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A Cross-Sectional Study on the Relationship Between STARA Awareness and Employee Creativity: Moderating Role of Psychological Resilience[1,2]

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Abstract

This study aimed to investigate the relationship between STARA (Smart Technology, Artificial Intelligence, Robotics, and Algorithms) awareness and employee creativity. The study also highlights the importance of psychological resilience and investigates its impact on this relationship. For this purpose, a questionnaire technique was employed to collect data from 318 employees in the healthcare sector at the University Hospital Centre (CHU) Hassan II in Fez, Morocco, including doctors, nurses, technicians, and secretaries. After confirming the scales' validity and reliability, hypotheses were tested through regression analyses. The results indicate a positive relationship between STARA awareness and employee creativity. Moreover, psychological resilience strengthens this relationship, meaning that psychologically resilient employees tend to be more creative in response to the threats posed by STARA.

Keywords: *STARA Awareness, Employee Creativity, Psychological Resilience.*

AYZERA Farkındalığı ve Çalışan Yaratıcılığı Arasındaki İlişki Üzerine Kesitsel Bir Araştırma: Psikolojik Dayanıklılığın Düzenleyici Rolü

Öz

Bu çalışmanın amacı AYZERA (Akıllı Teknoloji, Yapay Zeka, Robotik ve Algoritmalar) farkındalığı ile çalışan yaratıcılığı arasındaki ilişkiyi araştırmaktır. Çalışma ayrıca psikolojik dayanıklılığın önemine dikkat çekmekte ve bu ilişki üzerindeki etkisini incelemektedir. Bu amaçla, Fas'ın Fez kentindeki Hassan II Üniversitesi Hastanesi Merkezi'nde doktorlar, hemşireler, teknisyenler ve sekreterler dahil olmak üzere sağlık sektöründe çalışan 318 çalışandan Anket tekniği ile veri toplanmıştır. Ölçeklerin geçerlilik ve güvenilirliklerini doğruladıktan sonra, hipotezler regresyon analizleri ile test edilmiştir. Sonuçlar AYZERA farkındalığı ile çalışan yaratıcılığı arasında pozitif bir ilişki olduğunu göstermektedir. Ayrıca psikolojik dayanıklılık bu ilişkiyi güçlendirmektedir, yani psikolojik olarak dayanıklı çalışanlar AYZERA'nın oluşturduğu tehditlere karşı daha yaratıcı tepki verme eğilimindedirler.

Anahtar Kelimeler: *AYZERA Farkındalığı, Çalışan Yaratıcılığı, Psikolojik Dayanıklılık*

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1. Introduction

The emerging technologies (e.g., STARA) have radically changed workplace dynamics, introducing new job requirements and creating opportunities and challenges for employees. The increased use of these technologies is driving employees to understand better their potential to reshape their roles and career opportunities. In this respect, this study examines the relationship between employees' awareness of STARA and their creativity at work, focusing on how psychological resilience affects this relationship.

Brougham and Haar (2018) first introduced the concept of STARA awareness, demonstrating that it can lead to negative consequences, such as turnover intention. Concerning creativity in particular, Wang et al. (2022) found that service employees' awareness of AI and robotics indirectly boosted creativity through active learning. Similarly, Kang et al. (2023) indicate that employees who perceive STARA technologies positively are more engaged in job-crafting, thereby improving creativity. Conversely, some studies have identified potential adverse outcomes when employees see these technologies as threats. For example, Lestari and Djastuti (2020) found that STARA awareness can cause stress and burnout. As a result, these mixed studies suggest the relationship between STARA awareness and creativity might depend on other psychological factors.

One important aspect missing from the existing literature is the insufficient attention given to the role of psychological resilience in better understanding the relationship between STARA awareness and creativity. Although previous studies have examined the impact of STARA awareness from different perspectives, none have identified whether highly resilient employees can easily translate STARA awareness into creative behavior. This idea is theoretically sound, as the resilience theory of Luthans et al. (2007) suggests that resilient individuals are more likely to perceive challenges as opportunities for improvement and growth. That is why our research focuses on this issue by examining whether psychological resilience strengthens or weakens the influence of STARA awareness on creativity.

This research offers insights into both theoretical understanding and practical application. Theoretically, it contributes to existing literature, such as the job demands-resources model (Demerouti et al., 2001), by considering psychological resilience as a personal resource that can limit the adverse effects of STARA awareness while enhancing its positive impact on creativity. From a practical perspective, this study's findings may help

institutions adopt resilience training programs to prepare employees to confront and adapt to technological changes and challenges with greater creativity.

The paper is divided into a set of organized sections to provide a comprehensive and straightforward overview of the topic. The first section presents the theoretical framework, which outlines the study's basic concepts. It reviews the most important literature and studies on STARA awareness, employee creativity, and psychological resilience, and develops hypotheses. Then, in the Methods section, the study design, data collection, and analytical tools used are explained. Following this, we present the statistical analyses in the Results section. An extensive discussion of the interpretation of these results, from theoretical and practical perspectives, follows. Finally, the study concludes with the most critical findings, highlights some limitations, and provides suggestions for future studies.

2. Theoretical Framework

2.1. STARA Awareness

STARA, an acronym for Smart Technology, Artificial Intelligence, Robotics, and Algorithms, is a result of technological advancements and developments over the last few years. STARA awareness is a concept developed by Brougham and Haar (2018) to measure how employees perceive these types of technology as a potential replacement for their jobs. Therefore, STARA awareness refers to employees' perceptions of the workplace, including how it will change after adopting new technologies and how these changes will affect their job opportunities and careers (Ding, 2021). Each component of STARA is developed for a particular reason.

The first component of STARA, smart technology, was coined in 1999 by Kevin Ashton. It refers to devices having sensors that can interact with and detect their surroundings. They suggest that smart technology is a collection of devices or things that are a part of the Internet of Things (IoT), a network of interconnected devices. Because these devices contain integrated sensors, they can observe, record, analyze, and transfer data. Additionally, they can communicate and respond to the data gathered. Smart implies that these devices can reason and make decisions independently without human assistance (Violino et al., 2020).

