

# Technostress and cognitive fatigue: Reducing digital strain for improved employee well-being: A literature review



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**Abstract** Technostress and cognitive fatigue are increasingly prevalent issues in modern workplaces where employees depend heavily on digital technologies. Prolonged engagement with these technologies can lead to cognitive strain, emotional exhaustion, and reduced well-being. This paper aims to explore the phenomenon of technostress and cognitive fatigue by identifying contributing factors such as cognitive overload, multitasking, and constant connectivity. The paper presents strategies to mitigate these issues, emphasizing individual and organizational interventions that can enhance employee well-being and productivity. Individual-level interventions include promoting digital wellness practices, time-management strategies, and mental resilience training. Organizational-level strategies involve establishing supportive workplace cultures, providing mental health resources, and encouraging technological moderation. Ultimately, this study highlights the importance of proactive measures to alleviate technostress and cognitive fatigue, promoting a balanced and productive work environment.

**Keywords:** digital wellness, organizational interventions, mental resilience, psychological detachment, technological

## 1. Introduction

The exploration of technostress and cognitive fatigue within contemporary work environments has garnered significant attention in recent years, particularly as the reliance on information and communication technologies (ICT) has intensified. This literature review synthesizes key findings from a series of articles that delve into the complexities of technostress, its psychological ramifications, and potential interventions aimed at alleviating digital strain for enhanced employee well-being to provide a foundational understanding of the relationship between ICT use and employee energy and fatigue. Their review highlights the paradoxical nature of technology, where ICT can simultaneously invigorate and exhaust employees. The authors emphasize that the experience of conflict, particularly due to overload, has a more profound impact on fatigue than on energy levels. This nuanced understanding sets the stage for subsequent discussions on the psychological impacts of technology in the workplace.

Building on this premise, Bondanini et al. (2020) define technostress as a modern adaptation challenge linked to the negative psychological effects of technology. They argue that the stress experienced by employees is often a result of ineffective coping mechanisms when interacting with technology, leading to various stressors such as role ambiguity and job insecurity. This framing underscores the need for organizations to recognize the mental health implications of technology and to foster environments that mitigate these stressors. Meanwhile, Munir et al. (2020) introduce an innovative perspective by examining the role of digital humor in reducing work stress. They suggest that humor, particularly when disseminated through digital media, can act as a buffer against the negative emotional experiences associated with work-related stress. This article highlights the potential for creative solutions to alleviate the cognitive fatigue associated with technostress, suggesting that organizations might benefit from integrating humor into their workplace culture.

The rapid integration of digital technologies into workplace environments has introduced new challenges related to mental and emotional well-being. Technostress and cognitive fatigue are two interrelated phenomena that emerge from excessive technology use, often resulting in reduced productivity, emotional exhaustion, and overall deterioration of employee well-being. The concept of technostress refers to the stress induced by an inability to cope with technological demands, while cognitive fatigue denotes mental exhaustion stemming from prolonged cognitive engagement with digital tools (Riedl, 2022; Peper & Harvey, 2018).

Research has shown that digital fatigue and technostress significantly impact employees' psychological and physical well-being, resulting in burnout, decreased job satisfaction, and impaired cognitive performance (Ayyagari et al., 2011; Maslach & Leiter, 2016; Tarafdar et al., 2011). Moreover, while digital technologies are designed to enhance productivity, their misuse



or overuse can counterproductively diminish efficiency and mental health (Peper & Harvey, 2018; Chen et al., 2022). The adverse effects of technostress can be severe, including impaired decision-making, cognitive overload, anxiety, and diminished job performance (Eppler & Mengis, 2004; Reinecke & Oliver, 2021). Despite the growing recognition of these issues, there remains a substantial gap between theoretical frameworks addressing technostress and the real-world applications aimed at mitigating its effects (Tarafdar et al., 2019; Ellis, 2021). Many organizations continue to overlook the importance of developing structured interventions to manage technostress and cognitive fatigue effectively. This paper addresses this gap by synthesizing current knowledge and proposing actionable strategies for enhancing employee well-being in digitalized work environments.

