The Effects of Technostress and Safety Climate on Technological Productivity: The Moderating Role of Perceived Organizational Support[1]

Teknostres ve Güvenlik İkliminin Teknoloji Verimliliği Üzerindeki Etkisi: Algılanan Örgütsel Desteğin Düzenleyici Rolü

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Abstract

This study aims to address an important gap in the literature by examining the effects of technostress and safety climate on employees' technological productivity and by evaluating the moderating role of perceived organizational support in these relationships. Analyses conducted on survey data collected from 425 employees working in the defense industry reveal that technostress has a significant negative effect on technological productivity, whereas safety climate has a positive effect on technological productivity. The findings further indicate that perceived organizational support moderates the relationship between safety climate and technological productivity, strengthening the positive impact of safety climate on technological productivity. However, perceived organizational support does not exhibit a significant moderating effect on the relationship between technostress and technological productivity. By examining technostress, safety climate, and perceived organizational support—constructs that are rarely addressed together in the literature—within an integrated framework, this study contributes to a more comprehensive understanding of technological productivity. Furthermore, its focus on the defense industry, characterized by high-technology intensity and high reliability requirements, fills an important gap in the literature and provides actionable insights for improving employee well-being, safety, and technological productivity.

Keywords: Technostress, Safety Climate, Technological Productivity, Perceived Organizational Support

Özet

Bu çalışma, literatürdeki önemli bir boşluğu gidermeyi amaçlayarak teknostres ve güvenlik ikliminin çalışanların teknoloji verimliliği üzerindeki etkilerini incelemekte ve algılanan örgütsel desteğin bu ilişkilerdeki düzenleyici rolünü değerlendirmektedir. Savunma sanayinde görev yapan 425 çalışandan elde edilen anket verileri üzerinde gerçekleştirilen analizler, teknostresin teknoloji verimliliğini anlamlı ve olumsuz yönde etkilediğini, güvenlik ikliminin ise teknoloji

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verimliliği üzerinde pozitif bir etkiye sahip olduğunu ortaya koymaktadır. Bulgular ayrıca algılanan örgütsel desteğin, güvenlik iklimi ile teknoloji verimliliği arasındaki ilişkiyi düzenleyerek güvenlik ikliminin teknoloji verimliliği üzerindeki olumlu etkisini güçlendirdiğini göstermektedir. Diğer yandan, algılanan örgütsel desteğin teknostres ile teknoloji verimliliği arasındaki ilişkide anlamlı bir düzenleyici etkisi bulunmamıştır. Teknostres, güvenlik iklimi ve algılanan örgütsel destek gibi literatürde nadiren birlikte ele alınan kavramları bütüncül bir çerçevede inceleyen bu araştırma, teknoloji temelli verimliliğin daha kapsamlı biçimde anlaşılmasına katkı sağlamaktadır. Yüksek teknoloji ve yüksek güvenilirlik gereksinimleriyle karakterize edilen savunma sanayine odaklanması ise literatürde önemli bir boşluğu doldurmakta, ayrıca çalışan refahı, güvenliği ve çalışanın teknoloji verimliliğinin geliştirilmesine yönelik uygulanabilir çıkarımlar sunmaktadır.

Anahtar kelimeler: Teknostres, Güvenlik İklimi, Teknoloji Verimliliği, Algılanan Örgütsel Destek

Introduction

The rapid technological advancements of the contemporary era have fundamentally reshaped organizational structures, business processes, and the nature of work itself. As digitalization becomes a central driver of competitive advantage, organizations increasingly rely on sophisticated technological systems to streamline operations, enhance production efficiency, and access global markets. Yet, while these developments provide substantial strategic opportunities, they simultaneously introduce complex challenges for employees. The relentless pace of technological change often exceeds individuals' adaptive capacities, giving rise to psychological and behavioral strain (Alam, 2016; Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007).

Within this context, technostress—defined by Brod (1984) as the strain experienced in response to information technologies—has emerged as an unavoidable dimension of modern organizational life. Technostress may arise from factors such as information overload, constant connectivity, rapid system updates, and pressure to acquire new digital competencies. These stressors are closely associated with detrimental outcomes including burnout, job dissatisfaction, and diminished performance (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008; Tarafdar et al., 2007; Saeed, Xigen, Ahmad, Dukhaykh, & Khan, 2025; Oliveira Malaquias & Souza Júnior, 2026). As employees experience greater fatigue, lower motivation, and reduced work effectiveness, their ability to utilize technological systems efficiently declines, which may ultimately undermine organizational

productivity and long-term sustainability (Tu, Rao, Jiang, & Dai, 2025; Malik, Ali, Malik, & Malik, 2025).

As organizations navigate this digital transformation, perceived organizational support (POS) has become an increasingly salient mechanism for buffering the adverse effects of technological demands (Harunavamwe, Ward, & Marange, 2025; Solís, Lago-Urbano, & Real Castelao, 2023; Kasad & Jaber, 2025). POS reflects employees' beliefs regarding the extent to which their organization values their contributions, prioritizes their well-being, and provides adequate resources (Eisenberger, Huntington, Hutchison, & Sowa, 1986). Grounded in social exchange theory (Blau, 1964; Coyle-Shapiro & Conway, 2005), high levels of perceived support foster positive employee attitudes, enhance commitment, and strengthen coping responses in stressful work environments. Accordingly, organizational support may be critical in mitigating the negative consequences of technostress and sustaining employee performance during periods of technological change.

Technological transformation also introduces new occupational risks, extending the conversation beyond psychological strain to include concerns about workplace safety. Here, the concept of safety climate, defined as employees' shared perceptions of safety-related policies, practices, and priorities (Zohar, 1980), plays an essential role. A strong safety climate enhances employees' sense of physical and psychological security, contributing to improved attention, motivation, and ultimately, greater productivity (Dedobbeleer & Beland, 1991).

