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## The Digital Burden: Techno-Stress and Its Physiological Effects on IT Professionals

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### ABSTRACT

The study examines the impact of techno-stressors (techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty) on employees' physiological strain, while incorporating the moderating role of experience, and contributes novel insights to the growing body of techno-stress literature. Drawing from a sample of 641 IT sector employees, the findings reveal that all five techno-stressors significantly influence physiological strain, with techno-overload and techno-invasion demonstrating the strongest associations across all experience levels. However, techno-complexity has a more pronounced impact on experienced employees, while techno-insecurity disproportionately affects those with less experience. These results challenge the assumption that experience always mitigates techno-stress, suggesting that different levels of experience shape employees' physiological responses to technology-induced stress. This study highlights the importance of experience-based organizational interventions and emphasizes the need to adopt holistic strategies for managing techno-stress, particularly by addressing its physiological effects, thereby fostering a healthier and more productive work environment in the digital age.

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## 1. Introduction

In the contemporary digital era, technology has become deeply embedded in daily life, fundamentally altering the way employees interact with their work and personal environments (Kraus et al., 2021; Wei & Zheng, 2025). Recently, the ‘Global Workforce Hopes and Fears Survey,’ conducted in 2024 across 50 countries, indicates that more than 33% of employees have experienced a significant shift in their role over the past year (PwC, 2024). While technological advancements have significantly enhanced productivity and connectivity, they also lead to techno-induced stress, also known as techno-stress (Yang et al., 2025). According to PwC (2024), over the past year, 45% of employees (out of 56,000 across 50 countries) faced an increased workload and had to learn to use new technology to perform their jobs. Techno-stress encompasses five dimensions, known as techno-stressors, namely techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Nastjuk et al., 2023; Ragu-Nathan et al., 2008; Xie & Yang, 2025).

The extant literature reveals that techno-stressors lead to various outcomes (Nayak et al., 2025). Wherein, the impact of techno-stressors on psychological outcomes, such as exhaustion, anxiety, burnout, and satisfaction, and behavioural outcomes, such as productivity and performance, has been extensively examined and established (Wang et al., 2024; Yang et al., 2025). However, the physiological impact of techno-stressors remains underexplored as mentioned by the eminent scholars such as Nastjuk et al. (2023) in their meta-analytical study. Given that prolonged exposure to technology-induced stress leads to adverse health outcomes, including cardiovascular issues, hormonal imbalances, and sleep disturbances (Kumar, 2024; Mishra & Rasticova, 2024; Tams et al., 2018, 2020), understanding and empirically validating the physiological consequences of techno-stress is crucial. Scholars have long emphasized the need for physiological measures to assess stress responses to digital technologies (Ayyagari et al., 2011; Tams et al., 2018), yet empirical investigations in this area remain scarce. Particularly, the direct physiological effects associated with various techno-stress dimensions (Borle et al., 2021; Marsh et al., 2022; Nastjuk et al., 2023) are overlooked. In the same vein, Galluch et al. (2015) and Day et al. (2012) emphasize the need to measure the amount of physiological stress employees feel after working with an ICT-based task. This parallels Mishra and Rasticova (2024), who recently advocated for empirical studies to inspect the repercussions of techno-stress on physical health, emphasizing the urgency of addressing this long-neglected aspect.

Based on the above discussion, the study aims to achieve two major research objectives to deepen the understanding of the physiological consequences of techno-stress. (1) It examines the role of five dimensions of techno-stress, including techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty, in contributing to physiological strain among employees. (2) It identifies the role of varying experience levels of employees in influencing the relationship between the five techno-stress dimensions and physiological strain by performing multi-group analysis. Based on these findings, we provide theoretical insights into techno-stress frameworks and offer practical implications for employees, managers, and society to develop strategies that mitigate the adverse effects of techno-stress on employee health and well-being.

The structure of this paper is as follows: The next section provides a comprehensive literature review and the theoretical background. Following this, the study outlines the hypotheses that guide its investigation. Subsequently, the methodology section provides an overview of the research design and approach, which leads to an analysis of the collected data. The results are then discussed in the context of their theoretical and practical implications. The paper concludes with a reflection on the study's limitations and directions for future research.

## 2. Literature Review

### 2.1. Techno-Stress

Techno-stress is a type of stress that individuals experience due to their inability to keep up with the rapid advancements and demands of Information and Communication Technologies (ICTs) (Jain et al., 2025). Brod (1984) coined the term, describing it as a “modern disease of adaptation caused by an inability to cope with new technologies in a healthy manner” (p. 16). The concept was further revised by Weil and Rosen (1997), who describe techno-stress as an adverse impact that technology has on people's attitudes, beliefs, behaviours, or psychology. Over the years, many eminent scholars have delved into techno-stress in organizations, particularly the studies conducted by Ayyagari et al. (2011), Ragu-Nathan

et al. (2008), and Tarafdar et al. (2007), marking a significant shift in techno-stress literature. Ragu-Nathan et al. (2008) and Tarafdar et al. (2007) mention that techno-stress is driven by various factors, referred to as techno-stress creators or stressors, including techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. (1) Techno-overload refers to situations where ICTs compel users to work faster, more intensively, or for longer periods (Alhammedi et al., 2025; Thurik et al., 2023). (2) Techno-Invasion describes the pervasive nature of technology that blurs the boundaries between work and personal life, leading to the encroachment of work into personal time and space as well as creating a sense of constant pressure (Kumar, 2024; Nayak et al., 2025; Tarafdar et al., 2007). (3) Techno-complexity refers to the complexity of ICTs that makes users feel inadequate or overwhelmed about their technological skills (Jain et al., 2025; Marsh et al., 2022). It forces users to invest significant time and effort in learning and mastering new technologies, which can lead to frustration and stress (Tarafdar et al., 2014). (4) Techno-insecurity is the fear of losing one's job or relevance due to rapid technological advancements or being replaced by more tech-savvy employees (Thunberg et al., 2023; Wei & Zheng, 2025). This dimension highlights the anxiety associated with staying updated and competitive in a constantly evolving digital landscape (Tarafdar et al., 2014). (5) Techno-uncertainty reflects the continuous changes, updates, and modifications in ICTs that create user uncertainty. It requires them to continually learn and adapt, which can lead to feelings of instability and stress (Ragu-Nathan et al., 2008; Yuan et al., 2023; Wei & Zheng, 2025). Based on the above discussion, in this study, we conceptualize technostress as the stress or strain individuals experience due to the pervasive use of technology (Ficapal-Cusí et al., 2024; Tarafdar et al., 2014).