The COVID-19 pandemic has further accentuated the relevance of technostress, as evidenced by the work of (Satpathy et al., 2021 & González-López et al., 2021). Satpathy et al. (2021) identify specific techno-stressors that emerged during remote work arrangements, such as techno-overload and techno-invasion, which exacerbate feelings of stress and dissatisfaction among employees. (González-López et al., 2021) expand on this by discussing how the invasive nature of ICTs can disrupt the work-life balance, leading to increased pressure and expectations that contribute to technostress. Camacho and Barrios (2022) build on these insights by exploring the consequences of technostress in the context of teleworking. They argue that the heightened demands associated with ICT use lead to negative emotional responses, which can reduce job satisfaction and overall productivity. This article reinforces the critical need for organizations to address the psychological burdens imposed by technology, particularly in a remote work setting.

Harunavamwe and Ward (2022) further investigate the interplay between technostress, work-family conflict, and perceived organizational support. Their findings suggest that technostress can significantly hinder workplace flourishing, emphasizing the importance of organizational resources in mitigating the adverse effects of technology on employees' mental health and well-being. Pansini et al. (2023) adopt a systematic approach by positioning technostress within the Job Demands-Resources (JD-R) model. They argue that understanding technostress through this framework allows for a more comprehensive analysis of its implications for employee well-being, productivity, and burnout. This perspective underscores the dual nature of ICT as both a potential resource and a source of stress, necessitating a balanced approach to technology integration in the workplace. Lastly, Walambe et al. (2023) introduce a cutting-edge multimodal AI-based framework for stress detection, highlighting the importance of monitoring and addressing mental health in sedentary work environments. Their approach emphasizes the need for proactive measures to identify and manage stress levels in employees, particularly in the context of the ongoing digital transformation accelerated by the pandemic. Collectively, many scholars provide a robust framework for understanding the multifaceted nature of technostress and cognitive fatigue, offering insights into both the challenges posed by ICT and potential strategies for fostering employee well-being in an increasingly digital workplace.

## 2. Methodology

This study adopts a literature review approach, which is particularly useful for mapping key concepts, summarizing existing evidence, and identifying research gaps related to technostress and cognitive fatigue. According to Arksey and Arksey (2005), this method involves systematically examining a broad range of studies to provide an overview of the existing literature. This study follows the framework proposed by Arksey and O'Malley, consisting of five stages: identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing, and reporting the results.

**Data Collection:** The data collection process involved searching academic databases such as PubMed, Scopus, Google Scholar, and ScienceDirect using keywords including "technostress," "cognitive fatigue," "digital strain," "employee well-being," and "digital wellness." Inclusion criteria were established to select empirical studies, systematic reviews, and theoretical papers published within the last decade to ensure the relevancy of the findings. Additionally, gray literature such as conference proceedings and government reports were included where appropriate.

**Data Analysis:** Thematic analysis was employed to identify key themes, patterns, and gaps in the literature. Studies were analyzed with attention to factors contributing to technostress and cognitive fatigue, their impact on employee well-being, and strategies proposed for mitigating these issues. Patterns of intervention approaches were also critically examined to differentiate between individual-level and organizational-level solutions.

**Limitations:** This literature review is limited by its reliance on secondary data sources and excluding non-English literature. Additionally, while the study provides a comprehensive overview, it does not offer a meta-analysis of quantitative findings.

## 3. Results and Discussion

### 3.1. Conceptual frameworks of technostress and cognitive fatigue

Technostress is fundamentally defined as the stress stemming from the use of information and communication technologies (ICT) in professional environments. Brod was among the pioneers to conceptualize technostress, describing it as "a condition resulting from the inability of an individual or organization to adapt to the introduction and operation of new technology (Ibrahim et al., 2021). Subsequently, various scholars have contributed to the understanding of this phenomenon, with Tarafdar et al. refining the definition to "stress from using work-related technology" (Ibrahim et al., 2021), and introducing

a framework that categorizes technostress creators into five distinct factors: techno-overload, techno-invasion, techno-uncertainty, techno-complexity, and techno-insecurity (Tarafdar et al., 2014). Furthermore, the Job Demands-Resources (JD-R) model provides a robust theoretical framework for analyzing technostress. This model positions technostress as a job demand that can lead to personal strain when exceeded by individual resources (Pansini et al., 2023). It underscores the dual role of technology as both a resource that can enhance job performance and a demand that can generate stress if inadequately managed (Pansini et al., 2023), aligning with findings from various studies that highlight the negative impacts of technostress on employee well-being and performance (Saka et al., 2020; Ioannou, 2023).