Although prior studies have examined technostress, perceived organizational support, and safety climate in different contexts (Alam, Sagheem, & Hassan, 2025; Ismail, Abdelhamid, Khalil, & Abdelsalam, 2023; Gulo & Sihombing, 2024; Mutegi, Joshua, & Kinyua, 2023; Solís et al., 2023; Maipita, Rahman, Husrizal, & Sagala, 2023; Zhang, Wang, Su, Zhang, Sun, & Yuan, 2024.), these constructs have generally been investigated separately, with limited research examining their combined influence on employee productivity. This limitation appears particularly relevant in high-technology sectors, where employees operate in environments characterized by intensive technology use, continuous digital adaptation, and high-performance expectations (Alam, 2016; Harunavamwe et al., 2025; Saeed et al., 2025). Despite these characteristics, empirical evidence from defense industry settings remains scarce. Therefore, understanding how employees navigate technological pressures within such settings is essential for both scholarly advancement and organizational policy development.

In response to these gaps, the present study examines the relationships among technostress, safety climate, and POS in the defense industry and investigates how these variables collectively shape employees' technological productivity. By focusing on an underexplored yet strategically critical sector, this research aims to contribute to organizational behavior literature and support the design of evidence-based practices that enhance both employee well-being and technological productivity.

Theoretical Background and Hypotheses

Technostress and Technological Productivity

Technostress has become a significant occupational stressor as digital technologies increasingly permeate organizational life. Initially defined by Brod (1984) as a maladaptive response to computer technologies, technostress reflects the psychological strain experienced when individuals struggle to cope with technological demands. Expanding this perspective, Tarafdar et al. (2007) conceptualized technostress as an organizational phenomenon arising from continuous technological change and identified five key dimensions, which are briefly described below:

Techno-overload: Refers to situations where technology forces users to work faster and longer.

Techno-invasion: Describes scenarios in which users feel they are constantly connected or reachable, blurring the boundaries between work and personal life.

Techno-complexity: Occurs when users perceive themselves as lacking the necessary skills due to the complexity of the technology.

Techno-insecurity: Involves employees feeling threatened by the fear of being replaced by new technologies or by colleagues who are more technologically adept.

Techno-uncertainty: Describes the discomfort users experience due to the continuous and unpredictable changes in technology.

The pervasive use of mobile and communication technologies has blurred work–life boundaries, increased expectations of constant availability, and intensified perceived surveillance, thereby elevating stress levels (Tarafdar et al., 2007; Mordi, Akanji, & Ajonbadi, 2026). Additionally, frequent technological updates and increasing system complexity impose continuous learning demands on employees, often leading to fatigue, anxiety, and information overload (Fisher & Wesolkowski, 1999; Weil & Rosen, 1997; Malik et al., 2025). These conditions

place substantial cognitive strain on individuals and may hinder effective task performance.

Previous research has consistently associated technostress with adverse organizational outcomes, including reduced job satisfaction, lower performance and productivity, weakened organizational commitment, and negative health consequences (Alam, 2016; Chen, 2015; Ragu-Nathan et al., 2008; Tu et al., 2025; Oliveira Malaquias & Souza Júnior, 2026).

Productivity, defined as the efficient use of resources to achieve desired outputs (Drucker, 1977), is increasingly shaped by technological advancements, particularly information and communication technologies (Saeed et al., 2025; Oliveira Malaquias & Souza Júnior, 2026). Contemporary organizations rely on these technologies to improve efficiency, facilitate communication, support decision-making, and optimize work processes. Consequently, employees' ability to adapt to and effectively use technological systems has become an important determinant of both individual and organizational productivity (Torkzadeh & Doll, 1999; Cardona, Kretschmer, & Strobel, 2013).

The relationship between technostress and technological productivity can be explained through Conservation of Resources (COR) Theory and Socio-Technical Systems Theory. COR Theory posits that stress occurs when individuals perceive a threat to their personal resources or are unable to meet environmental demands (Hobfoll, 1989). In technology-intensive workplaces, employees confronted with technological complexity, rapid change, or continuous learning requirements may experience resource depletion, leading to burnout and reduced productivity (Hobfoll, Halbesleben, Neveu, & Westman, 2018; Tu et al., 2025). Socio-Technical Systems Theory similarly emphasizes that imbalances between technological structures and social processes—such as those arising from technological disruptions—can undermine collaboration and negatively affect performance (Scott, Mitchell, & Birnbaum, 1981). Drawing on these theoretical perspectives, the productivity-reducing effects of technostress can be understood through several interrelated mechanisms.

The dimensions of technostress may impair productivity through several interrelated mechanisms. Techno-overload increases cognitive demand and time pressure, making it more difficult for employees to process information effectively. Techno-complexity and techno-uncertainty require continuous learning and adaptation, which can consume employees' cognitive and emotional resources. Similarly, techno-invasion blurs the boundaries between work and personal life, reducing opportunities for recovery and increasing fatigue, while techno-

insecurity may generate anxiety regarding job continuity and technological competence. Collectively, these conditions can reduce concentration, decision quality, and task effectiveness, thereby undermining productivity.

Numerous studies have demonstrated the adverse consequences of technostress, including decreased job performance (Azam, Abidin, Yusof, Emang, & Entigar, 2014; Valiao, 2025), low job satisfaction (Suh & Lee, 2017), increased role stress (Tarafdar et al., 2007), burnout (Zhao, Wang, Wu, & Dong, 2022; Tu et al., 2025), and turnover intention (Tu, Wang, & Shu, 2005; Siddiqi & Rahman, 2026). Tarafdar et al. (2007) found that technostress reduces employee productivity through role stress. Similarly, Alam (2016) reported that in the aviation sector, technostress, along with role overload and sensitivity to fairness, exacerbates productivity loss. Tu et al. (2005) argued that technostress not only reduces productivity but also increases turnover intention, highlighting the importance of training, communication, and support mechanisms to mitigate its effects.

In this context, even when technology is employed with the aim of enhancing productivity, the technostress experienced by employees may undermine overall technology productivity.

Accordingly, this study proposes the following hypothesis:

Hypothesis 1: Technostress negatively affects technological productivity.