## **2.2. Physiological Strain**

Physiological strain refers to the adverse physical effects that arise from prolonged exposure to stressors, particularly in technology-driven work environments (Bhatt & Kothari, 2022; Kumar, 2024). Employees experiencing technostress often report elevated cortisol levels, increased heart rate, musculoskeletal discomfort, digital eye strain, and sleep disturbances, all of which impact their overall health and productivity (Weinert et al., 2020). Extended screen exposure contributes to headaches, eye fatigue, and disrupted sleep cycles (Riedl, 2013), while prolonged sitting and repetitive tasks lead to back pain, wrist strain, and neck stiffness, exacerbating fatigue and reducing work efficiency (Karim et al., 2024; Tams et al., 2014).

Beyond musculoskeletal discomfort, technostress is associated with cardiovascular strain and metabolic imbalances, as constant digital interruptions and workload pressures elevate blood pressure and stress-related physiological responses (Mishra & Rasticova, 2024). Additionally, exposure to blue light from screens inhibits melatonin production, leading to poor sleep quality and cognitive fatigue, which subsequently impair employee performance and well-being (Silvani et al., 2022). Given these risks, organizations must prioritize ergonomic interventions, structured breaks, and digital wellness initiatives to mitigate the physiological burden of technostress and enhance workplace health.

## **2.3. Theoretical Background: Person-Environment (P-E) Fit Model**

The Person-Environment (P-E) Fit theory provides a robust framework for understanding how techno-stress leads to physiological strain. According to this theory, stress arises from a mismatch between an individual's abilities and environmental demands (Caplan, 1987). This theory is applied to assess the alignment between employees and their digital work environments in techno-stress research. In modern workplaces, technology has become an integral part of the work environment, necessitating continuous employee adaptation. A person-technology misfit occurred when the technological demands exceeded employees' capabilities, resulting in the occurrence of techno-stress. This persistent misfit ultimately led to physiological strain.

## **3. Hypotheses Development**

### **3.1. Techno-Overload and Physiological Strain**

Techno-overload arises when employees are overwhelmed by the sheer volume of technology-related tasks, leading to excessive cognitive processing and mental fatigue (Alhammedi et al., 2025; Thurik et al., 2023). This cognitive overload stimulates the body's stress-response systems, resulting in physiological responses, such as elevated cortisol levels, increased heart rate, and heightened skin

conductance (Riedl, 2013). Elevated cortisol, a key stress hormone, is commonly associated with increased arousal and prolonged activation of the hypothalamic-pituitary-adrenal axis, contributing to chronic stress if the overload persists (Mishra & Rasticova, 2024; Riedl et al., 2012; Sonnentag & Fritz, 2015). Muscle tension is another common symptom, often manifesting in the neck, back, and shoulders, as employees constantly work with technology (Riedl, 2013). Chronic activation of these physiological markers may lead to immune system suppression, increased fatigue, and long-term health risks, such as hypertension and cardiovascular disease (Ayyagari et al., 2011; Riedl et al., 2012). Since employees experiencing techno-overload are forced to process vast amounts of information within tight deadlines, their cognitive fatigue translates into tangible physical symptoms. Prolonged engagement with multiple technological tools without adequate recovery time exacerbates physiological strain, leading to burnout and a weakened immune system (Kumar, 2024). Given the strong association between cognitive overload and physiological stress responses, it is crucial to examine the direct effect of techno-overload on employees' physical well-being. Thus, we hypothesise that:

**H1:** Techno-overload has a positive and significant effect on physiological strain.

### **3.2. Techno-Invasion and Physiological Strain**

Techno-invasion refers to the constant intrusion of technology into personal and professional lives, eroding boundaries between work and leisure (Nayak et al., 2025; Tarafdar et al., 2014). This continuous connectivity disrupts regular routines and extends exposure to stress. Consequently, physiological strains, such as sweating, gastrointestinal disturbances, and elevated blood pressure, emerge from the persistent pressure to respond to technology-driven demands (Mishra & Rašticová, 2024; Riedl, 2013). Over time, these sustained physiological responses can lead to more serious health problems, such as cardiovascular issues, including hypertension and increased risk of heart disease (Riedl et al., 2012; Riedl et al., 2013; Tams et al., 2018). The inability to disconnect from work-related digital tasks leads to hypervigilance, preventing employees from achieving proper relaxation. This sustained exposure to work pressure beyond regular working hours can trigger chronic activation of the stress response system, further exacerbating physiological strain. This indicates that employees' physical health may be adversely impacted by techno-invasion. Therefore, it is hypothesized that:

**H2:** Techno-invasion has a positive and significant effect on physiological strain.

### **3.3. Techno-Complexity and Physiological Strain**

Techno-complexity involves the cognitive challenge of understanding or using intricate technological systems, which places significant mental demands on employees (Borle et al., 2021; Jain et al., 2025). The complexity of these systems often results in frustration, confusion, and mental fatigue, triggering the activation of physiological stress responses. As users struggle to navigate complicated technologies, the body responds by releasing stress hormones such as cortisol and adrenaline (Riedl, 2013). Elevated cortisol levels are a marker of the activation of the hypothalamic-pituitary-adrenal (HPA) axis, a key system involved in the body's stress response, while adrenaline triggers immediate physiological changes, including increased heart rate and blood pressure (Riedl et al., 2012). Furthermore, techno-complexity has been linked to increased skin conductance, a physiological indicator of sympathetic nervous system activation (Mishra & Rasticova, 2024). These physiological markers not only indicate immediate stress but, if the complexity persists over time, may lead to chronic stress-related health issues, such as cardiovascular diseases and impaired cognitive functioning (Weinert et al., 2020). As employees encounter frequent technological updates, they may struggle to stay proficient with new software, devices, or interfaces, further amplifying stress. The continuous learning curve imposed by evolving workplace technologies can significantly contribute to physiological strain. Therefore, we hypothesise:

**H3:** Techno-complexity has a positive and significant effect on physiological strain.

### **3.4. Techno-Insecurity and Physiological Strain**

Techno-insecurity arises from fears of being displaced by technological advancements or becoming irrelevant in the workforce, which can significantly heighten stress levels (Fischer & Riedl, 2017; Wei