### 3.2. Understanding the psychological mechanisms

#### 3.2.1. Cognitive load theory

Cognitive Load Theory (CLT) posits that an individual's cognitive capacity is limited, and the overload of information can hinder effective problem-solving and learning (Svoray et al., 2022). CLT outlines three distinct types of cognitive load: intrinsic, extraneous, and germane. Intrinsic load is associated with the inherent complexity of the material; extraneous load arises from the way information is presented, while germane load refers to the effort involved in transferring knowledge into long-term memory (Saadi et al., 2021). This theory is particularly relevant in today's technologically driven environments, where constant interaction with multiple digital tools can lead to cognitive overload. This state may compromise cognitive processing and increase errors, potentially leading to heightened stress (Hu et al., 2022; Atler, 2015). Evidence suggests that excessive cognitive load can diminish performance outcomes and increase fatigue, making it essential to optimize task presentation and manage information effectively to maintain performance in high-demand scenarios (Saadi et al., 2021). Moreover, in the context of technostress, cognitive overload may impair individuals' abilities to manage their tasks and responsibilities, causing significant mental fatigue that ultimately affects job satisfaction and productivity (Håkansson & Matuska, 2010). Recent studies emphasize the intersection of cognitive load and environmental factors, demonstrating that certain settings can exacerbate cognitive fatigue, while others, such as green spaces, may alleviate these effects, thereby enhancing cognitive functionality and reducing stress levels (Hu et al., 2022; Schnell et al., 2022).

#### 3.2.2. Attention restoration theory

Attention Restoration Theory (ART) posits that individuals can restore their cognitive capacities through exposure to restorative environments, particularly those that promote indirect attention (Svoray et al., 2022). According to ART, environments that evoke soft fascination—such as natural settings—enable the mind to recover from directed attention fatigue, which is critical in high-stress workplaces where technostress often prevails (Goto et al., 2022). The cognitive restoration notion stems from the understanding that just as physical fatigue can be recuperated, so can mental fatigue through proper environmental design that fosters mental recovery and focus. Research indicates that exposure to nature significantly correlates with improved mental health and reduced levels of stress-related disorders (Schnell et al., 2022; Suseno, 2023). For instance, time spent in green spaces has been empirically linked to heightened mood and decreased feelings of fatigue, illustrating ART's foundational claim (Saadi et al., 2021; Schnell et al., 2022). This underscores the importance of integrating restorative spaces within workplace designs to facilitate cognitive recovery and enhance productivity among employees experiencing technostress (Huang et al., 2012; Zytoon & Basahel, 2017). Furthermore, ART also emphasizes that the mental process of restoration is governed by emotional and psychological components, suggesting that cognitive restoration is not merely environmental but also influenced by individual perception and emotional response (Saadi et al., 2021; Tsushita et al., 2018). Hence, fostering organizational practices that prioritize employee mental health through the design of restorative environments can help mitigate the adverse effects of technostress and cognitive overload, ultimately enhancing overall well-being and productivity in high-demand workplaces. In summary, both Cognitive Load Theory and Attention Restoration Theory provide critical insights into the psychological mechanisms underlying cognitive fatigue and stress in modern work environments. By understanding these frameworks, organizations can develop strategies to alleviate the impacts of technostress and cognitive overload, thereby promoting healthier, more productive workplaces.

### 3.3. Factors contributing to technostress and cognitive fatigue

The findings of this study suggest that technostress and cognitive fatigue are primarily driven by technological overload, multitasking, constant connectivity, and blurred boundaries between work and personal life. Technostress, as conceptualized by Tarafdar et al. (2011), comprises five key dimensions: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. These dimensions collectively contribute to negative psychological and physical outcomes such as mental exhaustion, anxiety, and decreased productivity (Tarafdar et al., 2019; Riedl, 2022). Additionally, the phenomenon of cognitive fatigue is exacerbated by prolonged digital engagement, multitasking, and fragmented attention (Chen et al., 2022; Reinecke & Oliver, 2021). Studies have highlighted the detrimental effects of technostress on employee performance and well-being, including impaired decision-making, reduced concentration, and emotional exhaustion (Eppler & Mengis, 2004; Maslach & Leiter, 2016). Furthermore, the lack of psychological detachment from work-related digital tools