Safety Climate and Technological Productivity

Safety climate, first introduced by Zohar (1980), refers to employees' shared perceptions of safety-related policies, practices, and managerial commitment within the workplace. Research has consistently shown that a positive safety climate is associated with fewer workplace accidents, as well as lower levels of stress and anxiety related to work conditions (Clarke, 2006; Mearns, Whitaker, & Flin, 2003).

Safety climate reflects the extent to which organizations prioritize employee well-being through leadership practices, communication, and formal safety procedures (Zohar, 2014). From a Social Exchange Theory perspective (Blau, 1964), employees who perceive strong organizational concern for their safety are more likely to reciprocate with higher engagement and performance. In technology-intensive work environments, such supportive conditions can facilitate employees' adaptation to new technologies, thereby enhancing technological productivity.

Similarly, Expectancy Theory (Vroom, 1964) suggests that employees' motivation to achieve organizational goals is influenced by their expectations regarding the relationship between effort and performance. A positive safety climate may therefore strengthen employees' confidence in using advanced technologies safely and effectively, reduce uncertainty regarding technology use, and encourage more effective utilization of these technologies, ultimately contributing to higher technological productivity.

Empirical evidence supports these arguments, demonstrating that favorable organizational climate factors, including safety climate, are positively related to employee performance and productivity (Patterson, Warr, & West, 2004; Mutegi, Joshua, & Kinyua, 2023; Obananya, 2025). Although occupational health and safety initiatives may appear costly in the short term, research indicates that they enhance long-term organizational effectiveness by strengthening social capital and improving productivity outcomes (Lanoie & Tavenas, 1996; Sabharwal, Kiel, & Hijal-Moghrabi, 2019).

In this context, a positive safety climate is expected to contribute to employees' effective use of workplace technologies and increase technological productivity.

Accordingly, the following hypothesis is proposed:

Hypothesis 2: Safety climate positively affects technological productivity.

POS as a Moderator Between Technostress and Technological Productivity

POS refers to employees' beliefs that their organization values their contributions and cares about their well-being (Eisenberger et al., 1986). Grounded in Social Exchange Theory (Blau, 1964) and the Norm of Reciprocity (Gouldner, 1960), POS suggests that employees reciprocate perceived organizational care with higher commitment, effort, and engagement (Rhoades & Eisenberger, 2002).

Extensive research has shown that POS is positively associated with job satisfaction, organizational commitment, performance, and work engagement, while negatively related to turnover intention (Du, Zhang, & Tekleab, 2018; Zhang, Qiu, & Teng, 2017; Başer, Büyükbeşe, & Ivanov, 2025). POS also strengthens organizational identification and employees' sense of obligation toward the organization (Ashforth & Mael, 1989; Anderson et al., 2025).

In technology-intensive work environments, POS may play a critical role in shaping employees' responses to technostress. Drawing on the stress-buffering model (Cohen & Wills, 1985), organizational support reduces the harmful effects of stress by providing psychological, informational, and instrumental resources. High levels of POS can therefore mitigate the negative impact of technostress and

help sustain employees' technological productivity (George, Reed, Ballard, Colin, & Fielding, 1993; Loi, Olivia, & Xu, 2014; Harunavamwe et al., 2025).

In the present study, POS is expected to function as a contextual resource that influences how employees respond to technology-related demands. Employees exposed to similar levels of technostress may not experience the same productivity outcomes, as their ability to cope with technological challenges may depend on the degree of organizational support available to them. When employees perceive high levels of organizational support, they are more likely to access informational, emotional, and instrumental resources that facilitate adaptation to technological demands. Consequently, POS is expected not to eliminate technostress itself, but rather to weaken its detrimental effect on technological productivity.

Indeed, there is substantial empirical evidence in the literature demonstrating the moderating effect POS on stress (Lai, Hossin, Li, Wang, & Hosain, 2022; Fathy Saad & Mohamed Abd Rabou, 2023). Furthermore, studies by Malik and Noreen (2015) and Jain, Giga and Cooper (2013) have shown that organizational support plays a moderating role in the relationship between stress and various organizational outcomes.

Accordingly, it is proposed that POS may serve as a moderator that weakens the negative impact of technostress on technological productivity. Based on this perspective, the following hypothesis is developed:

Hypothesis 3: Perceived organizational support weakens the negative relationship between technostress and technological productivity.

POS as a Moderator Between Safety Climate and Technological Productivity

Safety climate, a sub-dimension of organizational climate, represents employees' shared perceptions regarding the priority placed on safety within the organization (Griffin & Neal, 2000; Zohar, 1980). A positive safety climate fosters safe work behaviors, whereas negative perceptions heighten vulnerability to accidents and undermine job satisfaction (Gyekye, 2005).

Employees' evaluations of the safety climate are also influenced by their beliefs about the degree to which the organization values and supports them. POS, defined as employees' perceptions that the organization appreciates their contributions and cares about their well-being (Eisenberger et al., 1986), is rooted in Social Exchange Theory (Blau, 1964). When employees perceive organizational actions as genuine and discretionary, they tend to reciprocate with higher commitment and positive work behaviors (Rhoades & Eisenberger, 2002).

Supportive organizational safety practices play a significant role in shaping safety climate perceptions. Studies indicate that when safety policies are viewed as sincere and employee-centered, they enhance employees' sense of safety and trust (DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004; Michael, Evans, Jansen, & Haight, 2005). Empirical research further shows that POS is positively associated with safety climate perceptions at both individual and group levels (Gyekye & Salminen, 2007; Wallace, Popp, & Mondore, 2006; Soerjoatmodjo, 2025). Moreover, employees who perceive high organizational support are more willing to communicate about safety issues and provide safety-related suggestions, thereby contributing to the strengthening of the safety climate (Hofmann & Morgeson, 1999).

A strong safety climate may enhance technological productivity by promoting attentiveness, orderly technology usage, and a heightened sense of security in technology-intensive environments. However, the extent to which these benefits translate into higher levels of productivity may depend on contextual factors such as perceived organizational support.