& Zheng, 2025). This fear often triggers physiological stress responses, such as increased heart rate, muscle tension, and elevated blood pressure, as employees grapple with anxiety over their professional futures (Schellhammer et al., 2013). Research suggests that these physiological responses are primarily driven by the activation of the body's fight-or-flight system, particularly the sympathetic nervous system, which increases adrenaline and cortisol (Adam et al., 2016; Riedl, 2013). Over time, prolonged exposure to techno-insecurity can contribute to chronic health conditions, such as hypertension, elevated blood pressure, and stress hormones, which place a strain on the cardiovascular system (Sonntag & Fritz, 2015). The fear of technological displacement can lead to sleep disturbances, appetite changes, and heightened stress sensitivity, compounding the negative effects of physiological strain. Employees who perceive their skills as outdated may experience a persistent state of anxiety, increasing their overall health risks. As job security concerns continue to rise with technological advancements, exploring their direct impact on physiological strain is critical for understanding workplace stressors. Based on this comprehensive review, we hypothesise the following:

**H4:** Techno-insecurity has a positive and significant effect on physiological strain.

### **3.5. Techno-Uncertainty and Physiological Strain**

Techno-uncertainty refers to the continuous and unpredictable changes in technology, which create uncertainty about the future and lead to difficulties in adapting to new systems or software (Marsh et al., 2022; Wei & Zheng, 2025). Techno-uncertainty results in significant psychological and physiological strain as employees struggle to meet ever-evolving technological demands (Nastjuk et al., 2023). Physiologically, techno-uncertainty triggers stress responses, such as elevated cortisol levels, increased heart rate, and heightened blood pressure, reflecting the body's reaction to perceived instability and the constant need to adapt (Peters et al., 2017; Riedl, 2013). The uncertainty about effectively using or managing new technologies also leads to increased cognitive load, resulting in mental fatigue, which further activates the body's stress-response systems (Ayyagari et al., 2011). Prolonged exposure to techno-uncertainty can lead to chronic physiological issues, such as headaches, muscle tension, and gastrointestinal problems, as the stress resulting from constant technological change places a strain on the nervous and musculoskeletal systems. When employees face unpredictable technological changes, they may experience difficulty in long-term planning, contributing to persistent anxiety and physiological distress. The inability to foresee how emerging technologies will impact their roles adds another layer of stress, further straining physical health. Based on this context, it is hypothesised that:

**H5:** Techno-uncertainty has a positive and significant effect on physiological strain.

### **3.6. Experience as a Moderator**

Experience plays a crucial role in shaping an individual's ability to utilise technology (Chahal & Mahajan, 2024) and effectively manage workplace challenges. In the context of techno-stress, work experience has been significantly associated with techno-stressors, and it has been found that individuals with more work experience report a lower level of techno-stress, such as techno-overload and techno-invasion (Ficapal-Cusí et al., 2024). Highly experienced employees often develop coping mechanisms, technological proficiency, and resilience, reducing the adverse effects of techno-stressors on strain (Becker et al., 2022), such as exhaustion, fatigue, sleep disturbances, and headaches. Conversely, less experienced employees may struggle with digital adaptation, leading to heightened physiological strain. However, this moderation effect may not be strictly linear, as more experienced employees might face the highest strain due to prolonged techno-stressors with growing responsibilities. For example, previous research has found that more experienced workers are more affected by techno-stressors (Marchiori et al., 2019). This is because users with more experience in general tend to be older, and older workers are more susceptible to techno-stressors (Ficapal-Cusí et al., 2024). Based on the above discussion, the current study hypothesised whether work experience weakens or amplifies the impact of techno-stressors on physiological strain. Thus, the following hypothesis have been framed:

**H6:** Experience moderates the relationships between techno-overload (H6a), techno-invasion (H6b), techno-complexity (H6c), techno-insecurity (H6d), and techno-uncertainty (H6e) and physiological strain.

The conceptual model (Figure 1) is developed based on the above discussion.

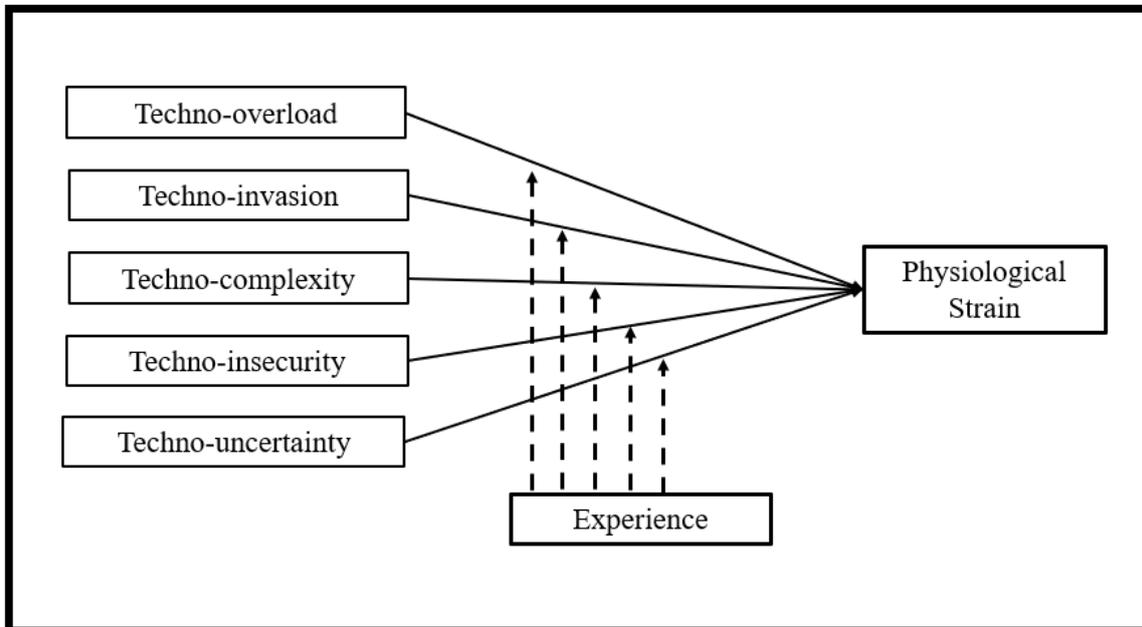


Fig. 1. Conceptual Model

## 4. Methodology

### 4.1. Measurement Development

The study employs a cross-sectional, survey-based design to collect data on the study topic. The research constructs are operationalised using items adapted from previous research, employing a 5-point Likert scale (see Table 1) where 1 indicates complete disagreement with the statement, and 5 indicates complete agreement. The study uses a comprehensive 31-statement-based scale to measure five independent variables, i.e., techno-stressors (techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty) and one dependent variable (physiological strain). Specifically, the scale items for all the techno-stressors are adapted from Ragu-Nathan et al. (2008). Physiological strain is measured using eight items adapted from Ishola et al. (2019) and Laspinas (2015).