The second component of STARA, artificial intelligence, is a computer science field that uses algorithms to help organizations achieve their goals. It emphasizes customer

participation in product development and using digital technology for creativity and innovation (Ahmad & Mustafa, 2022). John McCarthy introduced the term artificial intelligence in 1955. Since then, it has evolved dramatically, from its historical roots in humanoid automata and Leonardo da Vinci's designs to its current applications (Hamet & Tremblay, 2017). Some of the subfields of artificial intelligence are machine learning, deep learning, artificial neural networks, natural language processing, and computer vision. They are utilized by companies and organizations across various industries, including healthcare, education, manufacturing, and logistics, to boost productivity, automate processes, and improve decision-making. Artificial intelligence can revolutionize industries and change the way people live and work. However, it can raise ethical issues that need careful consideration, such as employment displacement, bias, and privacy (Ahmad & Mustafa, 2022). Machine learning, a form of artificial intelligence, involves creating models that can perform tasks without relying on predefined methods, instead focusing on training data (Alpaydin, 2020). Supervised learning is a method used in Machine Learning that utilizes input/output pairs provided by a human instructor. This approach enables the system to make generalizations and predictions (Müller & Guido, 2016). Machine learning has enhanced the efficiency and automation of several fields, including radiotherapy, a cancer treatment method (El Naqa & Murphy, 2015).

Deep learning is a subset of machine learning methods that utilize multilayer neural networks, also known as "deep neural networks," to process and interpret data, enabling the learning and decision-making process. Deep learning is likely to enhance automation, data analysis, and decision-making processes in smart factories and industries within Industry 4.0 (Ahmed et al., 2022). Artificial neural networks are computer models inspired by the way the human brain functions. Artificial neural networks possess a unique learning algorithm that enables them to adjust and learn from data, distinguishing them from other machine learning models. Their distinctive structure enables them to effectively learn and connect with real-world problems (Guresen & Kayakutlu, 2011). Natural language processing is a computer system that analyzes and emulates human speech. They include translation applications, text comprehension, and conversation maintenance. However, it confronts obstacles such as ambiguity and necessitates changes in programming language grammar and semantics (Allen, 2003). According to Reja et al. (2022), computer vision is a field that empowers computers to interpret visual information encompassing images and videos. Convolutional neural networks (CNNs) enable computer vision to discover sophisticated

patterns by automatically extracting hierarchical information from images, drawing inspiration from the human visual system (Krizhevsky et al., 2012). Computer vision has transformed many industries (Litjens et al., 2017). Computer vision aids pathologists in identifying malignant cells in histological images (Janowczyk & Madabhushi, 2016). Computer vision technology enables autonomous cars to navigate challenging roads, track objects, and recognize road signs. Additionally, enhancing self-driving automobiles (Ronneberger et al., 2015).

The third component of STARA is robotics. Robotics is an interdisciplinary field that encompasses robot design, construction, and programming. They are programmable machines capable of performing various tasks, just like humans. A typical robot consists of a power generator, sensors, actuators, a body, and a controller. The sensors help the robot understand its state and surroundings. The control system, typically software, modifies the robot's actions based on the information it receives. The mechanism transfers motions and forces, and the actuator converts energy into mechanical energy (Chen et al., 2017). Companies incorporate robots into their framework for various reasons. As Mai et al. (2022) noted, robots are utilized to automate tasks with high precision and efficiency, thereby enhancing manufacturing processes, research, and innovation. Arents and Greitans (2022) confirm that, in the industrial sector, companies are turning to AI-based robotic systems to meet the demands of this domain, aiming to improve performance, adaptability, safety, and reduce costs. Intelligent industrial robots, guided by the "see-think-act" principle, possess sensory capabilities, high-level instruction, context-aware task execution, knowledge acquisition, and adaptive planning.

The last element of STARA is algorithms. An algorithm is the sequence of tasks or activities of an intelligent system. For example, a robot operates according to a series of codes/programs written based on an algorithm (Başar, 2023). Cormen et al. (2022) define an algorithm as a method for efficient computation. It can be used for data sorting, DNA analysis, and e-commerce optimization. A wide range of professions and businesses, including legal research, report writing, and news media, are being profoundly impacted by systems run on algorithms. Programs can efficiently analyze and sort out massive volumes of documents. High-precision dexterity robots are becoming increasingly common, which increases the accessibility and affordability of automation. This trend may impact the

workforce, altering employment dynamics and job roles across various industries. It is anticipated that algorithms will become more commonplace (Brougham & Haar, 2018).

Some researchers believe the STARA is a product of the Fourth Industrial Revolution (i.e., Industry 4.0) (Ding, 2021). Historically, industrial revolutions have transitioned from primary and secondary to tertiary sectors, creating many new jobs as technology advances. This is similar to previous industrial revolutions, but with distinct difficulties given current technological development. There may be fewer readily available replacement jobs, which could prolong this transition. (Brougham & Haar, 2018). Software, robots, and intelligent machines are expected to replace one in three jobs by 2025. Both manual labor and knowledge-based work fall under this category. From agriculture to financial analysis, drones and intelligent machines are anticipated to play a significant role in various industries. Information technology professionals must adapt and take the initiative in utilizing these technologies, as this shift in employment patterns is viewed as the beginning of a new era of technological development (Thibodeau, 2014). In discussing the appearance of robots and the effects of automation on the labor market, Jones (2016) addresses that transportation, logistics, and administration will be particularly vulnerable to the adverse effects of automation. However, it is also noted that the effects of automation differ depending on the industry and type of job. The last recession witnessed a shift in employment patterns, with a rise in high-skilled jobs in professional services and the healthcare industry, and a decline in manual labor and low-paying sectors such as manufacturing and construction. The wide range of effects that robots can have on workers implies that there might be unfavorable short-term repercussions for ordinary employees.

According to Brougham and Haar (2018), STARA awareness refers to an employee's perception of the impact of STARA on their job and career opportunities. It is an important aspect of career planning, considering personal interests, values, and talents. Lestari et al. (2023) emphasized STARA's relevance in transforming workplaces, particularly in sectors such as hospitality. Mukhlis et al. (2023) also found that employees believe these technologies can enhance human jobs, which may lead to job loss. It is predicted that technological advancements over time would replace many jobs, referring to this phenomenon as “Software Substitution,” especially for those with lower skills, while people remain unaware of the fundamental changes that these technologies will bring. However, awareness of STARA and knowing everyone’s career planning and professional development are important to align with future changes (Lestari & Djastuti, 2020). In the