POS may strengthen the positive influence of safety climate on technological productivity by enhancing employees' trust in organizational practices and increasing their willingness to engage with organizational objectives. In technology-intensive environments, a positive safety climate provides guidance and structure for the safe and effective use of technological systems. However, the extent to which employees embrace and translate these safety-related norms into productive work behaviors may depend on the level of organizational support they perceive. When POS is high, employees are more likely to view safety initiatives as a genuine reflection of organizational concern for their well-being, fostering stronger commitment, greater compliance with safety procedures, and more effective utilization of technological systems. As a result, the positive relationship between safety climate and technological productivity is expected to be stronger under conditions of high perceived organizational support. Based on this theoretical reasoning, the following hypothesis is proposed:

Hypothesis 4: Perceived organizational support strengthens the positive relationship between safety climate and technological productivity.

The research model developed on the basis of the theoretical framework, the reviewed literature, and the proposed hypotheses is presented in Figure 1.

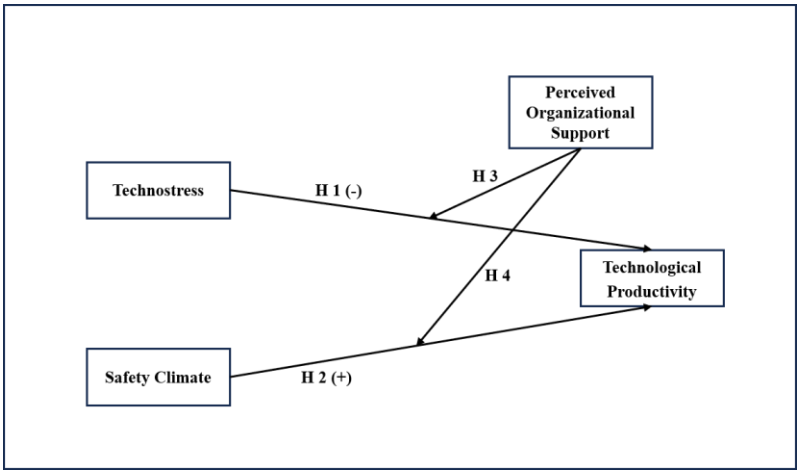


Figure 1. Research Model

Methodology

Participants

Given the technology-intensive nature of the study variables, the research population consists of employees working in defense industry organizations located in Ankara. The defense industry provides a particularly relevant context for examining technostress, safety climate, perceived organizational support, and technological productivity because employees operate in environments characterized by advanced technological systems, continuous digital adaptation, strict operational requirements, and high reliability expectations. In such settings, technostress may be more pronounced due to the complexity and rapid evolution of technologies, while a strong safety climate becomes critical because even minor errors can have substantial operational and safety consequences. Similarly, perceived organizational support may play an important role in helping employees cope with demanding work conditions and maintain effective technology use. Since organizational performance in the defense sector largely depends on employees' ability to utilize sophisticated technologies accurately, safely, and efficiently, technological productivity represents a strategically important outcome. Therefore, the defense industry offers an appropriate and theoretically meaningful setting for investigating the relationships among these variables.

It has been estimated that approximately 45,000 personnel are employed in defense industry firms based in Ankara (Capital, 2024; SASAD, 2023). According to the sample size calculation formula for quantitative research with multiple

variables, the ideal sample size was calculated as 381 based on a 95% confidence level and a 5% margin of error. (Bartlett, Kotrlik, & Higgins, 2001). Considering a potential non-response or incomplete response rate of 20%, the sample size was adjusted accordingly (381 / 0.80 = 476), and thus administering the survey to 500 participants was deemed sufficient. A total of 500 questionnaires were distributed, with 436 completed responses returned. After excluding 11 incomplete questionnaires, data from 425 participants were included in the final analysis.

Table 1. Demographic Characteristics

Sample N=425	Groups	Freq.	%	Sample N=425	Groups	Freq.	%
Sex	Male	326	76.7	**Job Position**	Manager	88	20.7
	Female	99	23.3		Engineer	159	37.4
	Total	425	100		Technician	73	17.2
Age	20-25	22	5.2		Worker	97	22.8
	26-30	24	5.6		Other	8	1.9
	31-35	33	7.8		Total	425	100
	36-40	41	9.6	**Work Experience**	1-5 years	71	16.7
	41-45	95	22.4		6-10 years	38	8.9
	46-50	162	38.1		11-15 years	67	15.8
	51 and above	48	11.3		16-20 years	80	18.8
	Total	425	100		21 years and above	169	39.8
Education Level	High School	36	8.5		Total	425	100
	Associate Degree	138	32.5	**Technology Competency Level**	Very Incompetent	0	0
	Bachelor's Degree	177	41.6		Incompetent	4	0.9
	Graduate Degree	74	17.4		Moderately Competent	114	26.8
	Total	425	100		Competent	231	54.4
					Very Competent	76	17.9
					Total	425	100

Detailed information regarding the demographic characteristics of the participants is presented in Table 1. When examining the age distribution of the participants, the largest group fell within the 46–50 age range, accounting for 38% of the sample. Of the sample, 76.7% were male and 23.3% were female. In terms of educational attainment, most participants held a bachelor's degree (41.6%). Engineers represented the largest occupational group, accounting for 37.4% of the sample. Regarding work experience, 39.9% reported having 21 or more years of work experience. With respect to technology competency, 17.9% of participants rated themselves as 'very competent,' 54.4% as 'competent,' 26.8% as 'moderately competent,' and 0.9% as 'incompetent. Technology competence was measured using a single self-assessment item. Participants were asked to evaluate their level of competence in using technology by selecting one of five response categories: very incompetent, incompetent, moderately competent, competent, and very competent.

Measures

The survey instrument consisted of five sections and a total of 57 items, covering demographic characteristics, technostress, safety climate, POS, and technological productivity. The ethical approval for the study was obtained from the Ethics Committee of Ankara Yıldırım Beyazıt University, dated 20 March 2024 and numbered 02-299.