Two pre-tests of the questionnaire are conducted. Three human resource management experts reviewed the initial draft of the questionnaire, leading to key revisions for enhanced clarity and reduced ambiguity. A subsequent pre-test with 25 respondents provided further validation, highlighting the need for more language clarity, removal of technical terminology, and a greater emphasis on colloquial expressions. Incorporating these insights, the scale items are modified and revised in the final version of the questionnaire.

### 4.2. Sample

This study adopts a quantitative research design, targeting IT professionals based in Delhi and Chandigarh, two prominent technology hubs in India. A non-probability snowball sampling technique was employed due to the difficulty in accessing a comprehensive sampling frame of IT employees. The initial set of respondents was identified through professional networks, such as LinkedIn, and employee contacts from major IT firms in the region. These participants were then asked to refer additional IT colleagues, thereby expanding the sample pool naturally.

**Table1. Psychometric Properties and SRW Values of the Measurement Items**

Construct	Items	CR	AVE	Alpha	SRW
Techno-Overload (TO)	TO1: I am forced by technology to work much faster	.871	.578	.860	.83
	TO2: I am forced by technology to do more work than I can handle.				.60
	TO3: I am forced by technology to work with very tight time schedules.				.80
	TO4: I am forced to change my work habits to adapt to new technologies.				.77
	TO5: I have a higher workload because of increased technology complexity.				.78
Techno-Invasion (TINV)	TINV1: Due to technology, I spend less time with my family.	.850	.588	.843	.86
	TINV2: Due to technology, I have to be in touch with my work even during my vacations				.75
	TINV3: I have to sacrifice my vacation and weekend time to keep current on new technologies.				.71
	TINV4: I feel my personal life is being invaded by technology.				.74
Techno-Complexity (TC)	TC1: I do not know enough about technology to handle my job satisfactorily	.867	.567	.855	.76
	TC2: I need a long time to understand and use new technologies.				.82
	TC3: I do not find enough time to study and upgrade my technology skills.				.71
	TC4: I find new recruits to this organization have a greater knowledge of computer technology than I do.				.75
	TC5: I often find it too complex to understand and use new technologies.				.72
Techno-Insecurity (TINS)	TINS1: Due to new technologies, I feel there is a constant threat to my job security.	.839	.510	.833	.71
	TINS2: I have to constantly update my skills to avoid being replaced.				.73
	TINS3: I am threatened by co-workers with newer technological skills.				.68
	TINS4: I do not share my knowledge with my co-workers for fear of being replaced.				.74
	TINS5: I feel there is a decreased level of sharing of knowledge among co-workers for fear of being replaced.				.71
Techno-Uncertainty (TU)	TU1: There are always new developments in the technologies we use in our institution.	.822	.537	.816	.75
	TU2: There are constant changes in computer software in our institution.				.74
	TU3: There are constant changes in computer hardware in our institution.				.72
	TU4: There are frequent upgrades in computer networks in our institution.				.72
Physiological Strain (PS)	PS1: I frequently experience headaches after prolonged use of technology.	.848	.650	.847	.73
	PS2: I often feel strain or pain in my eyes due to extended screen time.				.71
	PS3: I experience back pain due to long hours of sitting while using the computer.				.70
	PS4: I feel pain or numbness in my wrists or hands during or after working on digital devices.				.77
	PS5: I feel stiffness or soreness in my neck and shoulders after working on the computer.				.75
	PS6: My posture feels strained or uncomfortable after prolonged periods of technology use.				.73
	PS7: I often feel physically fatigued or drained after working on the computer or using digital devices.				.71
	PS8: I experience disrupted sleep patterns due to extended exposure to digital devices.				.73

Notes: <sup>a</sup> CR = Composite Reliability, AVE = Average Variance Explained, SRW = Standardized Regression Weights.

<sup>b</sup> Standardized coefficients reported.

Source: Author's Creation

This approach allowed us to reach a diverse sample in terms of gender, work experience, job roles, and organizational sizes, enhancing the study's representativeness within the Indian IT context. Snowball sampling was particularly suitable given the professional nature of the target population and the need to access respondents across different organizations and hierarchical levels. This sampling methodology has been widely adopted in techno-stress and technology-focused research, where access to organizational employees is restricted or formal sampling frames are unavailable (e.g., Maier et al., 2015; Ragu-Nathan et al., 2008).

Data collection took place over a five-month period (September 2024 to January 2025). A total of 852 IT employees were invited to participate voluntarily. Respondents were fully informed about the study's purpose, assured of confidentiality and anonymity, and were given the right to withdraw at any point during or after the survey. The ethical standards of voluntary participation and informed consent were strictly followed.

A total of 676 valid responses were obtained, reflecting a response rate of 79.3%. Subsequently, the data were screened for outliers using a boxplot, yielding a final sample size of 641 respondents. The majority respondents were male (64.43%), and the dominant age group was 26–33 years (54.76%). Most respondents held a bachelor's degree (79.41%) and were married (59.59%). In terms of work experience, over half of the participants (51.64%) had less than three years of professional experience, followed by 28.71%, with 3–8 years of experience, and 19.65%, having over eight years of experience.

## **5. Data Analysis and Results**

### **5.1. Common Method Bias (CMB)**

Response biases pose a potential threat to the integrity of the analysis. To mitigate this risk, we implemented both procedural and statistical techniques. Procedurally, we generally employed established measurement scales and guaranteed respondent anonymity (Podsakoff et al., 2003).

Statistically, we applied Harman's single-factor test (Harman, 1976) and the Common Latent Factor (CLF) method (Podsakoff et al., 2003) to assess CMB. Harman's test indicates that a single factor explains only 31.02% of the variance, well below the 50% threshold recommended (Harman, 1976; Kautish et al., 2023). Furthermore, the CLF method, conducted using AMOS software (version 23), confirms the absence of CMB. A comparison of Standardized Regression Weights (SRW) between models with and without the CLF indicates differences below the recommended threshold of 0.2, suggesting that CMB does not pose a significant effect in this study (Gaudioso et al., 2017; Mahajan, 2024).