same context, Arthur et al. (1995) introduced the concept of "Intelligent Careers" to address the dynamic nature of careers in response to various economic, technological, and social challenges. Individuals require specific competencies to effectively manage their careers in an era where traditional job security is becoming increasingly rare and organizational commitment to employees is waning (Waterman & Waterman, 1994). Intelligent careers equip individuals with adaptability, flexibility, and strategic career management skills to navigate modern work environments, enabling them to overcome challenges and uncertainties (Baruch, 2004). On the other hand, Lestari and Djastuti (2020) offer a different perspective on STARA awareness. They see that it is not restricted solely to job outcomes. However, they demonstrated how employees' awareness of STARA technologies impacts their psychology, resulting in negative consequences such as stress and burnout. Christensen (2015) discussed disruptive technological changes as a phenomenon and the challenges that organizations may face, indirectly suggesting that employees may need to adapt to new work patterns or might encounter uncertainties concerning job roles and job security throughout these technological changes. Technological progress is an important driver of change in today's society. Initially billed as a source of freedom and connectivity, it is now associated with caution and anxiety, despite the transformative power of technological innovations such as artificial intelligence, robotics, and big data analytics, which are reshaping industries and labor markets worldwide (Wenmoth, 2021). The perception of employees toward STARA may vary from one to another. According to Agrawal et al. (2017), employees recognize the potential of AI and predictive analytics to enhance productivity and streamline tasks. However, they also recognize the importance of human judgment in complex and sensitive situations, such as medicine. In such scenarios, the role of human judgment remains crucial. At the same time, Wenmoth (2021) notes that the evolutionary relationship between workers and advanced technology necessitates workers to develop new skills, such as critical thinking, problem-solving, and continuous learning. Moreover, Agrawal et al. (2017) noted that with lower forecasting costs, more tasks may become vulnerable to automation, potentially leading to shifts in workplace dynamics.

2.2. Employee Creativity

As explained by Kang et al. (2023), employee creativity is a process of utilizing imagination, creativity, and problem-solving skills to promote organizational performance and increase productivity. It is based on the ability to think creatively, adapt quickly, and

generate valuable ideas for the company. It is essential for innovation, productivity, and competitive advantage, supporting the business's success (Syamsidah et al., 2023).

Creativity research has garnered recognition since the mid-20th century, resulting in the creation of specialized journals and books that focus on understanding and enhancing individual creativity, particularly in the workplace (Barron & Harrington, 1981). Moreover, Shalley and Berry-Smith (2001) illustrate that the concept of employee creativity emerged due to the need for innovative work environments to meet competitive challenges. Initially, the focus was on understanding the factors influencing creativity, beginning with personal trait analysis (Ford, 1996).

Williams (2001) emphasizes the role of managers in fostering employee creativity by tailoring training to enhance performance and organizational culture. Wiig (1997) highlights the significance of employee creativity in intellectual capital management and knowledge management. He states that encouraging employee creativity is crucial for the longevity and competitiveness of organizations in the knowledge age. Jaiswal and Dhar (2017) noted that modern organizations operate in uncertain work environments and emphasize employee creativity to cope with uncertainty and foster innovation. Hanaysha (2023) emphasized the importance of companies keeping their employees engaged and motivating them to generate new ideas and consistently achieve set goals. Wenmoth (2021) suggests that education needs to be reformed to match the changing world of today's labor force. Knowledge management initiatives aim to harness and enhance employee creativity by fostering an environment that encourages idea generation, innovation, and knowledge sharing. Wiig (1997) also emphasizes the importance of organizational restructuring to effectively harness employee creativity and foster a culture that supports and encourages it. The concept of employee creativity was explored by Hanaysha (2023), who focused on the distinction between creativity and innovation, underscoring creativity as the generation of original and meaningful ideas, while innovation refers to the successful execution of those ideas.

Amabile (1988) realized that employee creativity contributes to innovation, problem-solving, and competitive advantage, enhancing organizational performance. Barsh et al. (2008) observed that innovation is key to companies' growth and success through the support of employee creativity. Additionally, this creativity contributes to developing new products and services, enhancing the organization's productivity (Ford, 1996). Zhou and Hoever

(2014) indicate that recognizing and fostering creativity through supportive management and climate are key to an organization's sustainable success. Jaiswal and Dhar (2017) assert that employee creativity is necessary for organizations, considering it benefits them in solving problems, staying competitive, and driving growth. Oldham and Cummings (1996) believe that employee creativity provides a competitive advantage, enabling organizations to adapt to changing circumstances and challenges. Innovation requires creativity, but it also comes with risk and uncertainty. Hon and Lui (2016) suggest that embracing creativity and variation from traditional practices can help organizations effectively manage these uncertainties. Employee creativity is a superpower that enables organizations to succeed in a rapidly changing world (Jaiswal & Dhar, 2017). That is why it is important to investigate factors that foster employee creativity.

2.3. STARA Awareness and Employee Creativity

Automating repetitive tasks in modern workplaces boosts employee creativity by freeing up critical time and knowledge resources for engaging in intellectually stimulating activities. This mitigates boredom and enables employees to focus on specific tasks, cultivating a culture of effectiveness and improvement that promotes innovation, adaptation, and the generation of new perspectives. Automation enhances operational efficiency and cultivates a culture of innovation and continuous improvement. Dias et al. (2019) highlight the transformative impact of robotic process automation on the human resources and finance services provided by the Finnish government's shared services center (FinServ) in Finland, enabling workers to complete more tasks and focus on innovative responsibilities. Fernandez and Aman (2018) found that automation, such as robotic process automation, enhances employee creativity by eliminating repetitive tasks, reducing errors, fostering trust in data, and encouraging innovative problem-solving. Güner et al. (2020) also demonstrate that robotic process automation liberates employees from repetitive tasks, enabling them to concentrate on creative work and pursue fresh ideas, leading to a more efficient workplace. Ratia et al. (2018) demonstrate how robotic process automation can enhance staff creativity in healthcare management practices. Automating routine administrative tasks frees staff, doctors, and nurses to focus on prioritizing patient care and interaction.

Problem-solving skills are essential for fostering innovation and cultivating creativity in the workplace. Acquiring knowledge in Smart Technologies, Artificial Intelligence, Robotics, and Algorithms (STARA) enhances these capabilities by exposing individuals to

advanced solutions and technologies that can solve complex challenges. AI can detect patterns, predict outcomes, and suggest new approaches that traditional technologies may overlook. Employees must be informed about technological advances to adapt and integrate new resources into their problem-solving skills. Park et al. (2023) highlight the valuable insights that innovative technologies provide employees, enabling them to identify patterns, make informed decisions, and utilize innovative problem-solving techniques to foster creativity. Chuang et al. (2022) state that Artificial Intelligence can foster innovation and creativity by enhancing problem-solving skills, providing valuable insights, and helping individuals tackle complex problems with greater creativity.