Technostress

To measure employees' technostress levels in the defense industry, the 23-item Technostress Scale developed by Tarafdar et al. (2007) and adapted into Turkish by Ilgaz, Özgür, and Çuhadar (2016) was employed. The scale, structured on a 5-point Likert format, comprises five subdimensions: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. Previous studies reported satisfactory reliability with Cronbach's alpha values above 0.70.

To assess the construct validity of the Technostress Scale, Exploratory Factor Analysis (EFA) was conducted using Principal Component Analysis as the extraction method and Varimax rotation to enhance factor interpretability. Prior to the analysis, the suitability of the data for factor analysis was confirmed using the Kaiser-Meyer-Olkin (KMO = 0.772) measure of sampling adequacy and Bartlett's Test of Sphericity ($\chi^2 = 3459.148$; df = 190; $p < 0.001$). These results indicated that the data were appropriate for factor analysis and met the assumption of multivariate normality. Based on the factor analysis results, Items 4 and 16 were

found to cluster under a new factor that was not included in the original scale structure, while contributing only marginally to the explained variance. Furthermore, Item 13 demonstrated cross-loading tendencies, and Item 19 exhibited a factor loading below the acceptable threshold of 0.40. Consequently, these items were excluded from the scale. The remaining items loaded onto five distinct factors, with factor loadings ranging between 0.580 and 0.872 (see Table 2). The factor structure was largely consistent with the original scale, with the final five-factor solution accounting for 65.44% of the total variance, indicating satisfactory explanatory power. Confirmatory Factor Analysis (CFA) was then conducted. The initial model showed suboptimal fit indices (χ^2/df = 4.420; RMSEA = 0.090; CFI = 0.847; GFI = 0.865). After adding covariances, both first-order (five-factor) and second-order (single higher-order factor) models achieved acceptable fit, with the second-order model demonstrating superior fit (χ^2/df = 3.220; RMSEA = 0.071; CFI = 0.915; GFI = 0.928) (Byrne, 2011; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Tabachnick & Fidell, 2019).

Reliability analyses showed Cronbach's alpha values between 0.809 and 0.827 for subdimensions and 0.829 for the total scale. These values exceed the commonly accepted threshold of 0.70 (Hair, Black, Babin, & Anderson, 2018). Convergent validity was supported by Composite Reliability (CR) values exceeding 0.70 and Average Variance Extracted (AVE) values above 0.50, except for techno-invasion, which remained acceptable given CR > 0.60 (Fornell & Larcker, 1981; Shrestha, 2021). (see Table 2).

Safety Climate

To assess employees' perceptions of safety climate, the 14-item, two-dimensional Safety Climate Scale developed by Choudhry, Fang, and Lingard (2009) and adapted into Turkish by Türen, Gökmen, Tokmak, and Bekmezci (2014) was used. The scale is based on a 5-point Likert format. Previous studies reported Cronbach's alpha values above 0.80, indicating high reliability.

Table 2. Factor Loadings and Reliability Analysis

Scale	Factors	Factor Loadings	Cronbach's alpha (α)	CR	AVE
Technostress	Techno-overload	0.580-0.875	0.829	0.828	0.620
	Techno-invasion	0.622-0.790		0.815	0.472
	Techno-complexity	0.751-0.864		0.865	0.616
	Techno-insecurity	0.658-0.778		0.766	0.523
	Techno-uncertainty	0.695-0.872		0.888	0.666
Safety Climate	-	0.455-0.882	0.935	0.945	0.597
Perceived Organizational Support	-	0.573-0.901	0.938	0.948	0.650
Technological Productivity	-	0.862-0.939	0.921	0.945	0.811

EFA confirmed the construct validity of the scale (KMO = 0.911; Bartlett's Test: χ^2 = 3808.809; df = 66; p < 0.001). Based on the EFA conducted using Principal Component Analysis as the extraction method and Varimax rotation to enhance factor interpretability, Items 13 and 14 were removed due to cross-loadings, and the remaining items loaded onto a single factor with loadings between 0.455 and 0.882. The structure explained 59.74% of the total variance. CFA initially showed inadequate fit (χ^2/df = 9.561; RMSEA = 0.142; CFI = 0.878; GFI = 0.846), but model fit improved after adding suggested covariances, reaching acceptable levels (χ^2/df = 3.447; RMSEA = 0.076; CFI = 0.974; GFI = 0.951). The scale demonstrated high internal consistency (Cronbach's alpha=0.935). The CR value exceeds the threshold (0.7), and the AVE value is higher than the threshold (0.5), supporting adequate convergent validity (Fornell & Larcker, 1981; Hair et al., 2018). (see Table 2).

Perceived Organizational Support (POS)

To assess perceived organizational support, the 10-item scale originally developed by Eisenberger et al. (1986), shortened by Armstrong-Stassen and Ursel (2009), and adapted into Turkish by Turunç and Çelik (2010) was used. The scale, structured on a 5-point Likert format, has a unidimensional structure consistent with the original version.

The EFA conducted using Principal Component Analysis as the extraction method confirmed construct validity (KMO = 0.927; Bartlett's Test: χ^2 = 3420.562; df = 45; p < 0.001). Consistent with the original version of the scale, all items loaded on a single factor, with factor loadings ranging from 0.573 to 0.901.

The resulting one-factor structure explained 65.03% of the total variance. CFA initially showed suboptimal fit (χ^2/df = 10.621; RMSEA = 0.151; CFI = 0.901; GFI = 0.839). After adding suggested covariances, the model achieved acceptable fit indices (χ^2/df = 3.169; RMSEA = 0.026; CFI = 0.982; GFI = 0.959). Reliability analysis indicated excellent internal consistency (Cronbach's alpha = 0.938). The CR value exceeds the threshold (0.7), and the AVE value is higher than the threshold (0.5), supporting adequate convergent validity (Fornell & Larcker, 1981; Hair et al., 2018). (see Table 2).

Technological Productivity

To measure technological productivity levels, a unidimensional 4-item scale developed by Torkzadeh and Doll (1999), revised by Alam (2016), and adapted into Turkish by Türen and Erdem (2017) was used. The scale employs a 5-point Likert format.

