, and Journalism Industry	Ninaus et al. (2015)

Source: Compiled by the authors based on the analyses of the reviewed studies

Consequences of Technostress

The consequences of technostress pertain to the effects experienced by individuals subjected to this phenomenon. The literature encompasses numerous studies that investigate the outcomes of technostress, with several endeavors categorizing these effects. Nastjuk et al. (2024), in their meta-analysis, identified significant behavioral outcomes (e.g., diminished performance, intentions to resign) and psychological consequences (e.g., burnout, role conflict), emphasizing that psychological outcomes are more profoundly affected than behavioral ones, with behavioral consequences emerging as a result of underlying psychological tension.

Erer (2021) classified the repercussions of technostress into three principal categories: behavioral effects, psychological effects, and physiological effects. Behavioral effects encompass low performance, reduced job quality, diminished efficiency, anxiety, elevated error rates, negative body language, and communication breakdowns. Psychological effects include life stress, dissatisfaction, technophobia, mental fatigue, job dissatisfaction, anxiety, diminished self-confidence, loss of motivation, distraction, disengagement from work, emotional exhaustion, intentions to resign, presenteeism, and depression. Physiological effects are characterized by fatigue, insomnia, energy depletion, back and lumbar pain, lethargy, headaches, loss of appetite, nausea, and intermittent fever.

Bhatt and Kothari (2020) conducted a systematic literature review, examining the outcomes of technostress within three categories: psychological strains, behavioral strains, and physiological strains. Psychological strains refer to the emotional responses elicited by technostress (Bhatt and Kothari, 2020), which include decreased job satisfaction and burnout. Behavioral strains denote the impact of technostress on user actions, exemplified by increased job pressure, decreased performance, intentions to resign, and heightened anxiety levels (Bhatt and Kothari, 2020). Physiological strains reflect the bodily responses to technostress, such as musculoskeletal pain and fatigue.

Nisafani et al. (2020) highlighted that technostress has both individual and organizational repercussions, underscoring that its effects on productivity and job satisfaction have been extensively explored. Empirical findings suggest that an increase in technostress is correlated with declines in productivity and job satisfaction (Ragu-Nathan et al., 2008; Yang et al., 2017; Tarafdar et al., 2007; Kim et al., 2015). Furthermore, technostress negatively influences employee engagement, intention to utilize IT, organizational commitment, and overall organizational performance (Nisafani et al., 2020; Jena, 2015).

The findings from research addressing the consequences of technostress are summarized in Table 2.

Table 2. Consequences of Technostress

Consequences	Sector	References
Behavioral consequences (decreased performance, intention to quit, etc.)	Various sectors	Nastjuk et al. (2024)

Psychological consequences (burnout, role conflict, etc.)		
Behavioral effects (low performance, decreased work quality, low productivity, etc.) Psychological effects (life stress, unhappiness, technophobia, etc.) Physiological effects (fatigue, insomnia, energy depletion, back and lumbar pain, weakness, etc.)	Banking	Erer (2021)
Psychological strains (reduced job satisfaction, burnout, etc.) Behavioral strains (increased work pressure, decreased performance) Physiological strains (back pain, fatigue, etc.)	Various sectors	Bhatt and Kothari (2020)
Performance decrease	Textile, Education, Sales	Dunmade et al. (2014) Küçükdursun et al. (2022), Bencsik ve Juhasz (2023), Wu et al.(2022), Jena (2015), Saganuwan (2015), Tarafdar et al. (2011), Tarafdar et al. (2015)
Work-family conflict	Education, Various sectors	Begenirbaş (2021), Oh and Park (2016), Leung and Zhang (2017)
Burnout	Education, Administrative Affairs, Banking, Accounting, Call Center, IT	Brown et al. (2014); Gül (2022), Yener (2018), Giang vd. (2021), Sharma and Tiwari (2023)
Intention to quit	Logistic	Çiçek and Kılınç (2020)
Presenteeism	Logistic	Çiçek and Kılınç (2020)
Decreased job satisfaction	Various sectors, Education, Sales	Selvi et al. (2021), Suh and Lee (2017), Jena (2015), Saganuwan (2015), Pullins et al. (2020); Ragu-Nathan et al. (2008); Kim et al. (2015)
Loss of work-life balance	Education, IT	Bencsik and Juhasz (2023), Sharma and Tiwari (2023)
Reduced productivity	Various sectors	Raišienė and Jonušauskas (2013), Özbozkurt (2019),
Counterproductive work behaviors	Various sectors	Kot (2022)