Job insecurity caused by STARA awareness can be a source of creativity. When employees realize that automation or innovative technologies may replace them, their stress and anxiety can lead them to think more creatively. Employees may seek unconventional solutions and showcase their unique human skills, such as emotional intelligence and innovative thinking, to demonstrate their worth and distinguish themselves from machines. This increased sense of alertness, caused by the threat of job loss, can also enhance their ability to think creatively. Thus, job insecurity deriving from STARA awareness can serve as a motivator. Some literature supports this. For example, Staw et al. (1981) reveal that job insecurity leads employees to work harder, find innovative solutions, enhance skills, adopt new technologies, and improve processes. Also, Parker et al. (2010) suggest that employees can protect their jobs and promote organizational growth by engaging in proactive behaviors that emphasize human skills. Friedman and Förster (2001) note that job insecurity can increase alertness and engagement, thereby enhancing creativity and fostering a positive workplace culture. Baer and Oldham (2006) found that the moderate effect of job insecurity can improve creativity by motivating employees to take risks and think creatively. Liang et al. (2022) explored the dual impact of AI awareness, which may cause emotional exhaustion that reduces innovation and enhances intrinsic motivation. Likewise, Wang et al. (2022) discovered that awareness of artificial intelligence and robotics promotes creativity by encouraging proactive behaviors, such as active learning and task crafting, especially in individuals with an internal locus of control. Accordingly, the first hypothesis is developed as follows.

***H*$_1$**: There is a positive relationship between employees' STARA awareness and creativity.

2.4. Psychological Resilience

Afek et al. (2021) articulated that psychological resilience is the ability to endure adversity and adapt to challenges while maintaining well-being, influenced by personal traits and environmental factors. It is also a dynamic process that enables individuals to overcome obstacles and view them as opportunities for advancement (Sisto et al., 2019). Alonazi et al. (2023) explained psychological resilience concerning stress. They found that nurses with higher resilience levels encounter less burnout and stress, while experiencing enhanced job satisfaction. Xu and Yang (2024) found that psychological resilience is correlated with lower stress levels, enabling individuals to manage stress more effectively, particularly during crises such as the COVID-19 pandemic. Koolhaas et al. (2011) discuss how the initial definition of stress as a generalized reaction of the body to a threatening environment has evolved to differentiate between a "stressor" and a "stress response." According to Chrousos (2009), the stressor is the stimulus that disrupts the balance, and the stress response is the organism's effort to restore that balance. Landy and Conte (2016) found that interpersonal conflict and job insecurity are significant stressors in the workplace, affecting individual well-being, team cohesion, and organizational effectiveness. Ganster and Rosen (2013) mentioned the adverse effects of burnout and chronic stress on job satisfaction, employee engagement, commitment to organizational goals, absenteeism, productivity, team cohesion, and long-term health.

Folkman and Moskowitz (2004) recognized that people employ various emotional, cognitive, and behavioral strategies to cope with stress, including seeking social support, engaging in hobbies, and practicing relaxation techniques. Salmon (2001) sees that regular physical exercise effectively manages stress and creates emotional stability. Steptoe et al. (2016) suggest that a healthy lifestyle, including a balanced diet, enough sleep, and moderate caffeine consumption, can help cope with stress. Stress-coping theories offer insights into individuals' strategies for managing challenging situations, enhancing our understanding of human behavior, resilience, and mental health. Parker and Endler (1992) categorize coping techniques into task-oriented, emotion-oriented, and avoidance-oriented, emphasizing problem-solving, emotional reactions, and the pursuit of social support (Stanisławski, 2019). Kariv and Heiman (2005) defined a task-oriented strategy as a problem-focused approach that seeks to change a situation directly to alleviate stress. Task-oriented coping can improve individual psychology and reduce anxiety and depression by promoting problem-solving and

engaging with stressors (Christine et al., 2002). The task-oriented style prioritizes logic and rationality in decision-making, focusing on reliable information (Maghan, 2017). Kundi (2021) reported that while task-oriented individuals rely on established rules and data-based decision-making, these strategies may overlook alternative solutions. A task-oriented strategy is more effective when it is possible to change or manage problems through practical procedures (Zouina, 2022). Carver et al. (1989) proposed that a task-oriented approach includes planning, seeking active support, and ignoring distractions to focus on problem-solving. Emotion-oriented coping involves managing stress through emotional responses, processing feelings, and considering ways to improve one's emotional state rather than directly altering the situation (Nagy & Balázs, 2023). Emotion-oriented coping strategies are classified into two categories. They are constructive and non-constructive strategies (Smith et al., 2015). Constructive strategies, such as positive reappraisal, social support, and mindfulness, effectively manage stress and promote positive emotional outcomes by reframing situations, addressing issues, and seeking support (Bargiel-Matusiewicz & Omar, 2015). Non-constructive strategies negatively affect emotional and psychological health, increase negative and aggressive thoughts and emotional instability, and obstruct correct adaptation and emotional well-being (Abdryahimova, 2014). Individuals who employ this strategy often rely on blaming others or themselves, suppressing their emotions, and passively accepting a situation (Endler & Parker, 1994). Emotion-oriented coping can exacerbate mental health issues, increasing the risk of self-harm, especially in individuals with disorders like borderline personality disorder (Frei et al., 2021). Studies on emotion-oriented coping have provided inconclusive and contradictory results. Matheson and Anisman (2003) found that individuals with mood disorders, anxiety, or depression often rely on emotion-oriented strategies, such as self-blame, which may lead to adverse effects on their emotions and hinder recovery. McWilliams et al. (2003) reveal that emotion-oriented coping is strongly linked to depression and anxiety, potentially worsening emotional distress. However, Van Harreveld et al. (2007) suggest that emotion-oriented coping strategies promote positive psychological well-being and long-term mental health by enabling individuals to manage emotions, reassess their attitudes, and focus on the positive aspects of challenging experiences. Avoidance-oriented coping involves distancing oneself from stressors to manage discomfort. It provides temporary relief but often fails to address the root problem (Veisi et al., 2024). They can also lead to poorer long-term outcomes, including increased stress and emotional difficulties (Billings & Moos, 1981). Avoidance-

oriented strategies, such as procrastination, denial, and disengagement, as well as behaviors like absenteeism or withdrawal from work, often lead to increased emotional distress in the long term (Achnak & Vantilborgh, 2021). These strategies lead to difficulties in problem-solving and healthy decision-making, while disrupting emotional regulation and hindering the development of constructive solutions (Chasiotis et al., 2021). Several studies have linked these strategies to specific illnesses. For example, Yu and Sherman (2015) found that avoidance-oriented coping, especially avoiding communication, particularly in women with breast cancer, increases mental distress by reducing emotional support and problem-solving abilities. Similarly, Burns et al. (2015) note that avoidance coping in type 2 diabetes patients, like avoiding stress and neglecting care, can impair disease management and harm mental health. Cognitive behavior therapy is a treatment that modifies dysfunctional thoughts to strengthen behavior and emotional well-being (Cuijpers et al., 2023). It fosters task-oriented coping through structured problem-solving and reduces avoidance by promoting engagement with stressors (Ihara et al., 2024).