contributes to chronic stress and reduced mental recovery (Lee et al., 2021). Even though digital fatigue in workplaces has gained attention, there has been little analysis of its impact on productivity (Mäkiniemi et al., 2020). Contributing factors include technological overload caused by constant notifications and messages, often interrupting daily activities (Peper & Harvey, 2018). Additionally, multitasking and constant task-switching at work exacerbate digital fatigue (Leroy, 2009). Jobs requiring workers to manage multiple streams of digital communication are particularly affected, as these demands result in cognitive fatigue and reduced productivity (Chen et al., 2022). The concept of "technostress," as introduced by Tarafdar et al. (2011), highlights the psychological strain caused by excessive technology usage in the workplace. The relationship between task-switching and digital fatigue is examined in Mark et al. (2014), showing how frequent interruptions and task-switching degrade attention and mental energy. Research by Wang et al. (2020) emphasizes the preference for synchronous communication (like video conferencing) over asynchronous methods (like email), as the former tends to be less mentally taxing.

### 3.3.1. Technological factors

Technological factors significantly contribute to technostress and cognitive fatigue among employees. The characteristics of technology itself, such as complexity and the requirement for constant engagement, can lead to mental exhaustion. For example, in healthcare settings, studies indicate that excessive use of technologies like electronic health records (EHRs) contributes to fatigue manifested as physical symptoms, emotional stress, and cognitive impairment (Hilty et al., 2022). This highlights the burden that IT systems place on users, leading to a multitude of negative experiences, such as irritability and stress, as employees navigate the complexities of these systems. Moreover, multitasking, which is often necessitated by technological tools, has been shown to compromise cognitive performance due to divided attention (Ioannou, 2023; Talib et al., 2022). Research suggests that engaging in multiple cognitive tasks simultaneously can lead to increased working memory load, thereby exacerbating feelings of cognitive fatigue (Hopstaken et al., 2014). Such findings align with the involvement of dopamine pathways in reward evaluation, where the cognitive cost of task engagement may exceed the perceived rewards, further contributing to mental fatigue and disengagement (Hopstaken et al., 2014). Additionally, cognitive fatigue resulting from inadequate management of technology use can impair concentration and overall job satisfaction, amplifying the stress associated with work tasks (Jimmy et al., 2023; Cuadrado et al., 2024).

### 3.3.2. Organizational factors

Organizational factors play a critical role in influencing levels of technostress and cognitive fatigue. Work environments that lack support structures for technology use may exacerbate feelings of stress and fatigue among employees. For instance, organizations that do not prioritize employee training in technology can lead to increased anxiety and inefficiency, as workers struggle to adapt to rapidly changing technological landscapes (Talib et al., 2022). Such a lack of preparation heightens feelings of technostress and diminishes overall productivity (Ioannou, 2023; Cuadrado et al., 2024). Additionally, organizational culture profoundly impacts employee well-being. Environments that promote high-performance expectations without offering adequate recovery mechanisms can lead to heightened cognitive fatigue and burnout. For example, constant connectivity through emails and messaging applications pressures employees to remain engaged beyond work hours, leading to an imbalance between work and personal life (Steward & Chib, 2024). A study reported that a high frequency of interruptions due to organizational demands further eroded cognitive resources and hindered effective task completion, thus reinforcing a cycle of fatigue and decreased job satisfaction (Hilty et al., 2022; MacMahon et al., 2014). Increases in workload without corresponding support mechanisms, such as employee assistance programs or mental health resources, can further perpetuate technostress and cognitive fatigue within organizations (Talib et al., 2022; Cuadrado et al., 2024). These supporting systems are crucial for mitigating the negative impacts of job demands and fostering a healthier work environment, thereby enhancing employee resilience against the challenges posed by contemporary technological demands. Overall, both technological and organizational factors substantially impact technostress and cognitive fatigue, highlighting the need for integrated approaches that encompass both dimensions to improve employee well-being and productivity in the modern workplace.

### 3.4. Prevalence and impact of technostress and cognitive fatigue

The prevalence of technostress in the workplace is increasingly acknowledged as a significant concern that affects employees across various sectors. Research indicates that technostress correlates with lower productivity, reduced job satisfaction, and increased work exhaustion, manifesting as a growing issue, particularly among younger employees who are often viewed as digital natives but can nonetheless experience considerable technostress due to constant technological updates (Hauk et al., 2019; Torre et al., 2020). This is supported by findings that suggest technostress negatively affects employees' job performance, leading to decreased overall productivity within organizations (Chen & Muthitacharoen, 2016; Tiwari, 2020). Moreover, the impact of technostress extends beyond immediate productivity concerns, influencing broader aspects of professional life such as work-life balance and mental health. For instance, a study involving higher education contexts noted a pronounced inverse relationship between technostress and academic productivity, suggesting that excessive