The EFA conducted using Principal Component Analysis as the extraction method confirmed construct validity (KMO = 0.812; Bartlett's Test: χ^2 = 1395.740; df = 6; $p < 0.001$). Consistent with the original version of the scale, all items loaded on a single factor, with factor loadings ranging from 0.862 to 0.939. The resulting one-factor structure explained 81.08% of the total variance. CFA initially indicated poor fit (χ^2/df = 18.225; RMSEA = 0.202; CFI = 0.975; GFI = 0.958), but after adding one covariance, the model achieved acceptable fit indices (χ^2/df = 2.664; RMSEA = 0.063; CFI = 0.999; GFI = 0.997). The scale demonstrated excellent internal consistency (Cronbach's alpha = 0.921). The CR value exceeds the threshold (0.7), and the AVE value is higher than the threshold (0.5), supporting adequate convergent validity (Fornell & Larcker, 1981; Hair et al., 2018). (see Table 2).

Common Method Bias

Additionally, due to the cross-sectional design of the study for data collection, Harman's single-factor test was conducted to assess the presence of common method bias. The results indicated that the single factor accounted for 25.66% of the total variance. Since this value is below the threshold of 50%, it was concluded that common method bias is not a concern in this study (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Results

Correlation Analyses

A correlation analysis was conducted to examine the relationships among the variables. A summary of the correlation analysis results is presented in Table 3.

Table 3. Correlations

Variables	1	2	3	4
1.Technostress	1			
2.Safety Climate	- 0.151*	1		
3.Perceived Organizational Support	- 0.202*	0.601*	1	
4.Technological Productivity	- 0.192*	0.324*	0.376*	1

* p<0,01

According to the findings, there are weak but statistically significant negative correlations between technostress and technological productivity ($r = -0.192$, $p < 0.01$), technostress and POS ($r = -0.202$, $p < 0.01$), and technostress and safety climate ($r = -0.151$, $p < 0.01$). On the other hand, statistically significant positive correlations were found between safety climate and technological productivity ($r = 0.324$, $p < 0.01$), safety climate and POS ($r = 0.601$, $p < 0.01$), and POS and technological productivity ($r = 0.376$, $p < 0.01$).

Regression analyses

Hypothesis 1 and Hypothesis 2 were tested with hierarchical regression analysis by controlling for demographic variables, and the results are presented in Table 4. Prior to the analysis, one of the fundamental assumptions of regression - normality - was assessed using the Kolmogorov-Smirnov test. Since all variables had p-values greater than 0.05, they were determined to be normally distributed.

Within the scope of Hypothesis 1, Model 1 of the hierarchical regression analysis revealed that technostress had a significant effect on technological productivity ($F(1, 423) = 16.215$, $p < 0.001$), accounting for 3.7% of the variance in technological productivity ($R^2 = 0.037$). Accordingly, technostress was found to have a statistically significant negative effect ($\beta = -0.192$, $p < 0.001$).

Model 2, which included demographic variables, was also found to be significant ($F(7, 417) = 8.283$, $p < 0.001$), explaining 12% of the total variance in technological productivity ($R^2 = 0.122$). In this model as well, the negative effect of technostress remained significant ($\beta = -0.128$, $p < 0.05$). Consequently, Hypothesis 1 was statistically supported.

Within the scope of Hypothesis 2, in the first model, the effect of safety climate on technological productivity was found to be statistically significant ($F(1, 423) = 49.546$, $p < 0.001$). Safety climate accounted for approximately 10.5% of the variance in technological productivity ($R^2 = 0.105$) and had a positive and significant effect ($\beta = 0.324$, $p < 0.001$). Model 2, which included demographic variables as control variables, was also significant ($F(7, 417) = 13.252$, $p < 0.001$), with the explained variance increasing to 18% ($R^2 = 0.182$). In this model as well, safety climate continued to have a positive and statistically significant effect on technological productivity ($\beta = 0.277$, $p < 0.001$). Based on these findings, Hypothesis 2 was supported.

Table 4. Hierarchical Regression Results for Predictors of Technological Productivity

Variables	Technostress Model 1		Technostress Model 2		Safety Climate Model 1		Safety Climate Model 2	
	β	SE	β	SE	β	SE	β	SE
Technostress	-0.192**	0.051	-0.128*	0.055	-	-	-	-
Safety Climate	-	-	-	-	0.324**	0.033	0.277**	0,033
Age			0.075	0.029			0.048	0.028
Sex			0.048	0.062			0.022	0.059
Education Level			0.131	0.047			0.124	0.045
Job Position			-0.109	0.036			-0.095	0.035
Work Experience			-0.194*	0.031			-0.185	0.029
Tech. Competence			0.153*	0.042			0.157**	0.037
R^2	0.037		0.122		0.105		0.182	

Notes: Model 1 includes the main independent variable only. Model 2 includes control variables (age, sex, education level, job position, work experience, and technology competence).
* p<0,05 ** p<0,01

Moderation Analyses

To examine the moderating role of POS in the relationship between technostress and technological productivity, the SPSS Process Macro developed by Hayes (2013) was used. The analysis was conducted using Model 1 which tests interaction effects. A summary of the results is presented in Table 5.

The findings indicate that the overall model was significant ($F(3, 421) = 26.521$, $p < 0.001$), and that technostress and POS together explained 15.9% of the variance in technological productivity ($R^2 = 0.159$). However, the interaction

effect was not statistically significant (β = -0.074, p = 0.188). The fact that the confidence interval includes zero and that the change in explained variance (ΔR^2 = 0.003) was not statistically significant indicates that no moderating effect was present. Accordingly, Hypothesis 3 was not supported.