Similar to task-oriented and emotion-oriented approaches, Lazarus and Folkman's (1984, 1987) transactional model of stress and adaptation outlines how humans evaluate stressful events and react through problem-solving (problem-focused coping) or emotional regulation (emotion-focused coping), utilizing meaning-based adaptation to navigate difficult situations (Theodoratou & Argyrides, 2024). Adopting a problem-solving approach can enhance stress management and reduce harmful behaviors, ultimately improving mental health and quality of life. Problem-focused coping involves actively engaging with problem-solving demands by utilizing knowledge and skills to generate effective solutions, thereby fostering a constructive approach to stress management (Ma et al., 2023). Problem-solving or active coping strategies, such as seeking help, joining social groups, and reframing thoughts, enhance stress management by improving adjustment, reducing symptoms, and boosting job satisfaction (Herman & Tetrick, 2009). Aprillia et al. (2024) suggest that emotion-focused coping may adversely impact work-family balance by reducing productivity and impairing decision-making due to the overwhelming presence of negative emotions. Kurogi et al. (2024) found that individuals with schizophrenia frequently employ emotion-focused coping strategies, which may heighten stress and adversely affect social engagement and quality of life.

Luthans et al. (2006a) developed the concept of psychological capital, a framework for positive organizational behavior that aligns with efforts to contribute to a positive psychology. Psychological capital has four dimensions. They are hope, self-efficacy, resilience, and optimism. Hope is a positive psychological force associated with the theory and research of positive psychology (Luthans et al., 2008). It comprises three distinct components: Agency, track, and goals. It is a psychological ability that enhances goal achievement, perceived control, and positive emotions, thereby improving performance in challenging tasks and contributing to success in academics and sports (Luthans & Youssef, 2004). The second dimension, self-efficacy, highlighted by Bandura (1990), emphasizes the belief in one's capabilities, which influences persistence and goal achievement (Luthans et al., 2006b). Self-efficacy can be enhanced through role models, positive feedback, and visualization techniques, all of which foster the confidence necessary for tackling new challenges (Luthans & Youssef, 2004). The third one, resilience, is a positive psychological ability that enables individuals to adapt to difficulties and changes and is associated with improved performance and happiness in the workplace (Luthans et al., 2008). It has three primary qualities: Facing brutal truths without ignoring them, discovering the meaning of difficulties, and adapting using what one must confront (Coutu, 2002). Optimism in psychological capital involves expecting positive outcomes, which influences resilience and well-being, and helps individuals maintain motivation in the face of challenges (Seligman, 2000). Optimism is associated with improved physical health, as individuals who are optimistic tend to adopt healthier behaviors and experience lower stress levels (Carver & Scheier, 2014). Optimism enhances psychological resilience, allowing individuals to adapt to challenges and maintain a positive outlook (Aspinwall & Taylor, 1997).

Resilience is a crucial aspect of psychological capital, enhancing adaptability and a proactive mindset essential for personal and professional growth, while promoting persistence, learning from setbacks, and overall well-being (Masten, 2001). Resilience enhances psychological capital by fostering ongoing growth and the attainment of goals, making it essential for individuals seeking to develop sustainable mental and emotional resources (Windle, 2011). Resilience is crucial in psychological capital as it fosters an adaptive mindset, essential for personal and professional growth, enabling recovery from setbacks and maintaining motivation (Luthans et al., 2007). Luthans et al. (2006b) discuss the association between psychological resilience and psychological capital, emphasizing the importance of positive psychological resources in overcoming challenges and achieving

life's triumphs. According to Vella and Pai (2019), psychological resilience refers to an individual's ability to successfully navigate and recover from difficult situations, resulting in beneficial outcomes. Graber et al. (2015) defined psychological resilience as a lifelong process that helps individuals adapt to adversity, evolving over time and in various circumstances, with childhood and adolescence playing crucial roles. Vella and Pai (2019) define resilience as the ability to overcome challenges and achieve positive results, even in difficult circumstances. Psychology studies resilience in individuals, particularly young people, who have achieved success despite challenging circumstances like low socioeconomic status and parents' mental illness (Grygorenko & Naydonova, 2023). The development of the psychological resilience concept is the focus of Luthar et al.'s (2000) study, which traces its origins to early schizophrenia studies and the current understanding of how resilience functions in changing life circumstances. Yavuz (2023) found that psychological resilience is a crucial aspect of human psychology, encompassing developmental psychopathology, traumatology, neurobiological psychology, and other related fields. Researchers have analyzed psychological resilience to explain why some individuals exhibit remarkable strength and adaptability in the face of adversity, while others struggle (Sisto et al., 2019).

2.5. Moderating Role of Psychological Resilience

Psychological resilience can be crucial in fostering the relationship between STARA awareness and creativity because it enables individuals to respond effectively to challenges and adapt to technological changes. Likewise, resilience enables employees to redefine technostress as a driver of creativity (Groeneveld, 2021). Demerouti et al. (2001) presented the Job Demands-Resources (JD-R) model that helps better understand how this process works. According to Bakker and Demerouti's (2017) study, the Job Demands-Resources model portrays resilience as a personal resource that mitigates the adverse effects of STARA challenges (e.g., job uncertainty) and transforms them into opportunities for creativity. Although there is a potential for job uncertainty and a need to develop skills continuously, individuals with high psychological resilience may be less affected by these challenges. Furthermore, they can adapt to changes and leverage their awareness of STARA to generate innovative solutions. Likewise, Chen et al. (2023) emphasized that resilience is crucial for effective stress management and mental health. It strengthens skills such as problem-solving and emotional regulation, enabling individuals to overcome uncertainties effectively. De