### **5.2. Measurement Model Evaluation: Reliability and Validity**

The analysis proceeds in two stages: first, evaluating the measurement model for reliability and validity, and second, testing the hypotheses through the structural model (Hair et al., 2019). Reliability is assessed using Cronbach's alpha and composite reliability (see Table 1). All constructs show Cronbach alpha and composite reliability values surpassing the recommended 0.70 threshold (Fornell & Larcker, 1981; Hair et al., 2019). Additionally, the average variance extracted (AVE) for each construct is also assessed, with all AVE values exceeding the 0.50 threshold value suggested by Malhotra et al. (2017) and Hair et al. (2019), confirming strong convergent validity. Furthermore, discriminant validity is evaluated using the Fornell and Larcker (1981) criterion, which requires the square root of AVE for each construct to be greater than its correlations with other constructs (Malhotra et al., 2017). As shown in Table 2, all constructs meet this criterion, confirming discriminant validity. Subsequently, a confirmatory factor analysis (CFA) is performed to assess the overall measurement model. The results indicate an acceptable fit (see Table 3), with  $CMIN/df = 2.647$ ,  $GFI = 0.943$ ,  $CFI = 0.956$ ,  $NFI = 0.956$ ,  $TLI = 0.949$ ,  $RMR = 0.053$ , and  $RMSEA = 0.061$ , all exceeding the recommended thresholds (Hair et al., 2019).

**Table 2. Discriminant Validity**

	TO	TINV	TC	TINS	TU	PS
TO	<b><i>0.760</i></b>					
TINV	0.672	<b><i>0.767</i></b>				
TC	0.641	0.608	<b><i>0.753</i></b>			
TINS	0.437	0.489	0.354	<b><i>0.714</i></b>		
TU	0.661	0.576	0.486	0.449	<b><i>0.733</i></b>	
PS	0.673	0.452	0.482	0.415	0.455	<b><i>0.806</i></b>

Note: <sup>a</sup> TO = Techno-overload, TINV = Techno-invasion, TC = Techno-complexity, TINS = Techno-insecurity, TU = Techno-uncertainty, PS = Psychological strain

<sup>b</sup> Diagonal values (bold and italic) are the square root of the AVE of each construct.

### 5.3. Structural Model Assessment and Hypotheses Testing

The hypothesis testing for the full model is performed using Structural Equation Modeling (SEM), employing IBM AMOS (version 23). Hair et al. (2019) noted that structural relationships should only be examined after confirming that the measurement model is validated and exhibits a good fit. The results of the structural model indicate a satisfactory fit (Table 3), with CMIN/df = 3.618, GFI = 0.925, CFI = 0.927, NFI = 0.945, TLI = 0.930, RMR = 0.059, and RMSEA = 0.066. All these values exceed the recommended thresholds, confirming that the model is acceptable (Hair et al., 2019).

Table 4 presents the results of the SEM analysis, demonstrating the relationships between various dimensions of techno-stress and psychological strain. The findings indicate that techno-complexity (H3) has the strongest positive impact on psychological strain (SRW = 0.813,  $p < 0.001$ ), followed by techno-overload (H1) (SRW = 0.782,  $p < 0.001$ ) and techno-invasion (H2) (SRW = 0.459,  $p < 0.001$ ). Additionally, techno-insecurity (H4) (SRW = 0.106,  $p < 0.01$ ) and techno-uncertainty (H5) (SRW = 0.109,  $p < 0.01$ ) also exhibit significant but relatively weaker/smaller effects on psychological strain. Hence, all hypotheses (H1–H6) are supported as illustrated in Figure 2.

**Table 3. Model Fit Statistics for the Measurement and Structural Model**

Fit Index	Measurement Model	Structural Model	Acceptable Values
CMIN/df	2.647	3.618	< 5.00
GFI	0.943	0.925	> .90
CFI	0.956	0.927	> .90
NFI	0.956	0.945	> .90
TLI	0.949	0.930	> .90
RMR	0.053	0.059	< .07
RMSEA	0.061	0.066	< .07

**Table 4. SEM Analysis**

Hypotheses	Relationship	SRW	t-value	p-value	Supported / Not Supported
H1	TO → PS	0.782	9.396	***	Supported
H2	TINV → PS	0.459	7.542	***	Supported
H3	TC → PS	0.813	2.660	***	Supported
H4	TINS → PS	0.106	2.247	**	Supported
H5	TU → PS	0.109	2.357	**	Supported

Note: <sup>a</sup> TO = Techno-overload, TINV = Techno-invasion, TC = Techno-complexity, TINS = Techno-insecurity, TU = Techno-uncertainty, PS = Psychological strain

<sup>b</sup> \*\*\* $p < 0.001$  and \*\* $p < 0.01$

<sup>c</sup> Standardized coefficients reported

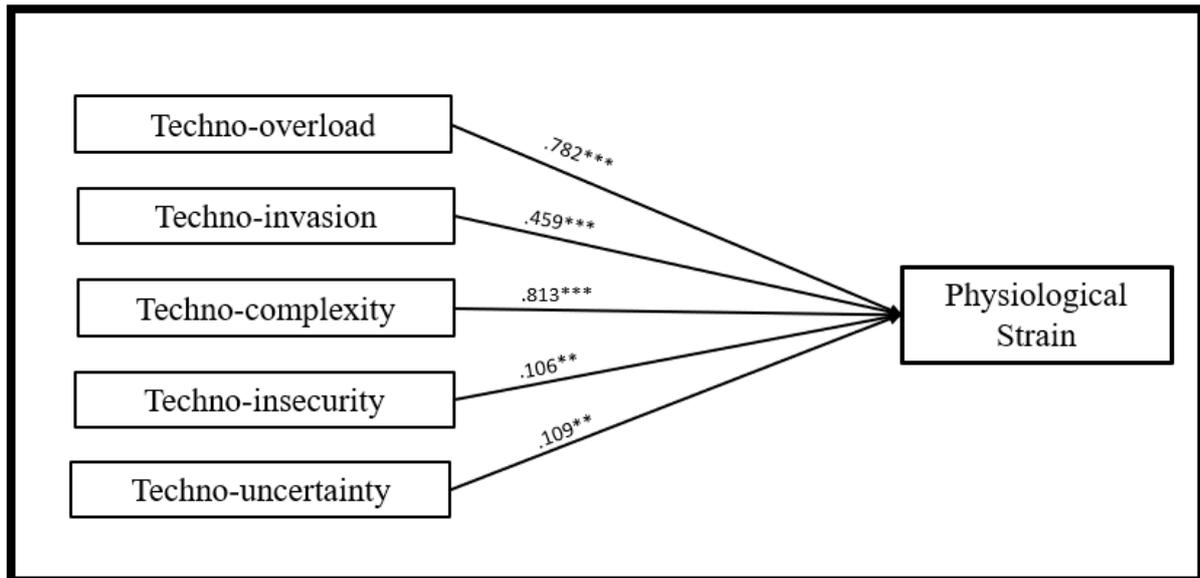


Fig. 2. Full Structural Model Analysis

<sup>a</sup> \*\*\* $p < 0.001$ , \*\* $p < 0.01$

<sup>b</sup> Standardized coefficients reported

#### 4.4. Moderating Effects of Experience

To examine the moderating role of experience, we employ measurement invariance testing (configural and metric) (Collier, 2020), followed by a multi-group analysis (Chahal & Mahajan, 2024). Participants are categorized into three experience levels: (a) less than 3 years, (b) 3 to 8 years, and (c) more than 8 years.