reliance on technology for educational purposes exacerbates stress and diminishes performance (Upadhyaya & Vrinda, 2020). This issue is not isolated to academia; overall workplace productivity and mental health are detrimentally affected by high levels of technostress (Tiwari, 2020; Sharma, 2024). In summary, understanding technostress within its comprehensive definition and its implications for workplace productivity underscores organizations' need to implement supportive measures to mitigate these adverse effects. Interventions such as promoting technical literacy and providing robust technical support can help organizations navigate the complexities of modern technological demands while maintaining employee well-being (Berger et al., 2023; Tarafdar et al., 2014)

Technostress and cognitive fatigue present significant challenges in modern organizational environments, especially in light of recent increases in digital demands brought about by events such as the COVID-19 pandemic. The impact of technostress, which includes psychological, physiological, and emotional responses associated with the use of information and communication technologies (ICT), has been well-documented in various settings, particularly among educators. Research has consistently shown a correlation between technostress and cognitive fatigue among teachers and educational staff. For instance, Abilleira et al. examined Spanish university teachers during the pandemic and found a statistically significant positive correlation between technostress and techno-fatigue, indicating that misalignment between technological demands and competencies contributes substantially to the feelings of fatigue experienced by educators (Ibrahim et al., 2021). This aligns with findings from Rosado et al., who conducted a systematic review showing a significant negative association between technostress and professional performance among teachers, despite their high satisfaction levels (Tarafdar et al., 2014).

Furthermore, Mushtaque et al. highlighted that various organizational stressors, including work overload and job insecurity, exacerbate technostress and hence cognitive fatigue. Specifically, burnout can be a direct outcome of increased job demands alongside technostress, which compromises teachers' willingness to adopt online teaching modes effectively during lockdown phases (Pansini et al., 2023). This suggests that organizational contexts significantly influence the degree of technostress experienced and the associated cognitive fatigue. In addition to the negative implications for mental health and job performance, the cognitive effects of fatigue in other populations, such as individuals with multiple sclerosis (MS), emphasize the broader ramifications of sustained cognitive fatigue. Lotfi et al. discussed how cognitive fatigue impacts the personal performance of individuals with MS, particularly as fatigue levels correlate with cognitive impairment, highlighting the intricate relationship between fatigue and cognitive abilities (Saka et al., 2020). Further investigation into these relationships can provide insights into workplace well-being and the need for supportive environments that mitigate stressors.

Research opportunities also exist to explore specific coping strategies employed by individuals experiencing technostress and cognitive fatigue. Guillemin et al. noted the varying impacts of fatigue among MS subtypes, suggesting that personalized approaches could enhance coping mechanisms and therapeutic outcomes (Ioannou, 2023). Understanding the cognitive mechanisms behind fatigue will further enhance the capacity to develop effective interventions. Moreover, the importance of organizational communication and support in mitigating technostress cannot be overstated. Zito et al. emphasized the role of effective communication in preventing psycho-physical discomfort and enhancing job performance, underscoring that supportive workplace environments can positively affect employees' emotional well-being, thereby reducing cognitive fatigue associated with technostress (Hauk et al., 2019). Such insights reinforce the need for organizations to implement structures that foster open communication and provide resources for coping with technological demands.

Looking ahead, continued research should focus on longitudinal studies to establish causal relationships between technostress, cognitive fatigue, and performance outcomes. Likewise, interventions aimed at enhancing employee agency in managing ICT-related stressors should be developed and empirically tested. Innovations in assessment tools, such as the incorporation of neurophysiological metrics like heart rate variability, could provide a comprehensive picture of the impact of technostress and cognitive fatigue on health and productivity. In summary, the impact of technostress and cognitive fatigue is profound, affecting not only individual well-being but also organizational effectiveness. As work environments continue to evolve with technological advancements, addressing these challenges through robust research and interventions will be critical for sustaining employee health and productivity.

### *3.5. Strategies for mitigating technostress and cognitive fatigue*

The concept of technological overload refers to the constant exposure to digital tools and the pressure to remain responsive (Eppler & Mengis, 2004; Mazmanian et al., 2013). This phenomenon has led to an "always-on" culture where personal and work boundaries blur, contributing to stress and burnout (Maslach & Leiter, 2016). Studies indicate that excessive use of digital devices correlates with depression, anxiety, and other negative psychological outcomes (Thomé et al., 2012). A study by Derks et al. (2014) discusses the impact of always being "on" and how it fosters a culture of overwork, resulting in stress and burnout. The blurring of work-life boundaries, as analyzed by Mazmanian et al. (2013), aligns with the narrative that personal life often intertwines with work responsibilities due to digital tools.