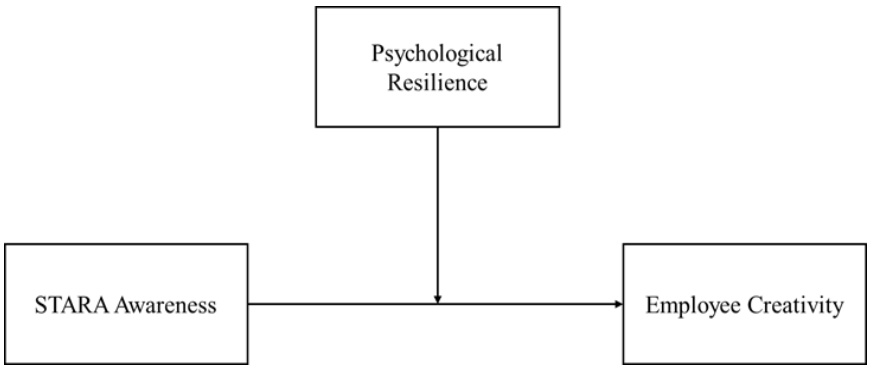
Lorenzo et al. (2023) demonstrate how resilience has transformed challenges into opportunities during the COVID-19 pandemic. This can be similar in the environments shaped by STARA, where resilient individuals can adapt to technological changes. Additionally, resilience enhances creative efficacy. Resilience boosts individuals' and teams' confidence in their abilities. Additionally, resilient teams work together effectively, generating new ideas that yield creative and innovative results (Fan et al., 2021). Fiksel (2003) suggests that resilience enables systems (e.g., social and industrial) to adapt to challenges, ensuring future sustainability while maintaining the dynamism of creativity and continuous improvement in the face of uncertainty. Mitchell et al. (2019) highlight that people with high resilience recover quickly from stressful situations, helping them avoid adverse outcomes and respond more positively. Resilience enables individuals to remain productive and maintain a positive outlook, facilitating the development of new skills and the discovery of creative workplace solutions (Hu et al., 2015). Xu et al. (2021) noted that psychological resilience fosters creativity, enabling individuals to consider a range of options. It also promotes collaborative thinking and practical problem-solving in complex environments. Psychological resilience is crucial in adapting to technological changes, particularly in STARA technologies. It fosters creativity and helps maintain competitiveness by embracing innovation (Purnomo & Rosadi, 2024). Batool et al. (2021) emphasize the importance of psychological resilience in overcoming challenges and facilitating organizational recovery during crises, noting a positive link between technology awareness and creativity. In addition, Tang et al. (2024) emphasize the importance of resilience as a vital personal resource that enables employees to manage technology-driven stressors, thereby facilitating their ability to tackle challenges and utilize their tech skills creatively. Meanwhile, Oosthuizen (2022) emphasized the vital role of industrial psychologists in helping employees navigate technological disruptions through tailored programs and interventions that promote resilience and creativity. Groeneveld (2021) found that while technological challenges, such as technostress, can harm employee performance, psychological resilience is vital for coping with them, as it enables employees to manage stress and foster creativity and innovation. Accordingly, the following hypothesis is developed.

H₂: The positive relationship between STARA awareness and creativity will be stronger for those with high psychological resilience.

Figure 1 illustrates the theoretical model, which is based on the hypotheses.

Figure 1

Theoretical Model



3. Method

3.1. Research Design and Participants

This research employed a cross-sectional design where the data were collected through a digital questionnaire survey from 318 participants. The survey was conducted in both English and French. The scales are translated into French using the translation-back technique (Brislin et al., 1973). The participants work in the University Hospital Center Hassan II (CHU Hassan II), which operates in the healthcare sector. They are located in Fez, Morocco. The total number of personnel working in this organization was approximately 5000, constituting the population of this research. Of the participants, 154 (48.4%) are male, 164 (51.6%) are female, 171 (53.8%) are married, 147 (46.2%) are single, 67 (21.1%) are medical doctors, 135 (42.5%) are nurses, 99 (31.1%) are technicians, 17 (5.3%) are administrative personnel, 66 (20.8%) have a doctorate, 42 (13.2%) have a master's degree, 206 (64.8%) have an associate degree and 4 (1.3%) have a high school degree.

3.2. Data Collection Instruments

A digital questionnaire form was developed to collect data. It had three sections. In the first section, an informed consent form was presented, and participants were asked to give their permission to share their ideas with us. In the second section, questions were asked to collect participants' demographic information. In the third section, items of STARA awareness, employee creativity, and psychological resilience were listed. Each item was scored on a scale of seven points (1: strongly disagree, 7: strongly agree). Below, detailed information about the scales and their validity and reliability tests is presented.

3.2.1. STARA Awareness Scale. Brougham and Haar's (2018) unidimensional and four-item scale was used to measure participants' STARA awareness.

3.2.2. Employee Creativity Scale. Zhou and George's (2001) unidimensional and thirteen-item scale was used to measure participants' creativity.

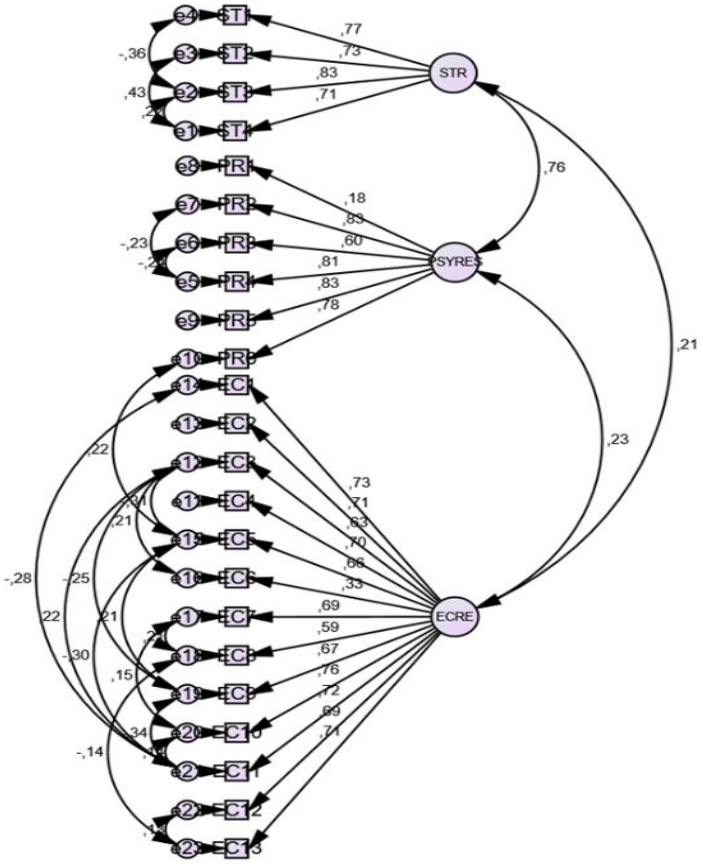
3.2.3. Psychological Resilience Scale. Luthans et al. (2007) used a unidimensional, six-item scale to measure participants' psychological resilience.