The first step involves assessing configural invariance, which ensures that the fundamental structure of the measurement model remains consistent across the three experience groups (Byrne, 2016; Chahal & Mahajan, 2024). As shown in Table 5, the measurement model exhibits satisfactory model fit indices for all three groups, confirming configural invariance. Next, we test for metric invariance, which assumes that factor loadings are equivalent across groups. This is assessed by comparing a constrained model, where factor loadings are restricted to be equal with an unconstrained model, where factor loadings vary freely. A non-significant chi-square difference ( $\Delta\chi^2$ ) indicates that metric invariance holds (Chahal & Mahajan, 2024; Collier, 2020). The results confirm metric invariance ( $\chi^2/df = 17.782$ ,  $\Delta\chi^2/df = 11$ ,  $\chi^2/df = 1.616$ ,  $p = .310$ ), suggesting that the constructs are interpreted consistently across experience levels.

Table 5. CFA Goodness of Fit Statistics for All the Subgroups of Experience

Years of Experience	CMIN/df	GFI	CFI	NFI	TLI	RMR	RMSEA
< 2 years	2.924	.981	.969	.985	.956	.063	.035
2 – 4 years	2.246	.944	.982	.971	.985	.027	.056
> 4 years	2.578	.964	.954	.988	.929	.042	.067

Following this, a multi-group analysis is conducted by imposing constraints on all regression weights simultaneously. The significant chi-square difference ( $\Delta\chi^2 = 15.768$ ,  $df = 10$ ,  $p < 0.001$ ) indicates that experience has a significant influence on the relationships between techno-stress dimensions and physiological strain. However, to identify the specific paths affected by experience, each structural relationship (techno-overload  $\rightarrow$  physiological strain, techno-invasion  $\rightarrow$  physiological strain, techno-complexity  $\rightarrow$  physiological strain, techno-insecurity  $\rightarrow$  physiological strain, and techno-uncertainty  $\rightarrow$  physiological strain) is individually tested for differences across experience groups (see Table 6).

The results (Table 6) indicate significant moderation effects for techno-complexity ( $p = 0.38$ , H6c) and techno-insecurity ( $p = 0.14$ , H6d), as the chi-square difference is statistically significant ( $p < 0.05$ ). This suggests that as employees gain more experience, the physiological impact of these stressors varies. Notably, techno-complexity exhibits an increasingly significant impact with greater experience, while techno-insecurity shows a fluctuating relationship, with physiological strain being more pronounced when experience is less than three years.

Conversely, no significant moderating effects are observed for techno-overload ( $p = 0.188$ , H6a), techno-invasion ( $p = 0.084$ , H6b), and techno-insecurity ( $p = 0.055$ , H6d), as the chi-square difference for these relationships is not statistically significant ( $p > 0.05$ ), indicating that employees experience similar levels of physiological strain from these stressors regardless of their experience (Table 6).

These findings highlight that while experience influences the impact of certain techno-stressors, other factors exert a consistent strain on employees, emphasizing the need for experience-specific interventions in workplace stress management strategies.

**Table 6. Results of the Chi-Square Difference Test for Multi-Group Analysis**

Hypotheses	Moderating effect of Experience between	SRW (p-value)			$\Delta\chi^2$	df	p-value
		< 3 years	3 – 8 years	> 8 years			
H6a	TO → PS	.331 (.009)	.253 (.014)	.236 (.017)	8.468	2	.188
H6b	TINV → PS	.183 (.029)	.221 (.022)	.317 (.011)	9.776	2	.084
H6c	TC → PS	.416 (.003)	.301 (.006)	.221 (.033)	7.844	2	.038
H6d	TINS → PS	.380 (.006)	.242 (.020)	.214 (.017)	2.368	2	.014
H6e	TU → PS	.343 (.012)	.375 (.013)	.319 (.010)	5.218	2	.055

Notes: <sup>a</sup> TO = Techno-overload, TINV = Techno-invasion, TC = Techno-complexity, TINS = Techno-insecurity, TU = Techno-uncertainty, PS = Psychological strain

<sup>b</sup>  $\Delta\chi^2$  = chi-square difference

## 5. Discussion

This is one of the first studies to empirically examine the relationships between various techno-stressors and their physiological strain. Additionally, the study provides new theoretical insights into the techno-stress literature by investigating the moderating role of experience in the relationship between techno-stressors and physiological strain.

While prior research has extensively examined the psychological and behavioural impacts of techno-stress (Ayyagari et al., 2011; Ragu-Nathan et al., 2008; Tarafdar et al., 2007), this study uniquely extends the techno-stress model by demonstrating the physiological consequences of techno-stressors (techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty). These results align with the findings of Dunmade et al. (2014), which identified a positive relationship between techno-stress and ergonomic hazards (e.g., tennis elbow, carpal tunnel syndrome, awkward and repetitive body movements or strains that can result from performing the same motion repeatedly).

Notably, techno-complexity demonstrates the most pronounced impact on physiological strain, indicating that the difficulties associated with understanding and utilizing complex technologies can lead to severe physical strain. This result aligns with Ishola et al. (2019), who highlight that employees experience physical stress due to the increasing adaptation of complex technologies. Furthermore, employees often invest prolonged hours in navigating technological challenges, resulting in physical ailments, such as muscle soreness, headaches, back pain, and eye strain. This relationship is also consistent with our theoretical framework, which explains techno-stress and resultant physical outcomes as a misfit between individual capabilities and technological demands (Caplan, 1987).

Furthermore, the significant association between techno-overload and physiological strain highlights the adverse effects of excessive technological demands on physical health. This aligns with Mattern et al. (2024), who assert that feeling overwhelmed by technology can lead to both psychological and physiological distress. The presence of physiological symptoms (e.g., chronic fatigue, sleep disturbances, and musculoskeletal discomfort) underscores the necessity for organizational interventions to regulate technological demands and promote employee well-being.

Similarly, the relationship between techno-invasion and physiological strain reinforces the notion that technology's encroachment on personal time exacerbates physical strain. The blurring of work-life boundaries can trigger chronic stress, leading to physical manifestations, such as muscle tension, persistent fatigue, and disrupted sleep patterns (Fisher & Riedl, 2015). Prior research suggests that continuous connectivity to work-related technologies contributes to heightened stress responses (Riedl, 2012; Zolg et al., 2021).