Effective strategies are required at both individual and organizational levels. On an individual level, promoting digital wellness through time-management practices, mindfulness, and mental resilience training is essential (Bordi et al., 2018; Peper & Harvey, 2018). On an organizational level, supportive workplace cultures, flexible work policies, and mental health resources can significantly reduce technostress and enhance employee well-being (Ashkanasy et al., 2014; Mazmanian et al., 2013;

Ragsdale & Hoover, 2016). Effective strategies to alleviate technostress and cognitive fatigue must be implemented at both individual and organizational levels. Individual strategies include promoting digital wellness through mindfulness, cognitive restructuring, time-management practices, and scheduled breaks from technology use (Bordi et al., 2018; Peper & Harvey, 2018). At the organizational level, promoting a supportive work environment is essential. This can be achieved through providing mental health resources, implementing flexible work policies, encouraging psychological detachment from work during non-work hours, and integrating AI-driven workload management systems (Ashkanasy et al., 2014; Mazmanian et al., 2013; Routray, 2024).

### *3.6. Interventions to reducing digital strain for improved employee well-being*

The growing prevalence of technostress in contemporary work environments demands targeted interventions and strategies to alleviate its impact on employee well-being and productivity. The escalating prevalence of technostress necessitates effective interventions and strategies to mitigate its adverse effects in the workplace. A multifaceted approach that addresses both organizational practices and individual coping mechanisms is crucial for fostering a supportive work environment. This section outlines various approaches that organizations can adopt to mitigate technostress effectively and enhance the overall user experience in technology-rich settings.

#### *3.6.1. Promoting technology self-efficacy*

Enhancing employees' self-efficacy with technology is crucial for reducing technostress. Cazan et al. found a significant relationship between technology self-efficacy and reduced perceptions of techno-complexity, particularly among academics (Pansini et al., 2023). Organizations can implement training programs that focus on developing digital skills and increasing confidence in technology use. Regular workshops and personalized coaching can help employees navigate complex systems and feel more competent in using new technologies, ultimately reducing feelings of overwhelm and anxiety associated with technology use.

#### *3.6.2. Promoting digital literacy and training programs*

Enhancing digital literacy among employees is a foundational intervention that can significantly reduce technostress. Technology-specific training programs should be implemented to improve employees' confidence and competence in using various digital tools. According to Tarafdar et al., developing technology self-efficacy and enhancing information systems literacy is integral to reducing the negative impact of technostress creators on performance (Ibrahim et al., 2021). Organizations can utilize tailored workshops focusing on specific technologies relevant to their workforce, empowering employees to navigate technological challenges effectively.

#### *3.6.3. Empowering leadership and managerial support*

The role of leadership in mitigating technostress has been underscored by studies indicating that empowering leadership can buffer the relationship between specific forms of tech-related stress, such as techno-invasion and emotional exhaustion (Ibrahim et al., 2021). Leaders should foster a supportive environment where employees feel comfortable voicing their concerns regarding technology use. Regular check-ins and open communication channels can help identify and address technostressors before they escalate into significant issues. Additionally, effective managerial intervention—providing guidance, resources, and showing understanding—can enhance employee resilience to technostress (Tarafdar et al., 2014). Empowering leadership styles can serve as a mechanism to mitigate technostress. Bauwens et al. emphasize the role of leaders in creating an environment that supports employees in managing technology-related stressors (Hauk et al., 2019). Training managers and supervisors to adopt health-oriented leadership practices is essential in promoting employee well-being. This leadership can facilitate open communication channels where employees feel comfortable discussing their technostress experiences and challenges.