Table 5. Results Regarding the Moderating Effect of POS on the Relationship Between Technostress and Technological Productivity

Variables	β	SE	p	t	Confidence Interval	
					LLCI	ULCI
TS	-0.136	0.049	0.006	-2.775	-0.232	-0.040
POS	0.217	0.028	0.000	7.661	0.161	0.273
TSxPOS→TP	-0.074	0.056	0.188	-1.320	-0.184	0.036
R^2	0.159					

Notes: TS: Technostress, POS: Perceived Organizational Support, TP: Technological Productivity

The results of the analysis examining whether POS plays a moderating role in the relationship between safety climate and technological productivity are presented in Table 6. The findings of the analysis examining whether POS plays a moderating role in the relationship between safety climate and technological productivity indicate that the overall model is statistically significant ($F(3, 421) = 30.137$, $p < 0.001$). POS and safety climate together explain approximately 17.7% of the variance in technological productivity ($R^2 = 0.177$).

Furthermore, the interaction effect between safety climate and POS was found to be significant (β = 0.110, $p < 0.001$), confirming the moderating role of POS. The confidence interval not containing zero further supports this conclusion.

Table 6. Results Regarding the Moderating Effect of POS on the Relationship Between Safety Climate and Technological Productivity

Variables	β	SE	p	t	Confidence Interval	
					LLCI	ULCI
SC	0.154	0.042	0.000	3.685	0.072	0.236
POS	0.169	0.034	0.000	4.925	0.102	0.237
SCxPOS→TP	0.110	0.034	0.001	3.226	0.043	0.178
R^2	0.177					

Notes: SC: Safety Climate, POS: Perceived Organizational Support, TP: Technological Productivity

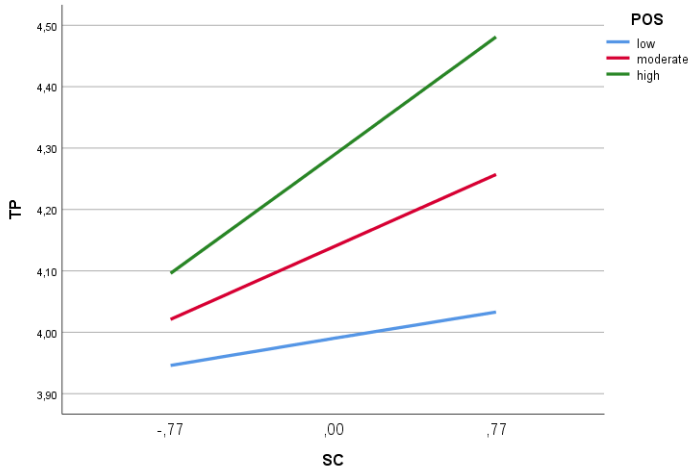


Figure 2. Graphical Representation of the Moderating Effect of POS

After controlling for demographic variables, the interaction effect remained significant (β = 0.113, t = 3.448, p < 0.005; LLCI = 0.047, ULCI = 0.179). According to the slope analysis, the effect of safety climate on technological productivity was significant at moderate (β = 0.154, p < 0.001) and high (β = 0.251, p < 0.001) levels of perceived organizational support, whereas this effect was not significant at low levels (β = 0.057, p = 0.182). The graphical analysis presented in Figure 2 supports these findings, indicating that the slope of the relationship between safety climate and technological productivity is steeper when perceived organizational support is high, suggesting a stronger effect.

In conclusion, POS was found to have a significant moderating role in the relationship between safety climate and technological productivity. Accordingly, Hypothesis 4 was supported.

Discussion

The primary objective of this study was to examine how technostress and safety climate influence technological productivity and to investigate the moderating role of POS within these relationships. As organizations increasingly rely on digital tools to enhance performance, understanding these dynamics is essential for managing the challenges and opportunities associated with technological transformation. The empirical findings offer important insights into the interplay between individual strain, organizational climate, and support systems in shaping employees' technology-related outcomes.

The findings provide support for Hypothesis 1, showing that technostress exerts a negative and direct effect on technological productivity. This aligns with prior research indicating that technology-induced overload, rapid technological change, and complexity reduce employees' ability to work efficiently (Alam, 2016; Tarafdar et al., 2007; Mat, Isa, Abdullah, & Alias, 2026; Tu et al., 2025; Ertaş, Kırlar-Can, Ceylan, & Kozak, 2026; La Torre, 2024). The finding is also consistent with recent evidence suggesting that technostress contributes to burnout, cognitive strain, and reduced work effectiveness in technology-intensive environments (Malik et al., 2025; Saeed et al., 2025). In sectors characterized by intensive technology use and high-performance expectations, employees may experience difficulties adapting to continuous technological demands, which can ultimately diminish productivity.

While the findings confirm the negative impact of technostress on technological productivity, the proportion of variance explained by technostress was relatively modest ($R^2 = 0.037$). This suggests that technological productivity is a multifaceted outcome influenced by a broader set of individual, technological, and organizational factors beyond technostress alone. Therefore, while technostress constitutes a risk factor for technological productivity, its influence should be interpreted as one component within a more complex network of determinants shaping employee performance in technology-intensive environments.

Drawing on Conservation of Resources (COR) Theory (Hobfoll, 1989), this finding can be interpreted as a resource depletion process: technology-induced demands such as overload, complexity, and constant updates drain employees'

cognitive and emotional resources, limiting their ability to work efficiently with digital systems. When individuals perceive that technology requires more resources than they can preserve or replenish, stress escalates and performance deteriorates.

This study further reinforces the argument that technostress does not merely represent discomfort or annoyance but functions as a significant performance inhibitor. Such effects may be especially pronounced in technologically intensive and safety-critical sectors, where mistakes or delays caused by stress can have amplified consequences. Overall, the results highlight the need for organizations to view technostress as a strategic issue—not only a psychological one—that directly influences technological productivity.

Consistent with Hypothesis 2, safety climate was found to have a positive and significant effect on technological productivity. This result positions safety climate as an important organizational resource that promotes effective engagement with technology. Guided by Social Exchange Theory (Blau, 1964) and the Norm of Reciprocity (Gouldner, 1960), employees who experience a supportive and safety-conscious organizational climate may feel obliged to reciprocate by engaging more carefully, confidently, and competently with technology. This collective reinforcement strengthens safe and productive technology use, demonstrating that safety climate is an important intangible resource that enhances digital performance.