Among the five techno-stressors, techno-uncertainty exhibits the weakest effects on physiological strain, while techno-insecurity has the second lowest impact. The frequent introduction of technological changes can induce confusion and stress, resulting in muscle soreness, headaches, and general physical discomfort. The impact of techno-insecurity on physiological strain is comparatively lower, suggesting that concerns about job security resulting from technological advancements contribute to stress-induced symptoms, such as sleep disturbances and headaches. These results are consistent with Zolg et al. (2021), which highlighted the physiological consequences of techno-stress.

To the best of our knowledge, this is one of the first research studies that provides valuable insights into how experience moderates the relationship between techno-stress dimensions and physiological strain. More importantly, it challenges the assumption that experience always mitigates techno-stress effects, revealing a more complex relationship between experience levels, stressors, and physiological strain. The findings indicate that techno-complexity and techno-insecurity significantly moderate physiological strain, suggesting that as employees gain experience, their ability to cope with these stressors changes. Specifically, techno-complexity exerts a stronger influence on physiological strain among employees with greater experience, possibly due to the cumulative cognitive burden associated with adapting to complex technologies over time. This finding is consistent with Ficapal-Cusi et al.'s (2024) study, which indicated that more experienced workers exhibited greater levels of techno-complexity. Additionally, some skills and experience may become obsolete, particularly in rapidly changing environments. As a result, individuals may face increased techno-complexity and the consequent strain.

In contrast, techno-insecurity has a more pronounced effect on employees with less than three years of experience, suggesting that newer employees feel more vulnerable to technological changes and fear obsolescence, which in turn heightens their physiological strain.

Conversely, techno-overload, techno-invasion, and techno-uncertainty do not exhibit significant moderation effects, indicating that their impact on physiological strain remains relatively stable across different experience levels. This suggests that excessive workload due to technology (techno-overload), perceived intrusion of technology into personal space (techno-invasion), and uncertainty about future technological changes (techno-uncertainty) impose consistent physiological strain regardless of an employee's experience. These findings emphasize the need for targeted interventions to mitigate the effects of techno-stress.

Overall, this study offers a nuanced understanding of the interplay between techno-stressors and physiological strain, underscoring the need for targeted organizational strategies (Mushtaq et al., 2017) to mitigate the negative physical consequences of technology-induced stress.

## **6. Implications**

### **6.1. Theoretical Implications**

This study significantly contributes to the techno-stress literature by being one of the first to examine the relationship between five key techno-stressors—techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty—and physiological strain. Additionally, this research offers novel insights that refine and extend the foundational techno-stress model (Tarafdar et al., 2007) and explain how employees' experience levels influence the impact of techno-stressors on physiological strain. Theoretically, this research advances the techno-stress literature by integrating Person-Environment (P-E) Fit theory to understand the multidimensional impact of techno-stress on physiological strain. The current study also demonstrated that techno-stress is not only a psychological and behavioural phenomenon but also a critical factor affecting employees' physical health (Tarafdar et al., 2019). The study presents a novel perspective on the detrimental effects of technology in the workplace, particularly validating the adverse effects of techno-stress on the physical health of

employees, which have been largely overlooked in previous techno-stress literature (Borle et al., 2021; Marsh et al., 2022).

By incorporating experience as a moderating factor, this study provides new theoretical insights into the stressors-strain relationship. While prior studies have primarily examined the direct impact of techno-stressors on cognitive and emotional outcomes (Ayyagari et al., 2011; Ragu-Nathan et al., 2008), our findings reveal that employees' experience levels shape their physiological responses to techno-stressors in different ways. These findings challenge the assumption that experience always mitigates the effects of techno-stress. Instead, the results suggest that certain stressors, such as techno-overload and techno-invasion, exert a relatively stable strain across all experience levels, indicating that some technological demands remain universally challenging, regardless of the level of experience. This advances our understanding of person-environment misfit by highlighting that while some stressors may become easier to manage with experience, others persist as fundamental stressors within digital work environments.

Finally, the study's findings have implications for the ongoing discourse on digital transformation (Jyoti et al., 2025; Mahajan, 2024). As organizations increasingly integrate digital technologies, understanding the physiological risks associated with techno-stress becomes essential for designing human-centric work environments. This research, therefore, lays the groundwork for future studies to investigate coping mechanisms, resilience factors, and intervention strategies that can mitigate the physiological effects of techno-stress, fostering a more sustainable digital workplace.

## **6.2. Practical Implications**

This study provides valuable insights into the physiological consequences of techno-stressors and the moderating role of employee experience in impacting the relationship. The study offers actionable recommendations for managers, employees, and society. Addressing these implications is crucial for creating a healthier and more sustainable digital work environment.

### **Implications for Managers**

Managers are crucial in mitigating the physiological risks associated with techno-stress by optimizing workload distribution and implementing digital ergonomics. Given that techno-overload significantly contributes to physical strain across all experience levels, organizations must reassess workload management strategies to ensure that technology enhances efficiency rather than imposing excessive cognitive and physical demands. Integrating automated systems, reducing redundant digital interactions, and setting realistic technology-related performance expectations can help alleviate the burden on employees.

The study highlights that techno-complexity has the strongest impact on physiological outcomes, particularly for more experienced employees. This highlights the importance of developing and implementing continuous, adaptive training programs that enhance employees' technological proficiency over time. Rather than assuming that experienced employees can adapt naturally, organizations should provide structured, role-specific training that evolves alongside technological advancements. Offering refresher courses, simplifying digital workflows, and ensuring access to intuitive technological systems can significantly reduce stress-related physical symptoms. Investing in technology onboarding for new employees and advanced digital literacy programs for experienced professionals can prevent frustration and prolonged physiological strain.

The findings further emphasize that techno-invasion disrupts work-life balance, with its effects remaining stable across experience levels. To counter this, organizations must establish clear boundary management policies, such as restricting work-related communication outside office hours and promoting asynchronous communication where possible. Implementing a "right to disconnect" policy can ensure that employees have sufficient recovery time, ultimately preventing the negative physiological effects of constant technological intrusion. These policies should be flexible, considering that employees with more experience may have different digital work habits from those early in their careers.

Additionally, managers should prioritize occupational health interventions to mitigate the impact of techno-stress on employees' well-being. Collaborating with occupational health experts to introduce workplace wellness initiatives, such as posture correction training, scheduled screen breaks, and

regular health assessments, can help employees manage physiological strain effectively. Encouraging an ergonomic workplace setup and integrating wellness programs into daily work routines can contribute to a healthier and more sustainable digital work culture. Since experience influences on employees' reaction to techno-stress, wellness programs should be customized to address varying needs, ensuring that both new and experienced employees receive appropriate support.