#### *3.6.4. Work-life balance initiatives*

Encouraging a healthy work-life balance is vital in combating technostress. Organizations should promote flexible work arrangements, such as remote work or flexible hours, allowing employees to better manage their time and reduce the pressures associated with rigid work schedules. The importance of setting boundaries around technology use, including discouraging after-hours communications, can help mitigate the feelings of techno-invasion and overload that contribute to stress (Saka et al., 2020; Ioannou, 2023). Policies that promote work-life balance, including flexible working arrangements and clear guidelines on work expectations, can significantly mitigate technostress. Initiatives that recognize the need for personal time away from technology are crucial, especially in the context of remote work environments that became prevalent during the pandemic. Lulli et al. suggested that clarifying distinctions between work and personal time can effectively alleviate the stress associated with constant connectivity (Pansini et al., 2023). In conclusion, addressing technostress requires a comprehensive, evidence-based strategy that encompasses training, leader support, wellness initiatives, and effective

communication practices. Organizations must prioritize these interventions to foster a healthier work environment, ultimately enhancing productivity, job satisfaction, and overall employee well-being.

### 3.6.5. Mindfulness and coping strategies

Incorporating mindfulness practices into the workplace can significantly reduce the negative consequences of technostress. Ioannou et al. discuss the role of mindfulness in alleviating stressors arising from technology use, promoting awareness of the present moment and reducing anxiety associated with performance expectations (Ioannou, 2023). Organizations can offer mindfulness workshops or access to mental health resources to empower employees to manage their stress proactively. Mindfulness practices have shown promise in reducing technostress by fostering resilience among employees. Interventions such as mindfulness training can assist individuals in coping with stress related to the use of technology. As noted by Munir et al., group counseling and mindfulness training have been effective in reducing technostress levels among students (Torre et al., 2020). Organizations could benefit from incorporating these practices into employee wellness programs, contributing to improved mental health outcomes.

### 3.6.6. Psychological capital development

Fostering psychological capital—characteristics such as self-efficacy, optimism, resilience, and hope—can help employees develop effective coping strategies against technostress. Research by Ingusci et al. suggests that these psychological resources can activate positive behaviors that mitigate the effects of stress from technology (Saka et al., 2020). Training programs focusing on personal development and resilience can enhance employees' ability to cope with the demands of technology. Using tools such as the Technostress Creators and Technostress Inhibitors Scale can provide valuable data to identify key stressors within the workplace (Saka et al., 2020). Regular assessments allow organizations to monitor technostress levels and implement targeted interventions accordingly. Taking a proactive approach to measuring and understanding technostress can lead to more effective strategies and support tailored to specific employee needs.

### 3.6.7. Technology management practices

Developing clear policies regarding technology use within organizations can create a more structured environment that reduces technostress. For instance, guidelines on appropriate technology usage, including how and when to engage with digital tools, help in managing expectations and responsibilities associated with ICT (Hauk et al., 2019). Additionally, implementing feedback mechanisms to monitor employee experiences with technology can inform ongoing improvements and adaptations to the workplace environment. Providing accessible IT support and resources can alleviate technostress significantly. As highlighted in the work of Kaltenecker et al., organizational resources—including reliable technical support—are crucial for helping employees manage technological demands effectively (Tarafdar et al., 2014). Regularly assessing the technological infrastructure and ensuring that employees have the resources they need to perform their jobs smoothly are essential considerations for reducing stress.

### 3.6.8. Cultural change and community building

Establishing a workplace culture that promotes open discussions about technostress and empowers employees to share their experiences can foster a supportive community. Encouraging peer support groups allows employees to connect over shared challenges, creating a sense of belonging and promoting collaborative problem-solving (Torre et al., 2020). This cultural shift can dismantle the stigma around technostress, making it easier for employees to seek help when needed. Creating a positive email culture and setting clear communication norms can help limit technostress stemming from excessive digital communication. Research indicates that organizations should establish guidelines that promote reasonable expectations for after-hours communication and the appropriate use of technology (Tarafdar et al., 2014). Encouraging employees to disconnect during designated "off" hours helps delineate boundaries between work and personal time, thereby reducing feelings of invasion and compulsion associated with technostress. In summary, a multidimensional approach to managing technostress is crucial for ensuring employee health and productivity in increasingly digital workplaces. By promoting self-efficacy, encouraging leader involvement, fostering work-life balance, offering mindfulness resources, developing psychological capital, implementing technology management practices, and cultivating supportive cultures, organizations can effectively combat the adverse effects of technostress.