Intention to quit	Real estate	Bao et al. (2024)
Cyberloafing	Various sectors	Güğerçin (2024)
Well-being	Hospitality	Wu vd.(2022)
Decreased organizational commitment	Education	Jena (2015), Ahmad et al.(2014)
Role stress	Sales, Public	Tarafdar et al. (2007), Pullins et al. (2020), Tarafdar et al. (2011)
Productivity	Public	Tarafdar et al. (2007); Yang et al., (2017); Alam (2016)

Source: Compiled by the authors based on the analyses of the reviewed studies

Discussion and Conclusion

This study examines the definition, determinants, and consequences of technostress, with a specific focus on the employee demographic. It highlights the sources of technostress encountered by employees, encompassing both personal and professional factors, and investigates the resultant effects on these individuals. The findings indicate that the concept of technostress has developed over time, revealing that, in contemporary contexts, technostress constitutes a type of stress stemming from the utilization of ICTs (La Torre et al., 2019).

The determinants contributing to the emergence of technostress and exacerbating its levels exhibit variability across studies. For instance, while some research posits that age correlates positively with technostress levels, others suggest a negative correlation (Shu et al., 2011; Ragu-Nathan et al., 2008). Furthermore, a plethora of studies have employed and scrutinized determinants such as techno-overload, techno-uncertainty, techno-invasion, techno-insecurity, and techno-complexity.

Empirical investigations focusing on the determinants of technostress, along with literature review studies, have categorized these determinants based on various criteria. Tarafdar et al. (2007) identified five primary categories: techno-overload, techno-uncertainty, techno-invasion, techno-insecurity, and techno-complexity. Conversely, Bhatt and Kothari (2020) classified the determinants into individual and organizational factors. Collectively, this suggests that technostress may emerge from diverse individual, organizational, and environmental sources, manifesting across various sectors, including education, banking, and textiles.

A substantial body of research has explored the outcomes of technostress on individuals, revealing a spectrum of findings (Nastjuk et al., 2024; Bhatt and Kothari, 2020). Nonetheless, as indicated by Nisafani et al. (2020), several studies have focused on the link between technostress, productivity, and job satisfaction, demonstrating that increased technostress adversely affects both. Additionally, various impacts such as decreased performance, burnout, disruption of work-life balance, and reduced organizational commitment have also been investigated in the context of technostress (Brown et al., 2014; Dunmade et al., 2014). A comparative analysis of research addressing both the determinants and consequences of technostress reveals a relative paucity of studies focusing on the former, with a predominance of research dedicated to the latter.

This study is not without limitations. First, it included only articles published in English and Turkish. Second, databases not incorporated within the Database Access and Statistics System (VETİS) were excluded from the search. Third, the search strategy utilized solely the term "technostress," which may have constrained the identification of relevant studies. Finally, the methodological rigor of the included studies was not evaluated, which may pose a constraint in the interpretation of the findings.

This work synthesizes numerous research articles and literature reviews that articulate various definitions of technostress while investigating its sources and outcomes. In this capacity, the study adds to the current body of literature on the subject.

Drawing upon the results of this study, several recommendations can be posited for future research and practitioners. The review revealed that many studies predominantly employed either qualitative or quantitative methodologies, with mixed-method approaches being underutilized. Future investigations employing both methodologies could yield significant contributions to the field. From a practical standpoint, awareness of the causes and consequences of technostress can facilitate the development of interventions aimed at addressing technology-related challenges faced by employees and promoting their psychological well-being. Consequently, this study may serve as a comprehensive guide in elucidating the sources of technostress and its effects on employees. Given the identification of technological literacy as a critical source of technostress, training initiatives organized by knowledgeable upper management and human resources professionals are anticipated to mitigate the prevalence of technostress.

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