### **Implications for Employees**

Employees must adopt proactive strategies to regulate their technology use and safeguard their physical health from the detrimental effects of techno-stress. Since the study shows that techno-insecurity affects less-experienced employees more severely, early-career professionals should actively seek training and mentorship opportunities to build confidence in navigating workplace technologies. Self-regulation techniques, such as setting technology-free hours, disabling non-essential notifications, and practicing digital detox routines, can help minimize the negative impact of techno-invasion on work-life balance. Creating structured boundaries around technology use can prevent prolonged stress and ensure adequate recovery periods.

Since physical strain is a key outcome of prolonged digital exposure, employees should prioritize ergonomic work practices to prevent musculoskeletal discomfort. Maintaining proper posture, using wrist and lumbar support, adjusting screen brightness, and engaging in regular stretching exercises can alleviate the physical symptoms of techno-stress. Organizations should encourage employees to take micro-breaks to reduce eye strain and prevent prolonged static postures. Experienced employees, who are more likely to face cumulative techno-complexity stress, should be particularly mindful of incorporating physical movement into their daily routines to counteract chronic strain.

Since techno-complexity was found to have an increasing impact on experienced employees, employees at all career stages should engage in continuous learning to enhance their technological literacy. Attending training sessions, utilizing self-paced learning platforms, and seeking peer support for technology-related challenges can reduce the frustration and stress associated with complex digital systems. For early-career employees, structured learning programs can help ease initial adjustment stress, while for experienced employees, ongoing skill development can prevent cognitive overload caused by increasingly complex systems. Improved digital competency can foster confidence and reduce the likelihood of experiencing physical symptoms related to techno-stress.

To further mitigate the adverse physiological effects of techno-stress, employees should incorporate stress management techniques (Matin et al., 2014) into their daily routines. Engaging in mindfulness exercises, deep breathing practices, and physical activities, such as yoga or walking, can help counteract the physical toll of prolonged digital exposure. Practicing these techniques regularly can reduce tension, improve focus, and enhance overall well-being in technology-intensive work environments. Given that employees with higher experience levels may develop accumulated strain over time, long-term stress management interventions should be emphasized in workplace wellness programs.

### **Implications for Society**

Public health awareness initiatives should be introduced at a societal level to highlight the physiological risks associated with excessive technology use. As this study demonstrates that techno-stress affects employees differently based on experience, public campaigns should be tailored to different workforce segments, ensuring that both newly hired and seasoned professionals are educated on effective coping mechanisms. Campaigns similar to those addressing sedentary lifestyles and screen fatigue should educate individuals on the physical consequences of techno-stress and encourage preventive measures such as ergonomic workspace setups, digital detox routines, and regular physical activity. Society can cultivate a more health-conscious approach to technology use by raising awareness.

Regulatory frameworks should also be developed to promote digital well-being in professional settings. Policymakers should introduce guidelines mandating ergonomic workplace standards, setting reasonable screen-time limits, and holding employers accountable for employees' digital health. Legislative interventions can ensure that organizations implement best practices to protect employees from the long-term health risks of prolonged technological exposure. Given the study's findings on differential stress responses, policymakers should consider experience-based guidelines, such as mentorship requirements for new employees and digital fatigue assessments for experienced workers.

Community-level interventions should be incorporated into educational institutions and public spaces to promote digital wellness from an early stage. Schools, universities, and community centers should integrate digital literacy programs that emphasize the importance of balancing technology use with physical well-being. Educational institutions should also prepare students for workplace technological challenges by incorporating training that aligns with industry demands, reducing early-career techno-insecurity. Teaching individuals how to engage with technology mindfully and responsibly can create long-term benefits for workforce sustainability and public health.

Furthermore, technology companies should adopt sustainable and human-centered design principles in the development of digital tools and platforms. Designing user-friendly interfaces, reducing unnecessary complexity, and integrating built-in reminders for posture correction and screen breaks can enhance user experience while mitigating the negative physiological effects of excessive technology use. A shift towards ergonomically conscious technological innovations can create a more sustainable and health-conscious digital ecosystem. Companies should also consider designing adaptive digital interfaces that cater to users' experience levels, ensuring that both novice and expert users can interact with technology in an efficient and stress-free manner.

By implementing these practical measures, managers, employees, and society can collectively address the physiological risks of techno-stress, recognizing that experience moderates its effects. A balanced and sustainable approach to technology use requires customized interventions that acknowledge how employees' levels of experience shape their ability to manage techno-stress.

## **7. Limitations And Future Research Directions**

While this study contributes to the understanding of techno-stress and its physiological strain, it has certain limitations that warrant consideration. First, the cross-sectional design limits the ability to establish causal relationships between techno-stressors and physiological strain. Future research could adopt longitudinal or experimental designs to better capture the temporal dynamics and causal pathways of these relationships. Second, the study primarily focuses on techno-stressors and their direct impact on physiological strain, without exploring potential mediators. Future studies could investigate variables such as coping mechanisms, organizational support, and individual traits, such as resilience, psychological empowerment (Hosseini et al., 2024), and psychological capital, that may influence the strength or direction of these relationships. Third, the research relies on self-reported data, which may introduce common method bias or social desirability effects. Future research could incorporate objective measures, such as physiological data (e.g., heart rate variability or sleep tracking), to validate and complement self-reported findings. Lastly, as technology continues to evolve rapidly, future research should examine emerging stressors associated with advancements such as artificial intelligence, machine learning, and remote work systems. This would ensure the continued relevance of techno-stress research in addressing the challenges of an increasingly digital workplace.

## **8. Conclusion**

This study offers novel insights by being among the first to highlight the significant impact of techno-stressors—techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty—on employees' physiological strain, while also demonstrating the moderating role of experience in shaping these effects. The findings reveal that while some physiological strains persist across experience levels, others, such as those related to techno-complexity and techno-insecurity, disproportionately affect employees at different career stages. This challenges the assumption that experience always mitigates techno-stress, underscoring the need for targeted interventions based on employees' experience levels. By empirically demonstrating that techno-stressors extend beyond psychological and behavioral outcomes to influence physical health, the research enriches the techno-stress literature and emphasizes the critical need to address the holistic effects of technology-related stress in the workplace. While this research offers valuable insights, it also opens avenues for further exploration into coping mechanisms, moderating factors, and the evolving stressors of rapidly advancing technologies. By addressing these challenges, future studies can build on this work to develop more effective strategies for enhancing employee well-being in the technology-dominant era.

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