3.3. Reliability and Validity Tests

Cronbach's alpha coefficients were calculated for each scale to assess their reliability. The score for the STARA awareness scale was 0.85. The scores were 0.90 for the employee creativity scale and 0.80 for the psychological resilience scale. Scores indicated that each scale was internally consistent and reliable, as evidenced by values greater than 0.70 (Hair et al., 2010). A measurement model was constructed to test the validity of the scales. The model is presented in Figure 2.

Figure 2

Measurement Model



Not: STR: STARA Awareness, PSYRES: Psychological Resilience, ECRE: Employee Creativity

The measurement model presented in Figure 2 had an acceptable fit (Meydan & Şeşen, 2011). Table 1 shows the indices and values. Accordingly, the validity of the scales is ensured (Hair et al., 2010).

Table 1

Measurement Model Fit Indices

	X^2	Df	X^2/df	GFI	IFI	CFI	RMSEA
Value	492.61	208	2.36	0.88	0.92	0.92	0.06

3.4. Data Collection Process

Before data collection, ethical approval, numbered E-65836846-044-341664, was obtained from Istanbul Ticaret University's ethics committee on December 30, 2024. To collect the data for this study, on December 23, 2024, the first author contacted a family member who works as a senior anesthesia nurse at CHU Hassan II Hospital in Fez, Morocco. Since the first author was residing abroad during the data collection period, the person of contact was responsible for coordinating the process on the author's behalf. She first contacted the hospital administration and presented a letter that the authors had already prepared, requesting permission to conduct the study. After receiving approval from the administration, she facilitated the distribution of the survey. The first author had previously created the questionnaire using Google Forms. She shared the survey link with her colleagues through WhatsApp. Additionally, she distributed the link to the heads of various departments to ensure that it reached a broader range of employees within the hospital. The data collection lasted approximately two months and was finalized on March 4, 2025.

3.5. Data Analysis Strategy

First, some demographic information regarding the participants and research variables was uncovered. Then, correlations between variables were calculated. Finally, hypotheses were tested through linear regression tests. These operations were performed on IBM SPSS and AMOS.

4. Findings

Variables' mean values, standard deviations, and correlation coefficients between them are presented in Table 2.

Table 2

Means, Standard Deviations, and Correlations

Variables	*M*	*SD*	1	2	3
1. STARA Awareness	5.05	0.96	1		
2. Employee Creativity	5.34	0.73	0.18**	1	
3. Psychological Resilience	5.13	0.92	0.70**	0.17**	1

**$p<0.05$

The results, shown in Table 2, indicate positive relationships between STARA awareness, employee creativity, and psychological resilience. Additional analyses were conducted to investigate how these scores vary according to demographic characteristics. The results, presented in Table 3, indicate that the mean scores for each criterion are close, suggesting that demographics play a minimal or insignificant role in explaining the relationships between research variables.

Table 3

Comparison of Mean Values According to Demographics

Criteria			n	*M*	*SD*
STARA Awareness	Gender	Male	154	5.22	0.80
		Female	164	4.90	1.07
	Marital Status	Married	171	5.17	0.91
		Single	147	4.92	1.00
	Position	Doctor	67	5.21	0.97
		Nurse	135	4.76	0.99
		Technician	99	5.22	0.82
		Administrative Personnel	17	5.82	0.64
	Education Level	Doctorate	66	5.25	0.94
		Master	42	5.05	0.78
		Associate degree	206	5.00	0.97
		High school	4	4.50	2.16
Employee Creativity	Gender	Male	154	5.47	0.76
		Female	164	5.23	0.69
	Marital Status	Married	171	5.52	0.65
		Single	147	5.14	0.77
	Position	Doctor	67	5.69	0.79
		Nurse	135	5.23	0.64
		Technician	99	5.46	0.55
		Administrative Personnel	17	4.21	0.85
	Education Level	Doctorate	66	5.73	0.72
		Master	42	5.38	0.74
		Associate degree	206	5.23	0.69
		High school	4	4.71	1.09
Psychological Resilience	Gender	Male	154	5.31	0.77
		Female	164	4.97	1.02
	Marital Status	Married	171	5.37	0.88
		Single	147	4.87	0.89
	Position	Doctor	67	5.60	0.94
		Nurse	135	4.98	1.00
		Technician	99	5.06	0.72
		Administrative Personnel	17	4.94	0.49
	Education Level	Doctorate	66	5.62	0.94
		Master	42	5.34	0.76
		Associate degree	206	4.96	0.85
		High school	4	4.04	1.78

Next, a linear regression test was performed to test the hypotheses. According to the results presented in Table 4, a positive relationship exists between STARA Awareness and employee creativity ($\beta = 0.25$, $p < 0.01$). Therefore, $\boldsymbol{H_1}$ is supported. When the second hypothesis was tested, a moderation analysis was performed according to Aiken and West's (1991) technique. This technique involves creating an interaction term by multiplying the centered scores of the independent variable (i.e., STARA Awareness) and the moderator variable (i.e., psychological resilience). The centered scores were produced by SPSS software. Thus, the interaction term represents STARA Awareness × Psychological Resilience. To discuss the moderating role of psychological resilience in the relationship between STARA awareness and employee creativity, the interaction term must have a significant relationship with the dependent variable (i.e., employee creativity). According to the results presented in Table 4, a positive relationship exists between the interaction term (i.e., STARA awareness × Psychological resilience) and the dependent variable (i.e., employee creativity). This indicates that psychological resilience strengthens the relationship between STARA awareness and employee creativity. The process is illustrated in Figure 3.