A strong safety climate may reduce uncertainty and fear of error, encouraging employees to adopt new technologies more willingly. It may also cultivate shared expectations regarding safe and correct usage of digital tools, thereby facilitating smoother workflows and better performance. This finding extends existing research by suggesting that safety climate, traditionally linked to accident prevention and physical well-being, also has broader implications for digital performance and technology-related outcomes.

An additional finding concerns the effects of the control variables on technological productivity. Technological competence was positively associated with technological productivity, suggesting that employees who perceive themselves as more competent in using technology are better able to utilize technological systems effectively. This finding is consistent with previous research indicating that higher levels of technological competence and technology self-efficacy facilitate the effective use of digital systems and contribute positively to performance-related outcomes (Maipita et al., 2023; Saeed et al., 2025). Work experience showed a significant negative association with technological productivity in the technostress regression model, but this association was not

statistically significant in the safety climate regression model. Therefore, the relationship between total professional work experience and technological productivity should be interpreted in the context of the specific regression model. Age, sex, education level, and job position did not have statistically significant effects, suggesting that technological productivity may be more closely associated with technology-specific competencies than with demographic and professional characteristics.

Hypothesis 3 was not supported, indicating that POS does not mitigate the negative relationship between technostress and technological productivity. This contrasts with some earlier studies (Jain et al., 2013; Malik & Noreen, 2015; Kasad & Jaber, 2025; Kong, Wu, Zhang, & Huang, 2026) that suggest POS can buffer the adverse effects of workplace stress. A potential explanation is that technostress is predominantly a task-specific and cognitive strain, requiring targeted interventions—such as training, access to help-desk support, ergonomic system design, or improved digital workflows. General organizational support (e.g., recognition, care, appreciation), while valuable, may not directly alleviate the cognitive burden or technical frustrations that generate technostress. In other words, employees tend to rely more on individual and emotion-focused coping mechanisms when dealing with technostress. Existing literature suggests that coping strategies for technostress can differ at both individual and organizational levels (Wang, Shu, & Tu, 2008).

This finding contributes new insight by highlighting that not all forms of stress respond to general support mechanisms. Instead, technostress appears to require specialized, technology-focused solutions.

In contrast, Hypothesis 4 was supported, demonstrating that POS moderates the relationship between safety climate and technological productivity. This interaction aligns strongly with Social Exchange Theory and the Norm of Reciprocity, which posit that when employees perceive high levels of organizational care, fairness, and support, they reciprocate through greater compliance with organizational norms and stronger performance behaviors. When employees feel supported by their organization, the positive effects of a strong safety climate are amplified. POS may strengthen employees' trust in organizational priorities, reduce perceived risks involved in using digital systems, and increase motivation to follow safety-oriented technological practices. Employees who feel valued are more likely to internalize organizational norms, including those related to safe and productive technology use.

Theoretical and Practical Contributions

This study offers several theoretical and practical contributions. Theoretically, it deepens understanding of technological productivity by integrating technostress, safety climate, and POS into a unified framework. The findings confirm that technostress undermines technological productivity, whereas safety climate enhances it, underscoring the dual importance of reducing technology-induced strain while strengthening safety-oriented organizational cultures. Moreover, the study demonstrates that POS selectively moderates organizational factors: it reinforces the positive influence of safety climate but does not buffer the detrimental effects of technostress. This distinction provides a more refined understanding of how different support mechanisms operate in technology-driven environments.

Furthermore, the findings contribute to the limited body of research conducted in defense industry settings, where employees operate in highly technology-intensive and safety-critical environments. Unlike many previous studies conducted in general organizational contexts, this study demonstrates that both technostress and safety climate play a significant role in shaping technological productivity under conditions characterized by advanced technological systems, strict operational requirements, and high reliability expectations. Therefore, the study extends the applicability of technostress and organizational support theories to the defense industry context.

Practically, the results suggest that organizations aiming to improve technological productivity should prioritize two parallel strategies: (1) implementing targeted interventions to reduce technostress—such as user-friendly technologies, adequate training, and balanced digital workloads—and (2) cultivating a strong safety climate that empowers employees to use technology confidently and effectively. Additionally, enhancing POS can further strengthen the benefits of a positive safety climate. Managers should therefore adopt policies that communicate care, recognition, and support for employees, not as isolated initiatives but as part of an integrated safety and productivity strategy.

These recommendations are particularly relevant for defense industry organizations. Because defense sector employees frequently operate advanced technological systems in safety-critical environments, even small reductions in technological productivity may have significant operational consequences. Therefore, investments in employee training, technostress reduction initiatives, organizational support mechanisms, and safety-oriented management practices

may contribute not only to employee well-being but also to operational reliability and mission effectiveness.

Limitations and Future Research

This study is not without limitations, which also provide opportunities for future research. First, the cross-sectional design restricts causal interpretation. Longitudinal approaches could provide stronger causal evidence. Second, technostress was measured as a general construct; future studies may examine specific dimensions such as techno-overload or techno-complexity to determine whether different forms of technostress interact differently with organizational support. Third, cultural or sector-specific characteristics may influence the relationships observed; comparative studies across industries or countries can enhance generalizability. Lastly, researchers may explore why POS fails to moderate the technostress–technological productivity relationship and investigate alternative resources—such as digital self-efficacy, technology training, or leadership style—that may more effectively buffer technostress.

Conclusion

The findings are especially important for the defense industry, where technological competence, operational reliability, and safety are strategic priorities. In such environments, minimizing technostress while strengthening safety climate and organizational support may help organizations maximize the benefits of digital transformation and sustain high levels of technological productivity.

In conclusion, the study provides meaningful contributions to technostress and organizational behavior literature by clarifying the mechanisms through which organizational climate and support shape technological productivity. As technology continues to transform workplaces, understanding these dynamics becomes increasingly essential for building resilient, productive, and psychologically healthy organizations.

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