## 3.7. Future directions and research opportunities

The study of technostress and cognitive fatigue presents numerous promising avenues for future research and practical application. It is essential to adopt a multifaceted approach that addresses the complexities of cognitive fatigue, particularly in light of the evolving dynamics of technology's role in various environments. One significant area for exploration is the relationship between cognitive fatigue and mental health disorders, such as anxiety and depression. Smejka et al. suggest that understanding how cognitive complaints intersect with societal participation can lead to targeted interventions that improve

outcomes for those experiencing fatigue (Ibrahim et al., 2021). This highlights the pressing need for studies focusing on how cognitive impairments influence not just workplace productivity but broader social engagement. Moreover, research should increasingly incorporate neurophysiological measures to gain a deeper understanding of the underlying mechanisms governing cognitive fatigue. For example, Chen et al. highlight the potential of studying functional connectivity alterations in specific brain pathways related to cognitive fatigue in various patient groups, including those with multiple sclerosis (Tarafdar et al., 2014). Such studies could inform the development of targeted cognitive rehabilitation therapies that could mitigate fatigue. Another promising direction involves developing integrated assessment tools that combine physiological and psychological methods. The combination of cognitive assessments, such as those performed with the Stroop test, and physiological measures, like heart rate variability (HRV), has shown promise in effectively detecting fatigue (Pansini et al., 2023). Future studies should work towards refining these assessment modalities to create a comprehensive fatigue monitoring system that can be employed in clinical settings. Technology-driven solutions also present opportunities for advancing research. For instance, wearable technologies and mobile apps can monitor cognitive fatigue in real-time, as illustrated by the Fimo health app, which measures various parameters affecting fatigue in individuals with multiple sclerosis (Saka et al., 2020). Leveraging technology to assess fatigue continuously could provide valuable insights for both individuals and healthcare providers. Furthermore, understanding the impact of occupational environments on cognitive fatigue is crucial. With recent increases in remote work and demanding digital tasks, studies need to investigate how various work configurations contribute to technostress. Research by Oliver et al. indicates the necessity of refining our understanding of mental fatigue within occupational settings (Ioannou, 2023) thus highlighting the importance of developing interventions tailored to specific work contexts. Finally, the incorporation of individual differences into cognitive fatigue research could facilitate the development of personalized fatigue management strategies. Studies examining how demographic factors, such as gender and age, influence the experience of fatigue can lead to tailored interventions that cater to specific groups and their unique challenges (Pansini et al., 2023). Overall, addressing these diverse avenues of exploration will enhance our understanding of technostress and cognitive fatigue and facilitate the development of evidence-based strategies that improve well-being in an increasingly technology-driven world.

#### 4. Conclusion

The review of the literature on technostress and cognitive fatigue reveals a complex interplay between the use of information and communication technologies (ICT) and employee well-being. The foundational article by elucidates the paradox of ICT, where its use can both energize and exhaust employees, establishing the groundwork for understanding the psychological impacts of technology in the workplace. The authors highlight that the experience of conflict and overload significantly contributes to fatigue, thereby underscoring the importance of examining how these factors affect employee engagement with digital tools. Subsequent articles build upon this foundation by defining technostress as a modern adaptation challenge linked to negative psychological effects. The multidimensional nature of technostress, characterized by stressors such as role ambiguity and job insecurity, necessitates organizational recognition of mental health implications and the fostering of supportive environments to mitigate these stressors. Creative interventions, such as the use of digital humor to alleviate work-related stress suggest that incorporating humor into workplace culture could serve as an effective coping mechanism against cognitive fatigue. The impact of the COVID-19 pandemic has further highlighted the relevance of technostress, with articles identifying specific stressors that emerged during remote work, such as techno-overload and techno-invasion, which exacerbate feelings of stress and dissatisfaction. The relationship between technostress and job satisfaction is further explored who argue that heightened demands from ICT use can lead to negative emotional responses, ultimately reducing productivity. The interplay between technostress, work-family conflict, and perceived organizational support emphasizing the importance of organizational resources in mitigating adverse effects on mental health and well-being. The systematic approach of positioning technostress within the Job Demands-Resources (JD-R) model provides a comprehensive framework for analyzing its implications for employee well-being and productivity. Finally, the introduction of a multimodal AI-based framework for stress detection underscores the necessity for proactive measures in identifying and managing stress levels in increasingly digital work environments. In conclusion, the literature collectively underscores the multifaceted nature of technostress and cognitive fatigue, highlighting the psychological burdens imposed by ICT and the critical need for organizations to implement supportive strategies that promote employee well-being. The insights from these articles not only enhance understanding of the challenges posed by technology but also offer potential pathways for alleviating digital strain in the workplace.

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Not applicable.

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