Table 4

Moderation Test

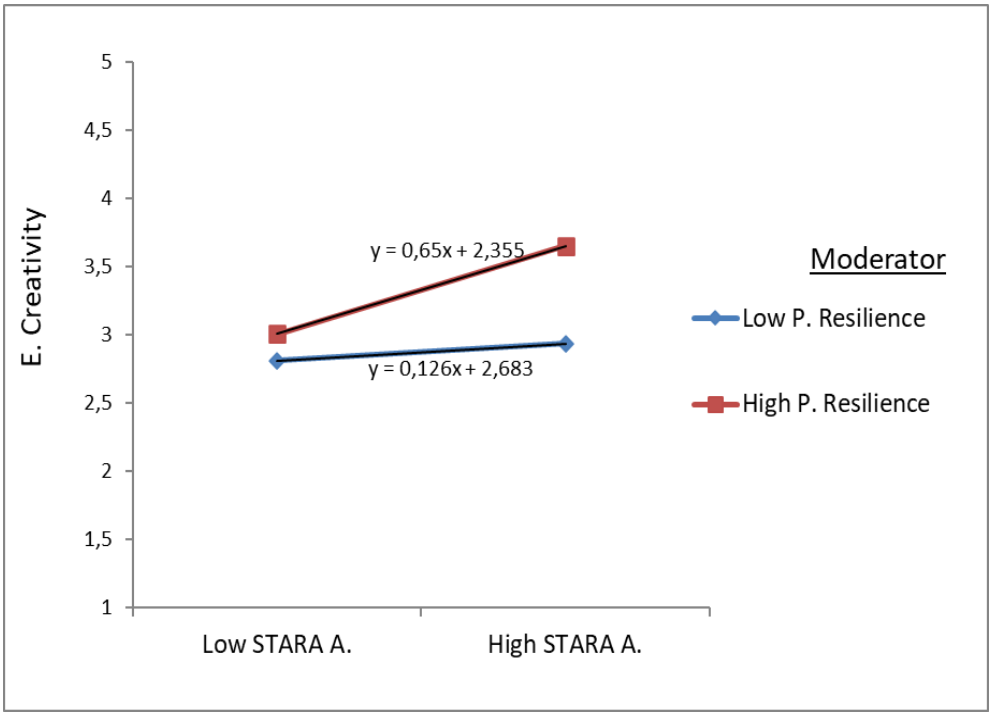
Independent Variables	Dependent Variable - Employee Creativity		
	B	***F***	R^2
STARA Awareness	0.25**		
Psychological Resilience	0.28**	14.77***	0.11
Interaction Term	0.42***		

***$p<0.001$, **$p<0.01$

Figure 3 illustrates a positive relationship between STARA awareness and employee creativity, regardless of whether psychological resilience is high or low. However, this relationship is stronger when psychological resilience is high because the slope of the high psychological resilience line is greater than that of the low psychological resilience line. Therefore, the relationship between STARA awareness and employee creativity was stronger for participants with high psychological resilience. Accordingly, $\boldsymbol{H_2}$ is supported, too.

Figure 1

Moderation



Note: E. Creativity: Employee Creativity, STARA A. = STARA Awareness, P. Resilience: Psychological Resilience

5. Discussion

This study examined the relationship between STARA awareness and employee creativity, with psychological resilience as a key moderator. The findings showed that employees who are aware of STARA are more creative, especially those with high psychological resilience.

These findings confirm the first hypothesis, which indicates a positive relationship between employees' STARA awareness and creativity; this supports the study by Dias et al. (2019) which showed that advanced technology enables employees to focus more on creative tasks by freeing them from routine work, unlike the other studies, which mainly looked at the adverse effects of STARA awareness, such as job insecurity, stress, turnover as well (Ding, 2022; Brougham & Haar, 2018). This study demonstrates that STARA awareness can enhance employee creativity by enabling them to solve complex and novel problems. Moreover, our research demonstrates that when employees are aware of the threats posed by STARA, they enhance their knowledge, skills, and abilities, becoming more competent and secure in their positions within the workplace.

To the best of our knowledge, psychological resilience was examined for the first time as a moderator in the relationship between STARA awareness and creativity, changing the view of STARA awareness from a negative to a positive one, and confirming that employees with higher resilience have a stronger connection between STARA awareness and creativity. Because some employees perceive STARA as a threat and challenge to their careers, psychologically resilient employees are expected to be more enthusiastic in updating their competencies and being more creative. Likewise, results supported our ideas. This contributes to the existing literature of the job demands-resources model (Demerouti et al., 2001) by considering psychological resilience as a personal resource that can either limit the adverse effects of STARA awareness (when it is seen as a threat, STARA acts like a job demand) or amplify its benefits for creativity (when it is perceived as an opportunity for innovation, STARA functions like a job resource). This aligns with Xu et al. (2021)'s study, which found that resilience enhances creativity by enabling individuals to accept change and overcome challenges. It also contributes to Groeneveld's (2021) study, which posits that psychological resilience enables employees to manage technology pressures, allowing them to adapt creatively to new demands.

These findings can be helpful for hospital managers, as they show that when employees understand what STARA technologies are and how they might impact their work, they become more creative. That is why hospital managers should prioritize clarifying these advanced technologies (STARA) to their employees and explain how they may impact their work, and then guide them on how to adapt. This can be achieved by providing training and discussing technology updates regularly. Additionally, the study found that employees with substantial resilience benefit even more from STARA awareness. Because of this, hospital managers should help their staff, including all professions, develop greater resilience. This can include teaching them stress management, being supportive when staff face challenges, and making an effort to create a more friendly work environment, which will encourage them to be more creative in their work.

This study has some limitations. The study was conducted in only one public hospital in Morocco; therefore, the results may not apply to other hospitals. Several hospitals were contacted via email, but most of them did not respond. Due to insufficient sample size, the findings may not be generalized to other contexts. Therefore, future researchers can replicate it in other contexts and compare the results. The study employed a questionnaire form

consisting of closed-ended items. This means that participants chose from a list of options rather than giving detailed answers. Although this method is quick and easy to analyze, it may limit the depth of participants' feelings or experiences, as they may not elaborate on their thoughts in detail. Thus, future studies can collect data through other techniques such as interviews and observation. Accordingly, this study can serve as a starting point for other researchers interested in understanding STARA awareness and employee creativity. Future researchers can build on this by collecting data from a large sample of hospitals or other sectors, including the public and private sectors, such as education and industry. This would help compare results and better understand how STARA awareness affects creativity. Future researchers can also examine other factors that may influence the relationship between STARA awareness and creativity, such as job satisfaction, training availability, and motivation. These could help establish a more comprehensive model for understanding employee creativity in an era of technological changes.

Overall, the results of this study showed that STARA awareness has a positive influence on employee creativity, and psychological resilience reinforces this positive effect. Thus, our study highlights psychological resilience as a moderator in the relationship between STARA and employee creativity, an aspect that has not been addressed previously. Theoretically, this study lays the groundwork for future research to investigate the impact of psychological resilience on creativity within the workplace. Practically, the findings of this study provide valuable recommendations for hospital managers, emphasizing the importance of increasing employees' awareness of STARA technology and supporting their mental health to foster a work environment that encourages creativity and innovation.

Support Information: This study has not received support from any organization, such as public, commercial, or non-profit organizations.

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: All procedures performed in studies involving human participants comply with the ethical standards of the institutional and/or national research committee and the 1964 Helsinki Declaration and its subsequent amendments or comparable ethical standards. Ethical approval, numbered E-65836846-044-341664, was obtained from Istanbul Ticaret University's ethics committee on December 30, 2024.

Informed Consent Form: Informed consent forms were obtained from all individual participants in the study.

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